ENVIRONMENTAL IMPACT ASSESSMENT STUDY REPORT

FOR

THE PROPOSED TATU WATERS RESIDENTIAL DEVELOPMENT AND OTHER ASSOCIATED AMENITIES

ON

PLOT L.R. NO. 28867, AT TATU CITY, OFF NAIROBI-THIKA SUPER HIGHWAY, RUIRU MUNICIPALITY, KIAMBU COUNTY.

(GPS CORDINATES: -1.15057, 36.901592)

PROJECT PROPONENT:
TATU CITY LIMITED
P.O BOX 2739-00621
NAIROBI, KENYA

FEBRUARY, 2017

Document Authentication

This project report on Environmental Impacts Assessment has been prepared by Katrina Management Consultants Limited; NEMA registered and licensed EIA/EA Firm of Experts.

This report has been done with reasonable skills, care and diligence in accordance with the Environmental Management and Coordination Act, Cap 387 and the Environmental (Impact Assessment and Audit) Regulations 2003.

We the undersigned, certify that the particulars given in this report are correct and righteous to the best of our knowledge.

PROJECT PROPONENT
TATU CITY LIMITED
P.O BOX 2739-00621
NAIROBI, KENYA

Signature……Date……

EIA/EA FIRM OF EXPERTS
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Email: katrinamcl@yahoo.com

Signature……Date……

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ACRONYMS

DSQ - Domestic Servant Quarter

EIA - Environmental Impact Assessment

EHS - Environmental, Health and Safety

EMCA - Environmental Management & Coordination Act, Cap 387

EMP- Environmental Management Plan

NEMA - National Environmental Management Authority

ISO - International Standard Organization

SERC - Standards and Enforcement Review Committee

SEA- Strategic Environmental Assessment

CO - Carbon Monoxide

COD - Chemical Oxygen Demand

CO_2 - Carbon Dioxide

KFS - Kenya Forest Service

KURA - Kenya Urban Roads Authority

KeNHA- Kenya National Highways Authority

WRMA- Water Resources Management Authority

KWS- Kenya Wildlife Service

IUCN - International Union for Conservation of Nature

NGOs - Non-Governmental Organization

NO_x - Nitrogen oxide

ODS - Ozone Depleting Substances

PPE - Personal Protective Equipments

PAP - Project Affected Population

PPE- Personal Protective Equipment

Masl - Metre above sea level

NON-TECHNICAL SUMMARY

This Environmental Impact Assessment project report was prepared as per the provisions of Environmental Management and Coordination Act, Cap 387 and more specifically to Environmental (Impact Assessment and Audit) Regulations 2003, Legal Notice No. 101.

The proposed development will consist of mixed residential basically Multi-family and town houses of 2, 3, and 4 bedroom (402 two bedroom, 1,294 three bedroom, 1019 four bedroom) with associated amenities in Tatu City for Tatu City Limited. The development may have significant impacts on the environment which has to be mitigated, if adverse, and optimized, if beneficial. The approval of the Strategic Environment Assessment (SEA) for the Tatu City Master Plan prescribed that EIA will be undertaken for the various components of the Master Plan prior to commencement of construction works. Conformity to the master plan zoning scheme is up held in this process.

TERRITORY BALANCE		
USE	**PLOT AREA (Ha)**	**% Land Use**
Residential	49.81	49.70%
Public Open space	30.20	30.14%
Public Facilities	9.69	9.67%
Infrastructure	0.16	0.16%
Road Network	10.35	10.33%
	100.22	100%

It is against this background that this study was commissioned as part of the preliminary planning stage of the proposed residential development. The firm of experts registered with the National Environmental Management Authority (NEMA) was contracted by the proponent to undertake the study with the objective of identifying both positive and negative impacts of the proposed project. Also identify areas that are likely to be impacted on the project and in accordance with laid down environmental legislation and guidelines, carry out a systematic EIA report that should contain among other issues, identification of key environmental aspects, and recommendations on appropriate mitigation measures to minimize or prevent adverse impacts, optimize on the positive impacts and develop an environmental management plan to guide the project planning, construction,

operation and decommission phases. Below is a summary of the anticipated significant impacts and their proposed mitigation measures.

Anticipated Impacts	**Mitigation measures**
Noise & vibrations	-Provision of barriers such as walls around the site boundaries to provide some buffer against noise -Installation of portable barriers to shield compressors and other small stationary equipment where necessary -Silenced machinery and instruments should be employed where possible -Provide and enforce use of PPE among workers e.g. ear muffs -Proper servicing of machinery & equipment (oiling, greasing etc) -Monitor noise levels as per NEMA guidelines
Soil Degradation	-Rocked construction entrance and exit to keep sediment from being tracked onto adjacent roads -Stock piles to be covered with tarpaulins and slope stability to be checked -Landscape all disturbed areas after construction phase
Air pollution	-Spray water on exposed areas twice daily during dry weather to suppress dust -Cover loads of friable materials during transportation and avoid pouring dust materials from elevated areas to ground -Provide dust screens where necessary -Control speed of construction vehicles and switch off machines when not in use -Regularly service and maintain vehicles, mobile plants and machinery -Provide PPE such as nose masks to the workers in dust generation areas. -All raw materials must be sourced as close as possible to the construction site thus reducing the emissions from vehicular traffic.
Loss of biodiversity	-Retain vegetation screens to reduce the

	visual effect of construction activities where possible -Clearance of vegetation should be done in necessary areas only - After project completion, proponent should carry out environmental compensation where harm cannot be avoided by use of indigenous plants
Increased solid waste	-Limit quantity by developing appropriate budgets for purchase of raw materials to reduce wastage through exposure to weather elements -Provision of a waste transfer station within the development -Segregation of waste at source through provision of separate bins -Contract a duly licensed waste handler to transport waste
Increased water demands	-Installation of flush toilets with low volume cisterns and high pressure -Efficient waste water recycling and rain water harvesting
River degradation	-Maintain a riparian buffer zone along the River as per WRMA recommendations -only permitted activities shall be undertaken within the full width of the river or within the riparian reserve as per Water Quality Regulations 2006 -To the extent possible, limit any modifications to natural streams Preserve and maintain the rivers, natural streams and drainage ways within the developed areas by designating them as part of the open space system. -To the extent possible, limit any modifications to natural streams and drainage ways, unless they are necessary for flood protection, to preserve water quality and protect aesthetic and biological resources.
River flooding	-Plant environmentally friendly trees on the riparian reserve to increase interception and storage while reducing surface run off

	- Discourage the planting of eucalyptus, sugarcane and invasive species in the water resource areas while giving alternative species such as bamboo. -Liaise with WRMA to decommission the weir in the river and further discuss all options with WRMA to prevent flooding. -
Public health and occupational safety and health	Adequate sanitary facilities should be provided and standard cleanliness maintained -Personnel to wear complete PPE -Only qualified personnel to operate the machinery -Designate a Health & Safety officer to be in-charge of enforcing site compliance with OSH rules & regulations -Provision of an adequately stocked first aid kit and at least one trained first aider on site -Display the contact numbers of the persons responsible for handling emergencies on the site Contractor should have workmen's compensation cover which should comply with workmen's compensation Act -Provision of fire fighting equipment
Traffic snarl ups during construction	-A traffic marshal shall be stationed along the entry and exit points within the project boundary to control vehicles during transportation of materials. -Planned deliveries to make sure they do not coincide with heavy traffic -Provision of separate traffic routes for pedestrians , bikes and vehicles during operation phase -Proponent to engage KURA and KeNHA in developing access roads for the proposed project -Security checks to be conducted inside the development NOT at the entrance to reduce traffic -Provision of designated entry and exit points

Socio economic concerns	-Development of a Corporate Social Responsibility programme which could provide assistance to the community -Give priority to the neighbouring local communities when providing employment opportunities -Where possible offer women equal opportunities as men - establish a complaint management system

The preparation of this report was done through consultation and public participation that included interviews and review of relevant materials. The potential environmental impacts are herein discussed, both the positive and negative. The negative environmental impacts, mainly concentrated during the construction phase include dust emissions, noise and vibrations, increased traffic (lorries transporting construction materials), increased runoff, occupational hazards, pressure on existing infrastructure, construction waste generation, and general nuisance to the neighboring facilities.

Adequate guidance is given to minimize nuisance caused to neighbours during the construction phase with emphasis being placed on:

- Provision of adequate sanitation to the construction workforce and strict enforcement of good behavior by the workforce.
- Transportation of building materials to site and construction debris from site has to be undertaken during off peak hours where possible.
- Construction activities at night shall obtain necessary authorization and shall be kept to minimum.
- Adequate dust screening and water sprinkling to control dust emissions
- Minimization of noise and vibrations by ensuring compliance with maximum permissible noise levels (day or night) in accordance with the Noise and excessive Vibration pollution control) Regulations 2009.
- and adhere to the provisions of Occupational Safety and Health Act, No. 15 of 2007 to ensure safety of the workforce.
- Establishment of complaint management system

Occupation/operation phase of the project presents lesser negative environmental impacts mainly restricted to the pressure on existing infrastructure (water, sewer, and road) and domestic waste generation. Furthermore protection of the Kianjibe River riparian reserve and Kamiti River has been factored in the project design. The proposed Tatu Waters project shall blend well with the surrounding residential

character (SEA for Master plan has already been approved by NEMA). Phase one development of Tatu City included the development of infrastructure such as sewerage network, piped water network which are already in place, road network are under construction.

The Environmental management plan of this report provides the project policy as a clean, Green, healthy and safe environment. Mitigation measures detailed out are minimizing land degradation, enhancing landscaping, aesthetics and revegetation, improving air quality, minimizing noise pollution, installation of water and energy saving fixtures, roof harvesting of rainwater for gardening and pavement washing, solid waste management plans, traffic management plan, protection of ecologically sensitive ecosystems such as river riparian reserve and provision of sanitary accommodation to the construction workforce.

The summary therefore posits that a number of environmental mitigation measures be implemented to minimize environmental degradation and enhance environmental quality. The proponent, contractor and the Environmental Consultant shall therefore ensure that adequate supervision is in place to implement the guidance in the Environmental Management Plan.

1.0 INTRODUCTION

1.1 Project Background and Rationale for an Environmental Impact Assessment

Katrina Management Consultants has been commissioned by Tatu City Limited to carry out a comprehensive full study Environmental Impact Assessment for the proposed project. This comprehensive study is meant to address any possible negative impacts, environment-related and social conflicts that may result from the activities of the proposed project. This will in the long term ensure not only a safe and clean environment, but also ensure that the proposed development activities are in conformity with the existing environmental rules and regulations.

The Proponent is aware that an environmental impact assessment (EIA) is a statutory requirement under section 58(2) of the Environmental management and coordination act, Cap 387 (EMCA, Cap 387). The expert undertook the study with the objective of identifying both positive and negative impacts of the proposed project; provide counter measures for the negative impacts and optimize the positive ones and come up with an Environmental Management Plan (EMP) as per the terms of reference (TOR).

The EMP will be useful in managing the activities at the site so that potential and actual impacts to the environment are addressed. The report has also provided guidelines on how to mitigate the negative environmental impacts and is confident that they will be implemented by the proponent. The EMP will also be an excellent reference tool for compliance audits in future. This is in line with the statutory requirements and the guidelines issued by NEMA.

1.2 The study

The second schedule to the Environmental Management and Coordination act (EMCA) specifies categories of projects that must be subjected to environmental impact assessment (EIA) at the project planning stages to ensure that significant impacts on the environment are taken into consideration at the design, construction, operation and decommission stages of the project.

The objectives of this EIA were therefore:

1) To identify and discuss the project's likely adverse impacts on the environment such as to include natural, social, cultural and economic aspects.
2) Ensure conformity with SEA approval for Tatu City Master Plan.
3) Note the positive impacts and suggest on augmentation/optimization
4) To consult with the likely affected public/institutions/offices as Project Affected Population to get their views on the proposal, create awareness and harmony,
5) To propose options for mitigation measures and develop an Environmental Management Plan for the project phases (Planning, Construction, Operation and Decommissioning phases).
6) To generate an Environmental Impact Assessment Study Report for submission to the NEMA as required by law for informed decision making.

1.2.1 Terms of reference

The key instructions to the environmental expert were as follows:

(i) Provide a description of the proposed projects activities with a focus on potential adverse impacts of all the activities
(ii) Establish the environmental baseline conditions of the project area and identify areas that are likely to be impacted on by the project in accordance with laid down environmental legislation and guidelines.
(iii) Carry out a systematic EIA following the gazetted regulations (The Environmental (Impact Assessment and Audit) Regulations, 2003 covering among others policy and legal framework.
(iv) Produce a comprehensive EIA Study report that should contain among other issues, identification of key environmental aspects, recommendations on appropriate mitigation measures to minimize or prevent adverse impacts while optimizing the positive impacts.
(v) Undertake consultation with the neighbours and/or Project Affected Population (PAP).
(vi) Develop an Environmental Management Plan detailing the prescribed mitigating measure, person(s) responsible, timeframe/timeline, cost of mitigation and monitoring mechanisms.

The following environmental issues were identified for coverage as per the terms of reference above;

a) Physical Environment
   (i) Pressure on water, road and sewer infrastructure,
   (ii) Soil contamination and land degradation

(iii) Drainage patterns
(iv) Air quality

b) Natural Environment
(i) Rivers and wetlands
(ii) Vegetation
(iii) Topography

c) Social, economic and cultural environment

(i) Changes in land use
(ii) Public health, safety and general hazards
(iii) Aesthetic changes
(iv) Construction materials and wastes
(v) Income generation opportunities

1.3 Scope and content of project

The project assessment investigates and analyses the anticipated environmental impacts of the proposed development in line with the Environmental (Impact Assessment and Audit) regulations 2003.

