ENVIRONMENTAL IMPACT ASSESSMENT PROJECT REPORT FOR PROPOSED CONSTRUCTION OF 12KM SECONDARY SEWER IN KIUU, GITHURAI, KAHAWA WENDANI AND KAHAWA SUKARI SHOPPING CENTRES IN RUIRU MUNICIPALITY

Site coordinates latitude -1.20804 Longitude 36.91864

Proponent: **County Government of Kiambu** **P.O Box 2344- 00900 Kiambu**	**NEMA Lead Expert:** **Esther N. Kaguima** **Registration No. 2529**

MAY 2020

CERTIFICATION

We, certify that the information provided in this report is true to the best of our knowledge. This report is correct and true reflection of the findings and anticipated environmental impacts of the Proposed ConstructionofSecondary Sewer in Kiuu, Githurai, KahawaWendani and KahawaSukari Shopping center in Ruiru MunicipalityKiambu County

LEAD EXPERT

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On behalf of Kiambu County Government

ABBREVIATIONS

EAR	Environmental Audit Report
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMS	Environmental Management Systems
GDP	Gross Domestic Product
IFA	International Fertilizer Industry Association
KIE	Kenya Industrial Estate
KPLC	Kenya Power and Lighting Company
MSDS	Material Safety Data Sheet
NEMA	National Environmental Monitoring Agency
SPM	Suspended Particulate Matter
UNEP	United Nations Environmental Programme
UNIDO	United Nations Industrial Development Organization
WCED	World Commission on Environment and Development

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EXECUTIVE SUMMARY

Environmental concerns have now been integrated in the planning and implementation processes of any proposed projects, to mitigate conflicts with the environment at the vicinity. In addition, it is now mandatory for projects of such nature to carry out an environmental impact Assessment (EIA), to enhance sustainable environmental management as well as controlling and revitalizing the much-degraded environment.

In pursuant to the Environmental Management and Coordination Act 1999 (revised 2018),Section 58(1) and the Environmental Impact Assessment and Audit Regulations, 2003 an Environmental Impact report is hereby submitted for theproposed Construction of secondary sewer in Kiuu, Githurai, Kahawa Wendani and Kahawa Sukari Shopping center in Ruiru Municipality Kiambu County. The project is planned to be financed by the World Bank under the Kenya Urban Support Program (KUSP). The proposed Projects will involve construction of 12Kilometer secondary sewer in Kiuu, Githurai, Kahawa Wendani and Kahawa Sukari Shopping center in Ruiru Municipality. The project land and way leave requirement was analyzed and results showed that no land requirement needed because sewer Lines will be constructed within road reserve

Planned activities within the project cycle will include and not limited to community sensitization, site boundary verification, site handing over, implementation of works/monitoring/ site inspection and commissioning

The likely significant environmental impacts expected to arise at the site of thesewer are on aspects like health hazards, noise, soil disturbance, biochemical spills, dust, solid waste and health and safety of workers. Mitigation of these potential adverse impacts has been addressed in the proposed Environmental Management Plan (EMP).

Noise will arise out of transporting trucks that will be ferrying soil and other excavated material and other machines, general waste nuisance when in construction phase and the general operations of the project. To mitigate levels of environmental hazards the contractor will see to it that all equipment used

on the site are mechanically sound and regularly serviced for optimal performance and also ensure proper disposal of debris and any other non-biodegradable waste and sharps. The levels of dust loading on the environment will depend on prevailing weather conditions. Should the excavations and transportation take place during the dry weather, all point sources ofdust will be identified and appropriate mitigation measures employed. Other emissions are not expected to be significant, but nevertheless this issue has been addressed in the E.M.P and the control measures well outlined.

Workers involved in site operations are exposed to a higher risk of getting work related ailments and injuries. To safeguard the workers from potential injuries during the process, the EMP requires that the contractor provides safety gear to all his workers as per the provisions of the Factories and other places of work Act and to ensure protective gear is used appropriately, and to take care of the workers in the event that they suffer injuries at work the contractor will provide a cover for his workers as per the provisions of the workmen's compensation Act. Public safety will be taken care of by proper fencing around the site regulating entry and posting warning signage at strategic place clearly statingsewer site indicating ‘entry allowed to authorized personnel only’. This will warn the public about the ongoing activities and the likely dangers.

The main objective of the EIA project is to provide information on the nature and extent of potential environmental impacts arising from the development of the proposed sewer and related activities taking place concurrently and to contribute to decisions on the overall environmental acceptability of the Project after the implementation of environmental mitigation measures.

The methodologies used to conduct this EIA project were

i) Questionnaires

ii) Interviews

iii) Field observations

iv) Photography

v) Desktop research

vi) Public consultation.

In carrying out the EIA for the project, various Acts of Parliament were reviewed: Environment Management and Co-ordination Act, 1999 revised 2018, The Science and Technology Act, Cap 250, The Water Act, Cap 372, The Public Health Act, Cap 242, The Local Government Act, Cap 265, Physical Planning Act, Cap 286 and Building Code, The land planning Act, Cap 303, The Penal Code, Cap 63 and The Occupational, Safety & Health Act, 2007, The Environmental Management and coordinating (water quality) regulation 2006, The Environmental Management and Co-ordination (Waste Management) Regulations, 2006.

The scope of the study was to describe the project, document all the baseline information, address both the positive and negative impacts and develop mitigation measures for negative impacts including designing environmental management plan for the project.

Conclusion and recommendation

Through the assessment and evaluation of all environmental concerns of the proposed Ruiru Municipality Sewer Project, it can be concluded that the establishment will bring a net ecological, economic, social and health benefits to all living within the Project area. On the other hand, some of the Project components are envisaged to have negative impacts depending on the different phases and components of the Project. These impacts have been discussed in great details in this report and appropriate mitigation measures proposed.

In order to alleviate the expected negative impacts and to make the Project environmentally sounder, an EMP has been prepared. All the recommendations/ mitigations mentioned in the assessment should be financed, and incorporated in the construction stage and also during operation and decommissioning stage of the Project

CHAPTER ONE

1.0 INTRODUCTION

1.1Background Information

The Government of Kenya received a credit from the World Bank through Kenya Urban Support Program to implement infrastructural projects and the Ruiru sewer Municipality has secured part of the proceeds of this credit.

Currently the Ruiru Municipality has very low sewerage coverage and most residents use onsite sanitation facilities. Also the existing sewage treatment plant has both design and operational defects which result in the discharge of final effluent that does not meet the acceptable effluent quality standards for discharge into a body of water. The designed infrastructure shall, therefore, ensure that the sewerage system efficiently conveys and treats wastewater to acceptable national effluent discharge standards

Towards fulfilling the requirements of this project, the proponent seeks to fulfill the requirements of Environmental Management and Coordination Act (1999) revised 2018 as well as Environmental Impact Assessment and Audit (2003) guidelines. This Project Report has been prepared to provide sufficient and relevant information on the proposed project to enable the National Environment Management Authority (NEMA) establish whether the activities of the project are likely to have significant adverse environmental impacts. If the negative impacts are adequately addressed as proposed in the Environmental Management Plan (EMP), then, this Report can form a basis for the issuance of an Environmental Impact Assessment (EIA) License.

