

Client: Kenya Power & Lighting Company Limited

Assignment: To carry out an Environmental & Social Impact Assessment of the proposed Athi River 220/66 Kv sub station on L.R. 18474/216 Plot. No. 11.

Project Cost:

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EXECUTIVE SUMMARY

Introduction and Study Objectives

The Kenya Power and Lighting Company Limited (KPLC) intend to construct and operate 90MVA 220/60 kV substation in Athi River for power transmission and distribution in Nairobi Metropolis over the planning period 2009 – 2015. The process will entail construction of transmission line, substations and sub-transmission lines for the Nairobi Metropolitan in order to sharply improve the quality of electricity. Electricity cannot be stored, it is therefore necessary to generate and deliver power over long distances at the very instant it is needed. Kilometres of high voltage Transmission Lines transmit power, mainly from the power generating stations like hydro powers, geothermal and thermal stations located at various parts of the country or from the neighbouring countries like Uganda to major substations around the country. The proposed 90MVA 220/60 kV substation in Athi River will step down the electricity voltage for distribution to smaller substations, from where the electricity is distributed to industries, businesses, homes and social institutions among others in Nairobi and its environment. KPLC has to supply power reliably to meet the increasing needs and demands of end-users. Therefore, KPLC has to expand and establish its infrastructure of Transmission Lines and substations on an ongoing basis. The substations have to be built while maintaining the balance between satisfying the society's needs and environmental constraints. KPLC propose the construct 90MVA 220/60 kV substation in Athi River which will increase the security of supply to the surrounding industries, businesses, homes and social institutions among others.

In line with environmental legislation, KPLC has used is in house environmental experts who are registered by NEMA to undertake the Environmental Impact Assessment (EIA) for the proposed construction of Athi River substation. The construction of the proposed Athi River substation was originally contained in the implementation of a medium term strategy for power transmission and distribution in Nairobi Metropolis over the planning period 2009 – 2015. However, due to the urgency of the construction of substation at Athi River will bring about positive impacts to the local community in terms of employment opportunities, economic development and informal businesses among others.

The proposed Athi River Substation site has low environmental sensitivity from a botanical, archaeological and avi-fauna perspective. Social impacts are expected to be of low significance with a good chance of mitigation, largely due to the fact that the proposed activity is in line with the existing land uses of the Export Processing Zone (EPZ). Visual impacts of the construction are expected to be minimal due to the fact that the proposed substation will not interfere with the general landscape of the proposed project site, and the viewing audience is minimal due to the peri urban/ rural nature of the site. The height of the new structures is similar to that of those already existing at the other substation.

No objections to the proposed construction and operation of the substation were received during the public consultation process.

The study objectives were to:

- Conduct an Environmental Impact Assessment to identify both positive and negative impacts of the proposed project and propose most appropriate interventions during construction, operation and decommissioning of the project;
- Collect baseline socioeconomic data of the project area and potential impact expected from project construction, implementation, operation and decommissioning;
- Develop an Environmental Monitoring Program during construction and operation and present plans to minimize, mitigate, or eliminate negative effects and impacts;
- Describe Environmental Management Plan implementation mechanisms;
- Identify and contact stakeholders to seek the views on the proposed project;

Scope Objective and Criteria of the Environmental Impact Assessment (EIA)

The Government of Kenya policy on all new projects, programs or activities requires that an Environmental Impact Assessment is carried out at the planning stages of any proposed undertaking. The scope of this Environmental Impact Assessment, therefore, covers:

- The baseline environmental conditions of the area,
- Description of the proposed project,
- Provisions of the relevant environmental laws,
- Public participation
- Identification and discuss of any adverse impacts to the environment anticipated from the proposed project,
- Appropriate mitigation measures,
- Development of an environmental management plan outline.

The scope covered various activities related to; construction works of the proposed development which included ground preparation, construction of the 90MVA 220/60 kV substation, operation of the 90MVA 220/60 kV substation, decommissioning of the 90MVA 220/60 kV substation and installation of service lines as well as the utilities required by the proposed 90MVA 220/60 kV substation.

The study terms of reference included:

- Establish the suitability of the proposed location of the proposed 90MVA 220/60 kV substation in EPZ Athi River.
- A concise description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project.
- A description of the technology, procedures and processes to be used, in the implementation of the project.
- A description of materials to be used in the construction and implementation of the project, the products, by-products and wastes to be generated by the project.
- A description of the potentially affected environment.
- Carry out ambient air quality, noise levels and soil quality baseline measurements.

- A description of environmental effects of the project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated.
- To recommend a specific environmentally sound and affordable wastes' management system.
- Provide alternative technologies and processes available and reasons for preferring the chosen technology and processes.
- Analysis of alternatives including project site, design and technologies.
- Development of Environmental Management Plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment, including the cost, timeframe and responsibility to implement the measures.
- Provide an action plan for the prevention and management of the foreseeable hazardous activities in the cause of the project cycle.
- Propose measures to prevent health hazards and to ensure security in the working environment for the employees, residents and for the management of emergencies.
- An identification of gaps in knowledge and uncertainties which were encountered in compiling the information.
- An economic and social analysis of the project.

Study Methodology

This study was carried out through desk and field investigations. The experts conducted extensive literature review pertaining to this project. During the field investigation, reconnaissance survey was conducted to gather information on biophysical and socio-economic aspects of the area and its environs.

In order to address these issues the study team adopted a participatory approach where the client and the immediate surrounding communities were consulted in addition to reviews and references to sources of information including legal statutes, design and relevant project documents. Among the key activities undertaken during the assessment are:

- (i) Interviews and consultations with the immediate neighbouring land users. A questionnaire was circulated to the people in the neighbourhood to obtain their honest opinion regarding the project (samples have been annexed to this report),
- (ii) Review of documents with necessary information on the proposed project details, the site planning and implementation plan as well as the desired nature building,
- (iii) Physical inspections of the proposed site and photography,
- (iv) Ambient air quality, noise levels and soil quality baseline measurements and analysis
- (v) Evaluation of the activities around the site and the environmental setting of the wider area, through review of existing information, literature and physical observations,
- (vi) Reporting, review and submissions.

The Environmental considerations evaluated for the proposed development include: Ecological considerations (biological diversity, sustainable use of ecological resources and ecosystem maintenance), social considerations (economic impacts, social cohesion or disruption, effects on human health, immigration or emigration, communication and effects on culture and objects of cultural

value), Landscape considerations (views opened up or closed, visual impacts, compatibility with surrounding areas and amenity opened up or closed) and land use considerations (water sources, effects of proposal on surrounding land use potentials and possibility of multiple uses).

Project Description

The proposed site for 90MVA 220/60 kV substation is in Athi River District which was formally within the large Machakos District. Athi River District borders Nairobi City and Kangundo District to the Northwest, Mwala District to the east, Kajiado District to the west and Makueni District on the south. It lies between Latitudes $0^{\circ}45'$ South and $1^{\circ}3'$ South and Longitudes $36^{\circ}45'$ East and $37^{\circ}45'$ East. The proposed site is located on a 16.17 hectare parcel of land along Nairobi-Namanga road within Athi River division approximately 34 km from Nairobi City Centre.

The design of the proposed substation lends itself to creating a number of separate terraces at different levels as may be required by the topography of the area the platform can be divided up into several different levels as follows

- Control building and substation access roads
- Transformer/reactor plinth
- Busbar sections
- Substation yards

It has been decided that by the KPLC planning engineers that the available land will be sufficient for the proposed substation and its future needs and extension to the substation's layout. The majority of the substation structures will be made up of tubular aluminum conductors, with earth wires. The power lines entering and leaving will be of different heights depending the voltage they will be carrying. The various stages of the substation construction phases include the following;

- Construction of the substation access road to the substation
- Removal of vegetation within substation footprint
- Terracing and levelling of the site
- Installation of foundations for infrastructure such as transformers, control room and radio tower
- Construction of bunds and oil holding dams (for emergency holding of transformer oil in the event of a spill) and wall safety walls
- Compaction and filling with gravel of the areas between the foundations
- Creation of formal drainage and storm water control measures
- Delivery and installation of transformers, towers, busbar and associated infrastructure
- Construction of control room and administrative infrastructure
- Redirecting of existing 220 kV lines to enter and leave the substation
- Connection of the new infrastructure to the proposed 220 kV network
- Construction of perimeter fencing and lighting

The proposed electrical substation is a subsidiary station of an transmission and distribution system where voltage is transformed from high to low using transformers to various consumers.

The estimated cost of the project is approximately One hundred and Twenty Five (125) Million US Dollars.

PROJECT POTENTIAL IMPACTS AND MITIGATION MEASURES

Both positive and negative impacts that are associated with the proposed 90MVA 220/60 kV of the transmission substation in Athi River during the construction phase, operation phase and decommissioning phase were identified. The following positive and negative impacts are associated with the proposed project.

Positive Impacts

The following are positive impacts associated with the proposed 90MVA 220/60 kV of the transmission substation in Athi River:

- Reliable supply of electrical energy.
- Improved electricity supply in support of the Vision 2030 of the Government of Kenya.
- Direct and indirect skilled and no-skilled employment opportunities.
- Gains in the local and national economy and increase in revenue.
- Provision of market for supply of building materials.
- Informal sectors benefits.
- Optimal use of land.
- Improvement in security as a result of lighting.
- Improvement in social infrastructures.
- Acceleration of the investment process in the region.
- Reduction in pressure on biomass which comes from forest resources.

Negative Impacts

Against the background of the above positive impacts, there will be negative impacts emanating from the construction and subsequent operation activities of the facility. The negative impacts will include:

Air Emissions: Dust will be generated during construction.

Noise Pollution and increased vibration: The proposed civil works and operation of the facility will bring about an increase in cumulative noise levels. Noise pollution from the proposed development during construction noise will be generated from the construction machines and construction workers during day time. Considering the existing background noise level, the operations activity during daytime is not expected to seriously affect the noise level in areas adjacent to the project site.

Fire Hazards: Potential adverse impacts related to fire hazards remain a main feature of this project. The substation will deal with combustible products like the transformer oil and the risks associated with fire hazards form a significant adverse impact on the human health and environment.

Soil Erosion: There is a likelihood of localized soil erosion during the civil works which entail compacting, earth excavations and moving works. However, these impacts will be largely localized to the project area and will only occur during the construction phase.

Oil Spills: The refilling and emptying of the transformer oil can lead to accidental oil spills. There is a possibility of oil leaking from the transformers can lead to oil spills. This may lead to potential contamination of surface and groundwater as well as soil.

Increased transformer oil Consumption: The proposed 90MVA 220/60 kV transmission substation shall consume large amount of transformer oil in the process of step up and step down of the electric voltage for use. Since transformer oil is produced mainly through non renewable resources, this will have adverse impacts on these non renewable resources base and their sustainability.

Liquid Waste Generation: Since the substation's transformers will use transformer oil to step up and step down of the electric voltage for use, sludge and other effluents will be generated. Waste oil is also an output of the project that poses potential environmental hazard in case of poor handling and disposal methods. This may affect the environment through water and soil contamination. The liquid waste to be generated is hazardous hence may cause long-term injurious effects to the environment.

Increase in Traffic flow: During the construction phase, heavy vehicles moving in and out of the project site are likely to increase traffic along the main road near the project site and could cause congestion. Deliveries of transformer oil by road during project operation will also increase the amount of traffic flow in the project area.

Strain in local resources: The proposed development is likely to strain the resources available like water in the area in the short term mostly during the construction phase. This is as a result of increased population in the project without commensurate services and facilities

Occupational Health and Safety: There will be potential risk of occupational hazards that could lead to occupational accidents and during construction and operation of the project. Adverse impacts on the workers health and safety is likely to occur especially through workers interaction with the equipments and machines during construction and operation of the substation. Accidents, injuries and diseases are likely to occur during project construction and operations and this could potentially harm the health of the employees.

Solid waste generation: Solid waste materials during construction and solid waste during operation are likely to be encountered. The waste will include soil, construction materials and office papers.

Visual Intrusion: The proposed project will change the natural appearance of the project area landscape.

Generation of Dust: Some dust will be generated during demolition works of the proposed 90MVA 220/60 kV transmission substation. This will affect demolition staff as well as the neighbours. The impact will be direct, temporary and minor.

PROPOSED MITIGATION MEASURES

Air Emissions Mitigation Measures

- During construction, any stockpiles of earth should be enclosed / covered / watered during dry or windy conditions to reduce dust emissions;
- Construction trucks removing soil from the site, delivering sand and cement to the site should be covered to prevent material dust into the surrounding areas;
- During construction, where water is available, sprinkle the construction area with water to keep dust levels down.
- Masks should be provided to all personnel in areas prone to dust emissions throughout the period of construction.
- Drivers of construction vehicles must be supervised so that they do not leave vehicles idling, and they limit their speeds so that dust levels are lowered.
- Maintain all machinery and equipment in good working order to ensure minimum emissions including carbon monoxide, NO_x, SO_x and suspended particulate matter;
- No burning of any waste materials whatsoever should be permitted within the site both during construction and operation;
- Use of low sulphur fuel for SO₂ where available or installing desulphurization equipment;

Dust Emission Mitigation Measures

- Fugitive emissions from site work to be eliminated or minimized by applying water on a need to need basis to unpaved surfaces and exposed construction areas during the dry season;
- Cover all trucks hauling soil, sand and other loose materials or require all trucks to maintain at least two feet of freeboard.

Noise Abatement Measures

- All construction equipments and machinery to be used must be tested to verify if they are compliant with Kenya and the internationally acceptable standards of noise. Tested noise levels should be recorded as baseline and used for future monitoring.
- Noise emitting equipment should be properly maintained.
- All workers in the project site must be equipped with suitable and adequate Personal Protective Equipment (PPE) for hearing protection.

Soil Erosion Mitigation Measures

- Excavations of the site will be confined only on the sections of the substation where structures and equipment shall be located.
- Excavated earth will be held away from the drains and on locations of the site not susceptible to surface runoff of storm water,
- The earth removed for external disposal will require to be deposited on sites without the risk of being washed down during rains and where it will not compromise other land use activities in those areas,
- Caution will be required during construction at times of heavy rains.
- Re-vegetate exposed areas around the site so as to mitigate erosion of soil by storm water runoff.
- The final site grade should facilitate drainage and avoid flooding and pooling. A site drainage plan should be developed to protect against erosion.
- Protecting stockpiles through the use of silt fencing and reduced slope angles should be used to minimize soil erosion during construction.
- Installation of drainage ditches, construction of runoff and retention ponds is necessary. Minimization of disturbances and scarification of the surface should be observed to reduce erosion impacts.
- All slopes and working surfaces should be returned to a stable condition.
- Topsoil on the final site would be graded and planted as appropriate.

Oil Spill Mitigation Measures

- To prevent oil spills and environmental contamination, the substation should be designed with spill prevention and detection systems to protect the environment especially where the transformers will be located.
- Need to design appropriate protection devices against accidental discharge of transformer oil substances.
- Storage and liquid impoundment areas for fuels, raw and in-process material solvents, wastes and finished products should be designed with secondary containment to prevent spills and the contamination of soil, ground and surface water.
- The substation design should provide adequate storage areas for the transformer oil.
- Drains should be routed through an oil/water separator.
- Frequent inspection and maintenance of the transformers should be done to minimize spilling.
- A written substation response plan should be prepared and retained on the site and the workers should be trained to follow specific procedures in the event of a spill.
- Constructing and maintaining facilities should be done so as to enable the easy removal of rainwater from the secondary containment structures and proper removal of oil from the surface of the accumulated storm water.
- The substation operator should ensure the proper containment or collection and disposal for the waste oil or used oil. In the Environmental Management Plan (EMP), disposal of used oil will be the responsibility of the project operator.

- All waste oils from maintenance of transformers and other associated equipments should be segregated and disposed properly by a reputable/registered waste handler in accordance with the waste disposal plan.

Solid waste generation

- The solid waste would consist primarily of packaging materials for lubricants, used oil filters and used rags.
- Contractor should develop a solid waste disposal plan which includes the provision of receptacles at strategic points within the site, recycling programmes for recyclable wastes.
- Solid wastes must be segregated and labelled to separate hazardous from non-hazardous waste. The substation should be provided with an inbuilt solid waste collection bin with compartments for recyclable materials, biodegradable materials and hazardous materials.
- The most appropriate options in waste management are identification of the waste types, segregation into the various categories and establish suitable mechanisms of collection, storage, transfer and final disposal. The ultimate destination for each of the waste categories should also be known.
- The contractor and project operator should engage a refuse handling company to remove the wastes from the site to the recommended waste management site.
- Warning signs against littering and dumping wastes in wrong places within the project site should be erected.
- Earth excavated from the construction site should be used as land fill in quarries or other excavated sites within or outside the project site. It is suggested that the contractors identify suitable land fill sites.
- Solid waste audit should be an integral section of the annual environmental audit of premises upon commissioning.

Hazardous waste

- The amount of hazardous waste generated will be very low and possibly originate from maintenance sources.
- The waste would consist primarily of spent lubricants, used rags and spent clean-up solvents.
- Hazards on the site should be clearly marked and the entire workforce trained to recognize the hazards and familiarize themselves with procedures to be followed before entering hazardous areas.

Fire Prevention Measures

- The project site must have in place appropriate and adequate fire fighting equipments of recommended standards and in key strategic points.
- A fire alarm system should be installed in the substation.
- A fire evacuation plan must be posted in various points of the project site including procedures to take when a fire is reported. All workers must be trained on fire management and fire drills undertaken regularly.
- A fire assembly point must be identified and labeled accordingly.

Public and Workers Health and Safety Mitigation Measures

- All workers entering the construction site must be equipped with Personal Protective Equipment (PPE) such as ear muffs, safety footwear, overalls, gloves, dust masks, among others. The PPE's should be those that meet the international standards.
- Personal protection gear must be provided and its use made compulsory to all. The entire workforce of the substation should be trained in the use and care of protective gear and in all relevant safety measures.
- Restricted 'ENTRY' signs should be installed to keep away unauthorized persons from access to restricted areas.
- Machines and Equipments must be operated only by qualified staff and a responsible person should be on site at all times to ensure adherence to safety requirements.
- The contractor and operator must develop a workplace Safety and Health Policy Manual which should be communicated to all persons at the site.
- The contractor and operator should develop a Substation Response Plan for handling any emergencies arising thereof during the construction.
- During construction, temporary washrooms should be constructed with soak-pits that can be easily exhausted.
- A well equipped first aid kit and a person who has been trained in first aid should always be available at the site.

Visual Impact

- Structures at the site should be designed in such a way that they will improve the beauty of the surroundings.
- Restore site area through backfilling, landscaping and planting of trees, shrubs and grass on the open spaces to re-introduce visual barriers,
- Landscaping and planting of trees at the site would also serve to mitigate any perceived negative visual impacts

Economic and Social Impact

- The Proponent should continually participate in community development activities where possible as part of their corporate social responsibility.
- Casual labourers should be sourced from the local community to boost them economically and create employment for the youth.

Minimization of increased Water Demand: The proponent of the proposed 90MVA 220/60 kV transmission substation in Athi River shall ensure that water is used efficiently at the site by sensitizing construction staff to avoid irresponsible water use.

Public Consultation

Consultations were also undertaken as part of the EIA in order to obtain the views of immediate community, interested groups and affected groups within the site's immediate area of influence. The

consultation was done with the immediate neighbourhood of the proposed site and involved use of a semi-structured public participation form. In general the project is acceptable and no objections were raised concerning the proposed 90MVA 220/60 kV transmission substation.

Conclusion

An Environmental Management Plan (EMP) outline has been developed to ensure sustainability of the site activities from construction through operation to decommissioning. The plan provides a general outlay of the activities, associated impacts, mitigation action plans and appropriate monitorable indicators. Implementation timeframes and responsibilities are defined, and where practicable, the cost estimates for recommended measures are also provided.

A monitoring plan has also been developed and highlights some of the environmental performance indicators that should be monitored. Monitoring creates possibilities to call to attention changes and problems in environmental quality. It involves the continuous or periodic review of operational and maintenance activities to determine the effectiveness of recommended mitigation measures. Consequently, trends in environmental degradation or improvement can be established, and previously unforeseen impacts can be identified or pre-empted.

It is strongly recommended that a concerted effort is made by the site management in particular, to implement the Environmental Management and Monitoring Plan provided herein. Following the commissioning of the 90MVA 220/60 kV transmission substation, statutory Environmental and Safety Audits must be carried out in compliance with the national legal requirements, and the environmental performance of the site operations should be evaluated against the recommended measures and targets laid out in this report.

It is quite evident from this study that the construction and operation of the proposed 90MVA 220/60 kV transmission substation will bring positive effects in the project area including improved supply of electricity, creation of employment opportunities, gains in the local and national economy, provision of market for supply of building materials, Informal sectors benefits, Increase in revenue, Improvement in the quality of life for the workers, Optimal use of land and Improved security. However, although the project will come with various positive impacts, negative impacts will also be experienced hence the need to also look at them.

Considering the proposed location, construction, management, mitigation and monitoring plan that will be put in place, the project is considered important, strategic and beneficial and may be allowed to proceed.