Consequently, the report will provide the following:-

- Nature of project and detailed project description
- The location of the project including the physical area that may be affected by the project's activities.
- The activities that shall be undertaken during the project design, construction and operation phases.
- The materials to be used, products and by-product including waste to be generated by the project and the methods of disposal.
- The potential environmental impacts of the project and mitigation measures to be taken during and after the implementation of the project.
- Analysis of comments from the PAP.
- An action plan for prevention and management of possible accidents during the project cycle
- A plan to ensure the health and safety of the workers and the neighboring communities
- The economic and social cultural impacts to local community and the nation in general
- Ensure conformity with the approved SEA for Tatu City Master Plan
- The project budget

- Use of environmentally friendly alternatives e.g. use of ODS alternatives
- Any other information that the proponent may be requested to provide by NEMA.

Methodology

To achieve all this, a systematic approach was followed by the consultants who include the general steps outlined below:-

- Environment screening
- Environmental scoping which provided the key environmental issues
- Review of Tatu City Master Plan and SEA report
- Desktop studies and interviews
- Physical inspection of the site and surrounding areas
- EIA Public participation via interviews and the use of questionnaires
- Discussions with the Proponent and project architect
- Reporting.

All these aspects will be considered accordingly. This report also seeks to ensure that all the potential environmental impacts are identified and that workable mitigation measures are adopted. The report also seeks to ensure compliance with the provision of the EMCA, Cap 387, and Environmental (Impact Assessment and Audit) Regulations 2003 as well as other regulations.

1.4 Environmental Concerns

The following were issues of concern during this Environmental Impact Assessment study.

- The site topography, vegetation, soil type, and general scenery
- How are the site maps, structure distribution
- The construction material to be used
- The proposed method to dispose the effluents and solid wastes
- Water supply system
- Traffic management
- Area zoning specifications and/or Tatu City Master Plan, a critical planning framework to guide on project level ESIA and the need to adhere to the same.
- If some of the materials will be obtained from within and where exactly, quantity, site regeneration program
- Whether any de-vegetation will take place
- The power sources to be used

- Infrastructure available and pressure on the existing infrastructure such as water, sewer and traffic.
- Protection of ecologically sensitive areas such as dams and river riparian reserves neighboring the plot.

1.5 Objectives of the project

The objectives of the proposed development include:

- To create a high quality mixed use development containing residential units and commercial amenities.
- To meet economic desires of the proponent
- To put the current land into more productive and economic use
- To protect environmentally sensitive areas, to instill efficient use of the resources (water, energy and space) and ensure sustainable development.

The conceived project is designed to blend with current land-use trend for the area (currently replacing the original coffee plantations), where a survey revealed that such development (suburbanization) is guaranteed of attracting the desired clientele.

1.6 Objectives of the EIA Study

Compliance with Environmental Management and Coordination Act (EMCA), Cap387 which establishes a requirement for the environmental Impact Assessment (EIA) study for a project such as this ,in order to establish the potential positive and negative impacts of the project to the integrity of the environmental Impact Assessment study was to identify significant potential impacts of the proposed project to the environment and social aspects and formulate recommendations to ensure the project takes in to consideration appropriate measures to mitigate any adverse impacts to the environment in all phases of its implementation. The key objectives of this study include the following:

i. To identify and evaluate the significant environmental impacts of the proposed project
ii. To determine the compatibility of the proposed development with neighbouring land uses;

iii. To assess and analyze the environmental costs and benefits associated with the proposed project.
iv. To evaluate and select the best project alternative from the various options available
v. To address any concerns raised by the public on the proposed project
vi. To incorporate environmental management plans and monitoring mechanism during implementation and operational phases of the project.

1.7 Duties of the Proponent

It will be the duty of the proponent to ensure that all legal requirements as pertaining to the development are met as specified by the law.

- The proponent shall provide the contractor with a site office complete with all the furniture and sanitary facilities to facilitate site meetings and inspections.
- The proponent will also provide the contractor with stores for his own use and for use by the subcontractors.

1.8 Duties of the Contractor

- Prepare and maintain an approved time and progress chart, showing clearly the period allowed for each section of the work
- The contractor is to comply with all regulations and by-laws of the local Authority including serving of notices and paying of the fees.
- During the night, public holidays and any other time when no work is being carried out onsite, the contractor shall accommodate only security personal and some critical personnel on site
- The contractor shall make good at his own expense any damage he may cause to public and private roads and pavements in the course of carrying out his work.
- The architect shall define the area of the site, which may be occupied by the contractor for use as storage, on the site.
- The contractor shall make his own arrangement for sanitary conveniences for his workmen. Any arrangements so made shall be in conformity with the public health requirements for such facilities and the contractor shall be solely liable for any infringement of the requirements.
- The contractor shall be responsible for all the action of the subcontractor in first instance.
- The contractor shall take all possible precaution to prevent nuisance, inconvenience or injury to the neighboring properties and to the public

generally, and shall use proper precaution to ensure that safety of wheeled traffic and pedestrian.

- All work operations, which may produce under level of noise, dust vibration, or any other discomfort to the workers and/or guest of the client must be undertaken with care, with all necessary safety precautions taken.
- Workers will not be allowed to assemble or wait around the premises main gate.
- Workers will be picked from elsewhere and transported through the main entrance to the internal perimeter of the project site.
- The contractor shall take all effort to muffle the noises from his tools, equipment and workmen to not more than 90 Decibels
- The contractor shall upon completion of working, remove and clear away all plant, rubbish and unused materials and shall leave the whole of the site in a clean and tidy state to the satisfaction of the Construction Manager He shall also remove from the site all rubbish and dirt as it is produced to maintain the tidiness of the premises and its immediate environs.
- No shrubs, trees, bushes or underground shall be removed except with the express approval of the Construction Manager
- No blasting shall be permitted without the prior approval of the Construction Manager and the local authorities.
- Borrow pits will only be allowed to be opened up on receipt of permission from the Construction Manager
- The standard of workmanship shall not be inferior to the current British codes of practice and /or the Kenya Bureau of Standards where existing.
- No materials for use in the permanent incorporation into the works shall be used for any temporary works or purpose other than that for which it is provided. Similarly, no material for temporary support may be used for permanent incorporation into the works.

All the materials and workmanship used in the execution of the work shall be of the best quality and description. Any material condemned by the architect shall be immediately be removed from the site at the contractors cost.

All contractor and sub-contractor personnel will be required to be briefed on environmental and social requirements to be observed during construction, operation and even maintenance of Tatu City infrastructure. The main contractor must do these briefings before his staff will be allowed to work on the project.

2.0 POLICY, LEGAL AND LEGISLATIVE FRAMEWORK

2.1 Policy framework

The Kenya Government's constitution (Article 42, 69 & 70), environmental policy aims at integrating environmental aspects into national development plans. The broad objectives of the national environmental policy include:

- Optimal use of natural land and water resources in improving the quality of the human environment;
- Sustainable use of natural resources to meet the needs of the present generations while preserving their ability to meet the needs of future generations;
- Integrate environmental conservation and economic activities into the process of sustainable development;
- Meet national goals and international obligations by conserving bio-diversity, arresting desertification, mitigating effects of disasters, protecting the ozone layer and maintaining an ecological balance on earth.

2.2 Legal framework

2.2.1 Environmental Management and Coordination Act No 8, Cap 387

Section 58.(1) Of the Act 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 report to the Authority, in the prescribed form, giving the prescribed information and which shall be accompanied by the prescribed fee.

Relevance to the proposed project

Environmental Management and Coordination Act, Cap 387 provides a legal and institutional framework for the management of the environmental related matters. This report has been written pursuant to section 58 (1) of this Act.

2.2.2 Environmental Impact Assessment and audit regulations 2003

These regulations stipulate how an EIA project report should be prepared and specifies all the requirements that must be complied with. It highlights the stages to be followed, information to be made available, role of every stakeholder and rules to be observed during the whole EIA project Report making process. It also requires that during the EIA process a proponent shall in consultation with the Authority seek views of persons who may be affected by the project or activity.

Relevance to the proposed project

The proponent and consultants shall seek the views of the project neighbours through the use of questionnaires so as to ensure that their concerns are addressed in this report.

2.2.3 Water Quality Regulations (2006)

The Water Quality Regulations (2006) are contained in the Kenya Gazette Supplement No. 68, Legal Notice No. 120. Water Quality Regulations apply to water used for domestic, industrial, agricultural, and recreational purposes; water used for fisheries and wildlife purposes, and water used for any other purposes. Different standards apply to different modes of usage. These regulations provide for the protection of lakes, rivers, streams, springs, wells and other water sources. It is an offence to contravene the provisions of these regulations with a fine not exceeding five hundred thousand shillings. In addition, of immediate relevance to the proposed project for the purpose of this Project Report is Part II Sections 4-5 as well as Part V Section24.

Part II Section IV states that —Every person shall refrain from any act which directly or indirectly causes, or may cause immediate or subsequent water pollution. Part IV Section 24 states that —No person shall discharge or apply any poison, toxic, noxious or obstructing matter, radioactive wastes, or other pollutants or permit any person to dump any such matter into water meant for fisheries, wildlife, recreational purposes or any other uses. According to these regulations, —Every person shall refrain from any action which directly or indirectly causes, or may cause immediate or subsequent water pollution, and it shall be immaterial whether or not the water resource was polluted before the enactment of the Act.

Relevance

All waste water shall be channeled to the main drain so as not to pollute the ground and surface water and if a pollution incidence occurs the contractor/proponent shall notify the authority immediately.

Table; 1

Quality standards for domestic water sources

Parameter	**Guide Value (max allowable)**
pH	6.5 – 8.5
Suspended solids	30 (mg/L)
Nitrate-NO3	10 (mg/L)
Ammonia –NH3	0.5 (mg/L)
Nitrite –NO2	3 (mg/L)
Total Dissolved Solids	1200 (mg/L)
Scientific name (E.coli)	Nil/100 ml
Fluoride	1.5 (mg/L)
Phenols	Nil (mg/L)
Arsenic	0.01 (mg/L)
Cadmium	0.01 (mg/L)
Lead	0.05 (mg/L)
Selenium	0.01 (mg/L)
Copper	0.05 (mg/L)
Zinc	1.5 (mg/L)
Alkyl benzyl sulphonates	0.5 (mg/L)
Permanganate value (PV)	1.0 (mg/L)

Nil means less than limit of detection using prescribed sampling and analytical methods and equipment as determined by the Authority. And any other parameters as may be prescribed by the Authority from time to time

Quality standards for recreational water

PARAMETER	**MAXIMUM PERMISSIBLE LEVEL**
Arsenic (mg/l)	0.05
Fecal coliform (Counts/100 ml)	Nil
Total coliform (Counts/100 ml)	500
Cadmium	0.01
Chromium	0.1
Colour (True Colour Units)	100
Light Penetration (meters)	1.2
Mercury (mg/L)	0.001
Odour (Threshold Odour Number, TON)	16
Oil and Grease (mg/L)	5
pH	6 – 9
Radiation, Total (Bq/L)	0.37
Surfactant, MBAs (mg/L)	2
Temperature (^{0}C)	30
Turbidity (NTU)	50

And any other parameters as may be prescribed by the Authority from time to time

2.2.4 EMCA (Wetlands, riverbanks, lakeshores and Sea shore management) regulations, 2009

PART III – MANAGEMENT OF RIVER BANKS, LAKE SHORES AND SEA SHORE

General Principles.

17. The following principles shall be observed in the management and conservation of river banks, lake shores and the seashore; (a) Resources on the river banks, lake shores and the sea shore shall be utilized in a sustainable manner; (b) Environmental impact assessment as required under the Act shall be mandatory for all major activities on river banks, lake shores and the seashore; and (c) Special measures, including prevention of soil erosion, siltation and water pollution are essential for the protection of river banks, lake shores and the seashore.

Relevance

The Proponent has engaged WRMA in pegging the riparian reserve in an effort to conserve it and all efforts shall be put in place to protect the Kianjibe River from degradation.

2.2.5 EMCA (Waste management) Regulation, 2006

The Waste Management Regulations (2006) are contained in the Kenya Gazette No. 69, Legal Notice No. 121. The Waste Management Regulations are meant to streamline the handling, transportation and disposal of various types of waste. The aim of the Waste Management

Regulations are to protect human health and the environment. The regulations place emphasis on waste minimization, cleaner production and segregation of waste at source. The regulation requires licensing of transporters of wastes and operators of disposal site (sections 7 and 10 respectively). Of immediate relevance to proposed development for the purposes of this project report is Part II Sections 4(1-2), 5 and 6. Section 4 (1) states that —No person shall dispose of any waste on a public highway, street, road, recreational area or any other public place except in a designated waste receptacle. Section 4(2) and 6 explain that the waste generator must collect, segregate (hazardous waste from non-hazardous) and

dispose waste in such a facility that shall be provided by the relevant local authority.
Section 5 provides method of cleaner production (so as to minimise waste generation) which includes the improvement of production processes through conserving raw materials and energy. Section 11 provides that any operator of a disposal site or plant shall apply the relevant provisions on waste treatment under the local government act and regulations to ensure that such waste does not present any imminent and substantial danger to the public health, the environment and natural resources. Section 12 provides that every licensed owner or operator shall carry out an annual environmental audit pursuant to the provision of the act In section 14 (1) every trade or industrial undertaking is obliged to install anti-pollution equipment for the treatment of waste emanating from such trade or industrial undertaking.

Relevance

The Developer is expected to take all responsibility to ensure that solid waste is properly disposed by a solid waste collection company that has a valid license from the National Environment Management Authority (NEMA).

2.2.6 EMCA (Noise and Excessive Vibration Pollution Control) Regulations, 2009

These Regulations require that no person or activity shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise that annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment. In determining whether noise is loud, unreasonable, unnecessary or unusual, the following factors may be considered:

Time of the day;

- Proximity to residential area;
- Whether the noise is recurrent, intermittent or constant;
- The level and intensity of the noise;
- Whether the noise has been enhanced in level or range by any type of
- Whether the noise is subject to be controlled without unreasonable effort or expense to the person making the noise.

These regulations also relate noise to its vibration effects and seek to ensure no harmful vibrations are caused by controlling the level of noise. Part II Section 4 state that: except as otherwise provided in these Regulations, no person shall

a) Make or cause to be made excessive vibrations annoys, disturbs, injures or endangers the comfort, response, health or safety of others and the environment; or

b) Cause to be made excessive vibrations which exceed 0.5 centimetres per second beyond any source property boundary or 30 metres from any moving source.