1.2 Project Justification and Benefits

The Project addresses improved sanitation, in small towns and surrounding rural areas that underpins the Kenyan economic and social developments (Vision 2030)

The project directly translates to achieving of Sustainable Development Goal (6) which is the new 2030 agenda and expands Millennium Development Goal

(MDG) as guided by resolutions of Rio+20 conferences. The goal focuses more on investment in adequate infrastructure in Water Sanitation, Hygiene, Water Quality, Waste Water Management, Water Scarcity and use Efficiency, Integrated Water Resource Management and Protection of Water related Ecosystems

1.3 Objectives

The objectives of the Environmental Impact Assessment (EIA) are:

- To fulfil the legal requirements as outlined in Section 58 to 69 of the Environmental Management and Coordination Act (EMCA) amended and Part I and II of the EIA/Audit Regulations
- To obtain background biophysical information of the site and legal and regulatory issues associated with the project
- To assess and predict the potential impacts during site preparation, construction and operational phases of the project
- To make suggestions of possible alterations to the proposed design, based on the assessment findings
- To propose mitigation measures for the potential significant adverse environmental impacts and safety risks
- To allow for public participation
- To lower project cost in the long term

1.4 Terms of reference

- Description of the proposed project.
- Review of national legislative and regulatory framework influencing the project.
- Description of the potentially affected environment.
- Waste management issues.
- Seek views of interested parties.
- Occupational health and safety concerns throughout the project cycle.

- Identification of probable impact of the proposed development on the environment.
- Proposed sufficient mitigation measures for anticipated impact.
- Preparation of a detailed Environmental Management Plan (EMP).

1.5 Methods and approaches

Use of reliable and accurate methods in collection and analysis of data is vital in any scientific study. In preparing this project report several methods and approaches were applied. Visits were made to the proposed site and information regarding land characteristics, ownership, and infrastructural facilities documented. The proposed plans were also reviewed. Views were collected from respondents drawn from the neighborhood; this was achieved through interviews and questioners .Views of questioner respondents are attached in this report. Finally, review of literature including reports on similar project and records at the land office was done. Every effort was made to minimize possible biases and errors to that the findings and conclusion of the report are accurate and reliable as to form basis for making decision regarding the project.

1.6 Registration

As required by NEMA, the Lead Expert is currently registered by NEMA as an Expert for “Environmental Impact Assessment and Audit” and also with EIK and is therefore authorised to undertake the EIA project study and submit a report.

CHAPTER TWO LEGISLATIVE FRAMEWORK

2. 0 General overview

Kenya has a policy, legal and administrative framework for environmental management. Under the framework, the National Environment Management Authority (NEMA) is responsible for ensuring that environmental impact assessments (EIAs) are carried out for new projects and environmental audits on existing facilities as per the Environmental Management and Coordination Act 1999 revised 2018.

EIA studies are carried out in order to identify potential positive and negative impacts associated with the proposed project with a view to taking advantage of the positive impacts whilst providing effective mitigation measures for the negative effects. The requirements on EIA are contained in sections 58 to 67 of the Act.

According to section 68 of the environmental management and coordination Act (EMCA) 1999 revised 2018; the Authority shall be responsible for carrying out environmental audits on all activities that are likely to have a significant effect on the environment. Environmental auditing (EA) is a tool for environmental conservation and has been identified as a key requirement for existing facilities to ensure sustainable operations with respect to environmental resources and socio-economic activities in the project neighborhood.

The government has established regulations to facilitate the process on EIAs and environmental audits. The regulations are contained in the Kenya Gazette Supplement No. 56, legislative supplement No. 31, and legal notice No. 101 of 13th June 2003

2.1EMCA (KENYA GAZETTE, 1999) revised 2018

This Act came to force in the year 2000, and was aimed at bringing into single legislation the 77 other statutes, which related to environmental issues yet scattered among the various government ministries. The lack of coordination in dealing with environmental protection thus necessitated the need for a comprehensive Act to deal with all environmental matters. The Act gives every

person in Kenya a right to a clean and healthy environment. It also confers upon every person the duty to protect and safeguard the environment. Part v of the Act provides measures for protection and conservation of the environment. Pollution and smells is prohibited. The Authority (National environment Management Authority) may issue and serve on any person in respect of any matter relating to the management of the environment a restoration order to require the person on whom it is served to restore the environment as near as it may be to the state in which it was before the implementation of a project or action. Thus the polluter pays principle shall apply. The Act also provide for Part XIII. Section 148 provides that the Act shall prevail over any written law in force immediately before the coming into force of this Act, relating to the management of the environment. Section 58 of the Act requires that every new development project (listed in schedule II of the Act) must undergo an Environmental Impact Assessment before its implementation.

Compliance: The proponent has commissioned the EIA expert to carry out this EIA in accordance with NEAP

2.1.1 Section 68 (3)

The owner of the premises or the operator of a project for which an Environmental Impact Assessment study report has been made shall keep accurate records and make annual reports to the Authority describing how far the project conforms in operation with the statements made in the environmental impact assessment study report submitted under section 58 (2).

2.1.2 Section 68 (4)

The owner of premises or the operator of a project shall take all reasonable measures to mitigate any undesirable effects not contemplated in the environmental impact assessment study report submitted under section 58 (2) and shall prepare and submit an environmental audit report on those measures to the Authority annually or as the authority may, in writing require.

2.1.3 Section 69 (1)

The Authority shall, in consultation with the relevant lead agencies, monitor; All environmental phenomena with a view to making an assessment of any

possible changes in the environment and their possible impacts; or the operation of any industry, project or activity with a view of determining its immediate and long-term effects on the environment.

2.1.4 Section 72 (1)

Any person, who discharges or applies any poison, toxic, noxious or obstructing matter, radioactive waste or other pollutants or permits any person to dump or discharge such matter into the aquatic environment in contravention of water pollution control standards established under this Part shall be guilty of an offence and liable to imprisonment for a term not exceeding two years or to a fine not exceeding one million shillings or to both such imprisonment and fine.

2.1.5 Section 72 (2)

A person found guilty under subsection (1) shall, in addition to any sentence or fine imposed on him: pay the cost of the removal of any poison, toxic, noxious or obstructing matter, radioactive waste or other pollutants, including the cost of restoration of the damaged environment, which may be incurred by a Government agency or organ in that respect;

Pay third parties reparation, cost of restoration, restitution or compensation as may be determined by a court of law on application by such third parties.