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LIST OF ABBREVIATIONS

AGO	Automotive Gas Oil
AST	Above Ground Storage Tank
CO ₂	Carbon Monoxide
EA	Environmental Audit
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMCA	Environmental Management and Coordination Act, 1999
EMP	Environmental Management Plan
EPZ	Export Processing Zone Authority
GHGs	Green House Gases
HFO	Heavy Fuel Oil
kV	Kilo Volt
KWS	Kenya Wildlife Service
L.R	Land Registration
Lmax	Maximum sound pressure level obtained during the measurement period
Lmin	Minimum sound pressure level obtained during the measurement period
Leq	Value of A-weighted sound pressure level of a continuous steady sound that, within a specified interval, has the same mean square sound pressure as a sound under consideration whose level varies with time
mg/kg	Milli grams per kilogram
MW	Mega Watts
NEMA	National Environment Management Authority
NOX	Oxides of Nitrogen
PM	Particulate Matter
PPE	Personal Protective Equipment
SOX	Oxides of Sulphur
PPE	Personal Protective Equipment
SHE	Safety Health and Environment
STD	Sexually Transmitted Diseases
TPH	Total Petroleum Hydrocarbon

CHAPTER ONE: INTRODUCTION

1.1 Project Background

Electricity cannot be stored, it is therefore necessary to generate and deliver power over long distances at the very instant it is needed. Kilometres of high voltage Transmission Lines transmit power, mainly from the power generating stations like hydro powers, geothermal and thermal stations located at various parts of the country or from the neighbouring countries like Uganda to major substations around the country. At these proposed 90MVA 220/60 kV substation electricity voltage of high voltage will be stepped down for distribution to smaller substations, industries, businesses, homes and social institutions among others in Nairobi and its environment. KPLC has to supply power reliably to meet the increasing needs and demands of end-users. Therefore, KPLC has to expand and establish its infrastructure of Transmission Lines and substations on an ongoing basis. The substations have to be built while maintaining the balance between satisfying the society's needs and environmental constraints.

The Kenya Power and Lighting Company Limited (KPLC) intend to construct and operate 90MVA 220/60 kV substation for power transmission and distribution develop in Nairobi Metropolis over the planning period 2009 – 2015. The process will entail construction of transmission line, substations and sub-transmission lines for the Nairobi Metropolitan in order to sharply improve the quality of electricity. This is because the existing transmission capacity is constrained particularly during peak hours when system capacity is constrained particularly during peak hours when system voltage in parts of Nairobi drop below acceptable levels, occasioning load shedding despite availability of generation capacity.

KPLC propose the construct 90MVA 220/60 kV of the transmission substation in Athi River various substations that surround the proposed transmission substation. The purpose of the proposed transmission substation is to increase the security of supply to the surrounding industries, businesses, homes and social institutions among others. In line with environmental legislation, KPLC has used is in house environmental experts who are registered by NEMA to undertake the Environmental Impact Assessment (EIA) for the proposed construction of Athi River substation. The construction of the proposed Athi River substation was originally contained in the implementation of a medium term strategy for power transmission and distribution in Nairobi Metropolis over the planning period 2009 – 2015. However, due to the urgency of the construction of substation at Athi River will bring about positive impacts to the local community in terms of employment opportunities, economic development and informal businesses among others.

Nairobi city region currently supplied via three main supply points; Dandora 220/132 KV, 400 MVA, Embakasi 220/66, 180 MVA and Nairobi north 220/66, 180 MVA substations with a total of 760 MVA transformation capacity against a peak demand of 570 MVA. From these supply points power is transmitted around the city over 132 kV and 66 kV sub transmission systems. These substations have over time become increasingly congested as more transmission lines are terminated there and also

complicated further due to surrounding urban settlements hence the proposed 90MVA 220/60 kV substation in Athi River.

The proposed Athi River Substation site has low environmental sensitivity from a botanical, archaeological and avi-fauna perspective. Social impacts are expected to be of low significance with a good chance of mitigation, largely due to the fact that the proposed activity is in line with the existing land uses of the Export Processing Zone (EPZ). Visual impacts of the construction are expected to be minimal due to the fact that the proposed substation will not interfere with the general landscape of the proposed project site, and the viewing audience is minimal due to the peri urban/ rural nature of the site. The height of the new structures is similar to that of those already existing at the other substation. No objections to the proposed construction and operation of the substation were received during the public consultation process.

The Government of Kenya through the Ministry of Energy and The Kenya Power & Lighting Company Limited (KPLC) have plan to improve the quality of electricity supply in Nairobi metropolitan area by constructing 90MVA 220/60 kV substation in Athi River. This electricity will be distributed to industries, businesses, homes and social institutions among others in Nairobi and its environment. This Environmental Impact Assessment study has been commissioned to ensure that significant impacts on the environment are taken into consideration at the construction operation and decommissioning phases. The ESIA is further conducted in accordance with Section 58 of Environmental Legislation, EMCA 1999 and its subsidiary Legislation i.e. Environmental Impact Assessment and Auditing Regulations of 2003 and in adherence World Bank Environment and Safeguard policies.

This Environmental Impact Assessment has identified both positive and negative impacts of the proposed project to the environment and proposes mitigation measures in the Environmental Management Plan developed to address potential negative impacts, during the construction, operation and decommissioning phases of the project, for overall environmental sustainability.

1.2 Scope and Objectives of the Study

The Kenyan Government Policy on all new projects, programs or activities requires that an Environmental Impact Assessment is carried out at the planning stages of any proposed undertaking that is likely to harm the environment to ensure that significant impacts on the environment are taken into consideration during the design, construction, operation and decommissioning of the proposed development.

1.2.1 Scope

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

The assessment was undertaken in full compliance with the Environmental Management and Coordination Act 1999 and also the Environmental Impact Assessment and Audit Regulations, 2003. In addition, appropriate sectoral legal provisions touching on such projects have also been referred to for the necessary considerations during the construction, commissioning and operation of the proposed 90MVA 220/60 kV of the transmission substation.

Specific objectives of the study included the following:

- ⇒ Present an outline of the project background,
- ⇒ Establish the environmental baseline conditions of the project area and review all available information and data related to the project,
- ⇒ Identify key areas for environmental, health and safety concerns as well as the anticipated impacts associated with the proposed project implementation and commissioning,
- ⇒ Establish a comprehensive environmental management plan covering the construction, operation and decommissioning phases of the project,
- ⇒ Preparation of a comprehensive Project Report in accordance with the local environmental legislation and submission to NEMA for further instructions and/or approval.

The EIA scope largely covered the following areas:

- (1) Baseline Conditions:
 - Environmental setting (climate, topography, geology, hydrology, ecology, water resources, sensitive areas, baseline noise levels, air quality and soil quality measurements etc.),
 - Socio-economic activities in the surrounding areas (land use, human settlements, economic activities, institutional aspects, water demand and use, health and safety, public amenities, etc.),
 - Infrastructural issues (roads, water supplies, drainage systems, power supplies, etc.).
- (2) Legal and policy framework:
 - Focusing on the relevant national environmental laws, regulations and by-laws and other laws and policies focusing on allied activities relative to the project in question.
- (3) Interactive approach was adopted for the immediate neighbourhood in discussing relevant issues including among others:
 - Land use aspects,
 - Neighbourhood issues,
 - Project acceptability,
 - Social, cultural and economic aspects,
- (4) Environmental impacts:

- Physical impacts,
- Biological impacts,
- Legal Compliance.

1.2.2 Terms of Reference (TOR) for the EIA Process

The ESIA Experts were assigned the task of carrying out Environmental and Social Impact Assessment of the proposed 90MVA 220/60 kV substation in Athi River. The scope of the assessment covers construction works of the proposed development which include ground preparation, civil works, structural works, fencing the substation, Installation of the circuit breakers, transformers, installation of service lines as well as the utilities required by the 90MVA 220/60 kV of the transmission substation. The output of this work is a comprehensive Environmental and Social Impact Assessment Report for the purposes of seeking a NEMA licence that will approve the project construction and operation and meeting the requirements of the World Bank Environmental and Social Safeguard Policies.

The ESIA experts conducted the study by using the following terms of reference:

- Establish the suitability of the proposed location of the proposed 90MVA 220/60 kV of the transmission substation in Athi River.
- A concise description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project.
- A description of the technology, procedures and processes to be used, in the implementation of the project.
- A description of materials to be used in the construction and implementation of the project, the products, by-products and waste to be generated by the project.
- A description of the potentially affected environment.
- A description of environmental effects of the project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated.
- To recommend a specific environmentally sound and affordable wastewater management system.
- Provide alternative technologies and processes available and reasons for preferring the chosen technology and processes.
- Analysis of alternatives including project site, design and technologies.
- Development of an Environmental Management Plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment, including the cost, timeframe and responsibility to implement the measures.
- Provide an action plan for the prevention and management of the foreseeable accidents and hazardous activities in the course of project construction, operation and decommissioning.
- Propose measures to prevent health hazards and to ensure safety in the working environment for the employees and the neighbouring community.
- An identification of gaps in knowledge and uncertainties which were encountered in compiling the information.

- An economic and social analysis of the project.

1.2.3 EIA Approach and Methodology

The approach to this exercise was structured such as to cover the requirements under the EMCA, 1999 as well as the Environmental Impact Assessment and Audit Regulations, 2003. It involved largely an understanding of the project background, the preliminary designs and the implementation plan as well as commissioning. In addition, baseline information was obtained through physical investigation of the site and the surrounding areas, informal interviews with a random sample of people from the surrounding community, use of public participation forms, site checklist, photography, and discussions with other stakeholders.

The key activities undertaken during the assessment were:

- ⇒ Continuous discussions with the stakeholders and accessing other sources of information on the proposed project details, the site planning and implementation plan,
- ⇒ Physical inspection of the proposed site, photography, and interviews with people in the immediate neighbourhood. A public participation form was used to record their opinion regarding the project (**samples have been annexed to this report**).
- ⇒ Evaluation of the activities around the site and the environmental setting of the wider area. This was achieved through existing information, literature and physical observations,
- ⇒ Review of available documentation,
- ⇒ Reporting, review and submissions.

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

Step 1: Screening

This was the first stage when the proposed project was evaluated, guided by EMCA (1999). Urban development activities are listed under schedule 2 of EMCA, 1999 among projects requiring EIA before commencement. In addition, other considerations taken into account during the screening process included the physical site location, zoning, nature of the immediate neighbourhood, sensitivity of the areas surrounding the site and socio-economic activities in the area, among others.

Step 2: Desk Study

Documentation review was a continuous exercise that involved a study of available documents on the project including the project set-up plans and architect's statement, land ownership documentation, environmental legislation and regulations, district development plans, location maps, etc.

Step 3: Site Assessment and Consultations

With the background obtained from the site investigation, discussions held, and the documentation review, the proposed project was evaluated and an assessment made on the potential environmental and social impacts. Consultations were made with the Proponent, the Architect, as well as selected members of the surrounding community.

Step 4: Establishment of Baseline Conditions

Physical inspections and observations constituted the main baseline survey activities. It was considered unnecessary to carry out environmental sampling and analysis (e.g. air, water, noise, soil) because the proposed development will not have hazardous emissions or residuals from the anticipated activities after commissioning; it will therefore not have any economic benefit to the client neither would it add any value to the report to analyse environmental parameters that are not expected to be adversely impacted by project activities.

Step 5: Reporting

Specific issues covered in the project report include but are not limited to:

- ⇒ Name of the proponent, address and contact person
- ⇒ Title of the project
- ⇒ Objectives and scope of the project
- ⇒ Nature of the project;
- ⇒ Location of the proposed project, including the physical area that may be affected by the project's activities;
- ⇒ Types of activities that will be undertaken during the project construction, operation and decommissioning phases;
- ⇒ Design of the project;
- ⇒ Proposed Project budget;
- ⇒ Materials to be used, products and by-products, including waste to be generated by the project and the method(s) of their disposal;
- ⇒ Potential environmental impacts of the project;
- ⇒ Economic and social impacts to the local community and the nation in general;
- ⇒ Views of the public/potentially affected people about the project; and
- ⇒ An Environmental Management Plan (EMP) for the entire project cycle to include mitigation measures to be taken during and after implementation of the project and an action plan for the prevention and management of foreseeable accidents during the project cycle.

CHAPTER TWO: PROJECT DESCRIPTION

2.1 Site Location Characteristics

Athi River is situated in Eastern, Kenya; its geographical coordinates are $1^{\circ} 27' 0''$ South, $36^{\circ} 59' 0''$ East. The proposed site is located in Athi River town, Mavoko Municipal Council. The site coordinates are $01^{\circ} 27' 27.8''$ South and $036^{\circ} 57' 17.9''$ East. The site is 1533 metres above sea level and occupies an area of about 11.48 Hectares. The proposed site is located along Nairobi - Namanga road within Mavoko Municipality which is approximately 30 km from Nairobi City Centre and 2 km off the Nairobi to Mombasa Highway.

Currently the project site is used vacant land used for grazing animals.



Figure 1: Map showing the location of the proposed site in Athi River for the construction of the proposed 90MVA 220/60 kV of the transmission substation.

2.2 Nature of the Project

The proposed 90MVA 220/60 kV substation in Athi River will have the following components namely; 8 No. 66KV line bays, 2No 66KV transformer bays, 2 No. 220KV bays, and 3 No. 220KV Line bays (Refer to Annex II for proposed 90MVA 220/60 kV substation Layout Plan). The transformers will be using oil for its cooling purposes as they will be stepping down their power supply. This transformer oil will be delivered to site using road transport and will be packed in drums.

The sub station site installations will include:

- Reactors
- Transformers (Current and Voltage/Potential Transformer)
- Disconnect Switches
- Bushings
- Surge Arresters
- Standoff Insulators and
- Earthing switches
- Lightning Arresters
- An open area for electrical equipment such as the air-cooled reactors, typically about 4.5m high, and switchgear, typically about 5m high.
- An auxiliary services building which will be built in the same style as the National Grid switchgear building.
- Fire deluge pump house and tank.
- Lighting
- Fencing
- Air break switches
- Voltage regulators
- Control house
- Cut off switches
- Distribution bus
- Metal clad switch gear
- Battery room among other components and facilities

Substation Design and Layout

Substation Design Services Include: One-Line Diagrams and Construction Drawings, Site Selection & Equipment Layouts, Equipment Procurement, Construction Coordination, Relay, Control & Metering, Protective Systems Coordination, Substation Automation, SCADA Systems Design, Grounding Systems and Final Checkout, Start-up and Testing

The layout of the substation is very important since there should be a Security of Supply. In an ideal substation all circuits and equipment would be duplicated such that following a fault, or during maintenance, a connection remains available. Practically this is not feasible since the cost of

implementing such a design is very high. Methods have been adopted to achieve a compromise between complete security of supply and capital investment.

The proposed substation layout consists essentially the arrangement of a number of switchgear components in an ordered pattern governed by their function and rules of spatial separation. The spatial separation will include; Earth clearance this is the clearance between live parts and earthed structures, walls, screens and ground, Phase clearance this is the clearance between live parts of different phases and Isolating distance this is the clearance between the terminals of an isolator and the connections thereto. The section clearance is the clearance between live parts and the terminals of a work section. The limits of this work section, or maintenance zone, may be the ground or a platform from which the man works.

2.3 Site Ownership

The proposed site is classified industrial. The land parcel, L.R. 18474/216, Plot. No. 11, measuring approximately 11.48 hectares is registered as for Export Processing Zone (EPZ) property under the Registration of Titles Act (Cap. 281). The land is owned by Export Processing Zone Authority (EPZ). KPLC has leased the land from EPZ (**refer to Annex III for copy of lease agreement**).

2.4 Project Justification

The bulk of the electricity demand of the Nairobi Metropolitan area via three main supply points; Dandora 220/132 Kv, 400 MVA, Embakasi 220/66 kV, 180 MVA and Nairobi North 220/66, 180 MVA substations with a total of 760 MVA transformation capacity against a peak demand of 570 MVA. From these supply points power is transmitted around the city over 132 kV and 66 kV sub-transmission systems. These sub stations have over time become increasingly congested as more transmission lines are terminated there and also complicated further due to surrounding urban settlements.

National load forecast projects rapid load growth over the 2009-2029 planning period with power demand expected to rise to 3600 MW by 2020 and to 8000 MW by 2029. Nairobi city region accounts for 52% of this demand, which translates to about 4000 MW by the end of the planning period. To ensure system adequacy it is therefore anticipated that power transformation in Nairobi region will have to be increased by at least 1100 MW by 2020 and by at least 3300 MW by 2029. For optimal power transmission and distribution around Nairobi, additional 220/66 kV substations will be required at suitable locations in the region along with associated 220 kV transmission and 66 kV sub-transmission networks.

It is envisaged that a number of additional 220/66 kV substations and associated transmission and sub – transmission lines will be required in Nairobi city region over the planning period. To enhance the level of supply reliability in Nairobi city region, the substation will be interconnected in a 220 kV ring circuit, with optimal interconnection of the ring circuit, it may also be necessary to review termination of the existing Kamburu – Dandora and Kiambere – Embakasi 220 kV transmission lines at either of the proposed new substation to optimize supply arrangements. Therefore Kplc proposes to construct 90MVA 220/60 kV substation at Athi River

2.5 Project Activities

It is expected that the proposed site will undergo alteration during the construction process to install the 90MVA 220/60 kV of the transmission substation and associated structures. Safety protocol and established International Environmental Protection Regulations/ Standards shall guide the Contractor and projector operator. Modest construction procedures will be followed to reduce noise levels and the production of dust that may affect the neighbouring community.

2.6 Construction Procedures

All construction activities including ground preparation, earth moving, materials delivery, building, walling, roofing and the installation of amenities (power, water, communication equipment, etc.), fittings (doors, windows, safety provisions, etc.) will be carried out by competent personnel obtained through respectable contractors to ensure consistent high standard of finish and providing superb value for money.

2.6.1 Construction activities Outline

Construction activities will involve the following:

- Construction of the substation access road to the substation
- Removal of vegetation within substation footprint
- Terracing and levelling of the site
- Installation of foundations for infrastructure such as transformers, control room and radio tower
- Construction of bunds and oil holding dams (for emergency holding of transformer oil in the event of a spill) and wall safety walls
- Compaction and filling with gravel of the areas between the foundations
- Creation of formal drainage and storm water control measures
- Delivery and installation of transformers, towers, busbar and associated infrastructure
- Construction of control room and administrative infrastructure
- Redirecting of existing 220 kV lines to enter and leave the substation
- Connection of the new infrastructure to the proposed 220 kV network
- Construction of perimeter fencing and lighting

2.6.2 Input Materials

The 90MVA 220/60 kV of the transmission substation will be constructed using common construction materials and construction procedures that are not expected to compromise the safety of the neighbouring communities as well as the general environment. The following inputs will be required for construction:

- (i) Raw construction materials e.g. sand, cement, natural building stone blocks, hard core, gravel, concrete among others
- (ii) Timber (e.g. doors and frames, fixed furniture, etc.),

-
- (iii) Paints, solvents, white wash, etc.,
 - (iv) A construction labour force (of both skilled and unskilled workers).

2.7 Project Budget

The estimated cost of the project is approximately One hundred and Twenty Five (125) Million US Dollars. The project lifespan will be 25 years.

2.8 Target Group for the ESIA Report

The ESIA Report has been prepared for use by different stakeholders to be involved in the construction and operation of the proposed 90MVA 220/60 kV of the transmission substation. The report contains useful information on policies and procedures to be adhered to, implementation modalities, analysis of potential environmental and social impacts and suggested mitigation measures at various stages of project activities. The information will be useful in planning, implementation, management and maintenance of the substation.

In this regard, the report is useful to the following stakeholders:

- Funding agencies and donors;
- Relevant government ministries and agencies for policy implementation;
- Affected and Interested persons;
- Planners and Engineers to be involved in preparation of designs and plans for the 90MVA 220/60 kV substation;
- Contractors to be engaged in the construction works for the 90MVA 220/60 kV substation;
- People to be involved in the management and operation of the 90MVA 220/60 kV substation.

CHAPTER THREE: BASELINE INFORMATION OF THE STUDY AREA

This chapter gives the physical description of the project site in terms of position and size, topography, climate and soils.

3.1 Location

The site is located in Athi River District which was formally within the large Machakos District. Athi River District borders Nairobi City and Kangundo District to the Northwest, Mwala District to the east, Kajiado District to the west and Makueni District on the south. It lies between Latitudes $0^{\circ}45'$ South and $1^{\circ}3'$ South and Longitudes $36^{\circ}45'$ East and $37^{\circ}45'$ East. The proposed site is located on a 16.17 hectare parcel of land along Nairobi-Namanga road within Athi River division approximately 34 km from Nairobi City Centre.



Figure 2. View of the proposed site. At the background is East African Portland Cement Company Limited

3.2 Site Neighbouring land-uses

The proposed site is owned by Export Processing Zone Authority whose mandate is to catalyse Industrial and Economic Development through Investments in Economic Zones. The proposed land is therefore zoned for industrial use. The immediate neighbours to the proposed site are: East African Portland Cement Company Limited on the East, Nairobi National Park boundary on the North and open fields in the South and West. The proposed project is compatible with the existing and proposed land uses.