Part III Section 2 (1) states that any person wishing to a) operate or repair any machinery, motor vehicle, construction equipment, pump, fun, air conditioning apparatus or similar mechanical device; or b) engage in any commercial or industrial activity, which is likely to emit noise or excessive vibrations shall carry out the activity or activities within the relevant levels provided in the First Schedule to these Regulations. Any person who contravenes this Regulation commits an offence.

Section 13 (1) states that except for the purposes in sub-Regulation (2) hereunder, no person shall operate construction equipment (including but not limited to any pile driver, steam shovel, pneumatic hammer, derrick or steam or electric hoist) or perform any outside construction or repair work so as to emit noise in excess of the permissible levels as set out in the Second Schedule to these Regulations. These purposes include emergencies, those of domestic nature and/or public utility construction.
Section 14 relates to noise, excessive vibrations from construction, demolition, mining or quarrying site, and state that: where defined work of construction, demolition, mining or quarrying is to be carried out in an area, the Authority may impose on how the work is to be carried out including but not limited to requirements regarding a) machinery that may be used, and b) the permitted levels of noise as stipulated in the Second and Third Schedules to these Regulations

*First schedule of (**Noise and Excessive Vibration Pollution Control) Regulations, 2009,*** Regulation 6(1) *shows the permissible Noise limit. See the table below;*

Table; 2

Maximum Permissible Noise Levels for General Environment

Zone	Sound level limit dB(A) Leq, 14h)		Noise Rating Level (NR) (leq, 14h)	
	Day	Night	Day	Night
Residential indoor	45	35	35	25
Residential outdoor	50	35	45	25
Places of worship	40	35	30	25
Silent Zone	40	35	30	25
Commercial	60	35	55	25

Mixed residential (with some commercial and places of entertainment)	55	35	50	25

Time Frame: use duration Day: 6.00 a.m - 10.00p.m.,Night: 10.00p.m - 6.00a.m
The time frame takes into consideration human activity

Relevance of the regulation

The contractor shall be required to implement these measures, ensure that all machineries are in good working condition to reduce noise. Also construction activities shall be between 0800Hrs-1700Hrs where possible obtain necessary authorization to extending working hours while ensuring that the neighbours are not disturbed.

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

The objective of these Regulations is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. The general prohibitions state that no person shall cause the emission of air pollutants listed under First Schedule (Priority air pollutants) to exceed the ambient air quality levels as required stipulated under the provisions of the Seventh Schedule (Emission limits for controlled and non-controlled facilities) and Second Schedule (Ambient air quality tolerance limits).

4. (l) These Regulations shall apply to-

a. All internal combustion engines;
b. All premises, places, processes, operations, or works to which the provisions of the Act and Regulations made there under apply; and
c. any other appliance or activity & at the Cabinet Secretary may by order in the Gazette, specify

(3) Notwithstanding paragraph (1) the following operations shall be permissible under this regulation provided that they are not used for the disposal of refuse

a) Back-burning to control or suppress wildfires;
b) Fire fighting rehearsals or drills conducted by fire service agencies
c) Traditional and cultural burning of savanna grassland
d) Burning for the purpose of public health protection; and
e) Emission of air pollutants from all stationary and mobile sources as set out under part1 of the fifth schedule

PART II - GENERAL PROHIBITIONS

5. (1) No person shall-

(a) Act in a way that directly or indirectly causes, or is likely to cause immediate or subsequent air pollution; or
(b) Emit any liquid, solid or gaseous substance or deposit any such substance in levels exceeding those set out in the First Schedule.

6. No person shall cause emission of the priority air pollutants prescribed in the Second Schedule to exceed the ambient air quality limits prescribed in the First Schedule.

7. No person shall cause the Ambient Air Quality levels specified in the First Schedule of these Regulations to be exceeded

8. (1) No person shall cause or allow particulate emissions into the atmosphere from any facility listed under the Fourth Schedule to these Regulations in excess of those limits stipulated under the Third Schedule

9. Any person, being an owner of premises, who causes or allows the generation, from any source, of any odour which unreasonably interferes, or is likely to unreasonably interfere, with any other person's lawful use or enjoyment of his property shall use recognized good practices and procedures to reduce such odours to a level determined by the odour panel, including any guidelines published by the Authority \for reducing odours

Relevance

The contractor shall implement the mitigation measures provided in the EMMP to prevent air pollution especially during construction phase.

2.2.8 Occupational Safety & Health Laws and Regulations

The following pieces of legislation form the basis for occupational safety and health matters in Kenya:

The Occupational Safety and Health Act, No. 15 of 2007

His Excellency the President assented to this Act on 22nd October 2007 and the date of commencement declared as 26th October 2007. This is the main operational law for health and safety in Kenya today. Its enactment led to the repeal of the Factories and Other Places of Work Act, Chapter 514 of the Laws of Kenya.

Work Injury Benefits Act, No. 17 of 2007

This law was assented to by His Excellency the President on 22nd October 2007 and the date of commencement is still contentious and the matter on various other sections is in court. This is an act of parliament designed to provide for compensation to employees for work-related injuries and diseases contracted in the course employment and for connected purposes. This is the law whose enactment led to the demise of the Workmen Compensation Act.

Rules and Regulations

The following rules have been promulgated by the Minister for Labour as provided for in the statues in the furtherance of the safety & health agenda in various applicable workplaces, processes, occupations and branches of the economy:

i. The Factories and Other Places of Work(Safety & Health Committee) Rules, 2004
ii. The Factories and Other Places of Work(Fire Risk Reduction) Rules, 2007
iii. The Factories and Other Places of Work(Hazardous Substances) Rules, 2007
iv. The Factories and Other Places of Work(First Aid) Rules, 1977
v. The Factories (Eye Protection) Rules
vi. The Factories and Other Places of Work(Electric Power(Special) Rules, 1979
vii. The Factories (Docks) Rules, 1962
viii. The Factories (Building Operations and Works of Engineering Construction) Rules, 1984.
ix. The Factories and Other Places of Work(MEDICALEXAMINATION) Rules, 2007

These rules apply in all workplaces where The Occupational Safety and Health Act, No. 15 of 2007 applies.

(c) Health and Safety Committee Rules

These rules are described in Legal Notice No. 31 of the Kenya Gazette Supplement No. 25 of 14th May 2004. The rules apply to all factories and other places work that regularly employ twenty or more employees. Among other items, the rules state that:

- The occupier of every factory or other workplace shall establish a health and safety committee;
- The committee shall consist of safety representatives from the management and the workers;

- The factory occupiers shall appoint a competent person from the management staff to be responsible for safety, health and welfare in the factory or workplace; and the person appointed shall be the secretary to the committee.
- Every member of the Health and Safety Committee shall undertake a prescribed basic training course in occupational health and safety within a period of six months from the date of appointment or election, and thereafter further training from time to time;
- The occupier of every factory or workplace shall cause a health and safety audit of the workplace to be carried out at least once in every period of twelve months by a registered health and safety adviser.

The Legal Notice also describes the functions and duties of the health and safety committee, the purpose of meetings and recording minutes, and the roles of the office bearers. It further describes the duties of the occupier and those of the Health and Safety Adviser.

(d) Noise

Kenya's Noise Prevention and Control Rules were passed in Legal Notice No. 296, dated 1996, as a subsidiary legislation of the Factories Act, and state that '*No worker shall be exposed to noise level excess of the continuous equivalent of 90 dBA for more than 8 hours within any 24 hours duration'*.

2.2.9 The Traffic Act, 2012

The Traffic Act, 2012 gives provisions and guidelines that govern the Kenya roads transport sector. These guidelines are essential to private, public and commercial service vehicles in ensuring safety and sanity on the roads hence ensuring the environment; the human being a component is safeguarded. In section 41 The Act demands for installation and certification of speed governors for the commercial vehicles ferrying goods adjusted to the loading condition of such vehicles to a limit of 80 KPH, registration and competence of drivers.
Moreover, the owner of commercial vehicles or trailer shall ensure clear markings on their vehicles in English language on the right side of the vehicle showing ownership details, tare weight of vehicle and maximum authorized weight.
Section 26 and 27 of the same discourages engines that emit exhaust gases to the atmosphere without passing via a silencer or expansion chamber

In ensuring safety of all the persons in transit section 56 encourages that every public and commercial vehicle be fitted with inspected and first class first aid box and fire extinguisher. In ensuring compliance to this Act the contractor and

developer shall ensure that all site drivers and all material suppliers to the site satisfy the provisions as stipulated in Act.

2.2.10 The Land Act, 2012

This is an ACT of Parliament to give effect to Article 68 of the Constitution, to revise, consolidate and rationalize land laws; to provide for the sustainable administration and management of land and land based resources, and for connected purposes. The Land Act of 2012 subsection (1) states that 'any land may be converted from one category to another in accordance with the provisions of this Act or any other written law.' it continues to state in subsection (2) that

Without prejudice to the generality of subsection (1)
a) Public land may be converted to private land by alienation
b) Subject to public needs or in the interest of defense, public safety, public order, public morality, public health, or land use planning, public land may be converted to community land
c) private land may be converted to public land by
i. Compulsory acquisition;
ii. Reversion of leasehold interest to Government after the expiry of a lease; and
iii. Transfers; or
iv. Surrender.

(d) Community land may be converted to either private or public land in accordance with the law relating to community land enacted pursuant to Article 63(5) of the Constitution.

It is important to note that any substantial transaction involving the conversion of public land to private land shall require approval by the National Assembly or county assembly
as the case may be.
Part I of the same Act states that title to land may be acquired through—
(a) allocation;
(b) land adjudication process;
(c) compulsory acquisition;
(d) prescription;
(e) settlement programs;
(f) transmissions;
(g) transfers;
(h) long term leases exceeding twenty-one years created out of private land; or
(i)any other manner prescribed in an Act of Parliament.

Part viii of this ACT provides procedures for compulsory acquisition of interests in land. Section 111 (1) States that if land is acquired compulsorily under this Act, just compensation shall be paid promptly in full to all persons whose interests in the land have been determined. The Act also provides for settlement programmes. Any dispute arising out of any matter provided for under this Act may be referred to the Land and Environment Court for determination.
In ensuring that no contravention to this Act is done, the proponent acquired the land through a 99 years leasehold and has applied for necessary approvals requisite to the proposed development i.e. amalgamation and change of user approvals.

2.2.11 The Energy (Solar Water Heating) Regulations, 2012 Installation and use of solar water heating systems

All premises within the jurisdiction of a local authority with hot water requirements of a capacity exceeding one hundred litres per day shall install and use solar heating systems.

A person who contravenes the provisions of this regulation commits an offence and shall, on conviction, be liable to a fine not exceeding one million shillings, or to imprisonment for a term not exceeding one year, or to both.

Responsibility for compliance

6. (1) A developer of a housing estate, a promoter of the construction, an owner of the premises or an Architect or an Engineer engaged in the design or construction of premises shall comply with these Regulations.
(2) An owner of premises, Architect and an Engineer engaged in the design, construction, extension or alteration of premises shall incorporate solar water heating systems in all new premises designs and extensions or alterations to existing premises.
(3) An owner or occupier of premises that has a solar water heating system shall use and carry out the necessary operational maintenance and repairs required to keep the installation in good and efficient working condition.
(4) An electric power distributor or supplier shall not provide electricity supply to premises where a solar water heating system has not been installed in accordance with these Regulations.

Relevance

In compliance to these regulations solar energy shall be adopted for water heating.

2.2.12 The Local Government Act (Cap. 265)

Section 160 helps local authorities ensure effective utilization of the sewerage systems. It states in part that municipal authorities have powers to establish and maintain sanitary services for the removal and destruction of, or otherwise deal with all kinds of refuse and effluent and where such service is established, compel its use by persons to whom the service is available.

Relevance to the proposed project

The appointed contractor and the Proponent will mitigate against such impacts by ensuring strict adherence to the Environmental Management Plan provided in this project report throughout the project cycle.

2.2.13 Persons with Disability Act (PWD), 2003

Kenya has a Person with Disabilities Act (PWD), 2003 which is a comprehensive law covering rights, rehabilitation and equal opportunities for people with disabilities.

- It creates the National Council of Persons with Disabilities as a statutory organ to oversee the welfare of persons with disabilities.
- The Act aims to ensure that Persons with Disabilities' issues and concerns are mainstreamed.
- Requires establishment of DMCs in all public institutions

Section 21 of this Act entitles Persons with disabilities 'to a barrier-free and disability-friendly environment to enable them to have access to buildings, roads and other social amenities, and assistive devices and other equipment to promote their mobility'.

The Proponent shall ensure that the main contractor adopts implements and mainstream PWD Provisions throughout the project phases.

2.2.14 Water Act, 2002

This Act of Parliament provides for the management, conservation, use and control of water resources and for the acquisition and regulation of rights to use water; to provide for the regulation and management of water supply and sewerage services; to repeal the Water Act (Cap. 372) and certain provisions of the Local Government Act. Section 25 (1) states that a permit shall be required for any of the following purposes:— (a) Any use of water from a water resource, except as provided by section 26; (b) The drainage of any swamp or other land; (c) The

discharge of a pollutant into any water resource; (d) Any purpose, to be carried out in or in relation to a water resource, which is prescribed by rules made under this Act to be a purpose for which a permit is required.

Relevance

Not applicable as the proponent will not be abstracting water from the dam or river.

2.2.15 Land Planning Act cap 303

Section 9 of the subsidiary legislation (the development and use of land Regulations 1961) under which it require that before the local Authority to submit any plans to then minister for approval, steps should be taken as may be necessary to acquire the owners of any land affected by such plans. Particulars of comments and objections made by the landowners should be submitted, which intends to reduce conflict of interest with other socio economic activities.

Relevance to the proposed project
The proponent shall submit architectural plans to Kiambu County Government for approval.

