KENYA TOWNS SUSTAINABLE WATER SUPPLY AND SANITATION PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT FOR THE PROPOSED KANGARI TOWN SEWERAGE PROJECT

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November, 2022

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KANGARI TOWN SEWERAGE PROJECT

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Final Report

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SUBMISSION DETAILS

Certificate of Declaration and Document Authentication

This document has been prepared in accordance with the Environmental Management and Coordination Act 2015 and Environmental Impact assessment and Environmental (Impact Assessment and Audit) Regulations 2003 with 2019 Amendments. This report is prepared for and on behalf of:

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DISCLAIMER:

This Environmental Impact Assessment Study Report is based on literature review and findings from field assessment. It is however, subject to conditions in the Environmental Management and Coordination Act 2015 and Environmental (Impact Assessment and Audit) Regulations 2003 with 2019 amendments.

FACT SHEET

Assignment Name	Environmental & Social Impact Assessment for the Proposed Kangari Town Sewerage Project
Lead Implementing Agency	Athi Water Works Development Agency (AWWDA)
Financier	African Development Bank
Project Components	• Laying of around 12.1km double wall corrugated HDPE pipes sizes 200mm to 300mm of sewer network to serve Kangari town and surrounding environs • Construction of a Waste Stabilization Ponds designed to treat 1,770 m3 per day; The water stabilization pond will comprise of the following components; ✓ A total number of 10 No. Wastewater Stabilization Ponds comprises of 2No. Anaerobic Ponds, 2No. Facultative Pond and 6No. Maturation Ponds; ✓ Inlet Works comprising of fine and coarse screens and grit settling channels ✓ Precast concrete pipes and concrete channels; ✓ Interpond connections; ✓ Flow measuring devices in inlet and outlet channels;
Project Location	Kigumo Sub County, Kangari location in Murang'a County
Lead Expert	Eng. Lawrence Mwangi Reg. Nr. 0317

ABBREVIATIONS

AWWDA	Athi Water Works Development Agency
AFDB	African Fund Development Bank
ADB	African Development Bank
COC	Code of Conduct
CSOs	Civil Society Organization
EHS	Environment Health and Safety
ESIA	Environmental and Social Impact Assessment
EMCA	Environmental Management & Coordination Act
GBV	Gender Based Violence
KTSWSSP	Kenya Towns Sustainable Water Supply and Sanitation Program
MoWSI	Ministry of Water, Sanitation and Irrigation
MUSWASCO	Muranga South Water and Sewerage Company
NEMA	National Environment Management Authority
NEP	National Environment Policy
OSHA	Occupational Health and Safety
PPEs	Personal Protective Equipment
RAP	Resettlement Action Plan
SDGs	Sustainable Development Goals
SEA	Sexual Exploitation and Abuse
STD	Sexually Transmitted Diseases
WIBA	Workplace Injuries and Benefits Act
WSTF	Water Services Trust Fund
WSP	Water Service Provider
WRUA	Water Resources Users Authority
WRA	Water Resources Authority

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EXECUTIVE SUMMARY

E-1 Project Information

This Report is an Environmental and Social Impact Assessment (ESIA) Study Report for the proposed Kangari Town Sewerage to be implemented by Athi Water Works Development Agency (AWWDA). The main objective of the proposed project is to ensure adequate sanitation systems that will cater for the growing populations in the project areas within Kangari Town and their surrounding environs.

The TOR for the project was submitted to the National Environment Management Authority (NEMA) for review on August 11, 2021 under NEMA /TOR/5/2/307. Upon review of the TOR a Letter of acknowledgement for approval (Annex 2) was issued on August 23,2021 to subject the project to a Full Study as required by Environment Impact Assessment and Audit Regulations 2003 with 2019 amendments.

The proposed sewerage project will consist of the following components;

- ✓ Laying of around 12.1km double wall corrugated HDPE pipes sizes 200mm to 300mm of sewer network to serve Kangari town and surrounding environs
- ✓ Construction of a waste stabilization ponds designed to treat 1,770 m^3 per day;

The water stabilization pond will comprise of the following components;

- ✓ A total number of 10 No. Wastewater Stabilization Ponds comprises of 2No. Anaerobic Ponds, 2No. Facultative Pond and 6No. Maturation Ponds;
- ✓ Inlet Works comprising of fine and coarse screens and grit settling channels
- ✓ Precast concrete pipes and concrete channels;
- ✓ Interpond connections;
- ✓ Flow measuring devices in inlet and outlet channels

E-2 Policy, Legal and Administrative Framework

The report has presented the relevant policies, legislation and institutional frameworks that guide preparation of ESIA at both National and International levels.

Policy provisions included; Constitution of Kenya 2010, Kenya Vision 2030, National Environment Policy (NEP) 2013, National Climate Change Response Strategy, 2010, The National Environment Policy, 2013, Kenya National Youth Policy 2006, The National Environmental Sanitation and Hygiene Policy-July 2007, Noise and Excessive Vibration Pollution (Control) Regulations, 2009, The Environmental Management and Coordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006 Legal Notice No. 160 , The Physical and Land Use Planning Act, 2019, Land Act, 2012, Water Act, 2016, Water Rules 2007, County Government Act No. 17 of 2012, Occupational Health and Safety

Act (OSHA 2007), The Public Health Act (CAP.242), Employment Act, HIV and AIDS Prevention and Control Act 2011, Sexual Offences Act 2006, Child Rights Act (Amendment Bill) 2014, Work Injury Benefits Act (WIBA), Labour Relations Act 2012, National Gender and Equality Commission Act 2011, Public Participation Bill of 2016.

The assessment has also made reference to AfDB's Operational Safeguards (OS). The OS include;

- OS 1: Environmental and Social Assessment.
- OS 2: Involuntary Resettlement: Land Acquisition, Population Displacement and Compensation.
- OS 3: Biodiversity and Ecosystem Services.
- OS 4: Pollution Prevention and Control, Greenhouse Gases, Hazardous Materials and Resource Efficiency.
- OS 5: Labour Conditions, Health and Safety.

E-3: Highlights of Stakeholder Consultations

Environmental Impact Assessment / Audit Regulations of 2003 with 2019 amendments require that in the process of conducting Scoping, Environmental Impact Assessment, the proponent shall in consultation with the Authority herein referred to as the National Environment Management Authority (NEMA); seek the views of persons who may be affected by the project.

Therefore, to comply with the above discussed statues, preliminary consultation at project report stage of the ESIA involved consultations with key stakeholders in Kigumo Sub County and Murang'a County as well as members of the public especially where the proposed STP is located and where the trunk sewer lines are proposed.

The method of engagement included a stakeholder's workshop, public barazas, one on one interviews and responding to the questionnaire (filled questionnaires annexed 4).

Table E-3.1 List of Stakeholder Consultations

Name	Designation
Elias K. Gachau	Chief Public Health Officer
Simon Wainana Ng'ang'a	Physical Planner Kigumo Sub County
Beatrice Gicheha	Sub County Administrator Murang'a County Government.

Summary of the outcome of stakeholder's consultation

- The project will result in appropriate waste disposal.
- The project will lead to growth of the local economy through engagement of local labor.
- Ablution block in Kangari Market will help in keeping the town clean.
- Concern about air pollution from STP
- Need to consider local employment

- Project will promote health management. Sanitation and vector borne related diseases will be reduced.
- Recommendation that there be coordination between the physical planning department and Athi Water Works Development Agency to ensure smooth operations.
- Concern about bust of pipes and seepages.
- Project will contribute in the reduction of sanitation related diseases like diarrhea to the catchment population

Summary of Comments from Public Sensitization Meetings

Table E-3.2 schedule of meetings held

No	Date	Venue	Location
1.	19.03.2021	Ikumbi Markat	Marira
2.	19.03.2021	Kangari town	Kangari

- The residents were concerned that the proposed sewerage would displace people. They also stated there is limited land space in the area. The residents further stated that they wanted the proposed STP to be constructed on public land and not in their private lands The residents were informed there would be compensation given for those that would be affected by the project.
- The community wanted to know how and who will be responsible for ensuring the STP does not result in air pollution especially through smell. They were informed trees will be planted around the area and act as buffer zones to purify the air around the Sewerage Treatment Plant. They were also informed there would be offices around the STP areas to ensure easy monitoring and maintenance.
- The residents wanted to know who will be the responsible person/s in managing pipe bursts after project implementation. They were informed that it will be the responsibility of the Water Service Provider, MUSWASCO.
- The residents wanted to know the depth that would be dug for laying of the pipes. They further enquired if they will be able to continue planting crops after project implementation. The Consultant informed the meeting that the project involved digging trenches approximately 3 meters deep and cover up the area. They were further informed they would continue planting their crops excluding the planting of trees and building houses once project implementation is complete
- The community wanted to know whether job opportunities will be given to the local people. They were informed job opportunities will be available and the Contractor will be

advised to liaise with the Chief to identify the area residents who will be considered for such opportunities. A committee will be formed to choose viable candidates.

- The residents were concerned that the sewerage treatment plant would result in air and water pollution. They were informed the system been used that Is a modern system which ensures efficient treatment and results in minimal bad odor
- One of the residents was concerned that the sewerage treatment would affect the tea Factory-Consultant informed the meeting that many factors are considered before setting up an STP. The factory been a food processing service all precautions have been put in place to ensure it is not affected.
- The residents wanted the construction of Kangari market ablution block to be given first priority since they did not have any sanitary facilities they could access after the existing one was demolished- The Consultant informed the residents they would require to liaise with the Contractor that is building Kangari market and also relevant authorities so as to establish a suitable site for the construction of the ablution block.
- The residents wanted to know if there would be compensation for the people that would be affected by the project. - The Consultant informed the residents that compensation will be fully given for the affected persons.

E-4 Project Impacts

Assessment of project Impacts was based on analysis of the proposed project components and existing environmental conditions. The impacts arising during each of the phases of the proposed development namely construction, operation and decommissioning, can be categorized into:

- Impacts on biophysical environment;
- Health and safety impacts; and
- Social-economic impacts

Sections E-4.1 to E-4.4 below provides a summary of the project impacts both positive and negative discussed in this Report.