3.3 Topography

The district has a variety of topographical features. The landscape is largely a plateau. The proposed site lies at an altitude of about 1533 m above sea level. The topography at the proposed site is generally flat with a gentle slope towards the north.

3.4 Climate

The district receives a bimodal rainfall with short rains coming in October to December and long rains in March to May. The annual average rainfall is between 500 mm and 1300mm, which are unevenly distributed and unreliable. Temperature varies between 18°C and 25°C throughout the year. The coldest month is July and warmest are October and March prior to the onset of the rains. Dry periods are experienced in February to March and August to September.

3.5 Geological Setting

The district is characterised by volcanic rocks, which were deposited by the solidification of the flowing lavas, have a very gentle slope having flowed eastwards away from the Rift Valley. The area is covered at the surface by dark clay soils that can be up to 10m thick in places. The surficial soils are expandable volcanic clays referred to as black cotton soil. Below the soils is a series of sediments termed the Upper Athi Series that consists mainly of sandy sediments, with some minor clays and boulders. The Upper Athi Series is underlain by Lower Athi Series that consists predominantly of clayey deposits that were laid onto the Kapiti phonolite. The Kapiti Phonolite consists of a series of lava flows that are separated by strata that are clayey in nature. These are old metamorphic rocks of sedimentary origin and are amongst the oldest rocks in the country and on the African continent.

The area of investigation comprises the following formation: The Upper Athi Series (tuffs) which were laid down by explosive activity on top of the western part of the Kapiti Phonolites. It is believed that they were laid down in water because they are stratified. To the east they thin out and only outcrop as isolated patches on the eastern bank of the Stony Athi River, dying out to the south about ten kilometres north of Kajiado Township. The Upper Athi series are underlain by the Kapiti phonolites that form the major outcrop East and North east, forming the western part of the Kapiti plains. The surface of these phonolites is generally flat. The Basement System rocks are at greater depths and underlie the Kapiti phonolites.

Soils at the site have developed on Tertiary Trachyte lavas, technically well-drained, extremely deep, dusky red to dark reddish brown friable clays, with acid humic topsoil. The soils of the area are products of weathering of mainly volcanic rocks under relatively high temperature, rainfall and poor drainage. The principal soils of the area include yellow-red friable clays (Ando-like soils) and dark red friable clays (Latosolic soils) with high humus overlaying clay. These are developed from lava, volcanic tuff ash in humid with rainfall of more than 1000 mm per annum. Other areas have dark-grey brown calcareous clay, loams that are associated with old lacustrine deposits areas have red-friable clays. The soils in the proposed site have low natural fertility hence not suitable for agricultural activities.

3.6 Surface Hydrology and Groundwater

The proposed site lies within the drainage basins of Athi River. Kitengela River is a tributary of Athi River. Water supply in the project area is unreliable since Kitengela River is seasonal which is located in the north part of the proposed project site. Rainfall is inadequate and unreliable; water from the permanent rivers and dams is not fully harnessed. Ground water resources are low and saline because of the basement rock systems. Due to the increase in population and growing economic activity, water resources are becoming increasingly scarce.

Ground water potential is low because of massive nature of the parent basement rock. No ground water was recorded during drilling when geotechnical site of the site was done. It can however be expected that a temporary water table will exist on top of the rock during rain seasons (Site Geotechnical Report, 2009). This therefore means that any oil spill from the proposed project can't easily reach ground water.

3.7 Ecology (Fauna and Flora)

The Athi-Kapiti ecosystem (consisting of the Nairobi National Park and southern Maasai land) which is next to site, but supports a large population of wildlife (more than 20 species) that includes long distance migratory species such as the wildebeests and zebras. The Maasai community of Kitengela have witnessed dramatic and rapid changes in the ecology since enacting subdivision of their communal lands into private plots in 1986. From observations made during an extensive survey of areas bordering Nairobi National Park in the South, it was observed that the Kitengela corridor and the Kapiti plains wildlife dispersal area are now virtually blocked to wildlife migration and dispersal. Development, including the rapid growth of Nairobi and the progressive fencing of land, has drastically reduced the extent of that former ecosystem, and the numbers of large mammals, both wild and domesticated, it can support. Since the mid 1980's these pastoral and rich wildlife areas have progressively being partitioned and fenced off, reducing their accessibility to livestock and wildlife.

At the time of the site visit, there were no game animals observed at the proposed site or within its immediate surroundings. Domestic animals use the open field for grazing. The site near the proposed site supports birdlife of various types. The type of vegetation cover found is predominantly grass cover and scattered trees and scrub. These include the *Mimosoideae* family of Acacia trees, and grasses

such as the *Tetrapogon bidentatus* and *Chrysopogon ancheri* species and Aloe Vera. There are no forest reserves within the immediate area of influence of the proposed development.

3.8 Infrastructure

Due to such rapid urban growth in Athi River, provision of basic infrastructure for all has become an important concern of development planners of Athi river town. Basic infrastructural services that have deteriorated due to such rapid increase in population include: Solid Waste Management (SWM) system; water and sewage systems; drainage and flood protection; roads; mass transportation; electric installations; and telecommunications. Greater environmental pollution, congestion and other problems have been the result of under-provision of such basic services. The propose site is well served, with good communication and transport network such as air (approximately 15 km to Jomo Kenyatta International Airport), road, and railway. The main railway line runs from Mombasa to Malaba though Nairobi City. This network facilitates transportation of agricultural products from western Kenya to the coast. Nairobi-Namanga road is an international road which is currently being resurfaced.

3.9 Population

Machakos district has high density population along the hills in Kathiani division, Athi River (where the proposed site is located), Mombasa road and in Central division (Machakos town) due to fertile soils and high rainfall which makes them suitable for agriculture. The presence of Export Processing Zone industries, East Africa Portland Cement Company and other Industries in Athi River has attracted skilled and non-skilled labour to the town.

Population of Machakos is projected to be 440,386 in 2010 and to 465, 749 in 2012. The district has a population density of 139 per km². Kathiani Division (now Athi River district) has the highest population density due to relatively high economic activities (presence of major manufacturing enterprise and Export Processing Zones).

3.10 Ambient air quality, noise levels and soil quality baseline measurements

In order to set the basis for future air quality, noise levels and soil quality in the proposed site, air quality, noise levels and soil quality baseline measurements was done by SGS (K) Limited (A NEMA accredited laboratory). The results of the measurements are given in **Table 1, 2 & 3**.

3.10.1 Noise Level Measurements

The Noise level measurements were carried on 12th January 2009 at three points located within the proposed site. The measurements duration was 30 minutes per point. (**Refer to Annex VI for detailed report**).

Table 1 Baseline Noise Level Measurement Results

Point	Location Details	Lmax	Lmin	Leq
1.	S 01°27' 27.8" E 036°57'17.9"	50.5	43.3	47.0

	Elevation 1533m			
2.	S 01°27' 40.9" E 036°57'21.5" Elevation 1535m	51.5	43.1	46.9
3.	S 01°27' 40.9" E 036°57'21.5" Elevation 1553m	58.5	40.3	45.6

3.10.2 Air Quality Test Analysis

The baseline air quality survey was done at three points on 12th January 2010. The measurements were done for the key pollutant gases Sulphur Dioxide (SO₂), and Nitrogen Oxides, (NO_x). **(Refer to Annex VI for detailed report).**

Table 2 Baseline Air Quality Survey Results

Point	Location Details	(NO ₂) (ppm) (LLD=0.2ppm)	(SO ₂) (ppm) (LLD=0.2ppm)	VOC(ppm) (LLD=0.2ppm)	Dust Levels (µg/m ³)
1.	S 01°27' 26.4" E 036°57'19.7" Elevation 1527m	ND	0.25	ND	0.00031
2.	S 01°27' 40.9" E 036°57'21.5" Elevation 1535m	ND	ND	ND	0.00029
3.	S 01°27' 40.9" E 036°57'21.5" Elevation 1553m	ND	ND	ND	0.00003

ND-Not detected

3.10.3 Soil quality Measurements

The baseline air quality survey was done at three points on 12th January 2010. The soil samples were tested for BTEX and PAH. **(Refer to Annex IV for detailed report).**

The test results are given **Table 3.**

Table 3 Baseline Soil Quality Test Results

TESTS	Units	Point 1	Point 2	Point 3
Lead as Pb	mg/kg	37.24	122	26.49
BTEX				
Benzene	mg/kg	Not Detected (DL=0.01)	0.09	Not Detected (DL=0.01)
Toluene	mg/kg	0.509	0.05	Not Detected (DL=0.01)
Ethylbenzene	mg/kg	Not Detected (DL=0.01)	0.05	Not Detected (DL=0.01)
Xylene	mg/kg	Not Detected (DL=0.01)	0.01	Not Detected (DL=0.01)
Total Detectable BTEX	mg/kg	0.509	0.19	Not Detected (DL=0.01)
PAH				
Naphthalene	mg/kg	Not Detected (DL=0.01)	Not Detected (DL=0.01)	Not Detected (DL=0.01)
Acenaphthylene	mg/kg	Not Detected (DL=0.01)	Not Detected (DL=0.01)	Not Detected (DL=0.01)
Acenaphthene	mg/kg	Not Detected (DL=0.01)	Not Detected (DL=0.01)	Not Detected (DL=0.01)
Fluorene	mg/kg	Not Detected (DL=0.01)	Not Detected (DL=0.01)	Not Detected (DL=0.01)
Phenanthrene	mg/kg	Not Detected (DL=0.01)	0.02	Not Detected (DL=0.01)
Anthracene	mg/kg	Not Detected (DL=0.01)	0.01	Not Detected (DL=0.01)
Fluoranthene	mg/kg	Not Detected (DL=0.01)	Not Detected (DL=0.01)	Not Detected (DL=0.01)
Pyrene	mg/kg	Not Detected (DL=0.01)	Not Detected (DL=0.01)	Not Detected (DL=0.01)
Benzo(a)anthracene	mg/kg	Not Detected (DL=0.01)	Not Detected (DL=0.01)	Not Detected (DL=0.01)
Chrysene	mg/kg	Not Detected (DL=0.01)	Not Detected (DL=0.01)	Not Detected (DL=0.01)
Benzo(b)fluoranthene	mg/kg	Not Detected (DL=0.01)	Not Detected (DL=0.01)	Not Detected (DL=0.01)
Benzo(k)fluoranthene	mg/kg	Not Detected (DL=0.01)	0.03	Not Detected (DL=0.01)
Benzo(a)pyrene	mg/kg	Not Detected (DL=0.01)	0.04	Not Detected (DL=0.01)
Dibenzo(a,h)anthracene	mg/kg	Not Detected (DL=0.01)	Not Detected (DL=0.01)	Not Detected (DL=0.01)
Benzo (g,h,i) perylene	mg/kg	Not Detected (DL=0.01)	0.05	Not Detected (DL=0.01)
Indeno(1,2,3-c,d) pyrene	mg/kg	Not Detected (DL=0.01)	0.05	Not Detected (DL=0.01)
Total PAH	mg/kg	Not Detected (DL=0.01)	0.20	Not Detected (DL=0.01)

Some Lead was detected on the proposed site but the levels are not alarming. This is attributed to past activities on site.

CHAPTER 4: RELEVANT LEGISLATIVE AND REGULATORY FRAMEWORKS

4.1 Introduction

There are many environmental problems and challenges in Kenya today. Among the cardinal environmental problems include: loss of biodiversity and habitat, land degradation, land use conflicts, human animal conflicts, water management and environmental pollution. This has been aggravated by lack of awareness and inadequate information amongst the public on the consequences of their interaction with the environment.

There is a growing concern in Kenya and at global level that many forms of development activities do cause damage to the environment. Development activities have the potential to damage the natural resources upon which the economies are based. Environmental Impact Assessment is a useful tool for protection of the environment from the negative effects of developmental activities. It is now accepted that development projects must be economically viable, socially acceptable and environmentally sound.

Kenya has over 77 statutes which relate to environmental concerns. Most of the statutes are sector specific, covering issues such as land use, occupational health and safety, water quality, wildlife, public health, soil erosion, air quality among others.

4.2 Environmental Policy Framework

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

4.3 Institutional Framework

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

4.3.1 National Environment Management Authority (NEMA)

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

4.3.1.1 Provincial and District Environment Committees

According to EMCA, 1999 No. 8, the Minister by notice in the gazette appoints Provincial and District Environment Committees of the Authority in respect of every province and district respectively. The Provincial and District Environment Committees are responsible for the proper management of the environment within the Province and District in respect of which they are appointed. They are also to perform such additional functions as are prescribed by the Act or as may, from time to time be assigned by the Minister by notice in the gazette. The decisions of these committees are legal and it is an offence not to implement them.

4.3.1.2 Public Complaints Committee

The Committee performs the following functions:

- Investigate any allegations or complaints against any person or against the authority in relation to the condition of the environment in Kenya and on its own motion, any suspected case of environmental degradation and to make a report of its findings together with its recommendations thereon to the Council.
- Prepare and submit to the Council periodic reports of its activities which shall form part of the annual report on the state of the environment under section 9 (3) and
- To perform such other functions and exercise such powers as may be assigned to it by the Council.

4.3.1.3 National Environment Action Plan Committee

This Committee is responsible for the development of a 5-year Environment Action Plan among other things. The National Environment Action Plan shall:

- Contain an analysis of the Natural Resources of Kenya with an indication as to any pattern of change in their distribution and quantity over time.
- Contain an analytical profile of the various uses and value of the natural resources incorporating considerations of intergenerational and intra-generational equity.
- Recommend appropriate legal and fiscal incentives that may be used to encourage the business community to incorporate environmental requirements into their planning and operational processes.
- Recommend methods for building national awareness through environmental education on the importance of sustainable use of the environment and natural resources for national development.
- Set out operational guidelines for the planning and management of the environment and natural resources.

- Identify actual or likely problems as may affect the natural resources and the broader environment context in which they exist.
- Identify and appraise trends in the development of urban and rural settlements, their impact on the environment, and strategies for the amelioration of their negative impacts.
- Propose guidelines for the integration of standards of environmental protection into development planning and management.
- Identify and recommend policy and legislative approaches for preventing, controlling or mitigating specific as well as general diverse impacts on the environment.
- Prioritise areas of environmental research and outline methods of using such research findings.
- Without prejudice to the foregoing, be reviewed and modified from time to time to incorporate emerging knowledge and realities and;
- Be binding on all persons and all government departments, agencies, States Corporation or other organ of government upon adoption by the national assembly.

4.3.1.4 Standards and Enforcement Review Committee

This is a technical Committee responsible for environmental standards formulation methods of analysis, inspection, monitoring and technical advice on necessary mitigation measures.

4.3.1.5 National Environment Tribunal

This tribunal guides the handling of cases related to environmental offences in the Republic of Kenya.

4.3.2 National Environment Council (NEC)

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

4.4 Kenyan Environmental Legal Framework

Previously, environmental management activities were implemented through a variety of instruments such as policy statements, permits and licences and sectoral laws. There was however need for a stronger enforcement machinery to achieve better standards in environment management. The enactment of the Environmental Management and Coordination Act in 1999 provided for the establishment of an appropriate legal and institutional framework for the management and protection of the environment.

4.4.1 The Environment Management and Co-ordination Act, 1999

The Environmental Management and Coordination Act (EMCA) 1999 is an Act of Parliament to provide for the establishment of an appropriate legal and institutional framework for the management of the environment and for matters connected therewith and incidental thereto. The main objective of the Act is to:

- Provide guidelines for the establishment of an appropriate legal and institutional framework for the management of the environment in Kenya;
- Provide a framework legislation for over 77 statutes in Kenya that contain environmental provisions;
- Provide guidelines for environmental impact assessment, environmental audit and monitoring, environmental quality standards and environmental protection orders.

The Act empowers the National Environment Management Authority (NEMA) to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of government in the implementation of all policies related to the environment.

Part II of the Environment Management & Coordination Act, 1999 states that every person in Kenya is entitled to a clean and healthy environment and has the duty to safeguard and enhance the environment. In order to partly ensure this is achieved, Part VI of the Act directs that any new programme, activity or operation should undergo environmental impact assessment and a report prepared for submission to the National Environmental Management Authority (NEMA), who in turn may issue a license as appropriate.

Part VIII section 72 of the Act prohibits discharging or applying poisonous, toxic, noxious or obstructing matter, radioactive or any other pollutants into aquatic environment. Section 73 require that operators of projects which discharges effluent or other pollutants to submit to NEMA accurate information about the quantity and quality of the effluent. Section 74 demands that all effluent generated from point sources be discharged only into the existing sewerage system upon issuance of prescribed permit from the local authorities or from the licensee. Finally, section 75 requires that parties operating a sewerage system obtain a discharge license from NEMA to discharge any effluent or pollutant into the environment.

Section 87 Sub-section 1 states that no person shall discharge or dispose of any wastes, whether generated within or outside Kenya, in such a manner as to cause pollution to the environment or ill health to any person, while section 88 provides for acquiring of a license for generation, transporting or operating waste disposal facility. According to section 89, any person who, at the commencement of this Act, owns or operates a waste disposal site or plant or generate hazardous waste, shall apply to the NEMA for a licence. Sections 90 through 100 outline more regulations on management of hazardous and toxic substances including oils, chemicals and pesticides.

Finally the Environmental Impact Assessment Guidelines require that a study be conducted in accordance with the issues and general guidelines spelt out in the Second and Third schedules of the Environmental Regulations (2003). These include coverage of the issues on Schedule 2 (ecological, social, landscape, land use and water considerations) and general guidelines on Schedule 3 (impacts and their sources, project details, national legislation, mitigation measures, a management plan and environmental auditing schedules and procedures).

Under EMCA 1999 NEMA has developed regulations to establish guidelines for better management of the environment and promote sustainable development. To date, the regulations presented in the following sections have been gazetted.

a) Environmental Impact Assessment and Audit Regulations (2003) Legal Notice No. 101

The Environmental Impact Assessment and Audit Regulations state in Part III Rule No. 6 that an environmental impact assessment study shall be conducted in accordance with the terms of reference developed.

Part III Rule 16, takes into account environmental, social, cultural, economic, and legal considerations, and shall:

- Identify the anticipated environmental impacts of the project and the scale of the impacts;
- Identify and analyse alternatives to the proposed project;
- Proposed mitigation measures to be taken during and after the implementation of the project; and
- Develop an environmental management plan with mechanisms for monitoring and evaluating the compliance and environmental performance which shall include the cost of mitigation measures and the time frame of implementing the measures

The Proponent has commissioned the environmental impact assessment study in compliance with the Act. The environmental management and monitoring plan laid out in this report shall be adhered to by the Proponent.

b) Environmental Management and Coordination (Water Quality) Regulation 2006

These regulations are described in Legal Notice No. 120 of the Kenya Gazette Supplement No. 74, September 2006. The regulation applies to drinking water, water used for agricultural purposes, water used for recreational purposes, water used for fisheries and wildlife and water used for any other purposes. This includes the following:

- Protection of sources of water for domestic use;
- Water for industrial use and effluent discharge;
- Water for agricultural use.

The regulations outline:

- Quality standards for various sources of domestic water;
- Quality monitoring for sources of domestic water;
- Standards for effluent discharge into the environment;
- Monitoring guide for discharge into the environment;
- Standards for effluent discharge into public sewers;
- Monitoring for discharge of treated effluent into the environment.

This Legal Notice on Water Quality provides that anyone who discharges effluent into the environment or public sewer shall be required to apply for Effluent Discharge License. The license for discharge is Ksh 5,000 while annual license fee for discharge into the environment will be Ksh. 20,000 or Ksh 100,000 depending on the facility. Non compliance with the regulations attracts a fine not exceeding Ksh 500,000 and the polluter pay principle may apply depending on the court ruling. **Table 4**, gives Waste Water Discharge Guidelines from NEMA

Table 4: NEMA Waste Water Discharge Guidelines

Parameter	Units	Discharge into public sewers	Discharge into open water bodies
PH	-	6.0 – 9.0	6.0 – 9.0
BOD (5 days at 20° C) not to exceed	Mg/l	500	20
COD not to exceed	Mg/l	1000	50
Total suspended solids not to exceed	Mg/l	500	30
n-hexane extract not to exceed	Mg/l	Nil	30
Oils(mineral, animal & vegetable)	Mg/l	10	5
Total phenol not to exceed	Mg/l	10	2
Copper (Cu) not to exceed	Mg/l	1.0	0.05
Zinc (Zn) not to exceed	Mg/l	5.0	0.5
Lead (Pb) not to exceed	Mg/l	1.0	0.1
Arsenic (As) not to exceed	Mg/l	0.2	0.002
Total Mercury (Hg) not to exceed	Mg/l	0.05	0.005
Alkyl mercury not to exceed	Mg/l	0.01	0.001
PCB (Polychlorinated biphenyl) not to exceed	Mg/l	Nil	0.003
Pesticides residues not to exceed	Mg/l	Nil	0.05
Sulphates not to exceed	Mg/l	1000	500
Dissolved manganese (Mn)	Mg/l	-	1.0
Chromium (total)	Mg/l	1.0	0.1
Chloride not to exceed	Mg/l	1000	1000
Fluoride not to exceed	Mg/l	-	2.0
Coliform bacteria	-	-	1000/100ml
Free ammonia not to exceed	Mg/l	2.0	0.2
Sulphides (S) not to exceed	Mg/l	2.0	0.1
Cadmium (Cd) not to exceed	Mg/l	0.5	0.05
Cyanide (CN) total not to exceed	Mg/l	0.5	0.1
Organic phosphorous not to exceed	Mg/l	30	1.0
Chromium six (Cr 6) not to exceed	Mg/l	0.5	0.005
Total dissolved solids not to exceed	Mg/l	3000	1200
Selenium (Se) not to exceed	Mg/l	1.0	0.05
Nickel (Ni) not to exceed	Mg/l	3.0	1.0
Barium (Ba) not to exceed	Mg/l	10	2.0
Temperature not to exceed	-	+/- 2° of the ambient temperature of the sewer	+/- 2° C of ambient temperature of the water body
Oil/ grease	Mg/l	No trace	Nil/ no trace
Toxic substances	Mg/l	Nil	Nil
Odour	-	-	Not objectionable to the nose
Colour	-	-	Not objectionable to the eye or not to exceed 5 mg Pt/l

C) Environmental Management and Coordination (Waste Management) Regulation 2006

These regulations are described in Legal Notice No. 121 of the Kenya Gazette Supplement No. 69, September 2006. These Regulations apply to all categories of waste as provided in the regulations. These include:

- Industrial wastes;
- Hazardous and toxic wastes;
- Pesticides and toxic substances;
- Biomedical wastes
- Radio-active substances.