2.2.16 Physical Planning Act, 1999

Part V—Control of development 30. (1) No person shall carry out development within the area of a local authority without a development permission granted by the local authority under section 33. (2) Any person who contravenes subsection (1) shall be guilty of an offence and shall be liable to a fine not exceeding one hundred thousand shillings or to an imprisonment not exceeding five years or to both. (3) Any dealing in connection with any development in respect of which an offence is committed under this section shall be null and void and such development shall be discontinued. (4) Notwithstanding the provisions of subsection (2)— (a) The local authority concerned shall require the developer to restore the land on which such development has taken place to its original condition within a period of not more than ninety days; (b) If on the expiry of the ninety days notice given to the developer such restoration has not been effected, the concerned local authority shall restore the site to its original condition and recover the cost incurred thereto from the developer.

31. Any person requiring development permission shall make an application in the form prescribed in the Fourth Schedule, to the clerk of the local authority responsible for the area in which the land concerned is situated.

The application shall be accompanied by such plans and particulars as are necessary to indicate the purposes of the development, and in particular shall show the proposed use and density, and the land which the applicant intends to surrender for— (a) Purposes of principal and secondary means of access to any subdivisions within the area included in the application and to adjoining land; (b) Public purposes consequent upon the proposed development. 36. If in connection with a development application a local authority is of the opinion that proposals for industrial location, dumping sites, sewerage treatment, quarries or any other development activity will have injurious impact on the environment, the applicant shall be required to submit together with the application an environmental impact assessment report.

Relevance to the proposed project

This Act provides for order in terms of development execution. The proponent shall submit the project designs to the local authority for approval. This development shall also comply with all the provisions of this law including vertical zoning requirements.

2.2.17 Building Code 2000

Section 194 requires that where sewer exists, the occupants of the nearby premises shall apply to the local Authority for permit to connect to the sewer line and all the wastewater must be discharged in to sewers. The code also prohibits construction of structures or building on sewer lines.

2.2.18 The Penal Code (Cap. 63)

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

Relevance to the proposed project

The Proponent will be required to ensure strict adherence to the Environmental Management Plan throughout the project cycle in order to mitigate against any possible negative impacts

3.0 DESCRIPTION OF THE PROJECT

3.1 Introduction

This section describes and highlights various aspects and design related to the proposed gated resort. The aspects include the following: Client's brief, location, access and design and response to the environment.

The proposed project is planned in such a way that will embrace the *Symbiocity approach*, a conceptual frame work for sustainability urban development.

Also, the proposed project will embrace the Green Building design whose objective is to reduce the overall impact of the built environment on human health and the natural environment by:

- Efficiently using energy, water, and other resources
- Protecting occupant health and improving employee productivity
- Reducing waste, pollution and environmental degradation

3.2 Project location

The environmental impact assessment (EIA) was carried out for the proposed Construction of Tatu Waters, a 2,715 unit medium density residential development (basically Multi-family and town houses of 2, 3, and 4 bedroom (402 two bedroom, 1,294 three bedroom, 1019 four bedroom) with associated amenities, along the C63 Ruiru to Kiambu highway in Kiambu County

Tatu City lies approximately 17km North-East from the centre on Nairobi, directly west of and bordering on the outskirts of Ruiru town, and 6.5km east of Kiambu town. Kenyatta University is situated approximately 5km south east of the site. The site is situated directly in the path of continuously growing urban development extending northwards from Nairobi.

The site, total area of approximately 100.22 Ha, is currently heavily vegetated, containing a coffee plantation and some 2000 trees of differing species most of which are located in Kianjibe and Kamiti Rivers. There are 34 different species of trees including Mugumo trees which have been reserved. The site also contains a school, dispensary and some residences with dirt access roads to the north and west. Between the C63 highway and the proposed eastern end of the development there is a lake formed by a dam that will form the feature public space in the

finished development. Construction and future access will be provided by junctions on the C63 highway.

The major nearby road is the A2-Thika-Nairobi superhighway which lies 4.5 km east of Tatu; the C65 Road which is located 1.5km to the north of the site and also connects with Ruiru and Kiambu Road (C63) which connects the western part of the site with Kiambu and Nairobi.

The site falls within an originally developed coffee plantation area, which to date has been uprooted to create land for the developments within Tatu City.

Picture: View of the proposed site from Tatu house

3.3 Project Description and design

Tatu Waters work like if it was a town within a city because it has the identity of a town where social relationship and welfare take place, but it is also provided with a remarkable amount of services and amenities to be considered as a city. It weaves together both cultural heritage and local identity

The proposed project will consist of residential homes, public facilities, open spaces and road networks and infrastructure.

There are two main residential sets; multi-family houses and several low density town houses. There will be a great diversity of houses and typologies provided with wide interior spaces, terraces and private gardens and parking lots.

Table; 3

TERRITORY BALANCE		
USE	**PLOT AREA (Ha)**	**% Land Use**
Residential	49.81	49.70%
Public Open space	30.20	30.14%
Public Facilities	9.69	9.67%
Infrastructure	0.16	0.16%
Road Network	10.35	10.33%
	100.22	100%

MULTI-FAMILY HOUSES

The **multi-family** houses are organized in condos and they are located on the west side of downtown, inside the area delimitated by the green loop. The condos will have communal spaces with pools and gardens, they will have elevators and parking lots, and they will be named as the groves. Multi-family are organized in Condos and each court has a security perimeter fence provided with vegetation to control the access to the community and make it safe for the residence**.** This perimeter encloses a communal garden with local trees, vegetation and a pool of water. The condos have a semi-underground parking designed not to interfere the views nor spatial continuity. They are provided with interior streets to distribute the traffic inside the residential area.

TOWNHOUSE

Townhouses are located on the east side of the town and also on the east side of downtown inside the green loop. Town houses will have private terraces, gardens and parking plots. They will be named as the Estuaries**.** Town houses are organized in courts and each court has a security perimeter fence provided with vegetation to control the access to the community and make it safe for the residence**.** This perimeter encloses a communal garden with local trees, vegetation and a pool of water. (**Check the master plan layout for more details)**

The total number of units for both multi-family and town houses will sum to a total of **2,715, 5,136 parking units, public green area measure 30.20 Ha, facilities and commercial will cover an area of 9.69 Ha, infrastructure including electrical substation 1&2 will cover an area of 0.16 Ha and road network will cover an area of 10.35 HA** as per the master plan annexed.

THE PUBLIC FACILITIES AND INFRUSTRUCTURE

The public facilities and infrastructure included in the project are;

- **The Edge**-it is a commercial area located on the west side of the town. it is provided with supermarket, retails, restaurants, cafes, a business hub and kindergaten
- **The Nova academies primary school and sports area**-Nova Group of schools are international schools. The primary school will be part of Tatu Waters development where as the high school is located on the west side of the town. The sports area is designed for both the school and the public
- **Sales office, polyclinic and hotel**.-Located at the north of the town inside Kianjibe park and close to the entrance and with a separate access from the retail centre
- **The central plaza area**. It is a plaza that has stores, restaurants and cafes, a bank ,a supermarket, post office, an academy, a gym and a health care centre
- **The highline area**-It is a green corridor provided with stores and sports club
- **The sanctuary area**-it is a garden provided with an academy, a cafe, a kindergarten and conveniences store
- **Infrastructure**-An existing substation

Photo; Nova Girls high school on the west of the project site

Public spaces framework

The public spaces can be defined as meeting spaces and consist of; plazas and parks and other spaces that connect them such as green corridors or green loop. The specific public spaces in Tatu waters are as follows

- **The Kianjibe Park;** It is a large natural space provided with local flora and fauna it has a water pool in the middle and is located in the north
- **Central plaza;** It is the main staying spaces in town and is located in its core
- **The highline;** It is a green corridor that connects two natural ecosystems; The Kianjibe River park (north) and Kamiti River valley (south)
- **The sanctuary;** It is the garden located on the east that surround Tatu house
- **The green loop;** It is a green circulation ring provided with local vegetation that surrounds down town. There is a ring Avenue that runs along the green loop, which supports vehicular traffic

The over 30 % of land use being allocated to public Open space is a key objective of green building principle of ensuring efficiently using energy, water, and other resources; Protecting occupant health and improving employee productivity and Reducing waste, pollution and environmental degradation

MOBILITY NETWORK

The road network

The mobility in Tatu waters will operate as an autonomous network, connected by the two points with the outside through the C63.This allows to create a clear functional hierarchy, Access roads from/to the outside (level 1) main avenue linked to the first level to distribute the flow and finally a group of local streets to give direct access to the residential area. Furthermore there will be a four road level within each housing to distribute the traffic inside it.

The layout of the road network is based on the topography. Within the town there will be a speed limit of 15km/h to guarantee comfortable conditions for pedestrian to walk through downtown

Soft modes

A soft mobility network is overlapped to the road grid. The pedestrians and bicycles paths are both integrated with the road network or through the green open spaces as an independent structure.

The Tatu waters, network is a way of mobility integrated in the roads and providing accessibility to the different functional spaces (point of access to facilities, residential e.t.c)

Photo: Main Entrance to the Tatu City

3.3.1 Infrastructure

The premise will have a comprehensive infrastructure including adequate parking space of 5,136, water storage facilities, electricity distribution with 2 substations and security considerations amongst other facilities.

3.3.2 Water reticulation system

Piped water from **RUJU-WASCO** will be used during both construction and occupation phases. More so there will be water storage tanks to increase water capacity at the project site to the required amount. Underground water tanks may be installed to ensure appropriate pressure at all times. Roof catchment has also been proposed to provide water for gardening and pavement washing.

Photo; Tatu City water supply station

3.3.3 Waste / Sewerage

Tatu City has concluded the general development of sewerage infrastructure within the city. It will be easier for the proponent to connect to the main sewer .All effluent discharge will drain to RUJU-WASCO main sewer.

Solid waste management will consists of dustbins cubicles (waste receptors) located appropriately within the compound and building to the main entrance of the compound. Waste Segregation at source will also be practiced. The wastes will be protected from rain and scavenging animals. This waste will then be collected by a contracted waste transporter registered as such by NEMA as per the Environmental Management and Coordination (Waste Management) Regulations 2006 for disposal in NEMA licensed disposal facilities.

3.3.4 Storm water run-off

The proposed project is designed in away such that all storm water network that collect water from the higher areas of town to the lower side of the town ones through a swale system.

The storm water routes follows the topography of site until it reaches the Kianjibe river or the Kamiti river .The swales are either located on the side of the streets or in the middle. The swales are then connected to the water features that are situated all over the town to generate a pleasant waterscape for the residents to enjoy

There are a number of reservoirs and storm water ponds to store water in order to slow it down and to provide the town with water deposits that might be used in case of fire.
Besides, this water network does not mix rain water with sewage.

The storm water network provides the proposed project with an efficient eco-friendly system to deal with rain water. Therefore it improves the bioclimatic behavior of the town and it reduces the amount of energy to manage rainwater

There will be rain water gutters in the roofs of all the building to facilitate storm water collection. All storm water drainage will be run into the open storm water drainage. There shall be soil water pipes (SVP) to be provided at the heads of all drainage systems. All drains passing beneath buildings and driveways will be encased in concrete surround and fitted with oil water interceptors.

Picture; Dam located in the proposed site to be preserved for aesthetics

3.3.5 Security

Tatu Waters have considered two elements in terms of security; the security lines, the accesses and the security office control all the said elements.

The security boundaries are divided in three levels;

- The perimeter fence of Tatu Waters around the site is the main line of security and will be controlled from the central security office. The boundary tract allows the security patrols to access to any point of Tatu Waters
- The security fence of the public facilities allows the access to the town from the outside
- The townhouses and condominium estates will have soft boundaries

Accesses

There are three accesses to the proposed development

- There are two entrances to the proposed development with checkpoints, vehicular, pedestrian and bicycle access
- Controlled accesses to the public facilities from outside and from inside Tatu waters and is only for residents
- Barriers for vehicular, pedestrian and bicycles access to the condominiums and town houses

All the security systems will be controlled from the central security office located in the central plaza

A reputable security company will be employed to deliver the security services as required.

3.3.6 Parking area and driveway

As per the master plan there are enough spacious parking spaces of 5,136 in total. The car parks will be well demarcated and provided with lights. The parking bays will be inclined to a degree that does not allow stagnation of water and thus linked to storm water drainage system. The parking units are shown in the table below

Table; 4

Plot	Type	On-street	Front Yard	Below Grade	Total
R-01	Multifamily	133	0	225	358
R-02	Multifamily	159	0	279	438
R-03	Multifamily	195	0	351	546
R-04	Mult./TownH	116	56	90	262
R-05	Mult./TownH	131	59	90	280
R-06	Townhouse	119	64	0	183
R-07	Townhouse	117	101	0	218
R-08	Townhouse	270	150	0	420

R-09	Townhouse	124	79	0	203
R-10	Townhouse	261	117	0	378
R-11	Townhouse	262	0	0	262
R-11b	Townhouse	81	84	0	165
TOTAL PARKING INSIDE RESIDENTIAL COURTS					3,713
ON-STREET PARKING AND PUBLIC PARKING LOTS					1,008
PARKING PLACES FOR RESIDENTIAL					4,721
FACILITIES PLOTS-PARKING PLACES					415
TOTAL PARKING PLACES IN TATU WATERS					**5,136**

3.3.7 Landscaping

There will be landscaped gardens using plant species available locally. This will include establishment of flower gardens to improve the visual quality of the site.

A functional landscaping and tree planting scheme will be undertaken to protect the Kianjibe River and to give the required and desired open space and recreational facility. Required expertise shall be put in place to guide the aesthetic and beautification programme for the proposed Tatu waters. An estimated 2000 trees will be planted during the landscaping and tree planting scheme. This is an estimation as the proponent will replace every tree removed with 3 replacements. Indigenous trees like the Mugumo trees and other trees of cultural importance together with all high value trees will be retained. A distance of 50m has been considered as per the SEA. Where the plots encroaches the environmental restricted areas, the proponent is advised not to interfere with it and/or obtain necessary authorization from WRMA and NEMA. The proponent in the design of the project has incorporated the strategies to improve the areas in its natural condition where necessary.