E-.4.1 Positive Impacts during Construction Phase

The project is envisaged to have more impacts that are positive after completion of the civil works and commissioning.

A summary of anticipated positive impacts of the project include:

- **Employment opportunities**-With the construction of the proposed project, there will be employment opportunities for both professionals and unskilled workers, earnings from the wages will improve their living standards

- **Creation of wealth-**The proposed development brings many opportunities in investment and procurement where the youth and people from Kigumo Sub County can compete to provide different goods and services to the proponent during construction of the tank and distribution pipelines**.**
- **Injection of money into the local economy-**A large sum of the project money shall be released into the local economy due to the construction activities.
- **Creation of a market for construction materials-**The project will require materials, some of which will be sourced locally and some internationally. These include plant steel and plastic pipes, valves, cement, sand, hardcore and chemicals.
- **Technology transfer -**The project will be associated with technological and knowledge transfer to the local sector, this will be through the artisan who will be employed and trained by the project

E-.4.2 Positive Impacts during Operation Phase

The project shall result in both direct and indirect benefits to the residents of Kangari Town and the surrounding as summarized below:

- Reduced cases of water borne diseases associated with pollution of water resources
- Creation of job opportunities especially, for those who will be employed to manage and maintain the STP. This will improve the living standards of these employees. MUSWASCO will also employ more staff to assist in connecting its customers to the sewer system.
- Improved Health and Sanitation status of Kangari town residents and their surrounding environs
- Reduced pollution of natural river systems which include Karuchu stream and River Chathanda within the project area.
- Trigger development of modern infrastructure within Kangari Town and the surrounding environs due to availability of sewage treatment infrastructure
- Reduce distances covered by exhausters to sludge discharge points eventually reducing costs.
- Residents will decommission pit latrines which are expensive to construct and unsustainable due to short fill-up duration.
- Improve aesthetic outlook of Kigumo Town and the surrounding environs.

E-.4.3 Positive Impacts during Decommission Phase

- Employment opportunities where both skilled and unskilled personnel will be recruited
- Rehabilitation of site to ensure the site is left as natural as possible close or better than before

E-.4.4 Negative Impacts and Mitigation Measures during Project Construction Period

Activities during the Construction Phase with potential to trigger negative environment and social impacts include the following;

i. Manual excavation of trenches
ii. Temporary stockpiling of soils, sub-soils and rock along the trenches

Table E-4 below provides a summary of potential negative impacts and proposed mitigation measures.

Table E-4: Negative Impacts and Proposed Mitigation Measures during Construction Phase

Associated Impacts	Management Actions
Vegetation Clearing	• Compensatory planting of trees • Vegetation should only be cleared along the Project corridor and where it will interfere with Project construction and/or present hazards. • The local community should be given a chance to harvest the targeted vegetation if they so wish. • Areas to be cleared should be agreed and demarcated before the start of the clearing operations to minimize exposure. • Also, stage vegetation clearance is recommended • The use of existing cleared or disturbed areas for the Contractor's Camp, stockpiling of materials etc. shall be encouraged
Air Pollution	• Maintain construction equipment at high operational conditions such as to control emissions into the air. • Earth moving be done under dump conditions as much as possible to prevent emission of dust into the air, • Similarly, piled materials (sand and aggregate) should be maintained dump to prevent dust emissions, • Notify the immediate neighborhoods on the potential odours during the excavations. • Use of sprinklers to regularly water construction site, this suppresses the dust menace at construction sites • People working in the sites with dust emissions to use dust masks to prevent respiratory infections.

Associated Impacts	Management Actions
Excessive Vibration and Noise Pollution	• Avoid night time construction when noise is loudest; • Conduct periodic noise measuring and monitoring to determine levels and extent of harmful noise; • Clearly label the high noise areas; • Provide personal protective equipment (PPE) including masks, goggles, scarfs, boots and overalls among other protective clothing to persons operating within or visit identified high noise areas. • In order to meet noise level requirements, the equipment should be equipped with standard noise attenuation features. Machines that exceed acceptable noise limits should be equipped with silencers or lagging materials or specially designed acoustic enclosures; • Inform local residents when construction activities are likely to generate excessive noise in order to minimize disruption to local residents through posters along construction sites. • Sensitize truck drivers to avoid hooting especially when passing through sensitive areas such as churches, residential areas and hospitals
Impact on soil resources	• Earthworks should be controlled so that land that is not required for the Project works is not disturbed; • Wherever possible, earthworks should be carried out during the dry season to prevent soil from being washed away by the rain. • Excavated materials and excess earth should be kept at appropriate sites approved by the Supervising Engineer. • The contractor should adhere to specified cut and fill gradients and planting embankments with shrubs and grass to reduce erosion and take care of stability problems of Project trenches once reinstated. • Areas cleared for improving sight distance should be planted with grass to reduce erosion.
Impact on water Resources	• No grey water runoff or uncontrolled discharges from the site/working areas (including wash down areas) to adjacent Karuchu stream shall be permitted;

Associated Impacts	Management Actions
	• Water containing such pollutants as cements, concrete, lime, chemicals and fuels shall be discharged into a conservancy tank for removal from site where applicable; • The Contractor shall also prevent runoff loaded with sediment and other suspended materials from the site/working areas from discharging to Karuchu stream • Works that are likely to generate silt-laden runoff (e.g., earthworks and excavations) will be undertaken preferentially during the drier months of the year; November to April; • Site compounds and stockpiles will be located away from Karuchu stream.
Risks of solid waste mismanagement leading to pollution	• Contouring of spoil site to approximate natural topography and drainage and/or reduce erosion impacts on the site • The Contractor shall ensure that the placement of spoil is done in such a manner to minimize the spread of materials and the impact on surrounding vegetation and that no materials‘ creep’ into‘ no-go ’areas
Land Take	• Undertake a Resettlement Action Plan which will act as guide for the compensation activities.
Labour Influx Impacts	• Effective community engagement and strong grievance mechanisms on matters related to labour • Effective contractual obligations for the contractor to adhere to the mitigation of risks against labour influx, the contractor should engage a local community liaison person as provided for in chapter 6 • Proper records of labour force on site while avoiding child and forced labour • Comply to provisions of WIBA 2007 • Develop and implement a children Protection Strategy, this strategy will ensure that no child under the legal age of 18 years in employed to the Project. • Contractor should give priority to the local people in the project area for employment opportunities

Associated Impacts	Management Actions
Human Right and Gender Inclusivity	• Mainstream Gender Inclusivity in hiring of workers and entire Project Management as required by Gender Policy 2011 and 2/3 Gender Rule. • The existing community structures headed by location chiefs should be involved in local labour hire, emphasize the requirement of hiring women, youth and people with disability. • Protecting Human Risk Areas Associated with, Disadvantaged Groups, Interfering with Participation Rights and interfering with Labour Rights
Child protection	• The contractor will develop and implement a Children Protection Strategy that will ensures minors are protected against negative impacts associated by the Project including Sexual Exploitation and Abuse (SEA). • All staff of the contractor must sign, committing themselves towards protecting children, which clearly defines what is and is not acceptable behaviour • Children under the age of 18 years should be hired on site as provided by Child Rights Act (Amendment Bill) 2014 • Wherever possible, ensure that another adult is present when working in the proximity of children. • Not invite unaccompanied children to worker's home, unless they are at immediate risk of injury or in physical danger. • Refrain from physical punishment or discipline of children • Refrain from hiring children for domestic or other labor, which is inappropriate given their age, or developmental stage, which interferes with their time available for education and recreational activities, or which places them at significant risk of injury. • Comply with all relevant local legislation, including labor laws in relation to child labor specifically provisions of Kenya's Employment Act Cap 226 of 2007 Part VII on protection of children against exploitation
Increase in Transmission of HIV /AIDS	• Sensitize workers and the surrounding communities on awareness, prevention and management of HIV/AIDS and sexual

Associated Impacts	Management Actions
	health and rights through staff training, awareness campaigns, multimedia and workshops or during community Barazas. • Use existing clinics to provide VCT services to construction crew and provision of ARVs for vulnerable community members • Ensure safety of women and girls in provision of VCT services. • Work to minimize or altogether eliminate mosquito-breeding sites.
Health Impact – Spread of Covid -19 among construction workers	• The Contractors will develop SOPs for managing the spread of Covid-19 during project execution and submit them for the approval of the Supervision Engineer and the Client before mobilizing to site. The SOPs shall be in line with the AfDB guidance on COVID-19, Ministry of Health Directives and site-specific project conditions; • Mandatory provision and use of appropriate Personal Protective Equipment (PPE) shall be required for all project personnel including workers and visitors; • Avoid concentration of more than 15 workers at one location. Where there are two or more people gathered, maintain social distancing of at least 2 meters; • All workers and visitors accessing worksites every day or attending meetings shall be subjected to rapid Covid-19 screening which may include temperature check and other vital signs; • The project shall put in place means to support rapid testing of suspected workers for covid-19; • Install hand washing facilities with adequate running water and soap, or sanitizing facilities at entrance to work sites including consultation venues and meetings and ensure they are used; • Ensure routine sanitization of shared social facilities and other communal places routinely including wiping of workstations, door knobs, hand rails etc.;
Social risk – spread of COVID -19 amongst community members during consultation	• Electronic means of consulting stakeholders and holding meetings shall be encouraged whenever feasible. One-on-one engagements for the PAPs while observing social distance and adhering to PPE wearing shall be enforced;

Associated Impacts	Management Actions
	• Avoid concentrating of more than 15 community members at one location. Where two or more people are gathered, maintain social distancing of at least 2 meters; • The team carrying out engagements within the communities on one-on-one basis will be provided with appropriate PPE for the number of people they intend to meet; • Use traditional channels of communications (TV, newspaper, radio, dedicated phone-lines, public announcements and mail) when stakeholders do not have access to online channels or do not use them frequently. Allow participants to provide feedback and suggestions • Hold meetings in small groups, mainly in form of FGDs if permitted depending on restrictions in place and subject to strict observance of physical distancing and limited duration. In situations where online interaction is challenging, disseminate information through digital platform (where available) like Facebook and Whats App & Chart groups. • Ensure online registration of participants, distribution of consultation materials and share feedback electronically with participants.