These Regulations outline requirements for handling, storing, transporting, and treatment/disposal of all waste categories as provided therein. For this project, anticipated waste includes domestic, industrial, hazardous and toxic waste. Wastes contaminated with petroleum product are considered to be hazardous. Treatment of toxic or hazardous waste should be done using the classes of incinerators presented in the third schedule of these regulations.

The regulation provides that a waste generator shall use cleaner production methods, segregate waste generated and the waste transporter should be licensed. The notice further states no person shall engage in any activity likely to generate any hazardous waste without a valid Environmental Impact Assessment licence issued by the National Environment Management Authority. Hazardous waste will not be generated from this development. The project proponent will ensure that waste is segregated and a licensed waste transporter is contracted to disposed solid waste.

d) Environmental Management and Coordination, (Conservation of Biological Diversity) (BD) Regulations 2006

These regulations are described in Legal Notice No. 160 of the Kenya Gazette Supplement No. 84, December 2006. These regulations apply to conservation of biodiversity which includes conservation of threatened species, inventory and monitoring of BD and protection of environmentally significant areas, access to genetic resources, benefit sharing and offences and penalties. Additionally, these links provide for the local enforcement of the International Convention on Biological Diversity (CBD).

The proposed site has no rich biodiversity and there is no known rare or endangered species in the site.

e) Environmental Management and Coordination, (Fossil Fuel Emission Control) Regulations 2006

These regulations are described in Legal Notice No. 131 of the Kenya Gazette Supplement No. 74, October 2006. These regulations include internal combustion engine emission standards, emission inspections, the power of emission inspectors, fuel catalyts, licensing to treat fuel, cost of clearing pollution and partnership to control fossil fuel emissions. The fossil fuels considered are petrol, transformer oil, diesel, fuel oils and kerosene.

f) Environmental Management and Coordination, (Wetlands, Riverbanks, Lake Shores and Sea Shore Management) Regulations 2009

These regulations are described in Legal Notice No. 19 of the Kenya Gazette Supplement No. 9, February 2009. These regulations include management of wetlands, wetland resources, river banks, lake shores and sea shores. Specific sections have requirements that apply to wetlands in Kenya either in private or public land. These regulations empower the District Environment Committee to coordinate, monitor and advise on all aspects of wetland resource management within the district.

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

These regulations are described in Legal Notice No. 31 of the Kenya Gazette Supplement No. 21, May 2009. These regulation prohibit any person from making or causing to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment. It also prohibits excessive vibration which annoys, disturb, injure or endanger the comfort, repose, health or safety of others and the environment or excessive vibrations which exceed 0.5 centimetres per second beyond any source property boundary or 30 metres from any moving source. Part 11 section 6(1) provides that no person is shall cause noise from any source which exceeds any sound level as set out in the First Schedule of the regulations.

4.4.2 Public Health Act (Cap. 242)

This is an Act of Parliament to make provisions for securing and maintaining health. Sections include those dealing with notification of infectious diseases; inspection of infected premises and examination of persons suspected to be suffering from infectious diseases; rules for prevention of diseases; venereal diseases and infection by employees, among others. The proposed project will encourage the movement of people in search of jobs and opportunities, and with this, the risk associated with spread of diseases.

Part IX, section 115, of the Act states that no person/institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 requires that Local Authorities take all lawful, necessary and reasonably practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable to be injurious or dangerous to human health. Such nuisance or conditions are defined under section 118 and include nuisances caused by accumulation of materials or refuse which in the opinion of the medical officer of health is likely to harbour rats or other vermin.

The environmental management plan (EMP) advices the Proponent on safety and health aspects, potential impacts, personnel responsible for implementation and monitoring, frequency of monitoring, and estimated cost.

4.4.3 Local Government Act (Rev. 1998)

This Act provides for the establishment of authorities for local government, to define their functions and to provide for matters connected therewith and incidental thereto. In all areas where the project shall be undertaken, the local authorities will require to be informed.

Section 160 helps local authorities ensure effective utilization of the sewage systems.

Section 170, allows the right to access to private property at all times by local authorities, its officers and servants for purposes of inspection, maintenance and alteration or repairs of sewers.

The Act under section 176 gives powers to local authority to regulate sewage and drainage, fix charges for use of sewers and drains and require connecting premises to meet the related costs. According to section 174, any charges so collected shall be deemed to be charges for sanitary services and will be recoverable from the premise owner connected to the facility. Section 264 also requires that all charges due for sewage sanitary and refuse removal shall be recovered jointly and severally from the owner and occupier of the premises in respect of which the services were rendered. This in part allows for application of the “polluter-pays-principle”

Section 163 allows the County Council to prohibit all business, which may be or become a source of danger, discomfort, or annoyance due to their noxious nature through smoke, fumes, dust, noise, or vibrations. Section 165 allows the local authority to refuse to grant or renew any license which is empowered in this act or any other written law on the grounds that the activity does not conform to the requirements of any by-laws in force in the area of such local authority the granting of the license would be contrary to the public interest.

Part XI section 168 provides that every municipal council, town council or urban council may establish and maintain sewerage and drainage works within or without its area of jurisdiction. For purposes of the land required for such development, section 144 states in part “A local authority may, subject to the approval of the Minister, apply to the government or any other authority having power to acquire land required for purposes of any of its functions, to be acquired compulsorily for and on behalf of, and at the expense of the local authority”. The Act, however, does not indicate the repercussions of impacts on landowners.

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. However, to protect against illegal connections, section 173 states that any person who, without prior consent in writing from the council, erects a building on: excavate or opens-up: or injures or destroys an sewers, drains or pipes shall be guilty of an offence. Any demolitions and repairs thereof shall be carried out at the expense of the offender.

For maintenance of such sewerage systems, the following relevant clauses have been drawn from section 169 of the Act that reads in part “A municipal council may for purposes of carrying out any drainage or sewerage works-----”:

“-----cause such sewers, drains and pipes to be made, altered, deepened, covered, laid and maintained either within or without as may be necessary for effectively disposing of the sewage and draining of its area -----“

“-----carry such sewers, drains and pipes through, across, or under any public road, street, square or open place laid out for public road, street, square or open space without paying compensation and after giving 30 days notices in writing to the owner or occupier of the intention to do so -----“

“-----from time to time alter, enlarge, divert, discontinue, close-up or destroy any sewers, drains, or pipes under its control -----“

Section 170, allows the right of access to private property at all times by local authorities, its officers and servants for purposes of inspection, maintenance and alteration or repairs. In addition, the municipal Council may establish and maintain sewage farms or disposal works, and dispose of the effluent therefrom, but shall not be liable for any nuisance or damage as a consequence of proper and ordinary conduct of the sewage farms or disposal works (section 171). To ensure sustainability in this regard, the local authority is empowered to make by-laws in respect of all such matters as are necessary or desirable for the maintenance of health, safety and wellbeing of the inhabitants of its area as provided for under section 201 of the Act.

To ensure sustainability in this regard, the local authority is empowered to make by-laws in respect of all such matters as are necessary or desirable for the maintenance of health, safety and wellbeing of the inhabitants of its area as provided for under section 201 of the Act.

The Proponent shall observe the guidelines as set out in the environmental management and monitoring plan laid out in this report as well as the recommendation provided for mitigation/minimisation/avoidance of adverse impacts arising from the project activities.

4.4.4 Physical Planning Act, 1996

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

Section 24 of the Physical Planning Act gives provision for the development of local physical development plan for guiding and coordinating development of infrastructure facilities and services within the area of authority of County, municipal and town council and for specific control of the use and development of land. The plan shows the manner in which the land in the area may be used.

Section 29 of the physical Planning Act gives county councils power to prohibit and control the use of land, building, and subdivision of land, in the interest of proper and orderly development of its area. The same section also allows them to approve all development applications and grant development permissions as well as to ensure the proper execution and implications of approved physical development plans. On zoning, the act empowers them to formulate by-laws in respect of use and density of development.

Section 30 states that any person who carries out development within an area of a local authority without development permission shall be guilty of an offence and the development shall be invalid. The act also gives the local authority power to compel the developer to restore the land on which such development has taken place to its original conditions within a period of ninety days. If no action is taken, then the council will restore the land and recover the cost incurred thereto from the developer. In addition, the same section also states that no person shall carry out development within the area of a local authority without development permission granted by the local authority. At the same time, sub-section 5, re-enforce it further that, no licensing authority shall grant under any written law, a license for commercial use for which no development permission had been granted by the respective local authority.

Section 36 states that if in connection with development application a local authority is of the opinion that, the proposed activity will have injurious impact on the environment, the applicant shall be required to submit together with the application an Environmental Impact Assessment report. The environmental impact assessment report must be approved by the National Environmental Management Authority (NEMA) and followed by annual environmental audits as spelled out by EMCA 1999. Section 38 states that if the local authority finds out that the development activity is not complying to all laid down regulations, the local authority may serve an enforcement notice specifying the conditions of the development permissions alleged to have been contravened and compel the developer to restore the land to its original conditions.

The Proponent has applied for Development Permission from the local authority and has also commissioned an environmental impact assessment study for approval by NEMA.

4.5.5 Land Planning Act (Cap. 303)

Section 9 of the subsidiary legislation (The Development and Use of Land Regulations, 1961) under this Act requires that before the local authorities 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.

4.4.6 Water Act, 2002

The Act vests the water in the State and gives the provisions for the water management, including irrigation water, pollution, drainage, flood control and abstraction. It is the main legislation governing the use of water especially through permit system.

Part II, section 18, of the Water Act 2002 provides for national monitoring and information system on water resources. Following on this, sub-section 3 allows the Water Resources Management Authority

(WRMA) to demand from any person or institution, specified information, documents, samples or materials on water resources. Under these rules, specific records may require to be kept by a facility operator and the information thereof furnished to the authority.

The Water Act Cap 372 vests the rights of all water to the state, and the power for the control of all body of water with the Minister, the powers is exercised through the Minister and the Director of water resources in consultation with the water catchments boards, it aims at provision of conservation of water and appointment and use of water resources.

Part II Section 18 provides for national monitoring and information systems on water resources. Following on this, Sub-section 3 allows the Water Resources Management Authority to demand from any person, specified information, documents, samples or materials on water resources. Under these rules, specific records may be required to be kept and the information thereof furnished to the authority on demand.

Section 25 of the Act requires a permit to be obtained for among others any use of water from a water resources, discharge of a pollutant into any water resource. According to section 29 of the same Act, application for such a permit shall be subject to public consultation as well as an environmental impact assessment as per the Environmental Management and Coordination Act, 1999. The conditions of the permit may also be varied if the authority feels that the water so used is causing deterioration of water quality or causing shortage of water for other purposes that the authority may consider has priority. This is provided for under section 35 of the Act.

Section 73 of the Act allows a person with a license to supply water (licensee) to make regulations for purposes of protecting against degradation of sources of water which he is authorised to take. Under the Act, the licensee could be a local authority, a private Trust or an individual and the law will apply accordingly under the supervision of the Regulatory Board.

Section 76 states that no person shall discharge any trade effluent from any trade premises into sewers of a licensee without the consent of the licensee upon application indicating the nature and composition of the effluent, maximum quantity anticipated, flow rate of the effluent and any other information deemed necessary. The consent shall be issued on conditions including the payment rates for the discharge as may be provided under section 77 of the same Act.

The proposed site shall include the construction of drainage channels for the Management of waste water. Bund walls and paved surface will be constructed so as to contain oil spills.

4.4.7 Energy Act of 2006

This is an Act of Parliament passed to amend and consolidates the law relating to energy, to provide for the establishment, powers and functions of the Energy Regulatory Commission and the Rural Electrification Authority and for connected purposes.

The Energy Act of 2006, replaced the Electric Power Act of 1997 and The Petroleum Act, Cap 116. The Energy Act, amongst other issues, deals with all matters relating to all forms of energy including the generation, transmission, distribution, supply and use of electrical energy as well as the legal basis for establishing the systems associated with these purposes.

The Energy Act, 2006, also established the Energy Regulatory Commission (ERC) whose mandate is to regulate all functions and players in the Energy sector. One of the duties of the ERC is to ensure compliance with Environmental, Health and Safety Standards in the Energy Sector, as empowered by Section 98 of the Energy Act, 2006.

In this respect, the following environmental issues will be considered before approval is granted:

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

Licensing and authorisation to generate and transmit electrical power must be supported by an Environmental Impact Assessment Report (EIA) approved by NEMA.

Part IV Section 80(1) provides that a person shall not conduct a business of importation, refining, exportation, whole sale, retail, storage or transportation of petroleum, except under and in accordance with the terms and conditions of a valid licence.

Part IV Section 90 (1) stipulates that a person intending to construct a pipeline, refinery, bulk storage facility or retail dispensing site shall before commencing such construction, apply in writing to the Energy Regulatory commission for a permit to do so. The application shall: specify the name and address of the proposed owner; be accompanied by three (3) copies of plans and specifications and be accompanied by an Environmental Impact Assessment (EIA) Report.

Part IV section 91(1) stipulates that the Energy Regulatory Commission shall, before issuing a permit under section 90, take into account all relevant factors including the relevant government policies and compliance with Environment Management and Coordination Act, 1999 and in particular EIA report as per Impact Assessment and Audit Regulations 2003, the Physical Planning Act, 1996 and the Local Government Act.

Part iv section 100 (1) provides that it is an offence if a person being the owner or operator of a refinery, pipeline, bulk liquefied Petroleum gas or natural gas facility, service station, filling station or storage depot, fails to institute appropriate environmental, health or safety control measures. The offence if convicted, he/she shall be liable to a fine not exceeding two million shillings or to a maximum term of imprisonment of two years, or to both.

The proposed project will be required to follow the guidelines set out in this Act.

4.4.8 The Standards Act Cap 496

The Act is meant to promote the standardization of the specification of commodities, and code of practice; to establish a Kenya Bureau of Standards, to define its functions and provide for its management and control. The proponent will ensure that commodities and codes of practice utilized in the project adhere to the provisions of this Act.

4.4.9 Building Code 1968

Section 194 requires that where sewer exists, the occupants of the nearby premises shall apply to the local authority for a permit to connect to the sewer line and all the wastewater must be discharged into sewers.

4.4.10 Penal Code Act (Cap.63)

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

The Proponent shall observe the guidelines as set out in the environmental management and monitoring plan laid out in this report as well as the recommendation provided for mitigation/minimisation/avoidance of adverse impacts arising from the project activities.

4.4.11 The Wildlife Conservation and Management Act, Cap 376

The Wildlife (Conservation and Management) Act, Cap 376 of 1976, as amended in 1989, covers matters relating to wildlife in Kenya including protected areas, activities within protected areas, control of hunting, import of wildlife, enforcement and administrative functions of Wildlife authorities.

This Act provides for the protection, conservation and management of wildlife in Kenya. The provisions of this Act should be applied in the management of the project.

Part III Section 13 subsection (I) stipulates that any person who not being an officer of Kenya Wildlife Service hunts any animal in a National Park shall be guilty of a forfeiture offence and liable to a fine or imprisonment. Subsection 2 of the Act likewise provides that any person who, without authorisation conveys into a National Park, or being within the area thereof, in possession of, any weapon, ammunition, explosive, trap or poison, shall be guilty of a forfeiture offence. The Act further provides that no person is allowed to use any aircraft, motor vehicle or mechanically propelled vessel in such a manner as to drive, stampede or unduly disturb any protected animal or game animal. Therefore it will be prudent that the construction workforce is conversant with the provisions of this Act.

The proposed project is not located within a conservation/protected area.

4.4.12 The Lakes and Rivers Act Chapter 409 Laws of Kenya:

This Act provides for protection of rivers, lakes and associated flora and fauna. The provisions of this Act may be applied in the management of the project.

4.4.13 The Forest Act

The forest Act, Cap 385 of 1962(revised 1982, 1992 and 2005) addresses the reservation, protection, management, enforcement and utilization of forests and forest resources on government land. The forest Act is applicable to gazetted forest areas (Forest Reserves) and specifically covers:

- Gazettement, alteration of boundaries and De-Gazettelement of Forest Reserves
- Prohibition of activities in Forest Reserves (removal of forest produce, grazing, cultivation, hunting etc) and on unalienated Government land (removal of trees, collection of honey, lighting of fires) except under license from the Director of Forest Services (Section 8);
- Enforcement of the provisions of the Act, penalties and powers afforded to enforcing officers, among others.

The proposed project is not on a forest reserve or near one.

4.4.14 The Forestry Services Act, 2005

The Act led to the establishment of Kenya Forest Service which is charged with management of forests in consultation with the forest owners. The body enforces the conditions and regulations pertaining to logging, charcoal making and other forest utilisation activities.

To ensure community participation in forest management, the service collaborates with other organizations and communities in the management and conservation of forests and for the utilisation of the biodiversity.

Section 43 (1) provides that if mining, quarrying or any other activity carried out in the forest, where the activity concerned is likely to result in forest cover depletion, the person responsible shall undertake compulsory re-vegetation immediately upon the completion of the activity.

The proposed project is not on a forest reserve or near one.

4.4.15 Occupational Safety and Health Act, 2007

This is an Act of parliament to provide for the safety, health and welfare of all workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes. It applies to all workplaces where any person is at work, whether temporarily or permanently.

The purpose of the Act is to:

- Secure the safety, health and welfare of persons at work;
- Protect persons other than persons at work against safety and health arising out of, or in connection with the activities of persons at work.

The Act provides that before any premises are occupied, or used as a workplace, a certificate of registration must be obtained from the Director of Occupational Safety and Health Services. The Act

provides for the health, safety and welfare for employees at workplaces. This shall be considered at the construction, implementation and decommissioning phases of the project. The following are other provisions of the Act.

4.4.14.1 Health

The premise must be kept clean and not overcrowded. The circulation of fresh air must secure adequate ventilation of workrooms. There must be sufficient and suitable lighting in every part of the premise in which persons are working or passing. There should also be sufficient and suitable sanitary conveniences separate for each sex, must be provided subject to conformity with any standards prescribed by rules. Food and drinks should not be partaken in dangerous places or workrooms. Provision of suitable protective clothing and appliances including where necessary, suitable gloves, footwear, goggles, gas masks, and head covering, and maintained for the use of workers in any process involving expose to wet or to any injurious or offensive substances.

4.4.14.2 Safety

Fencing of premises and dangerous parts of other machinery is mandatory. Training and supervision of inexperienced workers, protection of eyes with goggles or effective screens must be provided in certain specified processes. Floors, passages, gangways, stairs, and ladders must be soundly constructed and properly maintained and handrails must be provided for stairs. Special precaution against gassing is laid down for work in confined spaces where persons are liable to overcome by dangerous fumes. Air receivers and fittings must be of sound construction and properly maintained. Adequate and suitable means for extinguishing fire must be provided in addition to adequate means of escape in case of fire must be provided.

4.4.14.3 Welfare

An adequate supply of both quantity and quality of wholesome drinking water must be provided. Maintenance of suitable washing facilities, accommodation for clothing not worn during working hours must be provided. Sitting facilities for all female workers whose work is done while standing should be provided to enable them take advantage of any opportunity for resting. Every premise shall be provided with maintenance, readily accessible means for extinguishing fire and person trained in the correct use of such means shall be present during all working periods.

Regular individual examination or surveys of health conditions of industrial medicine and hygiene must be performed and the cost will be met by the employer. This will ensure that the examination can take place without any loss of earning for the employees and if possible within normal working hours. The (OSH) Act provides for development and maintenance of an effective programme of collection, compilation and analysis of occupational safety. This will ensure that health statistics, which shall cover injuries and illness including disabling during working hours, are adhered.

The Environmental Management Plan (EMP) advises the Proponent on safety and health aspects, potential impacts, personnel responsible for implementation and monitoring, frequency of monitoring, and estimated cost.