When overhead distribution lines are located within or adjacent to a road right-of-way, there should be sufficient width to permit the growth of trees adjacent to the transmission line, consistent with the applicable operations, maintenance, and safety requirements. The purpose of the landscaping is to divert attention from the overhead lines and, preferably, obscure views of the overhead line from the travel-way and adjacent residential areas.

3.4 Description of the project's construction activities

3.4.1 Pre-construction investigations

The implementation of the project's design and construction phase started with thorough investigation of the site biological and physical resources during the SEA study in order to minimize any unforeseen adverse impacts during the project cycle.

3.4.2 Clearing of Vegetation

The proposed site was initially a coffee plantation but has been cleared of to pave way for the upcoming development. Tree planting and beautification programme will compensate for the cleared vegetation later based on replacement ratio of 1 to 3.

3.4.3 Sourcing and transportation of building materials

Building materials will be transported to the project site from their extraction, manufacture, or storage sites using transport trucks. Greater emphasis will be laid on procurement of building materials from within the local area, which will make both economic and environmental sense as it will reduce negative impacts of transportation of the materials to the project site through reduced distance of travel by the materials transport vehicles.

Furthermore selection of contractor and transporter will be determined by their environmental credentials. For instance, company's environmental practices, compliance to Environmental Audit Requirements and compliance to Waste Management Regulations 2006 will form part of environmental credentials to be considered.

3.4.4 Storage of materials

Building materials will be stored on site. Bulky materials such as rough stones, ballast, sand and steel will be carefully piled on site. To avoid piling large quantities of materials on site, the proponent will order bulky materials such as sand, gravel and stones in bits. Materials such as cement, paints and glasses among others will be stored in temporary storage structures, which will be constructed within the project site for this purpose.

3.4.5 Excavation and foundation works

Excavation will be carried out to prepare the site for construction of foundations, pavements and drainage systems. This will involve the use of heavy earthmoving machinery such as tractors and bulldozers.

3.4.6 Masonry, concrete work and related activities

The construction of the building walls, foundations, floors, pavements, drainage systems, and parking areas among other components of the project will involve a lot of masonry work and related activities. General masonry and related activities will include stone shaping, concrete mixing, plastering, slab construction, construction of foundations, and erection of building walls and curing of fresh concrete surfaces. These activities are known to be labour intensive and will be supplemented by machinery such as concrete mixers.

3.4.7 Structural steel works

The building will be reinforced with structural steel for stability. Structural steel works will involve steel cutting, welding and erection.

3.4.8 Roofing

Roofing activities will be the last activity to be done; the proponent will decide the kind of material to use in doing the roofing. The proponent is urged to use environmental friendly roofing materials.

3.4.9 Electrical work

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

3.4.10 Plumbing

Installation of pipe-work for water supply and distribution will be carried out within the building and associated facilities. In addition, pipe-work will be done for

drainage of excess storm water from the rooftop into the peripheral storm water drainage system. Plumbing activities will include metal and plastic cutting, the use of adhesives, metal grinding and wall drilling among others.

3.5 Description of the project's operational activities

3.5.1 Occupation

During operation phase there will be production of domestic and sanitary wastes which has to be disposed of in an environmentally sound manner as discussed below.

3.5.2 Solid waste and waste water management

The occupants will be provided with facilities for handling solid waste generated .These will include dustbin cubicles for temporarily holding waste within the premises before final collection and disposal by appropriate contracted firm licensed by NEMA as per the Waste Management Regulations, 2006. Segregation at source will be emphasized.

Sewage generated from the building will be discharged into the main sewer line by RUJU-WASCO, while storm water from the project area will be channeled from high areas to lower areas through a swale system which are located at the side of streets; it drains all storm waters to Kianjibe River or the Kamiti River.

3.5.3 Cleaning

The proponent will contract a cleaning company to undertake the cleaning of the entire estate including cleaning of the compound; maintain the recreational parks, cleaning of streets and frontage gardens among other areas.

3.5.4 General repairs and maintenance

The buildings and associated facilities will be repaired and maintained regularly during the operational phase of the project. 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 green areas and replacement of worn out materials among others.

3.6 Description of the project's decommissioning activities

It is envisaged that the lifespan of buildings of this nature is between 50 to 80 years. When such a time come for the decommissioning of the building for any other reason, and then a decommissioning plan as outlined in this report will be adhered to guide the phase.

3.6.1 Building End of Life Situation

Demolition works and Dismantling of Equipment and Fixtures-In a situation where the building have completed their useful life the decommissioning process will involve demolition of the existing buildings, dismantling of plant equipment and fixtures (electrical installations, furniture partitions, pipe-work and sinks among others), clearing of the site, and reclaiming or restoring the affected land into a natural condition. The demolition process will entail removal of roofing using crowbars and hammers, breaking of walling and reinforced slabs using sledge hammers and/ or jack hammers which utilize compressed air and lowering of materials from high to low levels.

The exercise will therefore entail working at high level and all the necessary health and safety measures will need to be implemented including provision of personal protective equipment such as harnesses, helmets, gloves, respirators, safety shoes, coveralls, goggles and ear protectors.

In addition, all debris generated from the demolition process will need to be cleared from the site and dumped at the approved disposal facility. However some of the debris may be used as base material in new construction works.

Site Restoration-Once all the waste resulting from demolition and dismantling works is removed from the site, the site will be restored through replenishment of the topsoil, landscaping and re-vegetation using indigenous/suitable plant species (if no alternative use will be proposed). If alternative use is proposed the proposal shall adhere to laid down rules and guidelines governing development of that nature then.

3.6.2 Change of Use Situation

A change of use may arise before the buildings complete their useful life. In this case the proponent may decide to alter and/ or recondition the existing buildings. Change of use may also involve the transfer of equipment and materials from the site for appropriate disposal or reuse. Disposal of the equipment will either involve selling those that will not have completed their useful life to engineering workshops

undertaking similar operations or selling those which will have become “dead” to scrap dealers.

In order to affect the change of use, the project proponent will be required to seek a written consent from the council and the Ministry of Lands in which case a public notice in relation to the change of use will be published in the local newspapers to inform all the interested parties.

The proponent will need to follow the safety guidelines issued in the Kenya Gazette supplement No.13, Legal Notice No. 40, parts IX and X during the demolition process

4 PUBLIC PARTICIPATION

4.1 Introduction

In conducting the EIA, the EIA expert is required to seek views of the most likely affected immediate public/neighbor/institution. The views are of paramount importance in ensuring optimal operations and therefore sound environmental performance.

Prior to the commencement of implementation of the master plan proposals, a community consultation was undertaken with the local community including workers likely to be displaced by the project. Adjacent property owners were also consulted with respect to mitigation measures affecting their property and jointly develop a program to implement the required measures where relevant and consistent with statement of communities.

Interviews were carried out in the neighborhood by the use of questionnaires (attached), to find out all the views from the neighbors' towards the gated housing project. The site falls within agricultural area dominated with coffee plantation and shrub vegetation. Other associated developments include electricity supply, water, sewer (to be developed) and other infrastructure.

The main purpose for such interviews was to identify the positive and negative impacts and subsequently promote and mitigate them respectively. It also helped in identifying any other miscellaneous issues which may bring conflicts in case project implementation proceeds as planned. The following are main concerns raised by the neighboring companies.

4.1.1 Noise and dust

There was concern over the possibility high noise and dust levels in the project site as a result of construction works. The sources of noise pollution will include transport vehicles, construction machinery and metal grinding and cutting equipment. Concern was raised over possibility of generation of large amount of dust within the project site and surrounding areas as a result of transportation of building materials. It was suggested by some neighbors that the construction material should be transported to the site during weekdays and not on weekends and there should be sprinkling of water on loose ground to control dust.

4.1.2 Security and Loss of Jobs

Some residents expressed confidence that the project through development of the residential apartments and employment of guards, the security of the area will be enhanced. Other also fears that the removal of coffee plantations will lead to loss of jobs among the youth currently working in the plantations and this may lead to insecurity in the neighborhood.

4.1.3 Aesthetics and solid waste generation

It was seen that there will be minimal effect on the aesthetics of the area. Any disturbance of vegetation during construction works should be replaced through a functional landscaping and tree planting scheme. However it was suggested that the proponent should ensure high hygiene standards within the premise and surrounding areas during construction possibly by landscaping. Generation and sound handling of solid wastes during construction and operation was also a concern. Decent behavior of the construction workforce has also been emphasized by the neighbors.

4.1.4 Pressure on the infrastructure (water, sewer and roads)

Major concern was pressure on the existing infrastructure (water, need for sewer facility and roads). The proponent will ensure that proposed water and sewerage reticulation system is evaluated and approved by the zonal service providers. **Functional traffic management plan shall also be put in place to control traffic into and out of the proposed developments.** Adequate parking spaces have been proposed.

In relation to this was the positive comment on the low occupational density and the blending of the proposal with the surrounding.

4.1.5 Creation of employment

Other also felt that the project offers opportunity for employment because of its nature and by considering its size it will create both directly and indirectly to the employment of a large number of people such as masons, plumbers, and food vendor's etc.

4.1.6 Riparian interference

Other residence of Kiambu expressed the concern of Kianjibe, Mukuyu, Kamiti river and other water bodies being interfered with by the developer. There was the fear of losing water sources which have been contributing a lot to them.

5.0 BASELINE INFORMATION OF THE STUDY AREA

5.1 Introduction/Data information gathering procedure

Project information was gathered through discussions with the project proponent. Site visits were also undertaken for investigation of the site status and environmental status in the immediate neighborhood. In addition, a review of the proposed project operations and activities and the intended raw materials inputs was carried out at the preliminary stages of this assessment. Project records on approvals and permits from the relevant Government Departments were reviewed. Other physical observation taken into consideration were the geological status, drainage systems, water supply and waste disposal in the area, land-use patterns as well the typical socio economic activities around the proposed site.

A field database addressing various aspects of the proposed project and the environment had been pre-prepared for use in the data/information gathering. The datasheet was adopted from the international Environmental protocol, tailored to address issues listed in the Environmental (Impact Assessment and Audit) Regulations 2003.

5.2 Description of the area

5.2.1 The site Location

The environmental impact assessment (EIA) was carried out for the **proposed** Construction of 2,700 unit medium density residential development with associated amenities by Tatu City for Tatu Waters along the C63 Ruiru to Kiambu highway in Kiambu County

Tatu City lies approximately 17km North-East from the centre on Nairobi, directly west of and bordering on the outskirts of Ruiru town, and 6.5km east of Kiambu town. Kenyatta University is situated approximately 5km south east of the site. The site is situated directly in the path of continuously growing urban development extending northwards from Nairobi.

5.2.2 Biophysical Environment- Land use

The area is currently zoned for agricultural use. An application for extension of user from agricultural to include mixed use development (of residential, commercial and light industrial with requisite infrastructure) has been made to the Ministry of lands and Thika County Council. The Tatu City Master Plan was

approved by NEMA and other regulatory authorities through SEA process. It is important that the Master plan and/or land use plan considers: Protection of ecologically sensitive environment (Mukuyu and Kianjibe rivers), adequate parking spaces per unit, provision for Comprehensive infrastructural development in the area e.g roads, waste management infrastructure, waste water treatment facility, security.

5.2.3 Topography

The plot is gently sloping with a coffee plantation, shrubs and trees. In the vicinity of the project area are rivers, water pans, wetlands and a dam. These ecologically sensitive areas have been planned for protection and conservation. While there are no wildlife/wildlife corridor in the vicinity of the project site, presence of some few herbivores and birds were noted due to the vegetative nature of the site.

5.2.4 Geology and Soils

The location ground is predominantly red soil which has high load bearing capacity and therefore not prone to flooding during the rainy season. An elaborate drainage measures and appropriate foundation structure have been designed for this geology.

5.2.5 Climate conditions

The climate in Kiambu is warm and temperate. There is a great deal of rainfall in Kiambu, even in the driest month. This climate is considered to be Cfb according to the Köppen-Geiger climate classification. The temperature here averages 18.8 °C. In a year, the average rainfall is 962 mm.

The driest month is July, with 18 mm of rain. The greatest amount of precipitation occurs in April; with an average of 212 mm. March is the warmest month of the year. The temperature in March averages 20.4 °C. The lowest average temperatures in the year occur in July, when it is around 16.4 °C

5.2.6 Water source

About 90 percent of the county's water resources comprise of both surface and ground water resource potential. Domestic water supply has recorded a noticeable growth over the last 5 years; 35 percent of the population has access to potable water**.(http://www.kiambu.go.ke/about/water-resources)**

5.2.7 Flora and Fauna

Flora

The project area is generally characterized by coffee a plantation which is currently being cleared of, exotic kind of trees including mugumo which are preserved, vegetation such as shrubs, acacia, Aloe Vera and grass among others. The trees are estimated to 2000 in number 34 species .The project site is dominated by grass, scattered, shrubs and papyrus reeds in the swampy areas located within the proposed plot such as the rivers ,dams and other water pools. The only environmental sensitive feature in the site is the swampy pool within, no rivers and no lakes nor any other water sources.

Fauna

The water pools in near and within the area contain Hippopotamus and at times visit the site in search of the pasture, Crocodiles also exist in the area and pause a threat to the residence. Other kinds of fauna in the area include amphibians, small mammals, insects and bird species. There are no wildlife corridors in the proposed site.KWS are in contact with the client Tatu City in controlling the wildlife in the area

5.3 Socio Economic Environment

5.3.1 Population Size and Composition

According to the 2009 Kenya Population and Housing Census, Kiambu County population for 2012 was projected to be 1,766,058 with 873,200 males and 892,857 females. Further, the population is expected to reach 2,032,464 people by the end of

2017. This is influenced by the county's high population growth rate, which is at 2.81 per cent and the influx of people working in the city who prefer to stay in Kiambu and its environs where there is less congestion and well developed infrastructure.

5.3.2 Communication network

The project area is served with a good communication network such as mobile phone services like Safaricom, Orange and Airtel.

5.3.3 Road Network

The mobility in Tatu Waters will operate as an autonomous network, connected by the two points with the outside through the C63.This allows to create a clear

functional hierarchy, Access roads from/to the outside (level 1) main avenue linked to the first level to distribute the flow and finally a group of local streets to give direct access to the residential area. Furthermore there will be a four road level within each housing to distribute the traffic inside it.