2.1.6 Section 138

Any person who; fails to submit a project report contrary to the requirements of section 58 of this Act; fails to prepare an environmental impact assessment report in accordance with the requirements of this Act or regulations made there under; Fraudulently makes false statements in an environmental impact assessment report submitted under this Act or regulation made there under; Commits an offence and is liable on conviction to imprisonment for a term not exceeding twenty four months or to a fine of not more than two million shillings or to both such imprisonment and fine.

2.2 The Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009.

The regulations seek to control noise and vibration pollution generated from various sources. Regulation 13 prohibits any person from carrying out

construction activities at night, if such activities are likely to generate noise above the levels set under second schedule of these regulations. Regulation 14(3) requires that any person carrying out construction, demolition, mining or quarrying work shall ensure that the vibration levels do not exceed 0.5 centimeters per second beyond any source property boundary or 30 meters from any moving source.

Regulation 15 requires that any person intending to carry out construction, demolition, mining or quarrying work shall carry out an EIA. During the Environmental Impact Assessment studies the regulations required that natural resources, land uses or activities which may be affected by noise or excessive vibrations from the construction, demolition, and mining or quarrying shall be identified. Secondly, the EIA shall determine the measures which are needed, demolition, mining or quarrying noise or vibration impacts; and, finally to incorporate the needed abatement measure in the plans and specifications.

2.3 The Physical Planning Act Cap 286

The Act empowers local authorities to control development activities taking place within their areas of jurisdiction. Among the relevant powers the Act grants local authorities are the powers to prohibit or control the use and development of land and powers to consider and approve all development applications and grant all development permissions. In effect, no person is allowed to, carry out development within the area of local authority without a development permission granted by that local authority. The Act further provides for penalties relating to contravention of its provisions are relate to development activities. A local authority is in addition empowered to require a development applicant to submit an EIA report where a proposed development is considered of potential injurious impacts on the environment. (Sections 36)

2.4 The Public Health Act Cap 242

The public health Act regulates activities detrimental to human health. The owner(s) of the premises responsible for environmental nuisances such as noise and emissions, at level that can affect human health, are liable to

prosecution under this Act. An environmental nuisance is one that cause danger, discomfort or annoyance to the local inhabitants or which is hazardous to human health. The Act further set specifications for approval of building plans.

2.5 County Government Act 2012.

This Act empowers county governments to regulate businesses, which are conducted within their areas of jurisdiction. They ensure that any business is to be established conform to the areas laid down by laws, is acceptable to the locals, whether there is need for such business or premises and it is in line with proper and orderly development of the area. The county governments is also responsible to designate sites where waste generate should be disposed

2.6 The Occupational Health and Safety Act, 2007

Provision of the Act include:-

- Secures safety and health for people legally in all workplaces.
- Prevents employment of children in workplaces where their safety and health is at risk.
- Encourages entrepreneurs to set achievable safety target for their enterprises.
- Promotes reporting of work-place accidents, dangerous occurrences and ill health with a view to finding out their causes and preventing of similar occurrences in future.
- Promote creation of a safety culture at workplace through education and training in occupational safety and health.

2.7 Water Act 2016

The ministry of water is vested with duty to conserve and regulate the use of natural water resource. A section of the act related to the environment prohibits the abstraction of water without permit and also spells out penalties for pollution of water. The Acts also creates the water resource management authority responsible for the regulation of water allocation through the issuance and amendments of water permits.

2.8 Environmental Management and Co-ordination (Water Quality) Regulations, 2006 - Legal Notice No. 120

These regulations are established under the Environmental Management and Co-ordination Act. These regulations apply to drinking water, water used for industrial, agricultural and recreational purposes, including water used for fisheries and wildlife, among others.

These regulations prohibits discharge or application of any poison, toxic, noxious or obstructing matter, radioactive wastes, or other pollutants into water meant for fisheries, wildlife, recreational purposes or any other purposes. The regulations provide for the creation of a buffer zone for irrigation schemes of at least fifty (50) metres in width between the irrigation scheme and the natural water body. The proponent is hereby expected to adhere to regulation and apply for effluent discharge license during the operation phase.

2.9 The Water Resources Management Rules, 2007- Legal Notice No. 171

These rules are made pursuant to the Water Act. The rules requires permission by way of obtaining an abstraction permit from the prescribed authority (WRMA) by any person or institution seeking to abstract water from defined watercourses after payment of prescribed fees. It further requires permit holders for abstraction of water for irrigation purpose to renew after every 5 years. It prescribes that permit fees are based on the surface area to be irrigated. The rules restrict the permit holder only to use the flood flow for irrigation and will construct a reservoir to store enough water to irrigate the area specified in the permit for 90 days.

The Act has also provided for the formation of Water Resources Users Associations (WRUA) in order to ensure sustainable use of water management schemes.

The rules requires the permit holder storing or arresting the flow of water by means of a dam or weir located on a body of water or watercourse to provide at a depth measured from the top of the dam or weir, an outlet, controlled by a valve, sluice gate or other device, which is capable of being operated at all stages of the flow of such body of water or watercourse so that the normal flow,

or other flow as required by the Authority, of such body of water or watercourse can be passed through or around such dam or weir at all stages to enable for compensation of flow.

The rules also states that authorized water users to be appurtenant to land which should be proved by way of an authentic title deed, lease agreement, easement, way leaves or a letter from the land owner or community endorsed by the provincial administration.

The rules also requires permit holder to pay to the designated Authority water use charges on the basis of the water abstracted, diverted, obstructed or used including energy derived from a water resource.

2.10 Land Acquisition Act (cap 295)

The Act requires that where any land is required for the purposes of a public body, and that the acquisition of the land is necessary in the interests of, among other considerations, planning or the development or utilization of any property in such manner as to promote the public benefit, the Minister of Lands may in writing direct the Commissioner to acquire the land compulsorily under this Part. It further requires that the commissioner shall in effecting the directive cause a notice to be published in the Gazette that the Government intends to acquire the land, and shall serve a copy of the notice on every person who is interested in the land. The Act further requires that full compensation shall be paid out to those owning the land.

2.11 Work Injury Compensation Benefit Act 2007

The *Work Injury Compensation Benefit Act–2007* provides guideline for compensating employees on work related injuries and diseases contacted in the course of employment and for connected purposes. The act includes compulsory insurance for employees.

2.12 The Employment Act, 2007

The *Employment Act, 2007*, declare and define the fundamental rights of employees, to provide basic conditions of employment of employees, to regulate

employment of children, and to provide for matters connected with the foregoing.

2.13The Labour Institutions Act, 2007

The Labour Institutions establish institutions and bodies involved in the administration of management of labour relations. It provides for the functions, powers and duties, and other related matters relevant with labour. The Act establishes and strengthens institutions, which deal with labour administration and management of labour relations.