4.4.15 Work Injury and Benefits Act, 2007

This Act provides for compensation to employees for work related injuries and disease contracted in the course of their employment and for connected purposes. Key sections of the Act include the obligations of employers; right to compensation; reporting of accidents; compensation; occupational diseases; medical aid etc. In case of any accidents or incidents during the project cycle, this Act will guide the course of action to be taken.

4.4.16 Occupiers Liability Act (Cap. 34)

This Act provides that it's the duty of occupier of the premises owes to his visitors in respect of danger and risk due to the state of the premises or to things omitted or attributes an affliction on his/her health to a toxic materials in the premises.

4.4.17 The Radiation Protection Act (Cap 243 Laws of Kenya)

This is an Act of Parliament to provide for the protection of the public and radiation workers from the dangers arising from the use of devices or material capable of producing ionizing radiation and for connected purposes. Since 1982, Kenya decided to join in the global movement for the use of nuclear energy for peaceful purposes, a movement lead by the International Atomic Energy Agency (IAEA). Most of such uses are in the fields of medicine, agriculture, energy and environmental monitoring. The dangers of injury to the public prompted the adoption of the Radiation Protection Act (Cap 243) in November 1984 to provide according to its citation, protection of the public and radiation workers from the dangers arising from the use of devices or materials capable of producing ionizing radiation and for connected purpose.

The Act prohibits the unauthorized manufacture, production, possession or use, sale, disposal, lease, loan or dealership, import, export of any irradiating device or radioactive material. All authorized buyers, sellers, users, of such device must be properly licensed. The Act is administered by the Chief Radiation Protection Officer assisted by a Radiation Protection Board.

The proposed project won't emit/produce ionizing radiations.

4.4.18 The Traffic Act Chapter 295 Laws of Kenya

This Act consolidates the law relating to traffic on all public roads. Key sections include registration and licensing of vehicles; driving licenses; driving and other offences relating to the use of vehicles on roads; regulation of traffic; accidents; offences by drivers other than motor vehicles and other road users. Many types of equipment and fuel shall be transported through the roads to the proposed site. Their registration and licensing will be required to follow the stipulated road regulations. The Act also prohibits encroachment on and damage to roads including land reserved for roads. The project is under the provision of the Act.

4.4.19 The Public Roads and Roads of Access Act (Cap 22 Laws of Kenya)

Section 8 and 9 of the Act provides for the dedication, conversion or alignment of public travel lines including construction of access roads adjacent lands from the nearest part of a public road. Section 10

and 11 allows for notices to be served on the adjacent landowners seeking permission to construct the respective roads.

The project design concept has left the required road reserves and relevant road widening surrenders. This Act consolidates the law relating to traffic on all public roads. The Act also prohibits encroachment on and damage to roads including land reserved for roads.

The proposed facility location complies with the provision of the Act. It is not on road reserves.

4.4.20 The Way leaves Act Cap 292

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

The proposed site is not inhabited hence there will be no compensation.

4.4.21 The Agriculture Act, Cap 318 of 1980 (revised 1986)

This Act has stated objectives to promote and sustain agricultural production, provide for conservation of the soil and its fertility, and stimulate the development of agricultural land in accordance with accepted practices of good land management and good husbandry.

The proposed site is zoned industrial purposes and no agricultural activities will be done on site.

4.4.22 Antiquities and Monuments Act, 1983 (Cap 215)

This Act aims to preserve Kenya's national heritage. Kenya is rich in its antiquities, monuments and cultural and natural sites which are spread all over the country. The National Museums is the custodian of the country's cultural heritage. Through the National Museums many of these sites are protected by law by having them gazette under the Act.

The proposed site has no sites of cultural heritage.

4.4.23 The Registration of Titles Act Cap 281

This Act provides for the transfer of the land by registration of titles. Parts within the Act elaborate. On mechanisms of bringing lands under the Act, and for related purposes. The Act also elaborates on the incorporation of group representatives and the administration of groups.

Section 34 of this Act states that when land is intended to be transferred or any right of way or other easement is intended to be created or transferred, the registered proprietor or, if the proprietor is of unsound mind, the guardian or other person appointed by the court to act on his/her behalf in the matter, shall execute, in original only, a transfer in form F in the First Schedule, which transfer shall, for description of the land intended to be dealt with, refer to the grant or certificate of title of the land, or shall give such description as may be sufficient to identify it, and shall contain an accurate statement of the land and easement, or the easement, intended to be transferred or created, and a memorandum of all leases, charges and other encumbrances to which the land may be subject, and of all rights-of-way, easements and privileges intended to be conveyed.

4.4.24 The Land Titles Act Cap 282

The Land Titles Act Cap 282 section 10 (1) states that there shall be appointed and attached to the Land Registration Court a qualified surveyor who, with such assistants as may be necessary, shall survey land, make a plan or plans thereof and define and mark the boundaries of any areas therein as, when and where directed by the Recorder of Titles, either before, during or after the termination of any question concerning land or any interest connected therewith, and every area so defined and marked shall be further marked with a number of other distinctive symbol to be shown upon the plan or plans for the purposes of complete identification and registration thereof as is herein after prescribed.

4.4.25 The Land Acquisition Act Chapter 295 Laws of Kenya

The Act provides for the compulsory or otherwise acquisition of land from private ownership for the benefit of the general public. Section 3 states that when the Minister is satisfied on the need for acquisition, notice will be issued through the Kenya Gazette and copies delivered to all the persons affected. Full compensation for any damage resulting from the entry onto land to do things such as survey upon necessary authorisation will be undertaken in accordance with section 5 of the Act. Likewise where land is acquired compulsorily, full compensation shall be paid promptly to all persons affected in accordance to sections 8 and 10 along the following parameters:

- (i) Area of land acquired
- (ii) The value of the property in the opinion of the Commissioner of land (after valuation),
- (iii) Amount of the compensation payable,
- (iv) Market value of the property,
- (v) Damages sustained from the severance of the land parcel from the land,
- (vi) Damages to other property in the process of acquiring the said land parcel,
- (vii) Consequences of changing residence or place of business by the land owners,
- (viii) Damages from diminution of profits of the land acquired.

Part II of the Act allows for the temporary acquisition of the land for utilisation in promotion of the public good for periods not exceeding 5 years. At the expiry of the period, the Commissioner of Land shall vacate the land and undertake to restore the land to the conditions it was before. Any damages or reduction of value shall be compensated to the landowners.

4.5 International Environmental Guidelines

Kenya is a signatory to a number of conventions on sustainable development and is a member of various bilateral and multilateral organizations. Some of the relevant International treaties and conventions include:

- Vienna Convention for the Protection of the Ozone Layer. Inter-governmental negotiations for an International agreement to phase out ozone depleting substances concluded in March 1985 with The adoption of this convention to encourage Inter-governmental co-operation on research, systematic observation of the ozone layer, monitoring of CFC production and the exchange of information;
- Montreal Protocol on Substances that Deplete the Ozone layer: Adopted in September 1987 and intended to allow the revision of phase out schedules on the basis of periodic scientific and technological assessment, the Protocol was adjusted to accelerate the phase out schedules and has since been amended to introduce other kinds of control measures and to add new controlled substances to the list;
- The Basel Convention: Sets an ultimate objective of stabilizing greenhouse gas concentration in the atmosphere at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system;
- Kyoto Protocol: Drawn up in 1997, pursuant to the objectives of the United Nations Framework Convention on Climate Change, in which the developed nations agreed to limit their greenhouse gas emissions, relative to the levels emitted in 1990;
- Convention on Biological Diversity (CBD, 1992): This Convention entered into force on 29 December 1993, and its objectives are to: conserve biological diversity; use biological diversity in a sustainable fashion and share the benefits of biological diversity fairly and equitably. This Convention governs Kenya's international obligations regarding biological diversity;
- UNESCO Convention for the protection of the World Cultural and Natural Heritage (World Heritage Convention, 1972): This Convention aims to encourage the identification, protection, and preservation of Earth's cultural and natural heritage. It recognizes that nature and culture are complementary and that cultural identity is strongly related to the natural environment in which it develops;
- Convention on Wetlands of International Importance, especially as Waterfowl Habitat (Ramsar Convention): The Convention was signed in Iran in 1971 and came into force in 1975. It represents the first attempt to establish a legal instrument providing comprehensive protection for a particular type of ecosystem. The Ramsar parties agree to implement their planning so as to promote conservation of the wetlands included in the list. There is no Ramsar site near the proposed site.

- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES): This convention seeks to control the trade in species of wild animals and plants that are, or may be, threatened with extinction as a result of International trade. CITES is an important line of defense against the threat posed to diversity by invasive species.
- The Africa-Eurasia Migratory Water Bird Agreement (AEWA, 1995): The goal of the agreement is to protect migratory waterfowl by ensuring that they are protected for the entire length of their migratory routes. The list of birds protected under the AEWA Convention covers 235 species of birds.
- African Convention on Conservation of Nature and Natural Resources (1968): This Convention of the African Union is ratified by 40 African countries, including Kenya. The fundamental principle requires contracting states to adopt the measures necessary to ensure conservation, utilization and development of soil, water, flora and faunal resources in accordance with scientific principles and with due regard to the best interests of the people.

Kenya has a duty under these multilateral agreements. The project should adhere to strict guidelines and procedures to ensure the agreements are not violated.

4.6 World Bank /IFC Environment and Social Safeguards Policies

The objective of the World Bank's environmental and social safeguard policies is to prevent and mitigate undue harm to people and their environment in the development process. These policies provide guidelines for the bank and borrower staffs in the identification, preparation, and implementation of programs and projects. Safeguard policies have often provided a platform for the participation of stakeholders in project design, and have been an important instrument for building ownership among local population.

The Safeguard Policies aims at improving decision making, to ensure that project options under consideration are sound and sustainable, and that potentially affected people have been properly consulted.

Out of the ten (10) World Bank Safeguard Policies described below, only one policy will be triggered by the project.

4.6.1. Environment Assessment (Operational Policy, OP/BP 4.01)

The objective of this policy is to ensure that Bank-financed projects are environmentally sound and sustainable, and that decision-making is improved through appropriate analysis of actions and of their likely environmental impacts. This policy is considered to be the umbrella policy for the Bank's environmental 'safeguard policies'.

The proposed project triggers this policy because although there is justification of the proposed 90MVA 220/60 kV of the transmission substation, there are environmental and social concerns associated with the construction and operation of the proposed project.

4.6.2 Natural Habitats (Operational Policy, OP/BP 4.04)

This policy recognizes that the conservation of natural habitats is essential to safeguard their unique biodiversity and to maintain environmental services and products for human society and for long-term sustainable development. The Bank therefore supports the protection, management, and restoration of natural habitats in its project financing, as well as policy dialogue and economic and sector work. The Bank supports, and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. Natural habitats are land and water areas where most of the original native plant and animal species are still present. Natural habitats comprise many types of terrestrial, freshwater, coastal, and marine ecosystems. They include areas lightly modified by human activities, but retaining their ecological functions and most native species.

The proposed project doesn't trigger this policy because the project won't cause significant conversion (loss) or degradation of natural habitats, whether directly (through construction) or indirectly (through human activities induced by the project).

4.6.3 Indigenous Peoples (Operational Policy 4.10)

The objective of this policy is to (i) ensure that the development process fosters full respect for the dignity, human rights, and cultural uniqueness of indigenous peoples; (ii) ensure that adverse effects during the development process are avoided, or if not feasible, ensure that these are minimized, mitigated or compensated; and (iii) ensure that indigenous peoples receive culturally appropriate and gender and intergenerationally inclusive social and economic benefits.

The proposed project doesn't trigger this policy because the proposed site is not inhabited. It is an industrial area.

4.6.4 Physical Cultural Resources (Operational Policy 4.11)

The objective of this policy is to assist countries to avoid or mitigate adverse impacts of development projects on physical cultural resources. For purposes of this policy, "physical cultural resources" are defined as movable or immovable objects, sites, structures, groups of structures, natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings, and may be above ground, underground, or underwater. The cultural interest may be at the local, provincial or national level, or within the international community.

The policy won't be triggered because the proposed project is not located in, or in the vicinity of, recognized cultural heritage sites.

4.6.5 Involuntary Resettlement (Operational Policy, OP/BP 4.12)

The objective of this policy is to (i) avoid or minimize involuntary resettlement where feasible, exploring all viable alternative project designs; (ii) assist displaced persons in improving their former living standards, income earning capacity, and production levels, or at least in restoring them; (iii) encourage

community participation in planning and implementing resettlement; and (iv) provide assistance to affected people regardless of the legality of land tenure.

The policy won't be triggered because the proposed project won't cause physical relocation, loss of land or other assets resulting in: (i) relocation or loss of shelter; (ii) loss of assets or access to assets; (iii) loss of income sources or means of livelihood.

4.6.6 Forests (Operational Policy, OP/BP 4.36)

The objective of this policy is to assist borrowers to harness the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development and protect the vital local and global environmental services and values of forests. Where forest restoration and plantation development are necessary to meet these objectives, the Bank assists borrowers with forest restoration activities that maintain or enhance biodiversity and ecosystem functionality. The Bank assists borrowers with the establishment of environmentally appropriate, socially beneficial and economically viable forest plantations to help meet growing demands for forest goods and services.

This policy is not triggered because no forests exist in the proposed site.

4.6.7 Pest Management (Operational Policy, OP/BP 4.09)

The objective of this policy is to: promote the use of biological or environmental control and reduce reliance on synthetic chemical pesticides; strengthen the capacity of the country's regulatory framework and institutions to promote and support safe, effective and environmentally sound pest management. More specifically, the policy aims to (a) Ascertain that pest management activities in Bank-financed operations are based on integrated approaches and seek to reduce reliance on synthetic chemical pesticides (Integrated Pest Management (IPM) in agricultural projects and Integrated Vector Management (IVM) in public health projects. (b) Ensure that health and environmental hazards associated with pest management, especially the use of pesticides are minimized and can be properly managed by the user. (c) As necessary, support policy reform and institutional capacity development to (i) enhance implementation of IPM-based pest management and (ii) regulate and monitor the distribution and use of pesticides.

The policy is not triggered because no procurement of pesticides or pesticide application equipment is envisaged and the project won't lead to substantially increased pesticide use and subsequent increase in health and environmental risk

4.6.8 Safety of dams (Operational Policy, OP/BP 4.37)

The objectives of this policy are as follows: For new dams, to ensure that experienced and competent professionals design and supervise construction; the borrower adopts and implements dam safety measures for the dam and associated works. For existing dams, to ensure that any dam that can influence the performance of the project is identified, a dam safety assessment is carried out, and necessary additional dam safety measures and remedial work are implemented.

This policy is not triggered because the project doesn't involve construction of a large dam (15 m or higher) or a high hazard dam and is not dependent on an existing dam.

4.6.9 Projects in International Waters (Operational Policy, OP/BP 7.50)

The objective of this policy is to ensure that Bank-financed projects affecting international waterways would not affect: (i) relations between the Bank and its borrowers and between states (whether members of the Bank or not); and (ii) the efficient utilization and protection of international waterways. The policy applies to the following types of projects: (a) Hydroelectric, irrigation, flood control, navigation, drainage, water and sewerage, industrial and similar projects that involve the use or potential pollution of international waterways; and (b) Detailed design and engineering studies of projects under (a) above, include those carried out by the Bank as executing agency or in any other capacity.

This policy is not triggered because there are no International waters in the project site.

4.6.10 Projects in Disputed Areas (Operational Policy, OP/BP 7.60)

The objective of this policy is to ensure that projects in disputed areas are dealt with at the earliest possible stage: (a) so as not to affect relations between the Bank and its member countries; (b) so as not to affect relations between the borrower and neighbouring countries; and (c) so as not to prejudice the position of either the Bank or the countries concerned.

This policy won't be triggered because the proposed project won't be in a "disputed area". The proposed project site belongs to Export Processing Zone Authority (EPZ) which is government parastatals.

CHAPTER FIVE: PUBLIC PARTICIPATION

5.1 Sources of Information

Public participation was a key component of the EIA of the Proposed 90MVA 220/60 kV substation, in Athi River district. Positive and negative views of the immediate neighbours were sought as from 3rd to 15th of February 2010. The exercise was conducted using pre-designed questionnaires and interviews in the premises neighbouring the proposed project area. Their responses are found in **Annex VII**.

The table below shows the names of the neighbours who were interviewed and given the questionnaires to fill in relation to the proposed 90MVA 220/60 kV substation, in Athi River area.

Table 5. Names of neighbours Consulted

	Name of Respondent	Organization	Tel. Contact	Comments
1	Mr. Philip Abour	Environmental Services Manager, SGS K Ltd		Baseline air, noise and soil measurement
2	Mr. Mathew Were	Environment Superintendent-EPZA	+254-04526421-6 +254-722876504	Supports the project on condition that that expected negative impacts are mitigated
3	Mr. Kinuthia	Survey Office-Mavoko Municipal Council		The proposed site is zoned as Industrial
4	Mrs Joy Mideva	Property Executive-EPZA	+254-04526421-6 +254-712883883	Subdivision plan approved by Mavoko Municipal Council
5	Juma Anyanga	Environment Officer, East African Portland Company Limited	+254-725827209	Supports the project. Encourages the use of green energy
6	Dr. Benard Kaaria	EIA Head, KWS	+254-20-600800	Project brief done
7	Mr. Kenani	Research Scientist, KWS	+254-20-600800 +254-722656119	Project brief done
8	Mr. Chepkemwony	Assistant Warden, Nairobi National Park, KWS	+254-20-600800	Project brief done

NB. Consultation with KWS going on and a visit to the site is being organised. The consultant has briefed KWS officers about the project.

5.2 Issues Raised by the would be affected community

The following issues were raised by the project neighbours during public participation of the proposed 90MVA 220/60 kV substation, in Athi River.

5.2.1 Positive Issues

5.2.1.1 Employment opportunities

Most neighbours close to the proposed project site especially expected the project to create casual and permanent employment opportunities during the proposed project construction work, operation and decommissioning phases. The employment opportunities could be either directly in the project or indirectly through associated businesses. One of the main positive impacts during projects construction phase will be the availability of job opportunities especially to casual workers and several other specialised workers.

5.2.1.2 Improvement of local and national economy

Through the use of locally available materials during the construction phase of the proposed 90MVA 220/60 kV substation will contribute towards growth of the economy by contributing to the gross domestic product. The consumption of these materials, transformer oil and others will attract taxes including VAT which will be payable to the government hence increasing government revenue while the cost of these raw materials will be payable directly to the local producers. The power that could be distributed from the proposed 90MVA 220/60 kV substation in Athi River will be sold by KPLC to its consumers who will pay for their electricity consumption and in turn will pay taxes to the government.

5.2.1.3 Boosting of the informal sector

During the construction, operational and decommissioning phase of the proposed 90MVA 220/60 kV substation it is expected that the other businesses in the informal sector will flourish. These include activities such as food vending who will be benefiting directly from the construction, operational and decommissioning staff members who will be buying food and other commodities from them. This will promote the informal sector in securing some temporary revenue and hence livelihood.

5.2.1.4 Improved Electricity Supply

The proposed project aims to increase the quality and security of the power supply to the surrounding industries, businesses, homes and social institutions among others. The neighbours, who are mostly from the neighbouring industries, were optimistic that power outages will be minimized and that they will not be subjected to power rationing. With this additional reliable electricity in the national grid, the country and the local area are expected to attract more investments.

5.2.2 Negative Issues

5.2.2.1 Water Demand

Water supply within the proposed 90MVA 220/60 kV substation will be mainly from piped water that is supplied by the water and sewerage company serving Athi River town and its environment. However, the respondents were concerned that there will be worse water shortage in the area due to a lot of

water that could be used during the construction activities of the proposed 90MVA 220/60 kV substation in Athi River. During the operational phase of this proposed project will require minimal water use for its normal operations.

5.2.2.2 Increased Emissions (Air Pollution)

During construction and decommissioning phase of the proposed 90MVA 220/60 kV substation, there will be undesirable emissions that will be emitted like Sulphur Oxide and Nitrogen Oxide. Dust will also be emitted during the construction and decommissioning phases. Neighbours asked for air pollution control measures to be put in place.

5.2.2.3 Increased Noise Level and Vibration

There was concern over the possibility of high noise and vibration levels in the proposed project site as a result of construction works. However, the project proponent will have to take appropriate steps to minimize noise production by using silent machines, construction works should be done during the daytime working hours and ensuring that all equipments are well maintained.

5.2.2.4 Social concerns

Some neighbours thought that the location of the project will attract people to the area. This may lead to social vices like drug abuse, spread of diseases including HIV and insecurity.

5.2.2.5 Oil Spillage and Fire Incidents

Some neighbours expressed their concerns on the possibilities of transformer oil spills and fire outbreaks during project implementation. Neighbours want the project proponent to put in place oil spill prevention measures and to have the facility well fenced to prevent unauthorized access.

CHAPTER 6: IDENTIFICATION OF ENVIRONMENTAL IMPACTS OF THE PROPOSED 90MVA 220/60 kV SUBSTATION PROJECT

6.1 Introduction

This Section identifies and discusses both negative and positive impacts associated with the proposed 90MVA 220/60 kV substation, in EPZ Athi River. The impacts are identified according to Phases namely: Construction Phase, Operational Phase and Decommissioning Phase.