Disruption of amenities (access roads, services lines and driveways) causing inconveniences to the community	• The contractor shall develop a traffic management plan;
	• The Contractor should provide temporary road signs or notices to indicate ongoing works;
	• The Contractor together with the Resident Engineer Should Plan itineraries for site traffic on a daily basis and avoid peak traffic periods;
	• The Contractor should effect traffic controls and cleanliness to avoid congestion and truck accidents on roads;
	• For the site traffic the Contractor has to ensure that they:
	  ○ Only park in designated parking areas;
	  ○ Don't block pedestrian routes;
	  ○ Don't block traffic routes;
	  ○ Obey the speed limit
	• The resident Engineer has to ensure that the Contractor:

Associated Impacts	Management Actions
	○ Introduces segregated pedestrian walkways; ○ Introduces speed limits; ○ Reduces the need for reversing vehicles, by introducing a one-way system; ○ Uses a qualified BANKSMAN to control deliveries and reversing vehicles; ○ Designates loading/unloading areas.
Community accidents	• Provide notices, signage and information to the public for their safety at all locations • Install barriers along walkways, crossings and public places affected by the works for public safety • Where there is potential for nuisance from dust generation, ensure earth moving is under dump conditions (consider watering where necessary) • Inform immediate communities or stakeholders of the activities.
Gender Based Violence	• The contractor will mainstream Gender Inclusivity in hiring of workers and entire Project Management as required by Gender Policy 2011 and 2/3 Gender Rule. • The existing community structures headed by location chiefs should be involved in local labour hire, emphasize the requirement of hiring women, youth and people with disability and VMGs • Protecting Human Risk Areas Associated with, Disadvantaged Groups, interfering with Participation Rights and interfering with Labour Rights: • Treat women and children (persons under the age of 18) with respect regardless of race, color, language, religion, political or other opinion, national, ethnic or social origin, property, disability, birth or other status. • Do not use language or behavior towards women or children that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate. • Sexual activity with children under 18—including through digital media is prohibited. Mistaken belief regarding the age of a child and consent from the child is not a defense.

Associated Impacts	Management Actions
	• Exchange of money, employment, goods, or services for sex, including sexual favors or other forms of humiliating, degrading or exploitative behavior is prohibited. • Sexual interactions between contractor's and consultant's employees at any level and member of the communities surrounding the workplace that are not agreed to with full consent by all parties involved in the sexual act are prohibited. This includes relationships involving the withholding, promise of actual provision of benefit (monetary or non-monetary) to community members in exchange for sex – such sexual activity is considered "non-consensual". • Where an employee develops concerns or suspicions regarding acts of GBV by a fellow worker, whether in the same contracting firm or not, he or she must report such concerns in accordance with Standard Reporting Procedures. • A GBV code of conduct to be prepared and given to the workers during recruitment • All employees are required to attend an induction-training course prior to commencing work on site to ensure they are familiar with the GBV Code of Conduct. • All employees must attend a mandatory training course once a month for the duration of the contract starting from the first induction training prior to commencement of work to reinforce the understanding of the institutional GBV Code of Conduct.
Sexual Exploitation and Abuse (SEA)	• Develop and implement a SEA action plan with an Accountability and Response Framework as part of the C-ESMP. The SEA action plan will follow guidance on the AfDB Good Practice Note for Addressing Gender-based Violence in Investment Project Financing involving Major Civil Works (Sept 2018). • The SEA action plan will include how the project will ensure necessary steps are in place for: • Prevention of SEA: including COCs and ongoing sensitization of staff on responsibilities related to the COC and consequences of non-compliance; project-level IEC materials;

Associated Impacts	Management Actions
	• Response to SEA: including survivor-centered coordinated multi-sectoral referral and assistance to complainants according to standard operating procedures; staff reporting mechanisms; written procedures related to case oversight, investigation and disciplinary procedures at the project level, including confidential data management; • Engagement with the community: including development of confidential community-based complaints mechanisms discrete from the standard GRM; mainstreaming of Sexual Exploitation and Abuse (SEA) awareness-raising in all community engagement activities; community-level IEC materials; regular community outreach to women and girls about social risks and their SEA-related rights;
Public Health and safety risks Worker Occupational safety risks	• Notify public the intent to cut sections of the road for safety precautions • Provide signage and safety information in all work areas • Ensure compliance by workers with safety safeguards including the OHS, provision of safety gear and enforcement of application
Risks of Accidents, Injuries or death of workers or community member	• Provide construction workers with personal protective gear (gloves, gum boots, overalls and helmets), • Provide temporary toilets and bathrooms for the construction workers at the work sites • Provide onsite first aid kit accessible by the workers in need, • Isolate the site for access by the local communities during the construction for their safety and health • Contractor to provide a Healthy and Safety Plan prior to the commencement of works to be approved by the resident engineer.
Hazards of fire outbreak, oil and chemical spills.	• Follow specifications of the Occupational Health and Safety Act, EMCA, 1999 and others in the development and operation of stores.
Risk to health and safety of community and workers	• The Contractor shall keep noise level within acceptable limits and construction activities shall, where possible, be confined to normal working hours in the residential areas

Associated Impacts	Management Actions
	• hospitals and other noise sensitive areas shall be notified by the Contractor at least 5 days before construction is due to commence in their vicinity • Any complaints received by the Contractor regarding noise will be recorded and communicated to the RE • The Contractor must adhere to Noise Prevention and Control Rules of April 2005

The project once commissioned has the potential of triggering negative impacts associated with operation and maintenance as summarized in Table E-5 below.

Table E-5: Negative Impacts and Proposed Mitigation Measures during Operation Phase

Associated Impacts	Management Actions
Odour Menace from Wastewater Treatment Works	• Ensure appropriate covering/ventilation of the pre-treatment unit; • Ensure appropriate handling and removal of grit/grease; • Ensure proper sizing and alignment of the plant; • Ensure scum is appropriately disposed off or properly stabilized; • Ensure adequate water flow through the plant to reduce the potential of odour formation; • The perimeter of the proposed site should be vegetated with trees and plants of varying heights thereby forming windbreaker and reduce dispersion of odour; • Maintenance the roofs of the sludge drying beds to ensure quick drying of sludge and appropriate disposal to reduce odour emanating from wet sludge.
Waste Generation and Disposal	• Sludge drying beds should be incorporated in the design • Provision of solid waste storage bins. • Provision of adequately designed bins to prevent access by vermin. • Monitor exhauster trucks so that they do not become overfilled and spill waste enroute to the site. • Ensure that the solid waste generated is disposed of in an approved dumpsite or landfill.
Increase in traffic along the access	• Limit septage delivery to the site between the hours of 8 and 5 pm. This will limit the noise nuisance to residents and possibly reduce

Associated Impacts	Management Actions
Road	the population exposed to potential accidents, as most persons would have already left their homes to go to work or and schools. • Add adequate and appropriate signs including speed limits along the road in proximity to the access roads.
Inversion of Birds and Reptiles to the Waste Water Treatment Works	• The sewage treatment plants should be protected from wildlife encroachments by providing secure barriers to keep off the animals from interfering with the plant operations and safety. This will also ensure safety of the residents, • The quality of the discharging sewage into the river will be an important parameter on the regional control of the river eutrophication. Continuous generation and sharing of sewage quality data on pre-scheduled monitoring programmes will be necessary
Health and Safety Risks from Burst Sewers	• Activate a community watch group for information sharing on the status of the sewer line • Awareness raising among community members not to dump solids in manholes. • Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups • Development of an inventory of system components, with information including age, construction materials, and drainage areas served elevations. • Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replaced if broken to minimize entry of garbage and silt into the system • Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent build-up of solids and hydrogen sulphide generation
Risks of Overflowing Manholes due to Blockage of Sewers	• Blockages should be detected and promptly replaced; • Regular monitoring and sampling of the waste water at influent and effluent points as well as in the receiving water bodies; • Communities living within the river basins where the trunk sewers will be constructed should be enlightened on dangers of using raw sewerage to irrigate farmlands.

Associated Impacts	Management Actions
Visual and landscape impact management	• Elaborate landscaping and maintenance of these sites can limit the viewpoints to the facilities and thus reduce their visual impact
Grit, sludge and other solid wastes	• The sludge will be temporarily held in sludge drying beds for sludge digestion and the dry cake will be safe for disposal. • Sludge quality will need to be monitored to ensure that human health is protected
Pollution of Karuchu stream	• Follow the NEMA waste water quality guidelines strictly • The quality of the discharging sewage into the river will be an important parameter on the regional control of the river eutrophication. • Continuous generation and sharing of sewage quality data on pre-scheduled monitoring programmes will be necessary
Increase in Social Vices	• A security chain link fence including a gate and guard house should be erected at sewer treatment plant to protect the site from theft and vandalism. • Design manholes and manhole step iron from material which do not have any value in the scrap metal industry. • Proper security measures should be put in place to guard the equipment 24 hours to reduce cases of vandalism.

During decommission the project will be associated with negative impacts as summarized in Table E-6 below.

Table E-6: Negative Impacts and Proposed Mitigation Measures during Decommissioning Phase

Associated Impacts	Management Actions
Loss of Jobs and Income	• Notify the employees in advance on the project closure date and adequately compensate them; • Dismissal procedures to be compliant with Employment Act, 2007; • Provide counseling and alternative skills for alternative activities; • Employer should find alternative means of livelihood for the staff who were employed at the treatment plant. • Customers to be notified in advance of the proposed decommissioning

Associated Impacts	Management Actions
Noise Pollution	• Schedule noisy activities during the day time period; • Use silencers on machines where possible; • Ensure machinery is well maintained to reduce noise emitted
Solid Waste Material	• Disposal of solid waste in compliance with EMCA 2006 Waste Management Regulations; • Segregation of waste to encourage reuse and recycling; • Ensuring that the contracted waste collector is registered with NEMA to collect and dispose wastes.
Occupational Health and Safety	• Conduct training on health and safety procedures to the workers prior to commencement of demolition; • Proper plans should be made prior to demolition so as to contain the raw sewage and other waste water that poses as health risk to human beings and the environment, to prevent the workers and surrounding communities from getting into contact with it.