2.14 The Standards Act, Cap 496

The Kenya Bureau of Standard is the authority responsible for implementation of this act. The *StandardAct, Cap 496* provides standards on the requirements of equipments and project materials.

2.15 Occupiers Liability Act (Cap. 34)

Rules of Common Law regulate the duty which an occupier of premises owes to his visitors, in respect of danger and risk, due to the state of the premises or to things omitted or attributes of an affliction on his/her health to toxic materials in the premises.

The Proponent shall acquire Way leave along the proposed sewer alignment and shall endeavour to ensure that the management of health and safety issues is of high priority during the operational phase of the project.

2.16 Occupational Health and Safety Act 2007

This legislation provides for protection of workers during construction and operation phases. It is tailored at implementation of the EHS plan in compliance with the relevant sections of this Act.

Subsection 18 - *Sanitary conveniences*-Sufficient and suitable sanitary conveniences for persons employed in the factory/ work places shall be provided, maintained and kept clean, and effective provision shall be made for lighting the conveniences and where persons of both sexes are, such

conveniences shall afford proper separate accommodation for persons of each sex.

2.17Way Leaves Act (Cap. 292)

Way Leaves Act (Cap. 292) Section 3 states that the Government may carry any works through, over or under any land whatsoever provided it shall not interfere with any existing building or structures, of an ongoing activity. Notice, however, should be given one month before carrying out any such works (section 4) with full description of the intended works and targeted place for inspection. Any damages caused by the works would then be compensated to the owner as per the section. Finally, section 8 states that, any person who without consent causes any building to be newly erected on a way leave, or cause hindrance along the way leave, they shall be guilty of an offence and any alternations will be done at their costs

2.18 National Water Policy, 2000

The National Policy of Water which was promulgated in April 1999 as Sessional Paper No. 1 of 1999 calls for decentralization of operational activities from the central government to other sectors, including local authorities, the private sector and increased involvement of communities in order to improve efficiency in service delivery. It also tackles issues pertaining to water supply and sanitation facilities development, institutional framework and financing of the sector. According to the policy, in order to enable sustainable water supply and sanitation services, there is need to apply alternative management options that are participatory through enhanced involvement of others in the provision of these services but particularly the private sector. It is therefore important for the proposed project management to factor in sanitation facilities in the proposed project to avoid contamination of water resources.

The overall objective of the National Water Policy is to lay the foundation for the rational and efficient framework for meeting the water needs for national economic development, poverty alleviation, environmental protection and social

well-being of the people through sustainable water resource development and management.

2.19World Bank safeguard Policy

Safeguard policies are mechanisms for integration of environmental and social issues into decision making.

SAFEGUARD POLICIES

Environmental Policies

OP 4.01 Environmental Assessment

Objectives:

- To ensure that projects proposed for Bank financing are environmentally and socially sound and sustainable
- To inform decision makers of the nature of environmental and social risks
- To increase transparency and participation of decision makers in the decision-making process

OP 4.04 Natural Habitats

Objectives:

- Safeguard natural habitats and their biodiversity
- Ensure sustainability of services and products which natural habitats provide to human society
- Bank does not finance projects that convert critical Natural Habitats.
- Requires inclusion of mitigation measures if significant conversion or degradation of a (Non-Critical) Natural Habitat is needed to achieve project's objectives; includes establishing or strengthening an ecologically similar compensatory protected area.

OP 1.03 Cultural Property

Objectives:

To ensure that;

- Physical cultural resources are identified and protected in World Bank Projects

- National laws governing the protection of physical cultural property are compiled with
- Covers archaeological and historical sites, historic urban areas, sacred sited, graveyards and burials

Social Policies

OP 4.12 Indigenous Peoples

Objectives;

- To ensure that indigenous peoples:
  - Are afforded respect for their dignity and cultural uniqueness in the development process
  - Do not suffer adverse effects
  - Receive culturally-compatible social and economic benefits
  - Benefit from prior consultation and informed participation
- Implemented through an Indigenous Peoples Development Plan (IPDP)

OP 4.20 Involuntary Resettlement

Covers both:

i. The involuntary displacement (physical and non-physical) or affected people that arises from change in land use or water use, loss of productive assets or loss of income or means of livelihoods, whether or not the people must move to another location.
ii. The measures for mitigating the impacts of displacement.

Objectives:

- To avoid or minimize involuntary resettlement and related disruption
- To provide transparent compensation procedures for the involuntary acquisition of land
- To assist the affected persons in their efforts to improve their standards of living or at least to restore them
- Implemented through a Resettlement Action Plan (RAP)

Legal Policies

OP 7.60 Disputed Areas

Objective:

- To ensure any territorial dispute affecting a project is identified at the earliest possible stage so as:
- Not to affect relations between the Bank and its member countries
- Not to affect relations between the Borrower and neighboring countries
- Not to prejudice the position of either the Bank or the countries concerned

OP 7.50 International Waters

Applies to the following types of projects:

i. Hydroelectric, irrigation, flood control, navigation, drainage, water and sewage, industrial.
ii. International water ways that include: Any river, canal, lake or similar body of water that forms the boundary between any other rivers or body of surface water that flows through, two or more states.

Objectives:

- To ensure projects will neither affect the efficient utilization and protection of international waterways, nor adversely affect relations between the Bank and its Borrowers and between riparian states

CHAPTER THREE

3.0 BASELINE INFORMATION

3.1 General overview

Baseline information is needed on all central issues in the Environmental assessment, taking into account a broad definition of the environment. Baseline information provides a reference for all assessments, for accurately predicting and for the comparison of alternatives and mitigation measures. It is used as a starting point in the prediction of likely impacts resulting from the project and of naturally occurring changes in the environment. Baseline information was collected from documents and data banks, supplemented by field studies. The following baseline information details on environmental, socio-economic and bio-physical characteristics of the site. It is expected that it will provide for a benchmark for continued monitoring and assessment of the impact of the proposed storage structure on the environment.

3.2 Project Site Location

The proposed construction of Construction of secondary sewer in Kiuu, Githurai, KahawaWendani and KahawaSukari Shopping center in Ruiru MunicipalityKiambu County. The project neighboring environment is government offices, residential building, commercial buildings and unoccupied plots. Site coordinates of the project area:latitude -1.02840 Longitude 36.91864.

Plate showing proposed sewer will pass

3.3 Climate

Throughout the area mean daily temperature varies little with season and the diurnal variation is generally greater than the seasonal variation. With increasing altitude, daily minimum temperature values decrease more rapidly than the daily maximum. Typically the annual average diurnal range at elevations of 1,500 metres is 13°C to 25°C whilst at 2,500 metres the range is from 6°C to 22°C.