The proposed project a medium term strategy for power transmission and distribution in Nairobi metropolis over the planning period of 2009-2015 in the energy sector has immense benefits that could save Nairobi metropolis and its environment to enhance quality electricity supply. However poor planning of the project could also affect the environment that supports millions of Kenyans through the potential hazards that the project could pose to the public like water and soil contamination and poor waste disposal.

The summary of the main potential impacts of the proposed project are listed in Table below and have been analyzed into different categories based on stakeholder's views and perceptions as well as the consultant's previous experience in undertaking ESIA of similar nature. The project impacts are classified as positive or negative. However the study goes further to categorize the impacts in terms of direct or indirect, temporary or permanent, major or minor.

Table 6 Summary of Project Potential Impacts

Environmental & Social Impact	Positive/Negative	Direct/Indirect	Temporary/Permanent	Major/Minor	Occurrence		
					Construction	Operation	Decommissioning
Employment Opportunities	Positive	Direct	Permanent/Temporary	Major	√	√	√
Gains in the Local and National Economy	Positive	Direct	Permanent	Major	√	√	x
Provision of Market for Supply of Building Materials	Positive	Direct	Temporary	Major	√	x	x
Informal Sectors Benefits	Positive	Direct	Temporary	Minor	√	x	x
Environmental Benefits	Positive	Indirect	Permanent	Minor	√	√	x
Noise pollution & increased vibration	Negative	Direct	Permanent	Major	√	√	√
Generation of Exhaust Emissions	Negative	Direct	Permanent	Minor	√	√	√
Dust Emissions	Negative	Direct	Temporary	Minor	√	x	√

Disposal of Excavated Soil	Negative	Direct	Temporary	Minor	√	x	√
Increased water demand	Negative	Direct	Permanent	Major	√	√	x
Workers accidents and hazards	Negative	Direct	Permanent	Minor	√	√	√
Energy (Transformer oil) Consumption	Negative	Direct	Permanent	Major	x	√	x
Extraction and Use of Building Materials	Negative	Direct	Temporary	Minor	√	x	x
Solid Waste Generation	Negative	Direct	Permanent	Major	√	√	√
Liquid Waste Generation	Negative	Direct	Permanent	Major	√	√	√
Possible Exposure of Workers to Diseases	Negative	Direct	Permanent	Major	√	√	x
Increased Storm Water Runoff from New Impervious Areas	Negative	Direct	Permanent	Major	√	√	x
Soil Erosion	Negative	Direct	Temporary	Minor	√	x	√
Oil Spills Hazards	Negative	Direct	Permanent	Major	√	√	√
Destruction of existing vegetation	Negative	Direct	Permanent	Minor	√	x	x
Fire Outbreaks	Negative	Direct	Temporary	Major	√	√	√
Quality electricity supply	Positive	Direct	Permanent	Major	x	√	x
Increased Population around the project area	Negative	Direct	Permanent/ Temporary	Minor	√	√	x
Visual Impacts	Negative	Direct	Permanent	Minor	√	√	√

6.2 Positive Impacts during Construction Phase

The positive impacts associated with the proposed 90MVA 220/60 kV substation, in EPZ Athi River, during construction phase are as discussed below;

6.2.1 Employment Opportunities

With the construction of 90MVA 220/60 kV substation, in EPZ Athi River, there will be employment opportunities especially for casual workers from the local community. Creation of employment opportunities has both economic and social benefit. In the economic benefit, abundant unskilled labour will be used in economic production while socially these young and energetic otherwise poor people will be engaged in productive employment other than remaining idle. Employees with diverse skills are expected to work on the site during the construction period.

6.2.2 Gains in the Local and National Economy

There will be gains in the local and national economy as a result of the construction of the proposed 90MVA 220/60 kV substation, through consumption of locally available materials including: timber, glasses, metals, cement among other construction materials. The consumption of these materials in

addition to fuel oil and others will attract taxes including Value Added Tax (VAT) which will be payable to the government. The cost of the materials will be payable directly to the producers.

6.2.3 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 from the surrounding areas especially Kitengela town, Athi River town and Nairobi city. This provides ready market for building material suppliers such as quarrying companies, hardware shops and individuals with such materials.

6.2.4 Informal Sectors Benefits

During construction phase of proposed 90MVA 220/60 kV, the informal sectors are temporarily likely to benefit from the operations. This will involve kiosk operators who will be selling food to the construction workers on site. This will finally promote Jua Kali entrepreneurs in Athi River area for the construction period.

6.2.5 Environmental Benefits

The proposed 90MVA 220/60 kV has a potential for contributing to the good of the environment of the area. The project will enhance electricity to the surrounding customers of Nairobi metropolitan area. This will lead to a substantial reduction in reliance on other sources of energy that have impacts on the forest cover and greenhouse.

6.3 Negative Impacts during Construction Phase

The following negative impacts are also associated with the construction of the proposed 90MVA 220/60 kV substation in Athi River.

6.3.1 Noise pollution

The proposed area is relatively tranquil (**Refer to baseline noise measurement results in Annex VI**). The construction works of the proposed 90MVA 220/60 kV substation is most likely to be a noisy operation due to the moving machines (mixers, tippers, communicating workers) and incoming vehicles to deliver construction materials to site. The construction workers who will be working in the site will generate some noise as they are communicating to one another. This will be a potential source of disturbance at the site and surrounding neighbourhoods of the proposed 90MVA 220/60 kV substation.

6.3.2 Generation of Exhaust Emissions

Exhaust emissions are likely to be generated by the construction equipment during the construction phase of proposed 90MVA 220/60 kV substation. Motor vehicles that will be used to ferry construction materials would cause air quality impact by emitting pollutants through exhaust emissions. The impacts will be direct, permanent but not significant.

6.3.3 Dust Emissions

Particulate matter pollution is likely to occur during the site clearance, excavation and spreading of the topsoil during construction of proposed 90MVA 220/60 kV substation. There is a very small possibility

of PM₁₀ suspended and settleable particles affecting the site workers and even neighbours' health, it is minimal given the construction method of minimum excavation and nil cart away of soil. The impacts will be direct, temporary and minor.

6.3.4 Disposal of Excavated Soil

Though little excavation is likely to take place at the proposed 90MVA 220/60 kV substation, the excavation works to level the site will result in the generation of small amounts of excavated material. But there will be no cart away of excavated material. The impact will be direct, temporary and minor.

6.3.5 Increased water demand

During the construction phase of the proposed 90MVA 220/60 kV substation, both the construction workers and works will be using water that will cause additional demand for water in addition to the existing demands. Water will be mostly used in the creation of concrete for construction works and for wetting surfaces or cleaning completed structures. It will also be used by the construction workers to wash themselves and even drink. The impact will be direct, permanent and major.

6.3.6 Workers accidents and hazards during construction

During construction of the proposed 90MVA 220/60 kV substation, it is expected that construction workers especially non-skilled casuals are likely to have accidental injuries and hazards. Because of these 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 objects. The impacts will be direct, permanent and minor.

6.3.7 Energy Consumption

During the construction phase of the proposed 90MVA 220/60 kV substation 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 impact will be direct, permanent and major.

6.3.8 Extraction and Use of Building Materials

Building materials such as hard core, ballast, cement, rough stone and sand required for the construction of the proposed 90MVA 220/60 kV substation will be obtained from quarries, hardware shops and sand harvesters who extract such materials from natural resource banks such as rivers and land. Small quantities of these materials will be required for construction of the buildings transformer sites and pavements, the availability and sustainability of such resources at the extraction sites will be negatively affected as they are not renewable in the short term. In addition, the sites from which the materials will be extracted may be significantly affected in several ways including landscape changes, displacement of animals and vegetation, poor visual quality and opening of depressions on the surface leading to several human and animal health impacts. The impact will be direct, temporary and minor.

6.3.9 Solid Waste Generation

During construction of the proposed 90MVA 220/60 kV substation in Athi River district, will generate a lot of solid waste. These wastes include papers used for packing cement, plastics, metal scraps and timber remains among others. Dumping of these wastes around the proposed project site will interfere with the aesthetic status of the area. This has a direct effect to the surrounding community. Disposal of these solid wastes off-site could also be a social inconvenience if done in the wrong places. The off-site effects could be aesthetic, pest breeding, pollution of physical environment, invasion of scavengers and informal recycling communities.

6.3.10 Possible Exposure of Workers to Diseases

Workers are likely to be exposed to diseases from building materials during the construction phase of the proposed 90MVA 220/60 kV substation. It is therefore recommended that before the construction phase of the proposed 90MVA 220/60 kV substation commences, there is need for the construction materials to be well inspected according to the occupational health and safety standards and worker encouraged to use personal protective equipments.

6.3.11 Increased Storm Water Runoff from New Impervious Areas

Construction of the proposed 90MVA 220/60 kV substation buildings, pavements and its associated structures within the proposed project site will lead to additional runoff through creation of impervious areas and compaction of soils. Impervious areas and compacted soils generally have higher runoff coefficients than natural area, and increased flood peaks are a common occurrence in developed areas. The impact will be direct, permanent and minor.

6.3.12 Soil Erosion

There are possibilities of soil erosion occurring during the construction of the proposed 90MVA 220/60 kV substation especially during rainy and windy seasons. The impact will however be minimal as there area to be disturbed for the proposed development is small. The impacts will be direct, temporary and minor.

6.3.13 Oil Spills Hazards

The construction machines on the proposed site for the 90MVA 220/60 kV substation may be containing moving parts which will require continuous oiling to minimise the usual corrosion or wear and tare. This will contaminate the soil. Likewise, moving vehicles on site may require oil change. The impact will be direct, permanent and major.

6.3.14 Destruction of existing vegetation

The construction process of the proposed 90MVA 220/60 kV substation buildings and other associated facilities and structures will involve clearing of the existing vegetation cover (mainly grass) and some small trees on site. The developer intends to replace this with some planting of indigenous trees and grass around the project area. The impact will be direct, permanent and minor.

6.3.15 Surface and ground water Hydrology and Water Quality Degradation

Changes in surface hydrology alter the flow of water through the landscape. Construction of impervious surfaces such as transformers sites, cabling trenches, parking lots, walking pavements, roads and buildings might increase the volume and rate of runoff, resulting in habitat destruction, increased pollutant loads, and flooding. Contaminated soil or ground water in the path of the project could be disturbed by excavation resulting in a potential transfer of the contamination to surface waters. Oil spills during construction could introduce contaminants into subsurface which may end-up into ground water. Development activities such as the proposed 90MVA 220/60 kV substation development as well as the spill-over effects of development such as increased demand for water use and increased auto use can impact water quality by contributing sediment, nutrients, and other pollutants to limit water supplies, increasing the temperature of the water, and increasing the rate and volume of runoff. The impact will be direct, permanent and major.

6.3.16 Fire Outbreaks

Due to various construction activities at the proposed 90MVA 220/60 kV substation project, fire outbreaks can occur. Handling of inflammable products increases fire risks like the transformer oil. The impact will be direct, temporary and major.

6.4 Positive Impacts during Operation Phase

Like construction phase, there are positive impacts associated with the proposed 90MVA 220/60 kV substation during operation phase. These positive impacts are discussed below.

6.4.1 Quality electricity supply

The existing transmission system capacity In Nairobi and its environment has been constrained during the peak hours when system voltage do drop below acceptable levels, occasioning load shedding despite availability of generation capacity. The problem has been partly due to inadequate reactive power supply in major load centres and also transmission bottleneck. This could be sorted by establishing and constructing new high voltage line that will be stepped down at the proposed Athi River substation so as to enhance quality electricity supply in Nairobi and its environments. The impact will be direct, permanent and major.

6.4.2 Employment Opportunities

Employment opportunities are one of the long-term major positive impacts of the proposed 90MVA 220/60 kV substation in Athi River. This will occur during the operation and maintenance of the proposed 90MVA 220/60 kV substation. These will involve security personnel that will be employed to look after the proposed 90MVA 220/60 kV substation. Other sources of employment will involve direct technical service provision to the proposed 90MVA 220/60 kV substation e.g. electrical engineers, civil engineers, mechanical engineers, drivers among others. The impact will be direct, permanent and major.

6.4.3 Increase in Revenue

There will be positive gain for the revenue system arising from the step down and distribution of the electricity power from the proposed 90MVA 220/60 kV substation to Government, the fuel provider and KPLC. This will in turn be supplied to various customers who will be paying taxes to the Government. The impact will be direct, permanent and major.

6.4.4 Improved Security

With the establishment of the proposed 90MVA 220/60 kV substation in Athi River, the level of security will be improved around the project area. This is as a result of more security lights and security personnel being employed to guard the proposed 90MVA 220/60 kV substation. The project site will also be well fenced. Hence if the level of security is increased, the residents will feel more secure than before. The impact will be direct, permanent and minor.

6.5 Negative Impacts during Operation Phase

The following are the negative impacts that are associated with the proposed 90MVA 220/60 kV substation during the operation phase.

6.5.1 Solid Waste Generation

The proposed 90MVA 220/60 kV substation in Athi River is expected to generate some amounts of solid waste during its operation phase. The bulk of the solid waste generated during the operation of the project will consist of drums, paper, plastic, cables, metal, transformers and capacitors. Such wastes can be injurious to the environment. Some of these waste materials especially the plastic, cables, metals, polythene among others are not biodegradable hence may cause long-term injurious effects to the environment. The impact will be direct, permanent and major.

6.5.2 Liquid Waste Generation

Since the substation' transformers will be using oil for cooling purposes of the transformers for the purpose of stepping down and distributing electric, sludge and other effluents will be generated. Likewise waste oil will be generated through transformer leakages. The liquid waste to be generated will be hazardous hence may cause long-term injurious effects to the environment. The impact will be direct, permanent and major.

6.5.3 Increased oil Consumption

The proposed 90MVA 220/60 kV substation shall consume large amount of transformer oil in the process of stepping down electric power. Since transformer oil fuel is produced mainly through non renewable resources, this will have adverse impacts on these non renewable resources base and their sustainability. The impact will be direct, permanent and major.

6.5.4 Increased Population around the project area

With the construction and operation of the proposed 90MVA 220/60 kV substation in Athi River it will lead to the establishment of food kiosks within the proposed project area whereby the workers of the proposed 90MVA 220/60 kV substation will be eating from. Since the proposed project site doesn't

have adequate infrastructural facilities, for the speculated population will have some negative environmental impacts. The impact will be direct, permanent and minor.

6.5.5 Increased water demand

The operation activities during the operation phase of the proposed 90MVA 220/60 kV substation in Athi River district will involve the use of large quantities of water for substation cleaning, drinking, washing and toilet flushing. These will increase strain water resources in the area. The impact will be direct, permanent and major.

6.5.6 Increased Pressure on Infrastructure

The proposed 90MVA 220/60 kV substation in Athi River will have a potential of increasing pressure on existing infrastructure such as roads and water among others. This would be due to increased use of volumes on water, human and vehicle traffic in the project area. The impact will be direct, permanent and major.

6.5.7 Increased Storm Water Flow

The building roofs and pavements of the proposed 90MVA 220/60 kV substation in Athi River will lead to increased volume and velocity of storm water or run-off flowing across the area covered by the proposed 90MVA 220/60 kV substation during operation phase. This will lead to increased amounts of storm water entering the drainage systems. The impact will be direct, permanent and minor.

6.5.8 Water Pollution

During the operation phase of the proposed 90MVA 220/60 kV substation in Athi River, If the sites for dumping solid wastes are not well taken care of, they may cause contamination of ground water sources. There is need therefore for the project proponent to put in place an efficient waste management scheme that will prevent the accumulation of uncontrolled waste, as well as an efficient collection system and off-site disposal. The impact will be direct, permanent and minor.

6.5.9 Oil Spills Hazards

Potential oil spills and accidents during oil transportation, storage and operations of the transformers and batteries of the proposed 90MVA 220/60 kV substation in Athi River may occur. In the case of oil spill the relatively lighter, more volatile, mobile, and water soluble compounds in transformer oil will tend to evaporate fairly quickly into the atmosphere or migrate to groundwater. When exposed to oxygen and sunlight, most of these compounds will tend to break down relatively quickly. Accidental oil spills can occur due to leakage from the transformers. Poor maintenance of transformers can also lead to oil spills. The impact will be direct, permanent and minor.

6.5.10 Fire Outbreaks

Due to handling of flammable substances at the proposed 90MVA 220/60 kV substation project, fire outbreaks can occur. Handling of inflammable products increases fire risks. The impact will be direct, temporary and major.

6.5.11 Visual Impacts

The substation might present unwanted visual impacts, both by its physical presence and profile against the surrounding area, and by visual impacts its associated structures that may also have adversely impact the visual quality of the area. The impact will be direct, permanent and minor.

6.6 Positive Impacts during Decommissioning Phase

The following positive impacts are associated with the proposed 90MVA 220/60 kV substation during the decommissioning phase:

6.6.1 Site Rehabilitation

Upon decommissioning of the proposed 90MVA 220/60 kV substation in Athi River rehabilitation of the project site will be carried out to restore the site to its original status or to a better state than it was originally. This will include replacement of topsoil and re-vegetation which will lead to restoration of the visual quality of the area.

6.6.2 Employment Opportunities

For demolition to take place properly and in good time, several people will be involved. As a result several employment opportunities will be created for the demolition staff during the demolition phase of the proposed 90MVA 220/60 kV substation in Athi River. The impact will be direct, temporary and minor.

6.7 Negative Impacts during Decommissioning Phase

The following three negative impacts discussed below are associated with the proposed 90MVA 220/60 kV substation in Athi River during its decommissioning phase.

6.7.1 Noise and Vibration

The demolition works will lead to significant deterioration of the acoustic environment within the project site and the surrounding areas. This will be as a result of the noise and vibration that will be experienced as a result of demolishing the proposed 90MVA 220/60 kV substation in Athi River. The impact will be direct, temporary and minor.

6.7.2. Solid Waste Generation

Demolition of the proposed 90MVA 220/60 kV substation and other related infrastructure will result in generation of solid waste. The waste will contain the materials used in construction including concrete, metal, drywall, wood, glass, paints, adhesives, sealants and fasteners. Although demolition waste is generally considered as less harmful to the environment since they are composed of inert materials, there is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment. The impact will be direct, permanent and major.

6.7.3 Generation of Dust

Some dust will be generated during demolition works of the proposed 90MVA 220/60 kV substation. This will affect demolition staff as well as the neighbours. The impact will be direct, temporary and minor.

CHAPTER SEVEN: MITIGATION MEASURES AND MONITORING PROGRAMMES

This section highlights the mitigation measures for the expected negative impacts of the proposed 90MVA 220/60 kV substation in Athi River. The potential impacts and the possible mitigation measures have herein been analyzed under three categories: Construction, Operational and Decommissioning.

7.1 Mitigation of Construction Related Negative Impacts

The following measures can be considered as mitigation measures of the negative impacts associated with the proposed 90MVA 220/60 kV substation in Athi River during construction phase.

7.1.1 Minimization of Noise and Vibration

The project proponent of the proposed 90MVA 220/60 kV substation in Athi River should put in place several measures that will mitigate noise pollution arising during the construction phase. The following noise-suppression techniques will be employed to minimise the impact of temporary construction noise at the project site.

- Install portable barriers to shield compressors and other small stationary equipment where necessary.
- Use quiet equipment (i.e. equipment designed with noise control elements).
- Co-ordinate with relevant agencies regarding all construction.
- Limit vehicles to a minimum idling time and observe a common-sense approach to vehicle use, and encourage drivers to switch off vehicle engines whenever possible.

Compliance with the recently issued Noise and Vibration Regulations of 2009 is expected at all the phases of the project.

7.1.2 Control of generation of Exhaust Emissions

In order to control exhaust emissions that are likely to occur during the construction of the proposed 90MVA 220/60 kV substation in Athi River, the following measures shall be implemented during construction.

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

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

7.1.3 Dust Emissions and Air quality

Controlling dust emissions that is likely to take place during construction phase of the proposed 90MVA 220/60 kV substation in Athi River is useful in minimizing nuisance conditions. It is recommended that a standard set of feasible dust control measures be implemented for all construction activities. Emissions of other contaminants (NO_x, CO₂, SO_x, transformer oil and diesel related PM₁₀) that would occur in the

exhaust from heavy equipment are also included. The project proponent is committed to implementing measures that shall reduce air quality impacts associated with construction.

- During construction, any stockpiles of earth should be enclosed / covered / watered during dry or windy conditions to reduce dust emissions;
- Construction trucks removing soil from the site, delivering sand and cement to the site should be covered to prevent material dust into the surrounding areas;
- All personnel working on the project will be trained prior to starting construction on methods for minimizing air quality impacts during construction. This means that construction workers will be trained regarding the minimization of emissions during construction.
- Specific training will be focused on minimizing dust and exhaust gas emissions from heavy construction vehicles. Drivers of vehicles used during construction will be under strict instructions to minimize unnecessary trips and minimize idling of engines.
- During construction, where water is available, sprinkle the construction area with water to keep dust levels down.
- Masks should be provided to all personnel in areas prone to dust emissions throughout the period of construction.
- Drivers of construction vehicles must be supervised so that they do not leave vehicles idling, and they limit their speeds so that dust levels are lowered.
- Maintain all machinery and equipment in good working order to ensure minimum emissions including carbon monoxide, NO_x, SO_x and suspended particulate matter;

7.1.4 Excavated Soil during Construction

The Excavated soil during the construction of the proposed 90MVA 220/60 kV substation will not be disposed. It is recommended that part of the topsoil excavated from the proposed construction site be re-spread in areas to be landscaped to enhance plant health.