The layout of the road network is based on the topography. Within the town there will be a speed limit of 15km/h to guarantee comfortable conditions for pedestrian to walk through downtown

5.3.5 Water supply

The Ruiru-Juja Water and sewerage Company (RUJU-WASCO) is responsible for supplying water to the residents and businesses in entire Kiambu County.

5.3.6 Sanitation

The sewerage network in Tatu City was developed as the first phase of the entire city. Tatu Waters will do its sewerage network within the town and connect to the main line .Sewer line and storm water drain are separate.

6.0 POTENTIAL ENVIRONMENTAL IMPACTS

6.1 Introduction

This chapter outlines the potential negative and positive impacts that will be associated with the project. The impacts will be related to activities to be carried out during construction of the project. The operational phase impacts of the project will be associated with the activities carried out by the occupants. In addition, closure and decommissioning phase impacts of the project are also highlighted.

The impacts of the project during each of its life cycle stages (construction, operation and decommissioning) can be categorized into: impacts on the biophysical environment; health and safety impacts and socio-economic impacts.

6.2 Negative environmental impacts of construction activities

6.2.1 Vegetation clearance and excavation

Vegetation clearance will generate large quantities of solid waste. The waste will consist of tree stumps, stems and leaves.

Excavation works shall be undertaken to remove the black soil prior to installation of a foundation. The removal of this harmless overburden presents a disposal problem. It is suggested that the excavated soil be used to backfill/infill an identified abandoned quarry sites within the vicinity of the project site to assist in its rehabilitation and after-use plans.

6.2.2 Increased soil erosion

Clearance of land and excavation works will lead to increase soil erosion at the project site and release of sediments into the drainage systems. Uncontrolled soil erosion can have adverse effects on the local storm water drains, road network and sewer line blockages.

6.2.3 Solid waste generation

Large quantities of solid waste will be generated at the site during construction of the buildings and related infrastructure. Such waste will consist of metal cuttings, rejected materials, surplus materials, surplus spoil, excavated materials, paper bags, empty cartons, empty paint and solvent containers, broken glass among others. Such solid waste materials can be injurious to the environment through blockage of drainage systems, choking of water bodies and negative impacts on human and animal health. This may be accentuated by the fact that some of the

waste materials contain hazardous substances such as paints, cement, adhesives and cleaning solvents, while some of the waste materials including metal cuttings and plastic containers are not biodegradable and can have long-term and cumulative effects on the environment.

6.2.4 Dust emissions

During construction, the project will generate substantial quantities of dust at the construction site and its surrounding. The sources of dust emissions will include excavation and leveling works, and to a small extent, transport vehicles delivering building materials. Emission of large quantities of dust may lead to significant impacts on construction workers and the local/neighboring facilities, which will be accentuated during dry weather conditions.

6.2.5 Noise and vibration

The construction works, delivery of building materials by heavy tucks and the use of machinery/equipment including bulldozers, generators, metal grinders and concrete mixers will contribute high levels of noise and vibration within the construction site and the surrounding area. Elevated noise levels within the site can affect project workers and the residents, passers-by and other persons in within the vicinity of the project site.

6.2.6 Water use

The construction activities will require large quantities of water. Water will mainly be used for concrete mixing, sanitary and washing purposes. Excessive water use may negatively impact on the supply to neighboring facilities.

6.2.7 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 & Lighting Company (KPLC) Ltd. Electricity in Kenya is generated mainly through natural resources, namely, water and geothermal resources. In this regard, there will be need to use electricity sparingly since high consumption of electricity negatively impacts on these natural resources and their sustainability.

6.2.8 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 vegetation, poor visual quality and opening of depressions on the surface leading to several human and animal health impacts.

6.2.9 Exhaust emissions

The trucks used to transport various building materials from their sources to the project site will contribute to increases in emissions of CO_2, NO_x and fine particulate along the way as a result of diesel combustion. Such emissions can lead to several environmental impacts including global warming and health impacts. Because large quantities of building materials are required, some of which are sourced outside Nairobi, such emissions can be enormous and may affect a wider geographical area. The impacts of such emissions can be greater in areas where the materials are sourced and at the construction site as a result of frequent gunning of vehicle engines, frequent vehicle turning and slow vehicle movement in the loading and offloading areas.

6.2.10 Risks of accidents and injuries to workers

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.

6.3 Positive environmental impacts of construction activities

6.3.1 Creation of employment opportunities

Several employment opportunities will be created for construction workers during the construction phase of the project. This will be a significant impact since unemployment is currently quite high in Nairobi and the country at large.

6.3.2 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 in Nairobi and the surrounding areas. This provides ready market for building material suppliers such as quarrying companies, hardware shops and individuals with such materials.

6.3.3 Increased business opportunities

The large number of project staff required will provide ready market for various goods and services, leading to several business opportunities for small-scale traders such as food vendors around the construction site.

6.4 Negative environmental impacts of operational activities

6.4.1 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 these waste materials especially the plastic/polythene are not biodegradable 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.

6.4.2 Water use

The sanitary activities during the operation phase of the project will involve the use of large quantities of water considering that there are 2,715 units involved. Other water uses include, watering gardens, domestic uses, washing pavements, washing cars and many others.

6.4.3 Energy consumption

During operation, the family units will use a lot of electrical energy mainly for domestic purposes including lighting, running of air conditioning equipment, running of refrigeration systems, pumping water into reservoirs. Since electricity generation involves utilization of natural resources, excessive electricity consumption will strain the resources and negatively impact on their sustainability.

6.4.4 Increased demand for sanitation

The project involves the construction of 2,715 houses accommodating other support facilities. This will lead to increased demand for sanitation and sewage disposal.

6.4.5 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 building. 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.

6.5 Positive environmental impacts of operational activities

6.5.1 Provision of Housing, commercial and industrial facilities

The project aims at providing luxurious upper class housing facilities to meet the high demand of luxurious homes in Tatu city and a contribution to the Government vision of providing adequate housing to its citizens.

6.5.2 Employment opportunities

Some people will be employed by the project as management agents, caretakers, cleaners, security personnel and technicians.

6.5.3 Revenue to national and local governments

Through payment of relevant taxes, rates and fees to the government and the local authority, the project will contribute towards the national and local revenue earnings.

6.5.4 Improved security

Security will be ensured around the premise through distribution of suitable security lights and presence of 24-hour security guards. This will lead to improvement in the general security in the surrounding area.

6.6 Negative environmental impacts of decommissioning activities

6.6.1 Solid waste

Demolition of the project buildings and related infrastructure will result in large quantities of solid waste. The waste will consist of demolition debris 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 as a result of leaching of demolition waste, are known to lead to degradation of groundwater quality.

6.6.2 Dust

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

6.6.3 Noise and vibration

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

6.7 Positive environmental impacts of decommissioning activities

6.7.1 Rehabilitation/Restoration/Retention

Upon decommissioning the project, rehabilitation of the project site will be carried out to restore the site to its original status and/or a change of land-use adopted that will be consistent with the planning framework. Rehabilitation will include replacement of topsoil, landscaping and revegetation that will lead to improved visual quality of the area.

6.7.2 Employment Opportunities

Several employment opportunities will be created for demolition staff.

7.0 ANALYSIS OF PROJECT ALTERNATIVES

This section analyses the project alternatives in terms of site, technology scale and waste management options.

7.1 No project alternative

The No Project option in respect to the proposed project implies that the status quo is maintained. This option is the most suitable alternative from an extreme environmental perspective as it ensures non-interference with the existing conditions. This option will however, involve several losses both to the landowner and the community as a whole. The landowner will continue to pay land rates on the plot while the property is underutilized. The No Project Option is the least preferred from the socio-economic and partly environmental perspective due to the following factors:

- The economic status of the Kenyans and the local people would remain unchanged.
- The project design and low occupational density will blend with the area land use.
- The local skills would remain under utilized.
- Reduced commercial activities.
- Reduced interaction both at local, national and international levels.
- No employment opportunities will be created for numerous numbers of Kenyans who will work in the project area.
- Increased urban poverty and crime in Kenya.

From the analysis above, it becomes apparent that the No Project alternative is no alternative to the local people, Kenyans, and the government of Kenya as compared to the development of the proposed apartments

7.2 Analysis of alternative construction materials and technology

The building will be developed using modern, locally and internationally accepted materials to achieve public health, safety, security and environmental aesthetic requirements. Equipment that saves energy and water will be given first priority without compromising on cost or availability factors. The concrete pillars and walls will be made using locally sourced stones, cement, sand, metal bars and fittings that meet the Kenya Bureau of Standards requirements.

Heavy use of timber during construction is discouraged because of destruction of forests. The exotic species would be preferred to indigenous species in the construction where need will arise.

Eco-friendly materials and technology will be employed to ensure that the project blends with the surrounding area. Further more air conditioning equipment employed will be those of zero ozone depleting potential.

7.3 Solid waste management alternatives

A lot of solid wastes will be generated from the proposed 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 for the incoming tenants and/or owners and adherence to provisions of Environmental Management and Coordination (Waste Management) Regulations 2006.

Secondly, waste Refusal, Reduction, Return, Refill, Recycling, Reuse (6-R Oriented Resort) and composting of the waste will be the second alternative in priority. This will call for a source separation/segregation programme to be put in place. The waste will be collected by a private waste management company licenced by NEMA for sanitary land filling or ultimate appropriate disposal.

The third priority in the hierarchy of options is combustion of the waste that is not recyclable and this is NOT acceptable.

8.0 IMPACTS MITIGATION AND MONITORING

8.1 Introduction

This chapter highlights the necessary mitigation measures that will be adopted to prevent or minimize significant negative environmental, health and safety impacts associated with the activities the project during its construction, operation and decommissioning phases. Allocation of responsibilities, time frame and estimated costs for implementation of these measures are presented in the environmental management programme (EMP) in Chapter 9.

8.2 Mitigation of construction phase impacts

8.2.1 Minimization of Environmental disturbance

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 spill over effects on the neighbouring 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. In addition, the proponent will re-vegetate some of the disturbed areas through implementation of a well-designed landscaping and tree planting programme.

The contractor shall only clear the vegetation that needs to be cleared in accordance with the structure plan. These protection measures apply to both the construction areas as well as to any associated activities such as sites for stockpiles, disposal of clean fill and construction of diversion roads.

The contractor shall deploy, the following measures to protect flora and fauna within the project site;

Fell trees into the construction zone, not into undisturbed vegetation;
- Do not burn off cleared vegetation – where feasible, chip or mulch and reuse for the rehabilitation of affected areas; Mark the areas to be cleared;
- Do not disturb areas outside the approved construction zone;
- Mark access tracks and keep traffic to these areas;
- Confine vehicle movements to the old or new alignment where feasible
- Only disturb areas that must be disturbed;
- Place site depots, equipment compounds and stock pile areas on previously cleared areas away from trees, bushes and native grasses.

- If cleared areas are not available for stockpiles on the site, consider using cleared areas on adjoining land;
- Avoid work within the drip-line of trees to prevent damage to the tree roots and compacting the soil;
- Store fill, materials and equipment away from trees to avoid compacting the soil and preventing air and water reaching the tree roots;
- Limit the removal of topsoil and cleared vegetation from the site to reduce the risk of spreading weeds and diseases;
- Construction site may be a habitat for native animals. Constructor must be aware of the animals that live near your site and keep alert for native faunal movements;
- Retain or relocate tree hollows, where appropriate leave dead trees where possible as habitat for fauna;
- Report any animal kills or injuries to the site manager; and
- Check the site for the animals trapped in site works.

Management of borrow pits and quarries-The contractor undertakes to source materials only from licensed quarries as provided for under EMCA 1999 and the second schedule to the act. Where the contractor has entered into an agreement with the land owner for this purpose, he should undertake an EIA study and seek the necessary approval from NEMA.

The contractor, where applicable develop, implement and keep relevant records of quarry/borrow pit lease agreements, rehabilitation/restoration management plans. The contractor shall also undertake measures to prevent persons, or stocks other than dogs or poultry, from inadvertently entering the pit as provided for in the mining act (revised in 1987). The contractor shall ensure that borrow pits and quarries are properly secured (fenced with access limited to authorized persons only).

8.2.2 Minimization of run-off, soil erosion and Nuisance

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.

Transportation of building materials and construction debris will primarily be undertaken during weekdays, during off peak hours. Construction works shall be restricted to daytime and construction activity undertaken at night shall be minimized and where unavoidable necessary authorization will be obtained and disturbance and nuisance to neighbouring facilities minimized.

The contractor shall apply appropriate measures to control runoff, erosion and sediment including but not limited to the following:

-Divert natural runoff around construction areas prior to any site disturbance;
-Install protective measures on site prior to construction, for example, storm water basins or sediment traps;
-Temporary diversion pipe outlets beyond the fill toe line to avoid erosion of embankments; install ‘’cutoff drains ‘’ where long cut/fill batter slopes occur to control water runoff speed
-Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, hay bales or bunds;
-Restrict vehicular movements over cleared areas;
-Limit equipment and vehicular movements to within the approved construction zone;
-Construct temporary access tracks to cross concentrated water flow lines at right angles;
-Plan construction access to make use, if possible, of the final road alignment;
-Use vehicle- cleaning devices, for example, ramps or wash down areas;
-Remove debris from drainage part and sediment control structures;
-Observe the performance of drainage structures and erosion controls during brains and modified as required.

8.2.3 Minimization of construction waste

It is recommended that 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, and institutions.

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 of nature i.e. sunshine, rain etc
iii. Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste
iv. Use of construction materials containing recycled content when possible and in accordance with accepted standards.
v. Locate site storage depots away from watercourses and danger areas, areas prone to flooding, Avoid spillage during refueling and servicing of plants and equipment

It is further suggested that the excavated top soil be used to backfill/infill an identified abandoned quarry sites within Ruiru or nearby town to assist in its rehabilitation and after-use plans.