Mean annual relative humidity values range from 65% at lower elevations to 80% or more above 2,500 metres. Humidity is greatest at dawn and lowest in the early afternoon when the temperature reaches the diurnal maximum. Below 1,500 metres the mean daily duration of bright sunshine ranges from 4 hours during July and August to 9 hours during the Northern Monsoon season with an annual mean of 6.8 hours.

Sunshine decreases with altitude, with an annual mean of 5 hours at 2,500 metres. Mean annual free water surface evaporation as calculated by Woodhead ranges from around 1,800 mm in the piedmont zone to less than 1,400 mm in the Aberdares Range. Potential evapotranspiration is estimated to

be about 75% of free water evaporation in the highlands and 80% or more in dryer areas.

3.4 Soil and Geology

The Ruiru region is located in north east of Nairobi area. Geologically, the Ruiru area lies on Cenozoic volcanic material overlying Basement System rocks at greater depth. Before the volcanic episode, Nairobi area was made up of Pre-Cambrian Basement System crystalline rocks of the Mozambique Belt. These very old rocks were laid down, Metamorphosed, exposed and eroded and were in pre-tertiary times an ancient landsurface. The formation of the Great Rift was followed by extensive and widespread volcanic activity throughout much of Kenya. In the Nairobi area, this activity covered the old land surface ('OLS') and was characterized by periodicity. That is periods of extrusive activity followed by periods of relative calm activity during which erosion by wind and water occurred. In the early Tertiary period during a period of substantially moisture climate, numerous river system deposited erosion debris in extensive lakes the resulting deposits are know as the Athi tuffs and Lake Beds, which today form a very important Aquifer (Athi Series).

The area is covered by dark-brown soils and brown lateritic soil. These soils owe their origin to weathering and erosion of the underlying volcanic rocks. The volcanic rocks in the area are represented by Upper Kerichwa Valley tuffs, Lower Kerichwa Valley tuffs, Nairobi Trachytes, Nairobi Phonolites, and Upper Athi Series consisting of sediments and Lake Beds and Athi Tuffs. The thickness of these volcanics varies, but generally decreases towards the east, probably due to both deposition and erosion

3.5 Socio-economic Environment

3.5.1 Population

Ruiru town (urban Centre) had a population of 409,120 people according to the 2019 National Census, 259,867 people in 2012 and 282,723 people in 2015(Source; Kiambu county government Website and Kenya National Census 2019)

3.5.2 Land Use and Public Health

Ruiru sub-county's major concerns derive from the rapid population growth due to the expansion of metropolitan Nairobi. This is expansion is occurring in an environment in which there is little to no land use, transportation or infrastructure planning. Large buildings are "mushrooming", using septic tanks for sanitation that cannot contain the quantity of untreated waste. This waste is dumped surreptitiously at night into open fields.

Slums, small houses and large houses are all expanding here. Many of the smaller houses in the new subdivisions use pit latrines. Ruiru is surrounded by coffee plantations and because of that the land pattern is characterized by large plots. However, the large coffee plantation plots are being subdivided and rapidly sold by land companies without any public oversight or planning.

3.5.3 Transportation

Ruiru's growth can be attributed to its proximity to Nairobi. Traffic between the two cities clogs the highway as commuters travel to and from work. As Ruiru's population grows, it is likely that the traffic between it and Nairobi will increase, worsening the problem.

The development of a transportation and land use plan to accommodate both the Ruiru population commuting to and from Nairobi and commercial traffic created by the transformation of Ruiru from a dormitory town to a combination residential and industrial city is an important consideration. There is a railroad link between Ruiru and Nairobi the potential of which needs to be fully explored. There are plans to privatize the railroad and the possible effects of this may or may not increase train travel between Ruiru and Nairobi. Commuters also travel via private cars, matatus and on foot.

3.5.4 Economic status

Ruiru is famously known as one of the top producers of coffee in the country. The coffee plantations cover a sizable land and offer employment to many Ruiru residents especially those from the lower class. As such, Ruiru as is the

case in Nairobi is divided into three income groups, namely; the lower, middle and upper class.

The lower class forms a huge part of the population followed by the middle class. The upper class consists of a lower percentage. Ruiru is well-covered with industries that have not only provided employment but have contributed to economic growth in the town. These industries have also been instrumental in renovation, construction and expansion of schools that fall within the region and general infrastructure such as roads. These industries include both factories and banks. They are: Spinners & Spinners Ltd, Brookside Dairy Ltd, Devki Steel Mills, Bogani Industries, Jetlak Foods Ltd, National Bank of Kenya, Equity Bank of Kenya, Cooperative Bank, Kenya Commercial Bank, Family Bank and PostBank

CHAPTER FOUR

4.0 Project Design Considerations

The construction technology which will be used in the design of the sewer will be based upon approved standards, which have been customized by various institutions for their use in Kenya. The sewer will be made of hard concrete that make it stable and durable. In general, the design of the project tends to essentially optimize the use of the best available technology to prevent or minimize potentially significant environmental impacts associated with the project and to incorporate efficient operational controls to ensure optimum units.

4.1 Description of project construction

4.1.1 Sourcing and transportation of building materials

The proponent will source several building materials locally within the neighboring hardware's within Ruiru Municipality or any nearby building material hardware. The great emphasis laid on procurement of construction materials from within the local area makes both economic and environmental senses since it reduces negative impacts of transportation of the materials to the project site through reduced distance of travel by the transport vehicles.

Building materials areto transported to the project site from their extraction, manufacture, or storage sites using transport trucks. Construction materials will be stored at the site.

4.1.2 Masonry, Concrete Work and Related Activities

The construction of the sewer, drainage systems among other components of the project involves a lot of masonry work and related activities. General masonry and related activities include concrete mixing, plastering and stone pitching. These activities are known to be labor intensive and will be supplemented by machinery where possible and also such activities as concrete mixing and curing require large amounts of water.

4.1.3 Excavation and Foundation Works

The entire site is currently undeveloped and is covered with small scrubs. The same will be removed and disposed of to pave way for the construction.

4.2 Description of the Project Operation Activity.

4.2.1 Solid Wastes

The proponent will provide facilities for handling solid waste generated within the premise. This will include dustbins outside the premise to temporary hold waste before disposal.

4.2.2 General Repair and Maintenance

The sewer and associated facilities will be repaired and maintained regularly during the operational phase of the proposed project. Such activities will include repair of leaking water pipes and maintenance of grass lawns.

4.3 Description of the Project's Decommissioning Activities

Upon decommissioning, if need be the project components including the drainage systems be demolished. This will produce a lot of solid waste, which will be reused for other construction works or if not reusable, disposed of appropriately by a licensed waste disposal company. Priority will be given to reuse of this equipment in other projects. This will be achieved through resale of the equipment to contractors.

4.3.1 Site restoration

Once all the waste resulting from demolition and dismantling works is removed from the site, should be restored through replenishment of the top soil and re-vegetation using indigenous plan species.