E-7 Conclusion

The Environmental and Social Impact Assessment undertaken for the project indicates that the project will have the following impacts:

i. The project area is within in Kigumo sub-county Kangari location in Murang'a County and their surrounding environment, the project area is away from any sensitive environment ecosystems. The assessment identified that there will be no direct interaction of the project activities at the time of construction with the natural sensitive ecosystems.
ii. The Environment impacts will be less significant impacts as discussed in Chapter 7 of this assessment. However, it could result to significant water pollution impacts to Karuchu Sabasaba steam if not appropriately operated and maintained.

E-8 Recommendations

This assessment recommends the following provisions:

i. The Bid documents prepared for the project incorporate the Environment, Social Health and Safety Provisions discussed under Chapter 7 (Environment and Social Impact Assessment and Mitigation Measures).
ii. The proponent should be given all the available support to implement the project

iii. Necessary permits should be issued by the licensing authority so that the work can commence

iv. Contractor will be required to commit to implementing the Environment, Social Health and Safety (ESHS) Provisions by developing site-specific (ESHS) plans.

v. At project implementation stage, the Contractor to report to the project management team comprising of the Consultant and the project proponent on a monthly basis on how ESHS provision detailed in this ESIA are addressed

vi. On completion of the Civil Works, MUSWASCO to commission an independent Consultant to undertake an initial Environment, Social, Health and Safety Audit as required by Environmental (Impact Assessment and Audit) Regulations 2003 with 2019 amendments. The audit will identify nonconformities which the Contractor together with MUSWASCO will address through the defect's liability period of the project. This audit will also form basis of annual project self-audits by MUSWASCO.

CHAPTER 1 : INTRODUCTION

1.1 General Background

Athi Water Works Development Agency (AWWDA) is a state corporation under the Ministry of Water, Sanitation and Irrigation established under the Water Act 2016. AWWDA is mandated to develop water and sewerage infrastructure in its area of jurisdiction which includes Nairobi City, Kiambu and Murang'a Counties.

The Government of the Republic of Kenya (GoK) through AWWDA has secured funding from African Development Bank (AfDB) to implement the Kenya Towns Sustainable Water Supply and Sanitation Program (KTSWSSP).

The main objective of the program is to improve the access, quality, availability and sustainability of water supply and wastewater management services in multiple towns in Kenya, with a view to catalyzing commercial activities, driving economic growth, employment creation, improving quality of life of the people and building resilience against climate variability and change.

AWWDA has utilized received part of the funds to prepare designs environmental and social impact (ESIA) reports and Resettlement Action Plans (RAP) for the proposed Kangari, Kigumo and Kangema Sewerage Projets. These project areas are within the service area of 3 Water Service Providers (WSPs) namely; Murang'a South (MUSWASCO), Gatanga Community and Kahuti (KAWASCO).

Kangari, Kangari, Kangema Towns which are among the large urban centers in Murang'a County do not have sewerage systems. These shortcomings have led to the conception of this project.

This ESIA report discusses the proposed Kangari Sewerage Project, ESIA reports for the other sewerage projects in Kangema and Kigumo towns have been prepared separately.

1.2 Scope of the Project

The proposed Sewerage project works will comprise of the following components;

- Laying of around 12.1km double wall corrugated HDPE pipes sizes 200mm to 300mm of sewer network to serve Kangari town and surrounding environs
- Construction of a waste stabilization ponds designed to treat 1,770 m3 per day;

1.3 Project Justification

Kangari Town which is among the large urban centers in Murang'a County do not have a sewerage system. The lack of a proper sewer system has led to water -and soil pollution. The increased storm water brought about by a lack of proper sewer system contains harmful pollutants that pollute water. Most of the storm water also finds its way into people's farms and

in it has also contributed to erosion and carrying away of the top fertile soil. The construction of sewerage system in Kangari Town will lead to many benefits including the following:

- Improved health of the people- Reduced cases of respiratory and water borne diseases associated by poor sanitation due to poor domestic waste water management;
- Reduced pollution of natural river systems;
- Trigger development of modern infrastructure within the Towns due to availability of sewer infrastructure;
- Improved aesthetic value of the area due to cleaning up of the mess that is currently experienced in Storm water drains in the town;
- Dry sludge from the STP is a rich resource that can be utilized for farm application as fertilizer.

1.4 Significance of the Project

The project will contribute towards solving the wastewater related problems in Kangari Town and their surrounding areas and this will go far in reducing cases of water related diseases.

The project will also lead to realization of the Sustainable 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

1.5 Objectives of ESIA

1.5.1 General Objective

The purpose of an Environmental Assessment (EA) is to improve decision making and to ensure that the project under consideration is environmentally and socially sound and sustainable. This ESIA has been conducted in compliance with Environmental (Impact Assessment and Audit) Regulations 2003 with 2019 amendments established under the Environmental Management and Coordination Act (EMCA), 1999 (Amended in 2015).

1.5.2 Specific Objectives of ESIA Investigations

This Environmental & Social Impact Assessment (ESIA) is expected to achieve the following objectives**:**

- To present existing environmental, social and cultural setting of the target project area
- To identify potential environmental and social impacts (direct and indirect), including opportunities for enhancement; this includes the cumulative impact of the proposed project and other developments which are anticipated;

- To generate feasible alternative investments, sites, technologies, and designs,
- To provide preventive, mitigating, and compensatory measures
- To provide detailed results of the public consultation
- To prepare an Environmental and Social Management and monitoring Plan to mitigate the identified impacts so as to ensure sustainability of the proposed projects and
- To recommend cost effective measures to be implemented to mitigate against the expected impacts.

1.6 ESIA Approach and Methodology

The ESIA was carried out in line with the provisions of the Environmental Management and Coordination Act, 1999 and the Amendment Act of 2015 and the Environmental (Impact Assessment and Audit) Regulations 2003 emended in 2019

1.6.1 Literature Review

The Consultant reviewed literature related to the proposed project and the project area. These included project drawings ,project description, and other studies on physiography, geology, hydrogeology, water resources and socio-economics of the project area. Legislation, policies and procedures in social and environmental management were also reviewed.

1.6.2 Scoping

A scoping exercise was carried out to determine the range of issues to be addressed in the ESIA, the significant issues that would need detailed study and those that were not significant. Determination of the boundaries of the ESIA in terms of the geographical extent and timing was also done. The outcome of the scoping exercise was a Terms of Reference (ToR) which was prepared and submitted to NEMA for review on August 11, 2021 under NEMA /TOR/5/2/307. Upon review of the TOR a Letter of acknowledgement for approval (Annex 2) was issued on August 23, 2021 to subject the project to a Full Study as required by Environment Impact Assessment and Audit Regulations 2003 with 2019 amendments.

1.6.3 Baseline Data Collection

Baseline data was collected on the proposed project site and the immediate neighbourhood. The data collection begun in November 2020 during field reconnaissance and continued through the detailed ESIA study phase.

The data collected was on aspects such as: topography; local flora and fauna; soils and geology; socioeconomics, existing and past activities including human settlements; local surface and ground water resources; ambient air quality and noise levels (qualitative); waste management practices; and natural resources and cultural heritage aspects of the project areas.

1.6.4 Stakeholder Consultations

Stakeholder consultations were carried out to: inform project stakeholders of the proposed project; to explain the likely impacts (positive/negative) of implementing the project; and to obtain views, concerns, comments and suggestions from interested and affected parties regarding the proposed project.

Stakeholder identification and analysis was carried to determine who the project affected people were and the most appropriate means of engagement. Details of the outcome of consultation are discussed in chapter 6 of this report.

1.7 Limitation to the assessment

- The residents near the STP were in support of the project but against the proposed site.
- They proposed a public land opposite the proposed site. However, the site is not suitable for construction of an STP based on the survey data.

1.8 Project cost

The project construction cost is estimated at Ksh 492,286,981

CHAPTER 2 : PROJECT DESCRIPTION

2.1 Existing water and sanitation situation

2.1.1 Water Supply

Generally, Kangari town, a town situated on the highlands, has had deficiency in water. Kangari town receives its water from MUSWASCO enabling members of the community to have piped water in their houses. MUSWASCO main water sources are Irati River, Maragua River and Kiriciungu River which is a tributary of Thika River. People in Kangari who don't have access to piped water obtain their water directly from the rivers. This sometimes is a challenge to them since the accessibility is very difficult due to the steep terrains near rivers. During heavy rains the rivers tend to overflow and they may contain high turbidity. Others obtain their water from sunken wells and others harvest their water directly from rain.

2.1.2 Sanitation

There is no water-borne sewerage system at Kangari town. This is considered crucial owing to the high-water table and possibility of increased waste water from the project. Kangari town has one public sanitation facility located behind Kangari market. It serves around 6,000 people per day and it does not have a septic tank and relies on a pit latrine system for waste management. Due to the high usage and small capacity of the pit, filling up and overflowing of raw sewage is common around the area adding to the health risks.

Pit latrines and septic tanks are the main sanitation facilities in the towns and its environs. The nearest sewage treatment plant is at Murang'a Town. According to the 2019 Population Census Report, 95% use latrines, 4% use septic tanks while the remaining 1% use other means like cesspools and open defecation.

2.2 Proposed interventions

- Construction of a new sewerage treatment plant to treat 1,770 m^3 per day
- Laying of around 12.1km double wall corrugated HDPE pipes sizes 200mm to 300mm of sewer network to serve Kangari town and surrounding environs

2.2.1 General

In order to optimize the proposed Kangari Sewerage system, proposed reticulation and trunk sewers to serve the area have been developed for the ultimate 2042 capacity. The proposed sewerage system has been proposed in accordance to the design criteria and the proposed scope of coverage. The design has been based on the ultimate needs for the project area.

2.2.2 Sewer Network Layout

Each of the areas has been designed to have a sewage reticulation network that collects the wastewater by gravity and discharges to the proposed trunk and sub-trunk sewers.