8.2.4 Reduction of dust generation and emission

Dust generation is the main air quality issue on construction sites. Dust is a nuisance in the environment that can be a health hazard and a risk to traffic safety. Dust emission during construction will be minimized through strict enforcement of on site speed controls as well as limiting unnecessary traffic within the project site. In addition, it is recommended that excavation works be carried out in wet weather or sprinkle water to control dust and install appropriate dust screens; and traffic routes on site be sprinkled with water regularly to reduce amount of dust generated by the construction trucks especially during dry seasons. Furthermore the contractor is required to Limit the extent of disturbed areas and restore disturbed areas as soon as practicable to limit construction activities (including blasting on windy days); Water construction materials prior to loading and transport; use equipment and vehicles fitted with appropriate emission controls; and Service all equipment and vehicles regularly to minimize emissions; spray with water and/or cover pavement materials and aggregates before transporting; and dispose of any harmful solid and liquid waste at an approved and licensed disposal facility.

8.2.5 Minimization of noise and vibration

Noise and vibration will be minimized in the project site and surrounding areas through sensitization of construction truck drivers to switch off vehicle engines while offloading materials. In addition, they will be instructed to avoid gunning of

vehicle engines or hooting especially when passing through sensitive areas such as churches, residential areas and hospitals. In addition, construction machinery shall be kept in good condition to reduce noise generation. It is further recommended that:
- All generators and heavy duty equipment be insulated or placed in enclosures to minimize ambient noise levels;
- Use the quietest available equipment or modify equipment to reduce noise;
- Use the correct equipment within the defined operating hours and locations;
- Install temporary noise control barriers where appropriate;
- Notify affected people if noisy activities will be undertaken, eg pile driving, blasting;
- Plan deliveries to and from site to minimize impacts;
- Secure areas prior to blasting and inspect the area immediately afterwards to visually monitor for any incidence;
- Select all equipments having regard to its published sound power level;
- Investigate an alternative technique if an activity is inherently noisy (e.g. a driven piling) plant and equipment should be located having regard to its proximity to sensitive receptors (e.g. school, hospitals and residential property);
- Anti-social behavior involving loud talking, shouting or whistling, radios, sirens or hooters and motor revving should be avoided.

The contractor will undertake to comply with all the relevant legislation (existing and emerging) and regulations governing the generation of excessive noise and vibration. This includes:

-Using engineering controls by segregating or enclosing machinery w2hich emits noise levels exceeding 90 dB(A) and providing suitable hearing protection for affected workers as prescribed under factories and other p[laces of work(noise prevention and control) Rules, 2005-Rule 10 and 12.

-Conducting (occupational) noise measurements at least once every 12 months to determine prevailing noise conditions as [provided under factories and other places of work (noise prevention and control) Rules 2005-Rule 6

-Limiting construction activities within he nor mal working hours as provided for under factories and other places of work (noise and excessive vibration pollution)(control) Rules 2009-Rule 13. The same rule prescribes for evenly distribution of equipment used and avoiding concentrated usage of equipment at the same time.

-Acquiring requisite license to generate excessive noise and vibration as provided for under legal notice No.90 of 2009.

The contractor shall apply the appropriate measures to prevent or mitigate construction noise and vibration including but limited to;

8.2.6 Minimization of water use and Water Quality Protection

The proponent shall ensure that water is used efficiently at the site by sensitizing construction staff to avoid irresponsible water usage. The contractor shall apply the following measures to manage water quality
Leaving the site:

- Divert runoff from undisturbed areas around the construction site;
- Limit the area of disturbed land–progressively clears the site in accordance with construction needs and rehabilitate as soon as possible;
- Protect drainage lines with sediment basins, silt fences and hay bales;
- Dewater sites by pumping water to a sediment basin prior to release off site- do not pump directly;
- Monitor the water quality in the runoff from the site or areas affected by dredge plumes, and improve work practices as necessary;
- Stockpile materials away from drainage lines;
- Maintain equipment to prevent fuel and oil leaks; prevent all solid and liquid waste entering waterways by collecting solid waste;
- Oils, chemicals, bitumen spray waste an d waste waters from brick, concrete and asphalt cutting where possible and transport to a licensed waste disposal site or recycling depot;
- Minimize surplus waste water from brick and pavement cutting;
- Store all chemicals, fuels and other hazardous materials within bundled and covered areas.

8.2.7 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.

8.2.8 Efficient sourcing and 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 relevant licences from NEMA. 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 in the amount of raw materials extracted from natural resources as well as reducing impacts at the extraction sites

8.2.9 Minimization of exhaust emissions

This will 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. In addition truck drivers will be sensitized to avoid unnecessary racing of vehicle engines at loading/offloading areas, and to switch off or keep vehicle engines at these points

8.2.10 Reduction of risks of accidents and injuries to workers

The proponent is committed to adherence to the occupational health and safety rules and regulations stipulated in Occupational Safety and Health Act, No. 15 of 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.

The contractor will prepare and provide a current Emergency Contracts set of Procedures for each work site. The procedures will be followed in any site emergency. They will contain emergency phone numbers and the method of notifying requisite services for action by the contractor. Copies of the procedures will be issued to the Local Authorities, Fire Brigade, Ambulance Service and Statutory Authorities.

The contractor shall also do the following:

-Register all workplaces with Department of occupational Safety and Health Services as provided for under Osh Act 2007Part v section 43-46;

-Maintain a general register for entering particulars of every accident and cases of occupational diseases occurring at the workplace as prescribed under OSH Act 2007 established Safety Health and Environment committee as prescribed under the Factories and Other Places of Work (Health and Safety committees)Rules 2004,Rule 4;

-Provide and maintain so as to be readily accessible, a First Aid box or cupboard of the prescribed standard in all the workplaces as stipulated under OSH Act 2007 part x part 95 First Aid Rules1977,Rule 2;

-Issue a permit to work for any employee likely to be exposed to hazardous work as provided for under OSH Act 2007;

-Set out the work to be done, the hazards involved and precautions to be taken before the work commences in the aforesaid permit to work;

-Provide and maintain for use by employees in the workplace where employees are exposed to wet or any injurious activities, adequate, effective and suitable clothing and appliances as stipulated under OSH Act 2007.

8.2.11 Weed, Pest and Disease Control

The contractor shall undertake to use pest control products including herbicides with reference to the chapter 346; pest control products. This act covers the use, application, importation and trade in the pest products. The contractor shall apply appropriate measures to limit the spread of weeds, animal pests and diseases, including but not limited to the following;

- Control weeds on the site during construction;
- Be careful not to spread weed seeds around the construction site;
- Use only approved chemical sprays with dye to identify sprayed areas;
- Dispose of weeds to a licensed waste disposal site;
- Minimize the opportunity for weeds to multiply by minimizing disturbance;
- Limit topsoil movement along the road reserve;
- Store topsoil away from drainage lines;
- Clean the build-up of mud and waste form plants and equipment prior to relocation;
- Ensure vehicles used for cutting spoil and weeds are cleaned of all soil and plant debris prior to carting clean, materials (e.g. gravel), to reduce the risk of spreading weeds;
- Provide sealed bins for site waste to discourage animal pests;
- Avoid placing stockpile sites next to seeding weeds. Monitor stockpile/dump sites for weed growth and implement necessary controls to remove weed growth before flowering and seeding;

- Weed infested materials (e.g. drain spoil containing pasture grasses) should not be stockpiled on, or next to land which has native vegetation;
- Manage the weeds surrounding gravel and lime pits, to reduce the risk of introducing weeds to new sites;
- Shall consider and implement alternatives to herbicides where appropriate;
- Ensure that only trained staff only uses herbicides;
- Shall avoid herbicide runoff into watercourses, wetlands or drinking water catchment areas;
- Ensure care is taken to avoid drift onto non-target plants and waterways especially in areas of high conservation or adjacent agricultural land;
- Shall maintain records of herbicide application.

8.2.12 Protection of sites of cultural and natural heritage significance

All the sites of heritage already identified (or so demarcated later) including areas of geological significance must be protected. Heritage items include cultural sites, building, geological features, trees and natural areas. Sites of known significance within the construction zone will be flagged as “no-go” areas prior to construction to ensure their protection. Measures that maybe applied by the contractor to protect sites of heritage significance include but are not limited to the following;

- Restrict all construction activities and related activities including stock piling, servicing, drainage works etc to approved areas and not to enter”no-go” areas;
- Maintain flagging or fencing marking “no-go” areas during construction;
- Work in accordance with the contract documents;
- Take special care and use appropriate equipment when working next to a heritage site;
-If, during construction an Aboriginal heritage or burial site is discovered, stop work immediately and notify the site manager. It is an offense to recommence working the vicinity of the site until approval to continue is given by the project manager

8.3 Mitigation of operation phase impacts

8.3.1 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 waste generated at the premise. In addition, the proponent will ensure that such wastes are disposed of regularly and appropriately. It is recommended that the proponent puts in place measures to ensure that the occupants manage their waste efficiently through recycling, reuse and proper disposal procedures with emphasis on segregation at source.

8.3.2 Ensure efficient water use

The proponent will install water-conserving automatic/push taps and toilets. Moreover, any water leaks through damaged pipes and faulty taps will be fixed promptly by qualified staff. In addition, the occupants will be sensitized to use water efficiently. Furthermore, rainwater harvesting is emphasized for use in gardening and pavement washing.

8.3.3 Ensure efficient energy consumption

The proponent should install energy-efficient lighting system. This will contribute immensely to energy saving during the operational phase of the project. In addition, occupants will be sensitized to ensure energy efficiency in their activities. To complement these measures, it will be important to monitor energy use and set targets for efficient energy use.

8.3.4 Minimization of sewage release

The proponent will ensure that there are adequate means for handling the large quantities of sewage generated at the premise. It will also be important to ensure that sewage pipes are not blocked or damaged since such vices can lead to release of the effluent, resulting in land and water contamination. Such blockages or damages will be fixed expeditiously.

8.4 Mitigation of decommissioning phase impacts

8.4.1 Efficient solid waste management

Solid waste resulting from demolition or dismantling works will be managed as described in Section 8.2.3.

8.4.2 Reduction of dust concentration

High levels of dust concentration resulting from demolition or dismantling works will be minimized as described in Section 8.2.4.

8.4.3 Minimization of noise and vibration

Significant impacts on the acoustic environment will be mitigated as described in Section 8.2.5.

9.0 ENVIRONMENTAL MANAGEMENT/MONITORING PLAN

9.1 Introduction

This Environmental Management Plan (EMP) has been developed to assist in prioritizing the key findings of the EIA, suggesting necessary mitigation actions and allocating responsibilities. From the EMP, a schedule for the project implementation could also be drawn that takes into consideration all issues that could develop into serious risks to environment, health and safety when the operations starts.

The environmental management plan is based on the ISO 14001 principles, a semi circular process of activities comprising of the following key aspects:

9.1 Environmental Policy

(i) Nature and scale of operations
(ii) Continuous improvement strategies
(iii) Pollution prevention strategies
(iv) Legal compliance
(v) Objectives and targets
(vi) Documentation and maintenance
(vii) Employee involvement
(viii) Availability to the public

9.2 Planning

(i) Identification of potential impacts and their sources
(ii) Identification of legal and other requirements
(iii) Stetting objectives and targets
(iv) Developing an environmental management programme

9.3 Implementation and Operations

(i) Allocate responsibilities
(ii) Undertake training and capacity building
(iii) Ensure communication at all levels
(iv) Establish a documentation systems
(v) Establish an emergency preparedness procedure.

9.4 Corrective actions

(i) Scheduled monitoring and measurements
(ii) Identification areas of non conformance
(iii) Carry out prevention and corrective actions
(iv) Establish a documentation and recording procedures
(v) Environmental audits.

Finally, management reviews and continuous improvement determines which of the above issues require to be re-visited and at what schedules.
On the basis of the policy guidelines and development of the EMP, among other actions recommended to be undertaken by the management in the implementation of the latter are:

(i) Identification of additional issues that are not covered in the EMP
(ii) Establish a legal register
(iii) Develop a training plan and schedule
(iv) Develop an in house environmental audit protocol and schedule
(v) Establish a suitable and comprehensive database
(vi) Put in place an emergency preparedness procedure
(vii) Establish the EMP implementation schedule
(viii) Establish an incident log book to manage environmental incidents
(ix) Establish an environmental management committee to oversee and assist in the implementation of the EMP

The mitigation measures recommended and the targeted achievement have been tabulated below along side institutional responsibilities and indicators to assess success. A time frame has also been proposed. However, related costs could not be worked out per activities at appropriate times.