4.3.2 Solid waste generated

On decommissioning, large quantities of solid waste will be generated from demolition works and equipment dismantling. The proponent should provide measures for recycling, reuse or disposal of such waste.

4.4 Environmental monitoring and audit

Environmental monitoring and audit are essential in a project's lifespan as they are conducted to establish if project implementation has complied with set of environmental management standards as provided for in EMCA 2015 and the EIA/EA regulations of 2009 (Legal Notice No. 101. For this project, environmental monitoring and audit will be conducted annually to ensure compliance with environmental regulations

CHAPTER FIVE

5.0 PROJECT ALTERNATIVES

5.1 Project Alternative

This section in the EIA study report cross examined the proposed project against available feasible alternative, this analysis is often undertaken in order to determine whether the project can be implemented within an alternative which is sustainable than the one presented by the preliminary feasibility studies and engineering designs. In this chapter, consideration was made based on alternative parameters listed below.

- Project Location
- Project Technology
- Project Impacts to People Assets and Sources of Livelihood

Ultimately, after subjecting the project to the above mentioned option analysis, deduction was made between the Project Option alternative or No Project Option alternative. Sub chapters below present in summary criteria that will be considered during project options assessment

5.2 Project Location

The secondary sewer selection will be determined based on three main considerations

- Sewer line to be laid within depressions to allow for maximum drainage of raw sewer
- The proposed route for the secondary sewer lines to be a site at the lowest point which allows free flow of sewer from the catchment area.
- The available area, topography, and soil conditions of the route should be suitable for the construction of the trunks.

5.3 Project Technology

The main technological aspect considered during the design of the project was the gradient factor; the objective was to ensure that raw sewer flows by gravity to existing sewer.

5.4Project Resettlement Issues

Acquisition of easement for laying the sewer pipelines will be considered as the main factors in determining Project Impacts to people's assets and sources of livelihood. Secondary re planned to be located within existing way-leaves and riparian land in order to minimize project impact to private assets and sources of livelihood.

5.5 Project Option Alternative

The Project shall directly result to realization of benefits such as

- Improve drainage
- Economic empowerment of residents due to cash circulation during project cycle The Project shall lead to realization strategic goals of improving sewerage coverage in area to 84% in urban areas and to 67% in rural areas by 2017, the Project is among the initiatives of the board towards achieving the strategic goal above.
- Improved sanitation, in small towns and surrounding rural areas, as well as water storage, for water supply that underpins the Kenyan economic and social developments (Vision 2030) and its associated five years Medium Term Plan (MTP) for 2012 – 2017Sustainable Development Goal (6) which is the new 2030 agenda and expands Millennium Development Goal as guided by resolutions of Rio+20 conference. The goal focuses more on investment in adequate infrastructure in water sanitation, Hygiene, water quality, waste Water Management, water scarcity and use efficiency, integrated water resource management and protection of water related ecosystems

5.6 No Project Alternative

The No Project Option in respect to the proposed Project implies that the status quo is maintained. This option is the most suitable alternative from an extreme environmental perspective as it ensures non-interference with the existing conditions. Therefore if the Project is not implemented, the following issues are most likely to continue affecting residents of Ruiru Municipality.

- There will be no improved Health and Sanitation within the target beneficiaries
- There will be no improved living standard/well-being, employment and local economy in the target beneficiaries
- There will be no creation of employment during both construction and operation phases of the projects

From the above analysis, it becomes apparent that the No Project alternative is no alternative to the community

CHAPTER SIX

6.0 IMPACT IDENTIFICATION, ASSESSMENT AND MITIGATION MEASURES

6.1 Introduction

The main objective of the EIA process is to provide information for the decision making on environmental effects or impact of a proposed action and to promote environmental sound and sustainable development through the identification of appropriate enhancement and mitigation measures. The process of E.I.A involve identify, predict and evaluate the environmental effects or impacts of a proposed action. Environmental impact can be described as the change of environmental parameters which results from a particular activity or intervention. Change is viewed as the difference between environmental parameter with the project compared to that without the project.

After identification of key issues and impact in the scoping process those whose impacts are of significance undergo further impact analysis. Impact analysis involves identification of the likely environmental and social effects of a proposal and evaluating their significance. Impacts are looked in terms of their nature that is direct or indirect impacts direct are impacts which are obvious while indirect impacts are less obvious and they occur later in time or further away from the source of the impacts. Impacts are also looked in terms of their extent, timing, duration and their significance.

The next step after impact analysis is impact management and mitigation. The purpose of mitigation is to identify measures that safeguard the environment and community affected by the proposal it seeks to find the best ways and means of minimizing or remedying the impacts. Impact management involves translating the mitigation measures into action. During impact analysis the impacts were looked in terms of their effects to human and physical environment. The impacts were also analyzed in terms of the different stages of the project implementation.

Environmental issues related to the project

No.	Project Phase	Remarks	Threats
1	Environmental Abstraction	.Most of the waste water will be channeled into the pipeline	Water Pollution at source may impact a wider community at supply ends
			Loss of biodiversity
			Obstruction of businesses for access
			Injuries from associated works
			Dust emission
			Trip and falls into holes
			Ergonomics
			Reduced Aesthetics
3	Pipe construction	These will take some space and will be visible	Noise during construction
4	Laying Pipes		Loss of biodiversity
5	User End	Potential attributes by the project system	Fugitive flows from bursts
			Fugitive flows from waste
			Waterborne Diseases

6.2 Construction Phase

6.2.1 Soil and Solid Waste

During trenching for the Pipelines and treatment works site excavation, soil will accumulate and may pose significant negative environmental effects. If left unattended over a long period, the soil may be swept into the nearby rivers resulting in excessive flooding and silting during the rainy seasons. Further, the soil may find its way into the community's farms thereby reducing soil

fertility. Other solid wastes include; wasted ballast, cement, sandand garbage. These wastes generated during construction may impact negatively on the environment if not properly handled and managed.

6.2.2 Air pollution

Generation of dust and particulates during construction activities may have significant potential adverse environmental impacts to the workers and neighborhood. Other pollution sources will include diesel fumes from construction equipment and material transport vehicles.

6.2.3 Water quality

The overall potential impact of the project will be improvement of domestic water quality for the community in the project area. This is a major positive impact but there will be also negative impacts associated with implementation activities. The disturbance of soil by excavation for foundation of installations and pipeline trenches will make it loose and can easily be eroded and transported into the river, thereby negatively affecting the water quality. It is already evident that continuous erosion of the catchment area in the past has resulted in high turbidity and color of the rivers in the project area.