7.1.5 Minimization of increased Water Demand

The proponent of the proposed 90MVA 220/60 kV substation in Athi River shall ensure that water is used efficiently at the site by sensitizing construction staff to avoid irresponsible water use.

7.1.6 Minimization of Worker accidents and hazards during Construction phase

To reduce the workers accidents and hazards during the construction phase of the proposed 90MVA 220/60 kV substation in Athi River, the contractor and proponent are expected to adhere to the provisions of the Occupational Safety and Health Act, 2007 and its subsidiary legislation. It is the responsibility of the project proponent and contractor to provide a safe and healthy environment for construction workers as outlined in the EMP. The proposed 90MVA 220/60 kV substation Response and Evacuation Plan must be in place in addition to safety education and training shall be provided to the employees.

7.1.7 Reduction of Energy Consumption

The project proponent and contractor 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 (transformer oil, 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.

7.1.8 Reduction of Impacts at Extraction Sites and Efficient Use of Raw Materials

The proponent of the proposed 90MVA 220/60 kV substation in Athi River will source building materials such as sand, ballast and hard core from registered quarry and sand mining firms whose projects have undergone satisfactory Environmental Impact Assessment/Audit and received NEMA approval. Since such firms are expected to apply acceptable environmental performance standards, the negative impacts of their activities at the extraction sites are considerably well mitigated.

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

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

7.1.9 Minimization of Solid Waste during Construction Phase

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

The proponent shall put in place measures to ensure that construction materials requirements are carefully budgeted for 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 proposed 90MVA 220/60 kV substation in Athi River include:-

- i. Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time
- ii. Provision of facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements
- iii. Purchase of perishable construction materials such as paints incrementally to ensure reduced spoilage of unused materials
- iv. Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste
- v. Use of construction materials containing recycled content when possible and in accordance with accepted standards.
- vi. Adequate collection and storage of waste on site and safe transportation to the disposal sites and disposal methods at designated area shall be provided.

7.1.10 Possible exposure of workers to diseases

Possible exposure of workers to diseases from building materials at construction site shall be mitigated by compliance with occupational health and safety standards.

7.1.11 Minimization of Storm Water Run-off and Soil Erosion

The proponent of the proposed 90MVA 220/60 kV substation in Athi River 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 levelling the project site to reduce run-off velocity and increase infiltration of rain water 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. Increased runoff from paved grounds and expansive roofs causing extreme flooding and overflows of drainage systems shall be mitigated. Surface runoff and roof water shall be harvested and stored in underground reservoir for reuse. A storm water management plan that minimizes impervious area infiltration by use of recharge areas and use of detention and/or retention with graduated outlet control structures will be designed.

Excavations at the site will be restricted to the sections of the substation. Excavated earth will be held away from trenches and on locations of the site not susceptible to surface runoff of storm water. The earth removed for external disposal will require to be deposited on sites without the risk of being washed down during rains and where it will not compromise other land use activities in those areas. Caution will be required during construction at times of heavy rains.

Re-vegetate exposed areas around the site so as to mitigate erosion of soil by storm water runoff. The final site grade should facilitate drainage and avoid flooding and pooling. A site drainage plan should be developed to protect against erosion. Protecting stockpiles through the use of silt fencing and reduced slope angles should be used to minimize soil erosion during construction. Installation of drainage ditches, construction of runoff and retention ponds is necessary. Minimization of disturbances and scarification of the surface should be observed to reduce erosion impacts. All slopes and working

surfaces should be returned to a stable condition and topsoil on the final site would be graded and planted as appropriate.

7.1.12 Controlling Oil Spills during Construction Phase

The proponent of the proposed 90MVA 220/60 kV substation in Athi River will control the dangers of oil spills during construction by maintaining the machinery in specific areas designed for this purpose hence might not be a serious impact as a result of the construction of the proposed 90MVA 220/60 kV substation in Athi River.

7.1.13 Minimization of Vegetation Disturbance

Clearance of part of the vegetation (mainly grass and shrubs) at the proposed 90MVA 220/60 kV substation in Athi River site to pave way for construction will be inevitable. However, the project 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 is restricted to the actual project area and avoid spill over effects to 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. Another important measure aimed at reducing disturbance of vegetation in the proposed project area will be preservation of individual trees within the site. In addition, the proponent will be involved in re-vegetation of some of the disturbed areas through implementation of a well designed landscaping programme.

7.1.14 Hydrology and Water Quality Degradation

Several measures shall be put in place to mitigate the impacts that are likely to lead to Hydrology and water quality degradation at the proposed 90MVA 220/60 kV substation in Athi River. The project proponent will prepare a hazardous substance control and 90MVA 220/60 kV substation response plan that will include preparations for quick and safe clean up of accidental spills. It will prescribe hazardous-materials handling procedures to reduce the potential for a spill during construction, and will include a 90MVA 220/60 kV substation response programme to ensure quick and safe cleanup of accidental spills. The plan will identify areas where refuelling and vehicle maintenance activities and storage of hazardous materials, if any, will be permitted. Trial holes digging will be conducted before construction begins and soil information will be provided to construction crews to inform them about soil conditions and potential hazards. Oil absorbent material, tarps and storage drums will be used to contain and control any minor releases of transformer and other equipment oil.

7.2 Mitigation of Operation Phase Negative Impacts

The negative impacts of the proposed 90MVA 220/60 kV substation in Athi River will be mitigated as discussed below.

7.2.1 Ensuring Efficient Solid Waste Management

The project proponent of the proposed 90MVA 220/60 kV substation in Athi River 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 labelled waste bins and skips for temporarily holding solid waste generated at the site.

In addition, the project proponent will ensure that such are disposed of regularly and appropriately. It is recommended that the proponent puts in place measures to ensure that the proposed 90MVA 220/60 kV substation operating personnel manage the waste efficiently through recycling, reuse and proper disposal procedures.

The proponent will put in place an integrated solid waste management system and give priority to reduction at source of the materials. This option will demand a solid waste management awareness programme in the management and the operator employees. Solid wastes shall be disposed off in a manner that is acceptable to NEMA and Environmental Regulations.

7.2.2 Ensuring efficient liquid Waste Management

A sludge treatment unit is proposed to be constructed. An oil interceptor should be constructed to separate oil from water. The transformer oil should be re-used in the substation or other related sites and the unusable one should be disposed by a NEMA approved contractor. The substation should be well paved to prevent spilled oil from reaching the sub-surface.

7.2.3 Ensure Efficient Energy Consumption

To ensure efficient energy consumption during the operation phase of the proposed 90MVA 220/60 kV substation in Athi River, the proponent plans to install an energy-efficient lighting system at the project site. This will contribute immensely to energy saving during the operational phase of the project. In addition, the substation operators will be sensitised to ensure energy efficiency in their daily operations. To complement these measures, it will be important to monitor energy use during the operation of the proposed 90MVA 220/60 kV substation in Athi River and set targets for efficient energy use.

7.2.4 Ensure Efficient Water Use

The proponent of the proposed 90MVA 220/60 kV substation in Athi River will install water-conserving automatic taps and toilets. Moreover, any water leaks through damaged pipes and faulty taps will be fixed promptly by qualified staff. In addition, the substation operators of the proposed 90MVA 220/60 kV substation will be sensitized to use water efficiently.

7.2.5 Oil Spills

To prevent oil spills and environmental contamination, the substation and transformers should be designed with spill prevention and detection systems to protect the environment. With spill prevention and protection measures there should no adverse effects to the ground and surface water and soil. Need to design appropriate protection devices against accidental discharge of toxic substances (bases/airtight tanks for machines, reservoirs etc.).

Storage and liquid impoundment areas for fuels, raw and in-process material solvents, wastes and finished products should be designed with secondary containment (e.g. dikes/berms) to prevent spills and the contamination of soil, ground and surface water.

All the transformers should have secondary containment with sufficient volume to contain any spill from them in the containment structure. The containment area should have a means of removing accumulated water. The containment area should have a means of removing accumulated water. A retention area should be designed that surrounds the fuel storage tanks.

The substation operators should provide containers for the storage of chemical and lubricating products. Drains should be routed through a site/water separator. A spill and substation response plan would be developed and put in place prior to commencement of construction.

A written substation response plan should be prepared and retained on the site and the workers should be trained to follow specific procedures in the event of oil leakages and spills. The project proponent will orientate the workers on site on their specific EHS policies to prevent incidents and accidents of oil spill.

A floating boom should be used to contain spillage during refilling and unrefilling oil to transformers procedures. Frequent inspection and maintenance of transformer can minimize leakages.

The project operator will collect the waste oil or used oil from maintenance of the transformers for proper disposal. In the Environmental Management Plan (EMP), disposal of used oil will be the responsibility of the project operator. The proponent will identify a reputable company to handle disposal of oil and oil filters.

It's proposed to enclose transformers in an earth bund wall and the floor lined with plastic sheets to prevent accidental contamination of soils and groundwater. At the off loading area, they propose to mitigate leakage by constructing a sump for temporal containment when fuel is off loaded.

7.2.7 Visual Impacts

The visual negative impacts can be mitigated through landscaping the area with trees to screen the project stacks, poles, cables and transformers by the project proponent of the proposed 90MVA 220/60 kV substation in Athi River. Since the area is zoned as industrial, the visual impact will not be out of conformity with the surrounding areas.

7.2.8 Minimization of Sewage Release

The project proponent of the proposed 90MVA 220/60 kV substation in Athi River will ensure that there are adequate means for handling the sewage generated at the proposed 90MVA 220/60 kV substation. It will also be important to ensure that toilets are kept clean and properly maintained.

7.2.9 Fire Suppression

The construction site must contain fire fighting equipments of recommended standards and in key strategic points all over the proposed project site of the proposed 90MVA 220/60 kV substation in Athi River. Fire pumps, Hydrants, Sprinkler/water spray systems, Hose houses, Dry chemical systems, Carbon dioxide systems, Detection/alarm systems, Portable fire extinguishers among others. A fire evacuation plan must be posted in various points of the construction site including procedures to take when a fire is reported. All workers must be trained on fire management and fire drills undertaken regularly.

7.2.10 Workers Health and Safety

All workers entering the proposed 90MVA 220/60 kV substation must be equipped with appropriate and adequate PPE including ear muffs, safety footwear, overalls, gloves, dust masks, among others. The PPE should be those meeting the international standards of PPE. Personal protection gear must be provided and its use made compulsory to all. The entire workforce of the substation should be trained in the use of protective gear, handling of chemical products and acid storage cells, electric safety equipment, procedures for entering enclosed areas, fire protection and prevention, substation response and care procedures. Training given to the employees should be backed by regular on- site training in safety measures. 'Restricted ENTRY' signs such as "HATARI" should be installed to keep away unauthorized persons from access to restricted areas. Machines and Equipments must be operated only by qualified staff and a site supervisor should be on site at all times to ensure adherence. The project operator must develop a Workplace Health and Safety Policy Manual for which all the workers should be conversant and comply with. The project operator should appoint a responsible person from the management team to be in charge of workplace Safety, Health and Environmental issues. The operator should develop a substation Response Plan for handling any emergencies arising thereof during the project implementation phase.

7.2.11 Hazardous waste

The amount of hazardous waste created will be very low and possibly originate from maintenance sources. The waste would consist primarily transformer oil and their containers, used rags and spent clean-up solvents. The used oil should be stored in a place with a drip collection mechanism before they are collected by the disposal agent for proper disposal. The substation operator should ensure that the used oil and its containers are properly disposed off in an environmental sound way. The mitigation measure is to provide training to site operation and maintenance staff to properly handle and dispose of the hazardous wastes using acceptable methods. Hazardous wastes on the site shall be clearly marked out and the entire workforce trained to recognize the danger signs and familiarize themselves with procedures to be followed before entering hazardous areas.

7.2.12 Noise and Vibration

Noise and vibration are expected during the operation phase of the project. Mitigation is through installation of generator muffling materials and with inbuilt sound and vibration absorption materials. The project operator will be expected to comply with the recent EMCA (Noise and Vibration) Regulations of 2009 during the operation phase of the project. All equipments and machinery installed

must be tested to verify if they are compliant with Kenya and the World Bank acceptable standards of noise. Tested noise levels should be recorded as baseline and used for future monitoring.

Noise emitting equipment should comply with the applicable Kenya and World Bank noise standards and should be properly maintained. All workers in the project site must be equipped with the necessary and required Personal Protective Equipment (PPE) prescribed by the Directorate of Occupational Safety and Health of the Ministry of Labour like PPE.

7.3 Mitigation of Decommissioning Phase Impacts

Just as in the case during the construction and operation phase, the negative impacts of the decommissioning phase of the proposed 90MVA 220/60 kV substation in Athi River can be mitigated as follows.

7.3.1 Minimization of Noise and Vibration

Significant impacts on the acoustic environment will be mitigated by the project proponent of the proposed 90MVA 220/60 kV substation in Athi River shall put in place several measures that will mitigate noise pollution arising during the decommissioning phase. The following noise-suppression techniques will be employed to minimise the impact of temporary destruction noise at the project site.

- Install portable barriers to shield compressors and other small stationary equipment where necessary.
- Use quiet equipment (i.e. equipment designed with noise control elements).
- Co-ordinate with relevant agencies regarding all substation construction activities in the residential areas.
- Install sound barriers for pile driving activity.
- Limit pickup trucks and other small equipment to a minimum idling time and observe a common-sense approach to vehicle use, and encourage workers to shut off vehicle engines whenever possible.
- Demolish mainly during the day. The time that most of the neighbours are out working.

7.3.2 Efficient Solid Waste Management

Solid waste resulting from demolition or dismantling works associated with the proposed 90MVA 220/60 kV substation in Athi River during decommissioning phase will be managed as follows:

- Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of demolition waste generated during decommissioning phase
- Provision of facilities for proper handling and storage of demolition materials to reduce the amount of waste caused by damage or exposure to the elements
- Use of materials that have minimal packaging to avoid the generation of excessive packaging waste
- Adequate collection and storage of waste on site and safe transportation to the disposal sites and disposal methods at designated area shall be provided.

7.3.3 Reduction of Dust Concentration

High levels of dust concentration resulting from demolition or dismantling works will be minimized as follows:

- Watering all active demolition areas as and when necessary to lay dust.
- Cover all trucks hauling soil, sand and other loose materials or require all trucks to maintain at least two feet of freeboard.
- Pave, apply water when necessary, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at demolition sites.

7.3.4 Site Rehabilitation after Decommissioning

The project operator shall, on decommissioning of the project, restore the site to its original status as far as practicable and plant trees at the site.

CHAPTER 8: ANALYSIS OF PROJECT ALTERNATIVES

8.1 Introduction

One of the functions of the Environmental and Social Impact assessment process is to describe and evaluate the alternatives to the proposed project to be undertaken therefore this chapter will describe and examine the various alternatives available for the proposed 90MVA 220/60 kV substation in Athi River project. Alternatives examined during the study are discussed hereby;

8.2 Alternative Designs

The cost of a proposed substation project such as this is substantial, resulting in detailed research and development being put into the design of the components of the substation construction. The current design for the 220/66kV substations and its components at Athi River is regarded as the most cost effective whilst operationally sound for such a project.

8.3 Strategic Alternatives

Strategic alternatives to the construction of the Athi River Substation include the “do nothing” option, demand-side management, the construction of the Athi River Substation to 220/66kV capacity. An overview of the strategic alternatives is outlined below.

8.3.1 The “Do Nothing” Option

The environmental experts states that the “do nothing” or “no-go” option should be considered in cases where the proposed development could have negative impacts. For this project, the no-development option would mean the proposed Athi River substation 220/66Kv will not be constructed. The implications of this would be no additional security of quality electricity supply to the Nairobi metropolitan area. The low perceived level of impacts associated with the construction and high probability of mitigation of these lead to the conclusion that the “no-go” option would not be the most viable option in this instance, given the shortfalls in electricity supply and security of supply that need to be addressed.

8.3.2 Demand-side Management

Demand Side Management (DSM) is a function carried out by the electricity supply utility aimed at encouraging a reduction in the amount of electricity used at peak times. This is achieved by influencing customer usage to improve efficiency and reduce overall demand. These efforts are intended to produce a flat load duration curve to ensure the most efficient use of installed network capacity. By reducing peak demand and shifting load from high load to low load periods, reductions in capital expenditure (for network capacity expansion) and operating costs can be achieved. One of the basic tools is the price differentiation (such as time-of-use tariffs) between peak demand time and low demand time. This option is practiced to a certain extent, but is currently not considered feasible for managing the level of growth forecast for Nairobi metropolitan area.

8.4 Alternative Site

Relocation option to a different site is an option available for the project implementation. The project proponent can look for alternative land. Looking for the land to accommodate the scale and size of the project and completing official transaction on it may take a long time although there is no guarantee that the land would be available. The developer will spend another one year on design and approvals since design and planning has to be according to site conditions. Project design and planning before the stage of implementation will cost the developer a large sum of money.

Assessment of the proposed site with an alternative site was considered in this study. In the assessment, land use, impacts and technical feasibility of the two were used to arrive to a viable alternative. The proposed site is industrial zone and is not located close to residential area. Using the criteria of zoning industrial land use, the consultants went further to examine the environmental impact of the project on the area.

8.5 Alternative Processes and Materials

The process material that are consumed by the proposed project area, transformer oil for cooling the transformer and water for substation cleaning purposes. There is no alternative for transformer oil for transformer cooling and for substation cleaning water. So the task was to assess alternative water and transformer oil sources for the project. The study had four alternatives sources for substation cleaning water they include; piped Municipal water, groundwater and rainwater. Groundwater quality and recharge in the area is very poor, making it less viable for any firm to venture into groundwater extraction.

Surface water from streams and rivers is not a viable option for the substation as the area has no nearby river. But this would be costly and unfeasible for the proposed 90MVA 220/60 kV substation. Tapping rainwater would also be an option but it would require the project proponent to have a large roof catchment surface which is not the case. Nairobi City water supply thus is the only viable option for the project based on the steady supply and quantities that would not impact other water users. Another material input for the project that was assessed for sustainable alternative was fuel for running the generators.

The transformer oil helps cool the transformer, because it provides part of the electrical insulation between internal live parts, transformer oil must remain stable at high temperatures for an extended period. To improve cooling of large power transformers, the oil-filled tank may have external radiators through which the oil circulates by natural convection. Very large or high-power transformers (with capacities of thousands of KVA) may also have cooling fans, oil pumps, and even oil-to-water heat exchangers. Large, high voltage transformers undergo prolonged drying processes, using electrical self-heating, the application of a vacuum, or both to ensure that the transformer is completely free of water vapor before the cooling oil is introduced. This helps prevent corona formation and subsequent electrical breakdown under load. Oil filled transformers with a conservator (an oil tank above the transformer) tend to be equipped with Buchholz relays. These are safety devices that detect the build

up of gases (such as acetylene) inside the transformer (a side effect of corona or an electric arc in the windings) and switch off the transformer. Transformers without conservators are usually equipped with sudden pressure relays, which perform a similar function as the Buchholz relay.

8.6 Analysis of Alternative Construction Materials and Technology

The proposed 90MVA 220/60 kV substation in Athi River will be constructed 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 (washed and clean), metal bars and fittings that meet the Kenya Bureau of Standards requirements.

Beautiful and durable re-enforced concrete roofs with tile profile will be used because they are good in heat insulation as compared to the iron sheet roofs, and afford more security. This will ensure that the rainwater harvested will be used in the proposed 90MVA 220/60 kV substation operations and landscaping. 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.

8.7 Solid waste management alternatives

The proposed 90MVA 220/60 kV substation in Athi River will generate some of solid wastes. The proponent will give priority to reduction at Source of the materials. This option will demand a solid waste management awareness programme in the management and the residents. Solid wastes shall be disposed off in a manner that is acceptable to NEMA and Environmental Regulations.

CHAPTER 9: ENVIRONMENTAL MANAGEMENT PLAN (EMP)

9.1 Significance of an EMP

Environmental Management Plan (EMP) for development projects provides a logical framework within which identified negative environmental impacts can be mitigated and monitored. In addition the EMP assigns responsibilities of actions to various actors and provides a timeframe within which mitigation measures and monitoring can be done. EMP is a vital output of an Environmental Impact Assessment as it provides a checklist for project monitoring and evaluation. The EMP outlined below have addressed the identified potential negative impacts and mitigation measures of the proposed 90MVA 220/60 kV substation in Athi River during construction, operational and decommissioning phases, based on the Chapters of Environmental Impacts and Mitigation Measures of the expected Negative Impacts.

9.2 Construction phase EMP

Environmental Management Plan for the construction phase is as shown on the **Table 8**.