The sewer network layout has been considered in detail to ensure an economic alignment that provides the service required.

A desk review and field reconnaissance was conducted to identify:

a) Area to be served.
b) General topography.
c) The routes (streets or roads) to be traversed by the proposed sewer lines
d) Size and type of existing buildings

After field reconnaissance, the following references were used to prepare alignments:

a) Cadastral maps
b) Topographic maps
c) Google earth aerial image.

Criteria used for the horizontal layouts were to allow location of pipes so that all potential users could readily connect into the system. Considerations on the location for the pipeline and priority for the sewers were made for areas which were public or had existing right of way. The choice for sewer layouts enables utilization of road reserves and areas with adequate access to allow for routine inspection and maintenance. The best alignments have been adopted to serve targeted areas.

2.3 Sewer Network Design

The proposed sewer system comprises of double wall corrugated HDPE pipes sizes 250mm to 300mm. A summary of sewers considered for Kangari and Kigumo is presented in **Table 2-1** below.

Table 2-1: Summary of Sewer lines for Kigumo Sewerage Project

Internal Diameter (mm)		Total Length(m)
300	**250**	
6,786	5,314	12,100

2.4 Sewerage Treatment Works-Sequential Waste stabilization pond

2.4.1 Type of Sewerage System

The sewerage collection system has been designed to exclusively carry municipal sewage, which has been considered as predominantly domestic but would also contain normal pre-treated industrial trade wastes.

The proposed Waste Stabilization Ponds designed to treat 1,770 m^3 per day; will comprise of the following components;

- A total number of 10 No. Wastewater Stabilization Ponds comprises of 2No. Anaerobic Ponds, 2No. Facultative Pond and 6No. Maturation Ponds;
- Inlet Works comprising of fine and coarse screens and grit settling channels;
- Precast concrete pipes and concrete channels;
- Interpond connections;
- Flow measuring devices in inlet and outlet channels.

Table 2-2: Summary of Pond Sizes

Description	Effective Pond Depth (m)	Mid Water Level Dim (m)		Bottom level Dim (m)		Top Water Level Dim (m)		Top level Dim (m)	
		Length (m)	Width (m)	Length (m)	Width (m)	Length (m)	Width (m)	Length (m)	Width (m)
Anaerobic	4	28	14	20	6	36	22	39	25
Facultative Pond	1.8	156	52	153	49	160	56	163	59
Maturation Pond	1.5	47	54	44	51	50	57	53	60

2.4.2 Sewer Pipes Materials

Three pipe materials have been considered and are described below;

i. Concrete Pipes

Concrete pipes were recommended for use in the project due to their local availability, cost and durability. They are structurally more stable and allow lower protection backfill covers. The concrete pipes are manufactured in accordance with BS 556 and are available locally in different sizes. Concrete pipes are either rigidly jointed or flexibly jointed.

ii. HDPE Double Walled Corrugated pipes

Double Wall Corrugated (DWC) pipes are manufactured from HDPE resins and their use can be attributed to their strength, durability, joint integrity and long term cost effectiveness. DWC pipes are readily available in the Kenyan market and have been recommended for use in the project.

iii. uPVC

Although uPVC pipes are hydraulically more efficient than concrete pipes, they have not been widely used for sewer construction in Kenya due to their application being confined to locations where:

- Settlement is likely to occur
- Very steep gradients result in high velocities and possible pipe erosion or
- Water logged areas have to be traversed and concrete pipes become unsuitable because of their porosity.

iv. Steel pipes/ cast iron pipes

Use of steel pipes (bitumen lined) is limited to river crossings and pumping mains only due to the cost of the pipes.

Taking into consideration the hydraulics parameters, ease of installation in areas with limited access and the emerging technologies, DWC pipes have been adopted.

2.4.3 Minimum Size of Sewers

In order to reduce the risk of blockages and to simplify maintenance, it has been recommended that the minimum size of all sewers be 225 mm diameter.

2.4.4 Depth of Sewers

The depths of sewers must generally be sufficient to take the gravity flows of sewage from adjacent domestic and industrial premises.

The normal minimum depth to the crown of sewers has been recommended to be 1m.

Provided that suitable protection is given, property drains may be laid to shallower depths.

It is difficult to make any generalization about the maximum economic depth to which a sewer should be constructed because this depends on ground conditions, depth of the water table, local topography, size of the sewer and its proximity to buildings. However, sewers should rarely be deeper than 8m.

2.4.5 Groundwater Infiltration

Ground water infiltration into sewer pipes largely depends on the quality of the constructed joints and manholes. If these components are properly constructed, the infiltration should be reduced substantially. Further, since reticulation sewers are mostly built at depths of 1-2 meters below the ground surface, the amount of underground water that is likely to enter the sewer pipes would be small. A standardized infiltration rate of 0.025l/s/ha has been adopted.

The sewers have been designed to run at only half full capacity, thus there is adequate space for accommodating some of the unauthorized and unavoidable storm water.

2.4.6 Manhole Spacing and Manhole Diameter

Manholes have been provided on sewers at all changes of horizontal or vertical alignment, at all sewer junctions and generally, throughout the sewerage systems at intervals sufficiently close to simplify sewer cleaning. The manholes spacing and sizes recommended and used in the design are presented in table below. The manholes have been located so as to facilitate easy inspections and cleaning of the sewers and not to allow inflow of storm water runoff into the sewer lines. In open land, therefore, the manholes are to be constructed with the final cover level set at 500 mm above the ground level.

Table 2-3: Recommended Manhole Spacing and Sizes

Size of Sewer (millimeters)	Maximum Spacing (meters)	Minimum Manhole Diameters
230 to 375	60	1050
450 to 610	80	1200
685 to 900	100	1500

Source: Manual Code NCWSC/SC/TEC/ENG/002-M2

It is recommended that pre-cast concrete rings be used for construction of manholes except in special cases where in situ reinforced concrete rings may be used in accordance with approved specifications and standards. Rings of diameters 1050 mm or 1200 mm depending on the size and number of sewer pipes at the manhole junction have been adopted.

2.4.7 Effluent Quality Hydrogen Sulphide Generation and Control

All of the effluent parameters are expected to pass NEMA and WHO guidelines. Periodic testing should be carried out to determine the quality of waste water being discharged to the environment.

2.4.8 Hydrogen Sulphide Generation

Hydrogen sulphide gases are generated within the anaerobic slime layer formed on the submerged pipe walls. These gases released from the slime layer rise into the airway portion of the sewer pipe and react with the bacteria and moisture on the pipe walls to form sulfuric acid (H_2SO_4). It is the sulfuric acid that corrodes ferrous metals and concrete. The release of hydrogen sulfide which is most prevalent downstream of force mains and small diameter pressure sewers, occurs in all sizes of gravity sewers at transition manholes and in a portion of the piping and manholes downstream of the transition manhole and also at sludge processing points. Hydrogen sulfide is hazard to operations personnel (H_2S is a poisonous gas); odor generated during sludge processing can cause community complaints and make plant working conditions unpleasant.

Furthermore, damage to equipment and concrete structures caused by H2S initiated corrosion can be substantial.

2.4.9 Hydrogen Sulphide Control

Pipelines and structures shall be protected from this condition, either by the use of H_2S corrosion resistant pipe materials such as PVC and/or linings/coatings for the sewer pipe and associated manholes/structures, manhole steps, etc.

Proper design of sanitary sewers to establish a proper gradient and flow velocity will prevent grit accumulation and will either eliminate the development of anaerobic slime layer, or at least control such development.

2.4.10 Wastewater Treatment Plants

Sewage treatment works are designed to convert the waste water into an environmentally acceptable effluent and to dispose of the sludge produced during the treatment processes. In general, the required degree of treatment is determined by the existing national discharge standards and the assimilative capacity of the receiving stream.

The treatment works are designed using the following assumptions;

- That they will be operated at optimum hydraulic flow on daily basis;
- Crude sewage characteristics will remain as defined.

Two options have been proposed for consideration in this design report i.e., Waste Stabilization Ponds and Sequential Batch Reactors. Both systems are designed to treat a flow of 1,770 m^3/d

2.5 Implementation Schedule

A period of 30 months will be reasonable and adequate for implementation of project. This comprises of 3 months for bidding process, 3 months for selection of contractor, 12 months' construction period and a 12 months Defects Liability Period (DLP) is recommended.

CHAPTER 3 : ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS

3.1 Introduction

Baseline conditions entail the sum-total of all biophysical and geo-physical condition of the project area. Gathering of baseline data is necessary to meet the following objectives:

- To understand key social, cultural, economic, and political conditions in areas potentially affected by the proposed project;
- To provide data to predict, explain and substantiate possible impacts;
- To understand the expectations and concerns of a range of stakeholders on the proposed development;
- To inform the development of mitigation measures; and
- To benchmark future socio-economic changes/impacts and assess the effectiveness of mitigation measures.

3.2 Geographical Characteristics of project area

3.2.1 Location of the Project

The town is located at Kigumo sub-county in Murang'a County, approximately 80 km North of Nairobi along the Kaharati- Kangari road, on Latitude 0° 47'' South and Longitude 37° 52'26'' East. Based on Murang'a County Plan 2019, Kangari town is proposed to be a municipality. The Kangari town is at a high-altitude area at the foot of the Aberdare Ranges at 2126 mASL. The land falls rapidly to the East, punctuated by numerous hills and very deep valleys that are steep sided.

The main water supply for the town is from Kinyona Water Supply system and is managed by MUSWASCO. The main sanitation facilities within Kangari town are latrines and septic tanks. The nearest sewerage treatment plant where septage can be disposed is at Murang'a Town.