6.2.4 Noise

Construction activities during the trenching near residencies and market centers will have a negative effect to the neighbours. Sources of noise include; Mechanical earth working excavators, manual compressed air excavators and hand tools

6.2.5 Destruction of Indigenous Vegetation

During trenching for the pipeline it will be inevitable to avoid destruction of any existing indigenous vegetation at the proposed sites. Therefore, it will be important to formulate ways of mitigating the impacts caused at the end of construction phase.

5.2.6 Physical/Cultural Chance Find Procedures

Chance finds procedures are an integral part of the project EMP and civil works contracts. If the Contractor discovers archeological sites, historical sites,

remains and objects, including graveyards and/or individual graves during excavation or construction, the Contractor shall:

- Stop the construction activities in the area o
- Delineate the discovered site or area;
- Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities or the Ministry in charge of managing cultural heritage and related resources in the country (responsible ministry) take over; - Notify the supervisory Project Environmental Officer and Project Engineer who in turn will notify the responsible local authorities and the responsible ministry immediately (within 24 hours or less);
- Responsible local authorities and the responsible ministry would then be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archaeologists assigned by the government. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage, namely the aesthetic, historic, scientific or research, social and economic values. ·
- Decisions on how to handle the finding shall be taken by the responsible authorities and the responsible ministry. This could include changes in the layout (such as when finding irremovable remains of cultural or archaeological importance) conservation, preservation, restoration and salvage.
- Implementation for the authority decision concerning the management of the finding shall be communicated in writing by relevant local authorities.

Construction work may resume only after permission is given from the responsible local authorities or the responsible ministry concerning safeguard of the heritage.

6.3 Operation Phase

6.3.1Air pollution

The only air pollution expected during operation is that related to chemical mixing activities at the treatment works. While this is inevitable, the operators should be provided with the necessary protective gear. There is not any significant air pollution expected outside the treatment works.

6.3.2Disease hazards

If not properly managed, the waste water may overflow and pollute the environment with consequent outbreak of water borne and water washed diseases. Further, the raw sewage may end up percolating into the ground polluting adjacent ground water sources. Excessive discharge of grey water coupled with frequent leakages without proper drainage system may lead to accumulation of stagnant water thereby creating conducive habitat for breeding of mosquitoes.

6.3.3Insecurity

Availability of sanitary services will attract investors and start of small scale businesses especially within the market centres. The result will be a rapid population increase in the project area with consequent benefits and associated problems. The migration may lead to insecurity problems that may be difficult to handle using the existing set-up.

6.4Mitigation Measures against potential negative impact

6.4.1 Construction Phase

- ✓ **Air pollution**

During construction air pollution should be avoided by provision of nose masks to the workers and preferably wetting the dusty surfaces neighboring residences. These are all the areas where the trenches for the pipe will be excavated and at the site of treatment works. Though the ambient air conditions in the project area is dusty to an extent, effort must be made to

reduce dust and particulate emission adjacent to residences. To minimize pollution from hydro – carbon fumes from the excavator, exhaust should be oriented away from neighbors' residences. This should apply throughout the project cycle from construction to decommissioning.

- ✓ **Noise**

Generation of noise during construction activities is inevitable due to use of mechanical excavation equipment, concrete mixers and material delivery trucks. To minimize noise around the construction site, potentially low noise equipment which is also regularly serviced should be used. The major works sites apart from the pipeline should be temporarily enclosed using iron sheets. Further the material delivery vehicle engines should not be kept idling at the construction site. To ensure minimal disturbances of the neighboring community members at night and early morning hours, the work should be done between 8.00 am and 5.00 pm.

- ✓ **Destruction of indigenous trees and vegetation.**

Though it may be inevitable to clear some indigenous trees and vegetation along the pipeline and site for the water works, the vegetation cover and trees destroyed should be replaced soon after completion or as the rainy seasons begins.

- ✓ **Accumulation of solid waste**

All the solid waste generated during construction activities should be collected and sorted into non-recyclable and recyclable. The recyclable waste e.g., metal and plastic pieces and papers could be sold to licensed waste handlers while the hard-core materials could be re-used on site for construction and filling the voids along the road.

- ✓ **Soil erosion**

The soil removed from pipeline trenches excavation should be re-used in filling back the voids and compacted properly to avoid any chances of transport down the valley during the rainy season. Where necessary the appropriate vegetative cover should be planted to reduce chances of future soil erosion.

- ✓ **Prevention and Management of Accidents**

To prevent accidents caused by slipping into the dug trenches or stumbling into heap of trenched out materials along the road, warning tapes should be put along the trench line to alert pedestrians on the dangers. Additionally before the start of construction in each area, the residents should be warned of possible accidents to prevent idling around the sites Accidents could also occur to the workers while on duty. To avoid these accidents the following should be observed:

- The workers should be provided with personal protection gear to avoid cuts on the feet, hands and head during the course of duty. This include helmets, gloves, safety boots overalls, face masks and ear plugs in dusty and noise activities, goggles for welders etc.
- Training: the foreman should train the workers on procedures to prevent accidents while on site.
- The workers or their representatives should be trained on first aid and provided with first aid kits
- Emergencies: the workers should be provided with emergency telephone numbers to request for assistance at any time of accident. In areas of poor cell phone network there should be a stand by means of transmitting information
- The workers should be insured against accidental medical requirements and workmanship compensation.

6.5 Operation Phase

6.5.1Disease Hazards

Proper maintenance of grey water handling systems will be required to avoid pollution of environment and consequent spread of diseases. Further proper management of drainage systems will be necessary to eliminate chances of having stagnant water which would otherwise be a breeding site for mosquitoes and resultant outbreak of malaria and bilharzias.

6.5.2Insecurity and Strain on Infrastructure

Rapid increase in population is expected to impact negatively due to resultant over loading of services eg hospitals, schools, housing, security services, solid waste facility, sewage handling facility etc. These impacts should be monitored in order to advise the relevant institutions on the need to expand service delivery to match rising demands i.e.

- ✓ The administration and police on the need to increase surveillance
- ✓ The hospital and dispensaries to expand services
- ✓ The public to invest more in construction of rental residential buildings

6.5.3Prevention and Management of Accidents

Thesewer line personnel should be provided with overcoats/overalls, safety boots, helmets, goggles/masks for protection from accidents while on duty. They should also be provided with medical insurance cover and workman compensation or equivalent. The workers should be trained on first Aid treatment and first Aid kits installed at strategic sites in the water works.

6.6 Positive impacts

6.6.1 Construction Phase

- ✓ Increased wealth creation owing to influx of investors coming to exploit the increased business potential due to availability of hygienically environment.
- ✓ Savings arising from reduced price and time spent wastewater disposal·
- ✓ increase in the government revenue generation ·
- ✓ Creation of employment during construction and operation phases of the project
- ✓ Boost in business of construction materials and consumables especially during construction phase ·
- ✓ Increased value of land and property in the project area and environs

6.6.2Decommissioning of the project

The project can be decommissioned when the design period ends or due to one of the following reasons;

- ✓ The source may become inadequate due to unexpected change in climate rendering the project inefficient ·
- ✓ Other cheaper means may be developed near the entire or part the community and other target areas and cause the proponent to close and change method

Under these circumstances, the proponent will demolish the all the structures including sewer pipes; remove the salvage materials and restore the sections affected to the original state.