Table 6: Environmental Management Plan during CONSTRUCTION PHASE of the proposed 90MVA 220/60 kV substation Athi River

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
1. Minimize extraction site impacts and ensure efficient use of raw materials in construction				
Demand of Raw material	1. Source building materials from local suppliers who use environmentally friendly processes in their operations.	Resident Project Manager & Contractor	Throughout construction period	0
	2. Ensure accurate budgeting and estimation of actual construction material requirements to ensure that the least amount of material necessary is ordered.	Resident Project Manager & Contractor	Throughout construction period	5,000
	3. Ensure that damage or loss of materials at the construction site is kept minimal through proper storage.	Resident Project Manager & Contractor	Throughout construction period	0
	4. Use at least 5%-10% recycled refurbished or salvaged materials to reduce the use of raw materials and divert material from landfills.	Resident Project Manager & Contractor	Throughout construction period	0
2. Minimize vegetation disturbance at and or around construction site				
Vegetation disturbance	1. Ensure proper demarcation and delineation of the project area to be affected by construction works.	Contractor, Resident Project Manager	1 month	3,000

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
	2. Specify locations for trailers and equipment, and areas of the site which should be kept free of traffic, equipment, and storage.	Civil Engineer and Resident Project Manager	1 month	1,000
	3. Designate access routes and parking within the site.	Civil Engineer and Resident Project Manager	1 month	5,000
	4. Introduction of vegetation (trees, shrubs and grass) on open spaces and around the project site and their maintenance.	Architect & Landscape specialist	Monthly to Annually	10,000
	5. Design and implement an appropriate landscaping programme to help in re-vegetation of part of the project area after construction.	Architect & Landscape specialist	2 months	10,000
3. Reduce storm-water, runoff and soil erosion				
Increased storm water, runoff and soil erosion	1. Surface runoff and roof water shall be harvested and stored in tanks so that it can be used for cleaning purposes.	The Civil Engineer, Mechanical Engineer and Resident Project Manager	2 months	10,000
	2. A storm water management plan that minimizes impervious area infiltration by use of recharge areas and use of detention and/or retention with graduated outlet control structure will be designed.	The Civil Engineer, Mechanical Engineer and Resident Project Manager	1 month	

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
	3. Apply soil erosion control measures such as levelling of the project site to reduce run-off velocity and increase infiltration of storm water into the soil.	The Civil Engineer, Mechanical Engineer and Resident Project Manager	1 months	5,000 per unit
	4. Ensure that construction vehicles are restricted to use existing graded roads	Contractor	Throughout construction period	
	5. Ensure that any compacted areas are ripped to reduce run-off.	Contractor	2 months	
	6. Site excavation works to be planned such that a section is completed and rehabilitated before another section begins.	Resident Project Manager	Throughout construction period	
	7. Interconnected open drains will be provided on site.	Civil Engineer	Throughout construction period	
	8. Roof catchments will be used to collect the storm water for some substation uses.	Civil Engineer	Throughout construction period	
	9. Construction of water storage tanks to collect storm water for substation uses.	Civil Engineer	Throughout construction period	
4. Minimize solid waste generation and ensure efficient solid waste management during construction				
Increased solid waste generation	1. Use of an integrated solid waste management system i.e. through a hierarchy of options: 1. Reduction at source 2. Recycling 3. Reusing 4. Incineration 5. Sanitary land filling.	Resident Project Manager & Contractor	Throughout construction period	10,000
	2. Through accurate estimation of the dimensions and quantities of materials required.	Resident Project Manager & Contractor	One-off	0

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
	3. 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	Resident Project Manager & Contractor	Throughout construction period	0
	4. Provide facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements	Resident Project Manager & Contractor	One-off	12,000
	5. Use building materials that have minimal or no packaging to avoid the generation of excessive packaging waste	Resident Project Manager & Contractor	Throughout construction period	0
	6. Reuse packaging materials such as cartons, cement bags, empty metal and plastic containers to reduce waste at site	Resident Project Manager, Mechanical Engineer & Contractor	Throughout construction period	0
	7. Dispose waste more responsibly by contracting a registered waste handler who will dispose the wastes at designated sites or landfills only.	Resident Project Manager, Mechanical Engineer & Contractor	Throughout construction period	10,000 /month
	8. Waste collection bins to be provided at designated points on site	Resident Project Manager, Mechanical Engineer & Contractor	Throughout construction period	40,000
5. Air Pollution				
Dust emission	1. Ensure strict enforcement of on-site speed limit regulations	Resident Project Manager & Contractor	Throughout construction period	5,000
	2. Avoid excavation works in extremely dry weathers	Resident Project Manager & Contractor	Throughout construction period	30,000 per month

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
	3. Sprinkle water on graded access routes when necessary to reduce dust generation by construction vehicles	Resident Project Manager & Contractor	Throughout construction period	
	4. Personal Protective equipment to be provided to employees and worn	Resident Project Manager	Throughout construction period	
Exhaust emission	1. Vehicle idling time shall be minimised	Resident Project Manager & Contractor	Throughout construction period	0
	2. Alternatively fuelled construction equipment shall be used where feasible equipment shall be properly maintained	Resident Project Manager & Contractor	Throughout construction period	0
	3. Sensitise truck drivers to avoid unnecessary running engines of stationary vehicles and to switch off engines whenever possible	Resident Project Manager & Contractor	Throughout construction period	0
7. Minimization of Noise and Vibration				
Noise and vibration	1. Sensitise construction vehicle drivers and machinery operators to switch off engines of vehicles or machinery not being used.	Resident Project Manager & Contractor	Throughout construction period	Routine site operation
	2. Sensitise construction drivers to avoid running of vehicle engines or hooting	Resident Project Manager & Contractor	Throughout construction period	Routine site operation
	3. Ensure that construction machinery are kept in good condition to reduce noise generation	Resident Project Manager & Contractor	Throughout construction period	10,000

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
	4. Ensure that all generators and heavy duty equipment are insulated or placed in enclosures (containers) to minimize ambient noise levels.	Resident Project Manager & Contractor	Throughout construction period	
	5. Trees to be planted around the site to provide some buffer against noise propagation	Resident Project Manager & all site foreman	Throughout construction period	4,000
	6. The noisy construction works will entirely be planned to be during day time when most of the neighbours will be at work.	Resident Project Manager & all site foreman	Throughout construction period	0
8 Minimization of Energy Consumption				
Increased energy consumption	1. Ensure electrical equipment, appliances and lights are switched off when not being used	Resident Project Manager & Contractor	Throughout construction period	0
	2. Install energy saving bulbs/tubes at all lighting points instead of incandescent bulbs which consume higher electric energy	Resident Project Manager & Contractor	Throughout construction period	5,000
	3. Plan well for transportation of materials to ensure that fossil fuels (diesel, transformer oil, petrol) are not consumed in excessive amounts	Resident Project Manager & Contractor	Throughout construction period	10,000
	4. Monitor energy use during construction and set targets for reduction of energy use.	Resident Project Manager & Contractor	Throughout construction period	5,000

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
9. Minimize water consumption and ensure more efficient and safe water use				
Increased Water Demand	1. Water to be brought in from the City Water and Sewerage Company	Mechanical Engineer and Resident Project Manager	Throughout construction period	5,000 per unit
	2. Harness rainwater for office & gardening	Mechanical Engineer and Resident Project Manager	Throughout construction period	5,000 per unit
	3. Install water conserving taps that turn-off automatically when water is not being used	Resident Project Manager & Contractor	One-off	40% more than price of ordinary taps
	5. Promote recycling and reuse of water as much as possible	Resident Project Manager & Contractor	Throughout construction period	2,000
	6. Install a discharge meter at water outlets to determine and monitor total water usage	Resident Project Manager & Contractor	One-off	2,000
	7. Promptly detect and repair of water pipe and tank leaks	Resident Project Manager & Contractor	Throughout construction period	1,000 per month
	8. Sensitise construction workers to conserve water by avoiding unnecessary toilet flushing etc.	Resident Project Manager & Contractor	Throughout construction period	1,000
	9. Ensure taps are not running when not in use	Resident Project Manager & Contractor	Throughout construction period	1,000
	10. Minimize release of liquid effluent			
Generation of wastewater	1. Provide means for handling sewage generated at the construction site	Mechanical Engineer & Resident Project Manager	One-off	30,000

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
	2. Conduct regular checks for sewage pipe blockages or damages since such vices can lead to release of the effluent into the land and water bodies	Mechanical Engineer & Resident Project Manager	Throughout construction period	2,000/month
	3. Monitor effluent quality regularly to ensure that the stipulated discharge rules and standards are not violated	Mechanical Engineer & Resident Project Manager	Throughout construction period	2,000/month
11. Minimize occupational health and safety risks				
Statutory Requirements	Ensure compliance with The OSHA (Building Operations and Works of Engineering Construction Rules), L.N. 40 of 1984	Contractor	During the construction period	
Worksite Safety and Health Hazards to employees	Ensure compliance with the Occupational Safety and Health Act (OSHA) 2007 provisions e.g. employees to be provided with appropriate PPE	Developer	One-off	5,000
12. Minimize Oil Spills				
Oil spills Hazards	Install oil trapping equipments in areas when there a likelihood of oil spillage such during the maintenance of construction facility. Soil in such an area will be well protected from contamination	Resident Project Manager	Continuous	50,000

9.3 Operational Phase EMP

The necessary objectives, activities, mitigation measures, and allocation of costs and responsibilities pertaining to prevention, minimization and monitoring of significant negative impacts and maximization of positive impacts associated with the operational phase of proposed 90MVA 220/60 kV in Athi River, are outlined in this section.

Table 9 below indicates the operational phase EMP.

Table 9: Environmental management/monitoring Plan for the OPERATIONAL PHASE of the proposed 90MVA 220/60 kV substation Project

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
1. Minimization of solid waste generation and ensuring more efficient solid waste management				
Solid waste generation	1. Use of an integrated solid waste management system i.e. through a hierarchy of options: 1. Source reduction 2. Recycling 3.Composting and reuse 4. Combustion 5. Sanitary land filling.	Resident Project Manager & Contractor	Throughout construction period	20,000
	2. Provide solid waste handling facilities such as rubbish bags and skips	Resident Project Manager	One-off	20,000
	3. Ensure that solid wastes generated at the substation are regularly disposed of appropriately at authorised disposal sites	Resident Project Manager	Continuous	15,000/month
	4. Ensure that wastes generated at the substation are efficiently managed through recycling, reuse and proper disposal procedures.	Resident Project Manager	Continuous	0
	5. A private company to be contracted to collect and dispose solid waste on regular intervals	Resident Project Manager	Continuous	30,000 per month
	6. Install site smokeless incinerator	Resident Project and contractor	During design and construction	To be determined
2. Ensuring Efficient Liquid waste management				

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
	1. Paving of substation surface to reduce spilled liquid waste from reaching sub-surface	Resident Project Manager & Contractor	During Construction	Part of construction cost
	2. Install sludge treatment unit on site	Resident Project Manager & Contractor	During construction	Part of construction cost
	3. Install oil interceptor on site to separate oil and water	Resident Project Manager & Contractor	During construction	Part of construction cost
3. Minimise risks of sewage release into environment				
Release of sewage into the environment	1. Provide adequate and safe means of handling sewage generated at the substation	Resident Project Manager & Mechanical Engineer	One-off	40,000
	2. Conduct regular inspections for sewage pipe blockages or damages and fix appropriately	Resident Project Manager & Mechanical Engineer	Continuous	500 per inspection
	3. Ensure regular monitoring of the sewage discharged from the project to ensure that the stipulated sewage/effluent discharge rules and standards are not violated	Resident Project Manager & Mechanical Engineer	Continuous	500/parameter
4. Minimize energy consumption				
High demand for energy	1. Switch off electrical equipment, appliances and lights when not being used	Resident Project Manager	Continuous	0

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
	2. Install occupation sensing lighting at various locations such as storage areas which are not in use all the time	Resident Project Manager & Contractor	One-off	10-40 % higher than ordinary lighting
	3. Install energy saving fluorescent tubes at all lighting points within the substation instead of bulbs which consume higher electric energy	Resident Project Manager & Occupants	One-off	10-40% higher than ordinary lighting
	4. Monitor energy use during the operation of the project and set targets for efficient energy use	Resident Project Manager	Continuous	2,000/month
	5. Sensitise the substation workers to use energy efficiently	Resident Project Manager	Continuous	500/month
5. Minimize water consumption and ensure more efficient and safe water use				
High water demand	1. Promptly detect and repair of water pipe and tank leaks	Resident Project Manager & Mechanical Engineer	Continuous	2,000/month
	2. Substation workers to be sensitized on water conservation techniques.	Resident Project Manager & Mechanical Engineer	Continuous	500/month
	3. Ensure taps are not running when not in use	Resident Project Manager & Mechanical Engineer	Continuous	500/month
	4. Install water conserving taps that turn-off when water is not being used	Resident Project Manager & Mechanical Engineer	One-off	40% more than ordinary taps

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
	5. Install a discharge meter at water outlets to determine and monitor total water usage	Resident Project Manager & Mechanical Engineer	One-off	2,000
	6. Create water conservation awareness	Resident Project Manager & Mechanical Engineer	Continuous	2,000
6. Minimization of health and safety impacts				
Increased health and safety impacts	Implement all necessary measures to ensure health and safety of the substation workers and the general public during operation of the proposed 90MVA 220/60 kV substation as stipulated in the Occupational Safety and Health Act, 2007	Resident Project Manager, Mechanical Engineer, & Developer	Continuous	5,000 per month
7. Ensure the general safety and security of the proposed 90MVA 220/60 kV substation and surrounding areas				
Increased general safety and security impacts	Ensure the general safety and security at all times by providing day and night security guards and adequate lighting within and around the premises.	Security Officer, Resident Project Manager & Police	Continuous	10,000/month
8 Increased Pressure on Infrastructure	1. Coordinate with other planning goals and objectives for region	Architect, Project Manager, and the Developer	Continuous	40,000
	2. Upgrade existing infrastructure and services, if and where feasible.	Architect, Project Manager and the Developer	Continuous	
9. Air Pollution	1. Suitable wet suppression techniques need to be utilized in all exposed areas	Site Safety Officer	Continuous	20,000

	2. Enforce low speed limits for vehicles moving within the site	Site Safety Officer	Continuous	
	3. Ensure that the site is located away from such pollution sources	Site Safety Officer	Continuous	
	4. Use of transformer oil should have been sulphur free for the purpose of cooling the transformers	Residents project manager	Continuous	5,000 per month
10.Minimization of fire risks	1.Installation of fire fighting equipments	Substation manager and contractors	In design and Continuous	100,000PA
	2.Development of fire evaluation plan			
	3.Training of all staff in fire management			
12.Worksite Safety and Health Hazards to employees	Ensure compliance with the Occupational Safety and Health Act (OSHA) 2007 provisions e.g. employees to be provided with appropriate PPE	Developer	One-off	5,000

9.4 Decommissioning Phase EMP

In addition to the mitigation measures provided in the above two tables, it is necessary to outline some basic mitigation measures that will be required to be undertaken once all operational activities of the proposed 90MVA 220/60 kV substation in Athi River have. The necessary 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 proposed 90MVA 220/60 kV substation project are outlined in the **Table 10** below.

Table 10: Environmental management/monitoring Plan for the decommissioning phase of the proposed 90MVA 220/60 kV substation Project.

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
1. Demolition waste management				
Demolition waste	1. Use of an integrated solid waste management system i.e. through a hierarchy of options: 1. Source reduction 2. Recycling 3. Reusing 4. Combustion 5. Sanitary land filling.	Resident Project Manager & Contractor	One-off	20,000
	2. All machinery, equipment, structures and partitions that will not be used for other purposes must be removed and recycled/reused as far as possible or they be taken to a licensed waste disposal site	Resident Project Manager & Contractor	One-off	0
2. Rehabilitation of project site				
Vegetation disturbance	1. Implement an appropriate re-vegetation programme to restore the site to its original status	Resident Project Manager & Contractor	One-off	10,000
	2. Consider use of indigenous plant species in re-vegetation	Resident Project Manager & Contractor	One-off	0
	3. Trees should be planted at suitable locations so as to interrupt slight lines (screen planting), between the adjacent residential area and the development.	Resident Project Manager & Contractor	Once-off	0
3. Minimization of Generation of Dust				

Expected Negative Impacts	Recommended Mitigation Measures	Responsible Party	Time Frame	Cost (Ksh)
Generation of dust	1. Watering all active demolition areas as and when necessary to lay dust.	Resident Project Manager Contractor &	During Decommissioning	To be determined
	2. Cover all trucks hauling soil, sand and other loose materials or require all trucks to maintain at least two feet of freeboard.			
	3. Pave, apply water when necessary, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at demolition sites.			
4. Reduction of Noise and vibrations				
Increase noise and vibration	1. Install portable barriers to shield compressors and other small stationary equipment where necessary.	Resident Project Manager Contractor &	During Decommissioning	To be determined
	2. Demolish mainly during the day. The time that most of the neighbours are out working.			
	3. Co-ordinate with relevant agencies regarding all substation construction activities in the residential areas.			

Chapter 10. CONCLUSIONS AND SUMMARY OF RECOMMENDATIONS

10.1 INTRODUCTION

As a result of the ESIA findings, potentially significant environmental and social impacts have been identified. It is our recommendation that this project to go a head and implemented since various environmental concerns that will result up due to this development will be mitigated as required.

10.2 GENERAL MITIGATION AND INTERVENTION MEASURES

10.2.1 General Conclusions

- Mitigation of potential impacts (environmental and social) as described and implementation of the ESMP of this report, will help to prevent or avert negative impacts, and enhance the positive outcomes of the project. This will help to achieve project sustainability.
- The responsibility for the incorporation of mitigation measures for the project implementation lies with the project engineer, who must ensure that the Contractor implements all specified mitigation measures.
- Community participation will be encouraged;

10.3 General Recommendations

Avoidance of negative environmental impacts should be the Proponent's priority. Impacts can be avoided completely by a "no-project" alternative, but it should be recognized that even substations have impacts on their surrounding environment; these impacts can increase over time with economic growth and development, however their effect on the environment may be reduced by maintenance, rehabilitation, design and construction actions.

10.3.1 Mitigation

Mitigation is the lessening of negative environmental impacts through:

- Changes in the design, construction practices, maintenance, and operation of a project; and
- Additional actions taken to protect the biophysical and social environment, as well as individuals who have been impacted adversely by a project.

The extent and timing of mitigative actions should be based on the significance of the predicted impacts. Some aspects of impact mitigation can be incorporated into project design and can largely resolve the threat of impacts before construction commences.

However, many measures require an ongoing implementation plan to ensure that proposed actions are carried out at the correct times, that environmental measures such as planting and slope protection are maintained, and that prompt remedial actions are taken when the initial measures are not fully successful.

Some measures may not be the exclusive domain of the Proponent; Government departments, local authorities, neighbouring communities, businesses, non-governmental organizations, and the legal system may all be involved in their design and implementation of these mitigation measures. Clear definition of responsibilities, funding, and reporting requirements can help to ensure the success of such measures.

10.3.2 Compliance Monitoring

During construction, all mitigative measures designed to reduce the impact of the construction activities should be monitored and enforced by the environmental monitoring authorities. This requires:

- Defining the proposed mitigative and compensatory measures;
- Specifying who is responsible for the monitoring activity;
- Including implementation of mitigative measures in contract specifications;
- Making environmental competence one of the selection criteria for contractors; and briefing, educating, and training contractors in environmental protection methods.

Compliance monitoring should cover all sites affected by the project, including disposal sites, materials treatment areas, access roads, and work camps (if any) among others.

10.3.3 Effects Monitoring (Evaluation)

After mitigative measures are implemented, effects monitoring or evaluation can test the validity of hypotheses formulated in the environmental impact study; they can also determine if the mitigative measures have achieved their expected results. Evaluation is necessary not only for individual projects, but also to advance methodology, assist in designing future studies, and through lessons learned -contribute to the relevance and cost-effectiveness of environmental protection measures. Responsibility for corrective action to be taken in the event of mitigation failure should be defined clearly within the Proponent's organization.

10.3.3.1 Monitoring Guidelines

Continuous observations and assessment is essential for identification of impacts unforeseen during the EIA of the proposed substation project. To ensure success of the project adequate consultation should be undertaken in the project area with the community members.

Monitoring parameters/indicators should be identified and programmes developed for their observation and action. When developing a monitoring programme the following should be considered:

- Frequency of monitoring
- Required personnel -Monitoring should be conducted by trained personnel
- Methods of record keeping
- Availability of calibrated and maintained equipments
- Existence of baseline information
- Data analysis and review

The environmental indicators to be monitored during the project phases namely the construction; operation and decommissioning. The monitoring parameters can be revised as the project development proceeds to enable incorporate and foreseen indicators.

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ANNEXES

Annex I
Proposed Site Land subdivisions

Annex II

Proposed 90MVA 220/60 kV substation Site Layout

Annex III

Copy of Lease Agreement

Annex IV
Baseline Soil Test Results

Annex V
Baseline Air Test Results

Annex VI
Baseline Noise Survey Results

Annex VII
Public Consultation Forms

Annex VIII

Site Photographs



Plate 1: A view of site vegetation



Plate 4: View of Kitengela seasonal river approx. 0.5 km from proposed site



Plate 2: View of proposed site geological formations



Plate 5: View of vacant plots near the proposed site



Plate 3: View of site topography sloping towards the North



Plate 6: A view Industrial premises (East African Portland Cement Company Ltd) in the neighbourhood (east) of the proposed project site