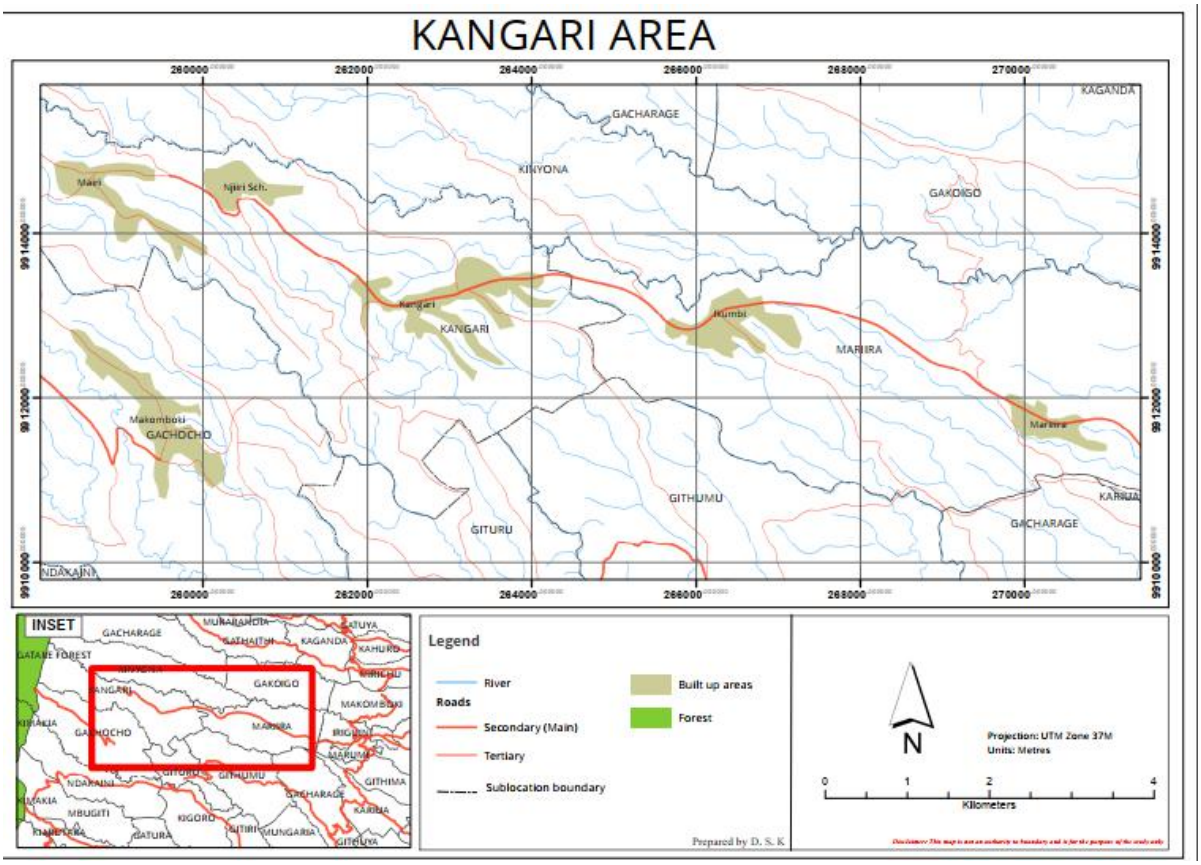


Figure 3-1: Kangari Sewerage Project Area

3.3 Existing Water and Sanitation Situation

3.3.1 Water Supply

3.3.1.1 Surface Water

Surface water resources in Kangari Town and the surrounding area consist of permanent, seasonal streams and rivers as well as weirs. The major rivers within the Town are river Irati, Chathada and Kanja to the North West of Kangari Town.

3.3.1.2 Ground Water

Ground water occurrence is dependent upon geology, rainfall, erosion and recharge. The best aquifers are found when a conjunction occurs of optimum recharge (rainfall, soil permeability), storage (porous rocks) and transmissivity (the ease with which water can travel both vertically and horizontally within an aquifer). Percolation is dependent on soil structure, vegetation coverage and the erosion state of the parent rock. Rocks which weather to clayey soils will naturally inhibit percolation (such as 'black cotton' soils); conversely, the sandy soils resulting from the erosion of some Basement System rocks are eminently suited to deep swift percolation.

A water table occurs between the fractured/weathered contacts of the Basement System rock formations.

The primary recharge source of the aquifer in the Town is lateral flow from the Aberdare catchment areas located south west of the project area, mainly from high mountainous areas. Secondary replenishment of the aquifer is through infiltration and percolation of precipitation through open fissures to the aquifer zones. The movement of groundwater is therefore controlled by the sub-surface morphology of the volcanic rocks. Weathered and/or fractured zones as well as buried valleys, faulty zones and joints are the main media for groundwater movement. The groundwater quality in the area is usually potable and depends mostly on the geology.

Groundwater in Kangari Town has been exploited and a number of sunk wells, for individual. According to feasibility report undertaken by Tana Water Service Board in liason with Howard Humpreys East Africa Ltd (April 2010) in Kigumo Sub County, data for only two boreholes is available. The lack of data in the area is attributed to the availability of sufficient surface water supply from the numerous rivers emanating from Aberdare catchment. Furthermore, the area is served by Kigumo Water Supply, which draws its water from Irati River. The depth of the borehole is 192 m. Aquifers are encountered between 60 and 108 m. The average yield is 3.5 m3/hr.

3.3.2 Sanitation

About 90% of the people in Kangari's rural set up use ordinary pit latrines. About 30% of households in the urban set up use pit latrines and about 70% use septic tanks. The area lacks a proper sewer system. There were no open defecation zones. Kangari town has one public sanitation facility located behind Kangari market. Due to the high usage and small capacity of the pit, filling up and overflowing of raw sewage is common around the area adding to the health risks.

3.4 Topography

The Kangari town high altitude area at the foot of the Aberdare Ranges is about 2400m A.S.L. The land falls rapidly to the East, punctuated by numerous hills and very deep valleys that are steep sided.

Slopes vary with altitude but are dominantly steep, in places exceeding 50%. River valleys are deep and incised. Slopes are moderate in the coffee zone and become gentler in the lower elevation, annual cropping zone. Throughout the catchment slopes tend to be long (i.e., continue a long distance without a significant break) in a longitudinal direction, but often short in a transverse direction. Steep and long slopes are, in principle, conducive to erosion unless carefully managed; short slopes reduce soil erosion.

3.5 Climate

The area experiences bi-modal type of rainfall, with the long rains falling between mid-March to May followed by a cold season usually with drizzle during June to August and short rains between Mid-October to November. The average annual rainfall is over 2,000 mm with an annual mean maximum temperature of the project, area is 23.5°C and the annual mean minimum temperature is 12.5°C. The annual average temperature is 18°C.

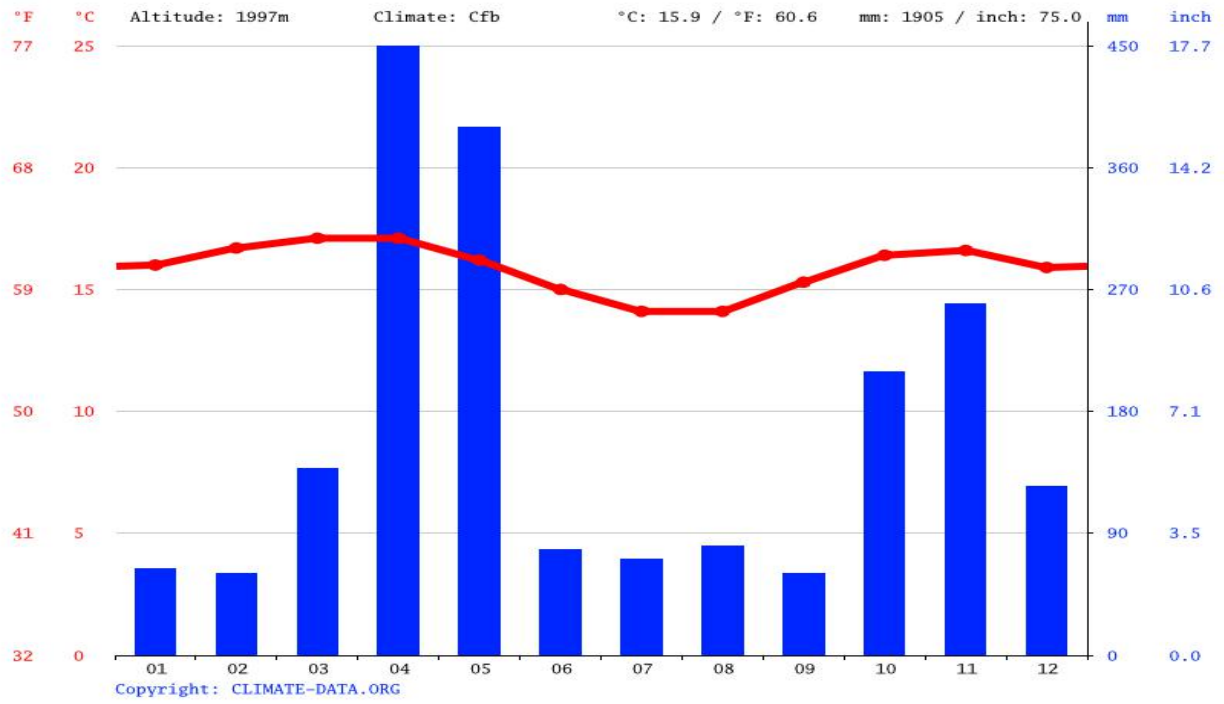


Figure 3-2: Kangari climate data graph (source; Climate-Data.org

Table 3-1: Kangari weather averages data table (source; Climate-Data.org)

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	17.6	18.4	18.9	18.5	17.7	16.4	15.4	15.5	16.8	18.1	18.3	17.4
Min. Temperature (°C)	9.4	9.8	10.7	11.3	11	9.6	8.9	8.9	9.1	10.3	11.3	10
Max. Temperature (°C)	25.8	27	27.1	25.7	24.4	23.2	22	22.2	24.6	25.9	25.3	24.8
Avg. Temperature (°F)	63.7	65.1	66.0	65.3	63.9	61.5	59.7	59.9	62.2	64.6	64.9	63.3
Min. Temperature (°F)	48.9	49.6	51.3	52.3	51.8	49.3	48.0	48.0	48.4	50.5	52.3	50.0

	January	February	March	April	May	June	July	August	September	October	November	December
Max. Temperature (°F)	78.4	80.6	80.8	78.3	75.9	73.8	71.6	72.0	76.3	78.6	77.5	76.6
Precipitation / Rainfall (mm)	51	56	132	372	306	58	47	53	40	151	232	92

Data: 1982 - 2012

3.6 Geology and Soils

The geology of the area consists of deeply weathered lava flows and agglomerates. A large part of the project area is composed of tertiary and Pleistocene volcanic lava which is overlain by red loamy soils. Along the streams recharge is provided by the infiltration of surface discharge, and underflow through the alluvium, faults and the weathered zones.