Table; 5

Environmental monitoring/Management plan for the construction and Occupation phases

IMPACT	MITIGATION MEASURES	PROJEC PHASE	RESPONSIBLE PERSONS	COST(KSH)/YR
Loss of biodiversity and archeological protection	• Maintain a riparian buffer zone as per WRMA recommendation • Preserve and maintain the rivers, natural streams and drainage ways within the developed areas by designating them as part of the open space system. To the extent possible, limit any modifications to natural gulches and drainage ways, unless they are necessary for flood protection, to preserve water quality and protect aesthetic and biological resources. • Clearance of vegetation should be done in necessary areas only • Carry out environmental compensation where harm cannot be avoided by planting of indigenous plants • Plant environmentally friendly native trees on the riparian reserve to increase interception and storage while reducing surface run off • Restrict the removal of the trees and other vegetation to the minimum required • Undertake landscaping and tree planting scheme for over 2000 seedlings within the Tatu Waters. • During construction an Aboriginal heritage or burial site is discovered, stop work immediately and notify the Environmental Consultant to inform National Museums of Kenya (NMK). Recommence working in the vicinity of the site until approval to continue is given by the NMK	Construction & Occupation	Civil Engineer in charge /Contractor /Proponent	500,000

Soil Degradation	• Use of gravel bags to trap sediment • Rocked construction entrance and exit to keep sediment from being tracked onto adjacent roads and keep vehicles off bare soils • Stock piles to be covered with tarpaulin • Excavated soil to be used for back filling • Top soil to be used for landscaping • Limit the use of heavy machinery at the site & control earth works • Ensure that soil erosion and sedimentation control measures are installed before commencing land disturbance, and remain in place until the erosion hazard reverts to its pre-existing level. •	Construction	Civil Engineer in charge.	Incorporated in the contactor costs
Air pollution	• Spray water on exposed areas during dry weather to suppress dust • Cover loads of friable materials during transportation • Provide appropriate dust screens to reduce dust exposure. • Buildings under construction to be covered with adequate screens to contain dust. • Stock piles to be covered with tarpaulins • Control speed of construction vehicles and switch off machines when not in use. • Regularly service and maintain vehicles and mobile plants and machinery • Provide PPE e.g. nose masks to workers	Construction	Civil Engineer in charge /Contractor	500,000

River flooding	• Plant environmentally friendly trees on the riparian reserve to increase interception and storage while reducing surface run off • Liaise with WRMA on solutions to mitigate flooding.	Construction	Proponent /WRMA	20,000
River degradation	• Maintain a riparian buffer zone along the River as per WRMA recommendations • No development activity shall be undertaken within the full width of the river or within the riparian reserve as per Water Quality Regulations 2006 • Liaise with WRMA and NEMA to guide on the acceptable design of the reticulation system as it crosses a river or wetland or encroaches into riparian reserve, • Site excavation works to be planned such that a section is completed and rehabilitated while another section begins.	Construction	Proponent & WRMA	50,000
Increased water demands	• Use water conserving fixtures such as ultra-low flush toilets and low-flow shower heads • Waste water recycling and rain water harvesting • To the maximum extent feasible, facilities should increase their dependence on water that is collected, used, purified, and reused on-site.	Operation/occupation	Contractor/ Proponent	Incorporated in the contactor costs
Effluent management	• Provision of portable toilets for the workers • Routine checkups and monitoring of the WWTP to avoid leakages and blockages • Proper construction of the WWTP to meet the standards • Construction of separate storm water and waste water drains • Treated effluent to be reused as non potable water for flushing	Construction and occupation	Civil Engineer in charge / proponent /estate Management	1,000,000

	toilets, watering lawns and cleaning purposes • Waste water to be treated to the standards set by NEMA (Water quality regulations, 2006) and effluent analysis to be conducted quarterly			
Excess noise & vibrations	• Workers working with machinery, vehicles and instruments that emit high levels of noise should be provided with ear plugs and ear muffs • Noise hazard signs should be put displayed where necessary. • Proper servicing of machinery & equipment(oiling, greasing etc) • Installation of portable barriers to shield compressors and other small stationary equipment where necessary • Construction Activities to be carried out primarily between 8:00am – 5:00pm - Monitor noise levels as per NEMA guidelines • If the hours of construction activities need to be varied, ensure prior certification is obtained from NEMA. Any request to alter construction hours should include: i. a clear justification of the need for the work ii. details of the type of activity and the extended hours iii. an analysis of the resultant noise levels at residences in the vicinity of the construction site • Establish Complaint Management System to ensure harmony with neigbours and ensure that all noise complaints are recorded in a logbook, investigated and concerns addressed.	Construction	Engineer in charge	200,000
Traffic snarl ups	• Develop traffic management Plan • Proponent to engage KENHA and KURA in developing access to the development • A traffic marshal to be stationed along the entry point within the project boundary to control vehicles during transportation of	Construction & operation	Engineer in charge / contractor	500,000

	materials. • Planned deliveries to make sure they do not coincide with heavy traffic • Provision of separate traffic routes for pedestrians and vehicles during operation phase • Provision of designated entry and exit points			
Increase in Solid Wastes	• Limit quantity by developing appropriate budgets for purchase of raw materials to reduce wastage through exposure to weather elements • Make provisions for sanitary facilities/accommodation for workers during construction. Cleanliness must be maintained at all times • Excavation material will be loaded into licensed trucks and be transported to designate disposal sites and/or used to backfill/infill abandoned quarry pits within the area to assist in their rehabilitation and after-use plans. • Minimize waste 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. • Provision of a waste transfer station within the development • Provide waste collection bins, segregate at source and ensure NEMA licensed transporters collects the wastes for appropriate disposal	Construction & operation	Engineer in charge / proponent /estate management	1,000,000

Occupational Health and Safety	• Conduct Site induction training for all personnel to alert them to sensitive work areas, explain the requirements of the EMP, explain the requirements of the EMP, Outline individual responsibilities and inform all workers of emergency response procedure • Personnel to wear complete personal protective equipment and appliances • Provision of firefighting equipment • Put in place an emergency response plan • Only qualified personnel to operate the machinery • Designate a Health & Safety officer otherwise known as site supervisor to be in-charge of enforcing site compliance with OSH rules & regulations • Provision of adequately stocked first aid kits and trained first aiders on site • Display the contact numbers of the persons responsible for handling emergencies on the site • Contractor should adhere to the provisions of Work Injury Benefits Act, 2007 during compensation process for injuries sustained at work • Acquire and display at a prominent place within the site abstracts • Acquire and maintain a General Register • Develop an occupational safety and health policy • Undertake the risk assessment and compile a report • Undertake a safety and health audit and compile a report • Undertake a fire safety audit and compile a report • Provide adequate shelter for use by workers during adverse weather conditions	Construction & operation	Contractor / Site Supervisor	1,000,000

Social concerns and Local Content	• Erection of billboards to sensitize locals on the need to practice safe sex to help in the fight against HIV/AIDS • Conduct awareness campaigns on HIV/AIDS among the workers and the locals. This can be undertaken by the various NGOs and government agencies in the county. • Employment of local community members in the ongoing project and integrate gender considerations • Develop procedure for sub-contracting local companies should need arise.	Throughout	Contractor / proponent /estate management	500,000
Complaint Management	• Establish a 24 hour complaints contact telephone number. The aim of the complaints line is to enable any member of the public or nearby facilities reach a person who can arrange appropriate response/corrective action to their complaint. • Establish a complaint system to: i. receive, record, track and respond to complaints ii. ensure that verbal response is provided to the complainant within 2 hours iii. Provide a written response within 7 calendar days if the complaint cannot be resolved verbally. iv. Ensure information on all complaints received and response times is available to the Environment Manager daily and on request to relevant Government Agencies	Construction & operation	Contractor / proponent /estate management	200,000

9.5 Decommissioning Phase

In addition to the mitigation measures provided in Table above, it is necessary to outline some basic mitigation measures that will be required to be undertaken once all operational activities of the project have ceased. The objectives, mitigation measures, allocation of responsibilities, time frames and costs pertaining to prevention, minimization and monitoring of all potential impacts associated with the decommissioning and closure phase of the project are outlined in Table below.

Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
1. Demolition waste management			
1. All buildings, machinery, equipment, structures and partitions that will not be used for other purposes must be removed and recycled/reused as far as possible	Contractor, Proponent	One-off	–
2. All foundations must be removed and recycled, reused or disposed of at a licensed disposal site			
3. Where recycling/reuse of the machinery, equipment, implements, structures, partitions and other demolition waste is not possible, the materials should taken to a licensed waste disposal site	Contractor, Proponent	One-off	–
4. Donate reusable demolition waste to charitable organizations, individuals and institutions	Contractor, Proponent	One-off	–
2. Rehabilitation of project site			
• Implement an appropriate revegetation programme to restore the site to its original or improved status	Contractor, Proponent	One-off	–
• Consider use of indigenous plant species in revegetation	Contractor, Proponent	One-off	–

Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
• Trees should be planted at suitable locations so as to interrupt slight lines (screen planting), between the adjacent residential area and the development.	Contractor, Proponent	Once-off	–
3. Change of Use Situation			
1. A change of use may arise before the buildings complete their useful life. In this case the proponent may decide to alter and/ or recondition the existing buildings. Change of use may also involve the transfer of equipment and materials from the site for appropriate disposal or reuse.	Contractor, Proponent	Once-off	-

10 EMP IMPLEMENTATION.

This EMP is applicable to all the components of the project activities specified for the various land uses and phases of the structure plan. The planning, construction works and operation of the project will be undertaken according with the Environmental Management Plans (EMPs) for the various activities. These are described in the sections below.

a). Health and Safety Management Plan;
b). Infrastructure and Services Management Plan;
c). Transport Management Plan;
d). Pollution Prevention Management Plan; (covering Noise and Vibration Management, Air Quality Management, Soil and Water Management and Natural open spaces Management)
e). Waste Management Plan;
f). Emergency Response Management Plan.

Table; 6

PLAN NAME	PURPOSE AND OBJECTIVES OF PLAN	RESPONSIBILITY FOR PLAN DEVELOPMENT AND IMPLEMENTATION.
Traffic Management Plan.	Set out specific actions for the contractor and Tatu City Limited to properly manage traffic and its potential impacts, including safety and accidents.	The contractor is responsible for the implementation for the plan in the construction phase. Tatu City is responsible for implementation of the plan during the operation/occupation phase.
Waste Management Plan.	Outlines specific aspects for the contractor and Tatu city limited management to ensure that best practice waste management procedures are implemented.	The contractor is responsible for the implementation for the plan in the construction phase. Tatu city limited management is responsible for implementation of the plan during the operations/occupation phase.
Health and Safety Management Plan.	Foster health and safety during construction and for the entire operation of the city to minimize worker exposure to dangerous work environments	The contractor is responsible for the implementation for the plan in the construction phase. The proponent is responsible for implementation of the plan during the operation/occupation phase.

Infrastructure and Services Managements plan:-Heritage sites, Power Transmission, Water and sewerage, -Road construction, Solid waste	Sets out specific actions for the contractor to minimize the disruption and negative impact associated with infrastructure, natural resources, households and community assets e.g. land	The contractor is responsible for the implementation for the plan in the construction phase. The proponent is responsible for implementation of the plan during the operation/occupation phase.
Pollution Prevention Management Plan; Noise, Air, Soil, Water, Natural open spaces	Sets out specific actions for the contractor to ensure that polluting emissions and disturbance are to be prevented or mitigated	The contractor is responsible for the implementation for the plan in the construction phase. The proponent is responsible for implementation of the plan during the operation/occupation phase.
Emergency Response Plan	Sets out specific actions for the contractor and Tatu city management to ensure that incidents, including fire and those involving spillages of chemicals or oil are properly managed during construction and operation	The contractor is responsible for the implementation for the plan in the construction phase. The proponent is responsible for implementation of the plan during the operation/occupation phase.

11.0 AUXILLIARY INFORMATION

11.1 Budget

The total project cost is estimated to cost **Ksh. 35 Billion**

11.2 Monitoring Guidelines

Continuous observations and assessment is essential so that if foreseen safety dangers are noticed, alternatives must be sort for. Risk assessment of fire outbreaks, and others should not be ignored in the construction plan. Waste management plan should be strictly followed. Mitigation measures of storm water management are essential. Safety standards should constantly be maintained, in brief, monitoring guidelines could be based on the following parameters:

- Efficient use and Pressure on existing infrastructure such as water, sewer and traffic
- Health and safety measures using such standards as ISO 14000 and EMS and the laid down regulatory framework
- Waste management practices
- Examine the changing land use patterns including those for residential, ecological and economic purposes
- Accidents and risk assessment arising from the use of water, roads, electricity and or any other amenity

11.3 Reporting

Constant reporting by the site contractor to the architect and Environmental consultant is necessary to ensure the project is executed as per the architectural drawings and Environmental Management Plan respectively. The Environment and safety officer should always remain on site to report any safety concerns for urgent mitigation. He should also at all times enforce safety requirements as per the relevant legislation.

11.4 Conclusion and Recommendations

During the preparation of this report for the development of the proposed development it is observed and established that most of the negative impacts on the environment are rated low and short term with no significant effect. The negative environmental impacts

that will result from establishment of the project which include increased population without commensurate services and facilities; increased pressure on infrastructure; air pollution; and generation wastes among others which however can be mitigated.

The positive impacts are highly rated and will benefit all stakeholders. The project proponents have proposed to adhere to prudent implementation of the environmental management plan. They are obtaining all necessary permits and licenses from the relevant authorities and have qualified and adequate personnel to do the project as proposed. They have proposed adequate safety and health mitigation measures as part of the relevant statutory requirements

This project should be licensed subject to undertaking environmental audits in the first year of operation to confirm the adequacy and efficacy of the EMP and to prescribe appropriate measures for any emerging issues not foreseen during this study. The proponent is further required to comply with all other lead agencies requirements governing development of this nature such as:

- Project design to blend with the surrounding and to conform to the SEA approval.
- Obtaining an extension of user to include the residential use.
- Obtaining development permission from the Kiambu County Government
- Approval of water and sewerage reticulation system by the zonal service providers.
- Adherence to the provisions of Occupational Safety and Health Act, 2007 as appertains to the safety of the construction workforce.
- Protection of ecologically sensitive areas as per the requirements of WRMA, NEMA and KWS.

This will be in compliance with the Environmental Management and coordination Act, Cap 387 and the Environmental (Impact assessment and Audit) Regulations 2003.

REFERENCES

Kenya gazette supplement Acts 2000, Environmental Management and Coordination Act, Cap 387. *Government printer, Nairobi*
National Environment (*Wetlands; River Banks and Lake Shores Management*) Regulations, 2000

Kenya gazette supplement Acts *Building Code 2000 by government printer, Nairobi*

Kenya gazette supplement Acts *Land Planning Act (Cap. 303) government printer, Nairobi*

Kenya gazette suplementActs *Local Authority Act (Cap. 265) government printer, Nairobi*

Kenya gazette supplement Acts Penal Code Act (Cap.63) *government printer, Nairobi*

Kenya gazette supplement Acts *Physical Planning Act, 1999 government printer, Nairobi*

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

Kenya gazette supplement number 56. Environmental (Impact Assessment and Audit) Regulations 2003. *Government printer,* Nairobi

Strategic Environmental Assessment for the Tatu City Master Plan

Symbiocity Sustainability by Sweden-SKL International 2012

Annex 1: Copy of lease agreement

Annex 2: Certificate of incorporation

Annex 3; KRA Certificate

Annex 4; Public consultation questionnaires

Annex 5: Tatu waters master plan and Architectural details

Annex 6: Copy of TOR Approval

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