The resultant waste should be sorted into re-recyclables and non-recyclables before disposal at the designated site in accordance to NEMA regulations on Solid Waste. The recyclables could be re-used in new projects or sold to recyclers.

The following table summarizes the impacts and associated mitigation measures during decommissioning phase

Environmental Impacts and Mitigation measures table

ENVIRONMENTAL/SOCIAL IMPACTS	MITIGATION MEASURES
Accumulation of solid waste after demolition	Collection and sorting for waste disposal or recycling to ensure NEMA waste management regulation and procedures are followed as required
Aesthetic beauty and possible Soil erosion	Restoration of the affected site e.g. Ponds, rising main route etc. through landscaping and planting vegetation cover
Possible loss of income for workers and neighbouring community	Sensitize the workers and the community on imminent occurrence so that they can absorb the psychological shock without devastating consequences. The proponent could redeploy some of the staff in other relevant areas of operation
Associated impacts after	Periodic monitoring for associated development as well as foot

demolition and site clearance	prints from the decommissioned project

CHAPTER SEVEN

7.0 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

7.1Introduction

An Environmental Management Plan (E.M.P) describes the processes that an organization will follow to maximize its compliance and harm to the environment. This plan also helps an organization map its progress toward achieving continual improvements. Each project is unique and, as a result, so is environmental management plan. The level of detail and length of an E.M.P will vary depending on the type of project and the complexity of the processes involved.

The EMP helps in environmental monitoring and management. The process of environmental monitoring involves collection of data and information relating to project characteristics, quantities and functioning of environmental variable as they impact on the project area over time and space. It forms an integral part of the overall project management process given that environmental protection forms an indispensable part in the overall project sustainability. The rationale for environmental monitoring is to assess the success of the implementation of the mitigation measures proposed in an EIA report.

Monitoring is the continuous assessment of both the functioning of the project activities in the context of implementation schedules of the use of project inputs by the targeted population in the context of design expectations.

The goals of monitoring are:

- To ensure that inputs, work schedule and output are proceeding according to plan i.e. that the project implementation is on course.
- provide record of input use, activities and results; and
- Early warning of deviations from initial goals and expected outcome.

7.2 Environmental Management Plan (EMP)

The measures proposed in the EMP presented in the table below are aimed at ensuring that the total environment is not adversely affected by the implementation of the proposed project. In preparing this EMP issues of health,

safety and environment have been taken into account. In addition, the need for compliance with the laid down regulations was also considered. It is hoped that the Kiambu Countywill fully implement the EMP.

Environmental Management Plan table

Environmental Issues or Impacts	Proposed Mitigation Measures	Procedure for Implementation	Responsibility	Time Frame
Solid waste management	Proper solid waste management as per NEMA waste management regulations	Collection, sorting and recycling or disposal at designated site	Contractor Proponent during construction and operation phases respectively	Throughout construction and operation phases
Air pollution	Control of dust and hydrocarbon fumes during trenching and excavation	➢ Reduce dust generation by wetting using water. ➢ Where diesel mechanical equipment are used, ensure the engines are in good working condition and properly maintained ➢ Enclose the works and orient exhaust away from the nearby residences	Contractor	Throughout trenching and excavation activities Continuously during operation and at regular intervals
Noise	Control noise to be within the recommended limits to avoid disturbance of neighbours	➢ Enclose sites where mechanical equipment are used ➢ Ensure the work is done	Contractor and proponent during construction and operation phases	Throughout construction phase

Environmental Issues or Impacts	Proposed Mitigation Measures	Procedure for Implementation	Responsibility	Time Frame
		during the normal working hours (8.00am-5.00pm) ➢ Use low noise equipment during construction ➢ Ensure the equipment is regularly and properly maintained	respectively	
Health and safety	Prevention of accidents Protection against advanced health effects	➢ Use of physical barriers and labeled icons to prevent and warn the public on dangers of construction activities ➢ Provision of protective gears to the workers ➢ Training and Provision of first aid kits to the workers. ➢ Training workers on environmental health and	Contractor and Proponent during construction and operation phases respectively	Throughout construction and operation

Environmental Issues or Impacts	Proposed Mitigation Measures	Procedure for Implementation	Responsibility	Time Frame
		safety procedures and emergency preparedness ➢ Insuring the workers on medical and workman compensation		
Diseases Hazards	Sensitize the public on consequences of accumulation of stagnant waste water near leakage points	Sensitization, training on spillage waste management	Proponent	During operation phase
Project acceptance	Consultation and information during public interviews	consultations	Proponent and consultant	During feasibility and design studies
Insecurity	Sensitize the community and security institutions on the possible impacts of the project	Increased security surveillance	Proponent	During commissioning and operation phase
Physical cultural resources Chance	Chance find procedures Resident Engineer to stop	Meanwhile the Engineer will be required to liaise with	Contractor/ proponent	Throughout the project

Environmental Issues or Impacts	Proposed Mitigation Measures	Procedure for Implementation	Responsibility	Time Frame
find/discoveries e.g. archaeological site, historical site, graveyard discovery	works, secure the site and report to the relevant authority for evaluation and decision.	authority to allow for project progress e.g. redesigning to avoid the site giving way for preservation, conservation, restoration and salvage as detailed under impacts during construction phase.	/consultant/ relevant authority.	implementation period.

CHAPTER EIGHT

8.0 CONCLUSION AND RECOMMENDATIONS

8.1 Conclusion

Based on the information gathered from site visit, review of relevant literature, it is in our professional opinion that the proposed development will not adversely affect the environment if properly managed. The engineers, supervisors and the proponent have the responsibility to ensure that the running of the sewer and their processes meet the required standards. This will ensure that the site acquires environmental, durability and serviceability as well as safeguarding the general public. The site must be as per the approved drawings.

8.2 Recommendations

The following are the recommendations:-

- Close supervision of all operational activities and processes by a qualified engineer.
- Ensure that all construction wastes are disposed of in accordance with the KiambuCounty environmental by-laws, Public Health regulations and environmental regulations applicable in the country.
- The EMP prepared in this report should be fully complied with and evaluated within twelve (12) months of project completion.

We hope and believe that the county will make every effort to ensure compliance with regulatory and legislative requirements at all stages of the project cycle. The impacts of the proposed project on the environment will be minimal and insignificant.

REFERENCE

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APPENDIX

1) Copy of expert practicing license
2) Proof of consultation and public participation
3) Bill of quantities
4) Sewer design