The soil characteristics of the lower slopes of aberdare ranges (generally below 2,600m) are influenced by the amount of rainfall received in those areas. Soils in the forested mountain areas with high rainfall amounts are intensively red with considerable amounts of clay. The main soil groups are Nitisols, Cambisols and Andosols.

3.7 Socio Economic Characteristics

3.7.1 Population

The most recent census in 2019 indicated an inter-censal growth rate of 1.79% for Kangari and Mareira sublocations and an inter-censal growth rate of 1.89% for Murang'a County. The growth rate of 1.72% has been adopted for population projections in the planning horizon for present and initial years and growth rate of 1.89% has been adopted for population projections in the planning horizon for future and ultimate years.

Adopted growth rates for the projected population for each planning period is as shown in the **Error! Reference source not found.**below:

Table 3-2: Growth Rates for Kangari

Present	Initial	Future	Ultimate
2020	**2023**	**2033**	**2043**
1.72%	1.72%	1.89%	1.89%

Based on the above growth rates, the population has been projected as shown in the Table 3-3 below:

Table 3-3 Projected Population per Location

	Census	Present	Initial	Future	Ultimate

Area	2019	2021	2023	2033	2043
Kangari	2,037	2,108	2,181	2,630	3,171
Mareira	561	581	601	724	873
Total	2,598	2,689	2,782	3,354	4,044

3.7.2 Source of Energy

A vast majority of people in Kangari both the rural and urban areas are well connected to electricity.

The main cooking fuel for people in the rural parts of Kangari is firewood and charcoal. Firewood is obtained from the existing natural forests and vegetation in the area. It is also obtained from the pruning of trees planted on farms and farm boundaries. High dependency on firewood is putting a strain on the few trees remaining in the project area. Residents in the urban areas of Kangari use gas for cooking.

3.7.3 Infrastructure

The area is well served, with good communication and transport. This network facilitates transportation of agricultural products from the area to Nairobi and other parts of the country. Kangari is well linked to Thika and Murang'a towns via Kandara-Gachirigwi, Githumu Road and Kaharati-Kangari road respectively. The town is rapidly growing and so is the need for better infrastructure. More roads like the Kangari-Njabini have started been constructed.

Telephone services in the project area are available with coverage from mobile network service providers.

Figure 3-3: Road to the proposed project site Kangari-Kaharati Road

3.7.4 Education

According to Murang'a Integrated Development plan 2018-2022 Murang'a County, there are 512 primary schools with a pupil enrolment of total enrolment of 191,829 (and 306 Secondary schools with enrolment of 103,946). The county has a public university; Murang'a University of Technology and a private university; Pioneer University Health access.

3.7.5 Health

The major health facility in Kangari is the Kangari Health Centre. There are also several chemists around town where people can have access to medicine.

3.7.6 Economic Activities

The major economic activities in Kangari town include tea farming and dairy farming. Most of the land is under tea plantation. Tea factories that have been established like the Ikumbi Tea Factory have also created employment for the residents of Kangari town. Dairy farming also brings them a lot of income; this is proof especially with the Kangari Creameries present in the town. Many other residents are involved in retail business across the town and in open air markets selling agricultural produce and other essential household items. Many other residents are involved in retail business across the town and in open air markets selling agricultural produce and other essential household items.

3.7.7 HIV/AIDS

According to Murang'a County HIV&AIDS Strategic Plan 2014/15-2018/19 the prevalence rate of HIV &AIDS is 5.6% (KAIS 2012). According to Kenya HIV revolution roadmap, all counties are classified into three clusters high medium and low according to their HIV incidences. Murang'a county is categorized as one of the 28 medium HIV prevalence counties. In 2013 the county recorded 1984 new infections among the adults and 65 among the children below the age of 14 years. It is recognized that some of the major drivers of the high prevalence include: alcoholism, poverty, early sexual debut, low condom uses and multiple sex partners especially among married couples.

HIV & AIDS mostly affects people in the productive age leaving minors and the elderly to take care of the households. Implementation of the project thus needs to create comprehensive HIV & AIDS awareness among the workers along the project area.

3.7.8 Settlement Patterns

The settlements mainly found around the town area and rural parts of the project area clustered along the ridges and near the road. Majority of the structures around the town are multiple storey structures while a few has low rise single storeys.

3.7.9 Land Tenure and Ownership

Majority of the land in Kangari is privately owned. Encroachment of the riparian reserve by farmers was observed during the ESIA Study.

3.7.10 Land use

From observation, vast amount of land in the project area and at the proposed STP site is used for tea growing. Other parts especially around the town comprises of commercial and residential premises. The main crops grown include Tea plantation, cabbage, kales, maize, beans, bananas, coffee and Napier grass amongst others. The people in the area are predominantly farmers and apart from crops, they also practice livestock keeping. The animals reared include dairy animals, poultry, sheep and goat keeping on a small scale.

3.8 Biological Environment

3.8.1 Flora

The general area has natural vegetation and planted vegetation mostly along the plot boundaries and in designated gardens within the respective plot boundaries. The proposed project route has rich vegetation comprising of Napier grass, trees, and the crops planted by the farmers. The vast

vegetation that can be found along the routes and in the proposed STP site is tea plantation. Trees like the silky oak, eucalyptus can be found within and in the immediate neighborhood.

Napper Grass along the propose pipeline route

Tea plantation in the proposed STP

Eucalyptus found along the route

Shrubs along the proposed pipeline route

Figure 3-4: Crops in the project area

3.8.2 Fauna

The site is situated within an area of dense tea vegetation and forests. Consequently, there are no major animals in the environs except for birds, insects, and small rodents. The project phases are not likely to have adverse impacts on the animals

CHAPTER 4 : ANALYSIS OF PROJECT ALTERNATIVES

4.1 Overview

The purpose of this section of the ESIA is to examine feasible alternatives to the project and, highlight the benefits of and general rationale for the project that need to be considered against any potential environmental cost. The general principle involved in identifying option(s) to the proposed development is to ensure that the option chosen, which indeed may be the 'non development' option, would result in optimal returns in social and environmental capital: In effect, the option chosen should bode well not only for the developer, but also for the environment and stakeholders in the area.

This section is a requirement of the National Environment Management Authority (NEMA), and is critical in consideration of the ideal development with minimal environmental disturbance.

4.2 Land Use Options

Feasible land use options are compared in terms of lowest costs and most benefits criteria: environmental impacts, social acceptability, economics (including productivity of land use) and design feasibility. The following land use options detailed below are considered:

- Waste water treatment Methods
- Land acquisition and resettlement impacts
- The "No-Action" Alternative
- The proposed development as described in the ESIA
- The proposed development as described but with alternative location
- EIA With/Without an EMP

4.3 Waste Water Treatment Method

The choice of Waste Water Treatment Technology depends on factors which include; standards of treatment and effluent quality, process complexity and process reliability, ease of operation, land requirements, civil construction requirements, mechanical and electrical plant, sludge production and environmental consideration. The technologies below were considered by the design team before a choice of waste water treatment technology was identified for the proposed project.

I. Waste water Stabilization Ponds

Where climatic conditions are favorable and land is readily available, stabilization ponds are generally the most suitable method of waste water treatment. The units are open, shallow, flow-through lagoons. They require relatively large areas of land to provide the necessary long

retention periods needed to stabilize the organic material in the waste. They operate without mechanical plant and with limited supervision.

II. Aerated Lagoon's

This is a more intensive system of treatment results in greater removal of organics per unit volume of treated waste water than is achieved in stabilization ponds. However, machinery and energy to drive it are necessary. Oxygen is supplied to the waste water by mechanical surface aerators immersed in the liquor, supported either by floating pontoons or by fixed structures in the lagoon. Aerated lagoons are normally considered where there is shortage of land for the development of a straightforward system of Waste Water Stabilization Ponds. The construction requirements of the lagoons are very simple and so capital costs are low. Operation and maintenance procedures are simple, although power costs can be high. The process is not particularly efficient in the reduction of faecal bacteria and subsequent maturation ponds are needed.

III. Biological Filters

These comprise a permeable bed of media, of either graded natural stone or inert synthetic material, usually plastic, around which sewage flows. The filter is generally 2.0m deep and circular in plan. Sewage is evenly distributed on the surface and effluent is collected through under drains in the base, while allowing circulation of air upwards around the material. The units are preceded by primary settlement tanks followed by secondary (humus) settlement tanks to collect the settleable organic solids delivered from the filters. Percolating filters are able to withstand shock loads and provide a reliable means of treating wastewater with relatively little maintenance or skilled supervision. Subsequent maturation ponds or effluent disinfection would be needed for bacterial reduction.

IV. Conventional Activated Sludge Process

The process basically involves the aeration of settled sewage mixed with return sludge within an aeration tank, the air being introduced either by surface aerators or by diffused system into the liquid. The settled incoming sewage is aerated for several hours, during which the micro-organisms in the sewage multiply through assimilation of the organics in the influent wastewater. Part of this reaction synthesizes new cells and the subsequent separation of the biological mass and oxidation reaction are the principle components of BOD removal in the process.

V. Extended Aeration Using Oxidation ditches

Extended aeration using oxidation ditches has the advantage of simple construction, relatively simple operation, no preliminary settling is required, and the sludge produced tend to be stable. An oxidation pond system would normally comprise an oxidation ditch with final clarifiers and

recirculation pumps to re-circulate return sludge to the inlet of the ditch. Because of the length of the aeration period (around 24 hours), power costs can be significant. Subsequent maturation ponds or effluent disinfection would be needed for bacterial reduction.

Table 4-1: Description Comparison of Alternative Wastewater Treatment Methods

Treatment Process	Standard of Treatment	Process Reliability	Process Complexity	Operation & Maintenance Requirements	Land Requirements	Civil Construction Requirements	M & E Equipment	Sludge Production	Environmental Considerations
Waste Stabilization Ponds	Good, except for nutrient removal	Very Good, but climate dependent	Extremely simple. No skills needed	Very limited and simple	large areas of land needed	very simple	Almost none. except possibly at the inlet works	Limited sludge production. Sludge is stable and requires no further treatment	Moderate environmental acceptance Difficult in compliance with stringent effluent standards
Sequential Batch Reactors	Very Good., except for nutrient & bacterial removal	Good, subject to power outages & mechanical failure	Simpler than the other activated sludge system	High requirement for O & M and skilled staff but usually has fewer maintenance problems over its lifetime.	low land requirements	Very Complicated RC structural requirements	Less equipment than other activated sludge system	Sludge from primary & secondary settlement needs treatment	Environmental acceptance They produce effluent low in organic compounds and thus can be used to meet strict effluent standards.
Aerated Lagoons	Good., except for nutrient and	Good, but partly subject to power outages	Very simple. No skills needed	Limited and straight forward	High land requirements, but not as large as WSPs	very simple	Apart from the inlet works, only the	Limited sludge production. Sludge is stable and	Moderate environmental acceptance

Treatment Process	Standard of Treatment	Process Reliability	Process Complexity	Operation & Maintenance Requirements	Land Requirements	Civil Construction Requirements	M & E Equipment	Sludge Production	Environmental Considerations
	bacterial removal	and mechanical failure					surface aerators	requires no further treatment	
Biological Filters	Very Good., except for nutrient and bacterial removal	Good, subject to power outages and mechanical failure	Simple. Limited skills needed	Moderate, but straight forward	Moderate land requirements	Complicated RC structural requirements	Moderate degree of M&E plant needed	Sludge from primary & secondary settlement needs treatment	Some aspects need further environmental consideration
Oxidation Ditch	Very Good., except for nutrient & bacterial removal	Good, but subject to power outages & mechanical failure	Simple Limited skills required	Moderate requirement for skilled O&M staff	Moderate land requirements	Moderate construction requirements	Moderate degree of M&E plant needed	Limited sludge production. Sludge stable & requires no further treatment	Some aspects need further environmental consideration

The waste water stabilization ponds are proposed as the most suitable method of wastewater treatment because it is simple to operate and have high efficiency in both BOD and pathogen removal. They also have low initial, operation and maintenance costs compared to other plants.

4.4 Land Acquisition and Resettlement Impacts

A site for the Wastewater Treatment Plant has been identified as the most favorable site for the proposed project as this will allow gravity flow of the sewer hence avoid pumping which would be expensive on the long run of the project. The site is located in Kigumo Sub County, Mariira Location, Mariira sub location. The site is under cultivation of tea plantation. The site is along Karuchu stream near Ikumbi Tea Factory. Other than the main town, STP strategically located to serve Ikumbi Tea Factory, Ikumbi primary & Ikumbi Secondary School. The Client will be required to acquire Approx. 29acres for the STP.

4.5 "No-action" Alternative

The No action alternative in respect to the proposed project implies that the status quo is maintained. Forgoing development of the sewerage infrastructure project implies that all potential environmental and social impacts associated with the implementation of the project are forgone.

Without adequate sanitation system(s) coupled with an increase in waste generation, the following issues are most likely to continue affecting residents of Kangari Town and their surrounding environs

- Increased pollution of the water sources such as Karuchu stream from untreated waste water.
- Water borne diseases are likely to become prevalent due to consumption of contaminated water
- No improved Health and Sanitation within the target beneficiaries
- No improved living standards, employment and local economy to the target beneficiaries
- Limited opportunities for future growth of Kangari Town and their surrounding environs
- Continued use of exhausters with no designated discharge points
- Continued construction of pit latrines

The expected environmental impacts are not extreme and can be managed to reduce negative impacts on the environment. The No project option was therefore discounted on the basis that sanitation and proper sanitary facilities are critical for population health and prevention of environmental pollution.

4.6 The Proposed Development as described in the EIA

The impacts and mitigation measures for this alternative are discussed in detail throughout this report. The positive impacts have been identified as social and economic opportunities for the local area, as well as a positive impact on the national economy.

This alternative will have minimal impact on the physical environment and has considered the necessary measures to almost eliminate the identified issues of sanitation and water pollution. Implementing the proposed Kangari Town Sewerage Project was considered to the most feasible scenario because of the following reasons

- Reduce cases of water borne diseases associated with pollution of water resources
- Improve Health and Sanitation status of Kangari Town and their surrounding environs
- Reduce pollution of natural river systems which include Karuchu stream and numerous springs within the project area.
- Trigger development of modern infrastructure within Kangari Town and their surrounding due to availability of sewer infrastructure
- Reduce distances covered by exhausters to sludge discharge points eventually reducing costs.
- Residents will decommission pit latrines which are expensive to construct and unsustainable due to short fill-up duration.
- Alleviate the already deficient sanitation systems in Kangari of the only existing dilapidated pit latrine in Kangari Public Market.
- Improve aesthetic outlook of Kangari Town and their surrounding environs
- The project will be associated with technological and knowledge transfer to the local sector, this will be through the artisans employed and trained by the project
- Provision of ready market for construction materials such as sand, ballast and cement that will be sourced from local market, this will lead to injection of money into the local economy
- Employment opportunities during construction especial on unskilled labour force.

4.7 The Development but Alternative Location

This is a no option because residents at the target area are not yet connected to sewer system despite having developed their existing property to deserving standards. The population has already invested in their current land of occupancy. There is good potential for local growth in the area if the project is maintained to serve the target population as planned.

Selection of a new site means the current community would be ignored and the sanitation challenge in the area would continue.

4.8 ESIA With/Without ESMMP

4.8.1 Without ESMMP

This scenario was based on the assumption that the proposed development would go ahead without any environmental management options being implemented. The total project impact for the scenario is on the appreciably adverse side. This shows that if the project goes ahead without ESMMP, the adverse impact on the existing environment would be several times that of the impact without the project. Thus, the ESMMP described in Chapter 8 will have to be implemented to minimize the potential negative impact due to the proposed activity.

4.8.2 With ESMMP

If the environmental management strategies discussed in Chapter 8 is fully implemented, the adverse impact of the project would be reduced, and there will be an overall improvement in physical, chemical, biological and socioeconomic environment of the proposed project area. Therefore, the proposed activity will be beneficial for the environment of the area, provided the ESMMP is in place.

Conclusion: It is clear from the above, that the proposed sanitation project would have negative affect without implementing certain environmental management strategies. If ESMMP, as discussed in Chapter 8, is adopted and implemented, the adverse impacts will be reduced and the overall environmental quality of the area would improve.

CHAPTER 5 : POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

5.1 Introduction

Development of infrastructure projects is dealt with under several laws, by-laws, regulations, Acts of Parliament as well as policy documents and it is not possible to bring all those statutes under one heading. This section is therefore aimed at assessing the existing policies and legislative framework, economic tools and enforcement mechanisms for the management of infrastructure projects at different stages. In so doing, the discussion will be based on the following legislations and policy provision:

5.2 Policy Provision

The proposed investments will be implemented within provisions of various government policies as summarized in **Table 5-1** below:

Table 5-1: Policy Framework

No	Policy	Applicability
1.	Constitution of Kenya 2010	The CoK at Article 43 (1) provides that every person has the right – (b) to accessible and adequate housing, to reasonable standards of sanitation; and, (d) to clean and safe water in adequate quantities. These provisions oblige state organs and bind them to provide not just high quality or clean and safe water but also adequate quantities to all people that they will serve. Also, the Constitution of Kenya provides for sound management and sustainable development of all of Kenya's projects, both public and private investments. It also calls for the duty given to the project proponent to cooperate with State organs and other persons to protect and conserve the environment as mentioned in Part II. **Relevance** The constitution of Kenya provides for sound management and sustainable development of all of Kenya's projects, both public and private investments. It also calls for the duty given to the project proponent to cooperate with State organs and other persons to protect and conserve the environment as mentioned in Part II.
2.	Kenya Vision 2030	This is the current national development blueprint for period 2008 to 2030. The vision has three pillars – economic, social and political. It is recognized that Kenya is a water scarce Country but stated (Kenya, 2007: 115) that the Vision for the water and sanitation

No	Policy	Applicability
		sector is "to ensure water and improved sanitation services availability. **Relevance** The project will directly contribute towards achievement of objectives of vision under the environment and social pillar through provision of the planned sanitation in Kangari Town
3.	National Land Policy 2003,	Chapter 2 of the policy is linked to constitutional reforms; regulation of property rights is vested in the government by the Constitution with powers to regulate how private land is used in order to protect the public interest. The Government exercises these powers through compulsory acquisition and development control. Compulsory acquisition is the power of the State to take over land owned privately for a public purpose. However, the Government must make prompt payment of compensation. Chapter 4 of the land policy under Environmental Management Principles, the policy provides actions for addressing the environmental problems such as the degradation of natural resources, soil erosion, and pollution. For the management of the urban environment it provides guidelines to prohibit the discharge of untreated waste into water sources by industries and local authorities; it also recommends for appropriate waste management systems and procedures, including waste and waste water treatment, reuse and recycling. The policy goes further to advocate for environmental assessment and audit as a land management tool to ensure environmental impact assessments and audits are carried out on all land developments that may degrade the environment and take appropriate actions to correct the situation. Public participation has been indicated as key in the monitoring and protection of the environment. Chapter 4 further advocates for the Implementation of the polluter pays principle which ensures that polluters meet the cost of cleaning up the pollution they cause, and encourage industries to use cleaner production technologies. **Relevance**

No	Policy	Applicability
		The project proponent shall implement the ESMP to ensure that the environment within the project area and adjacent areas is not polluted by the subsequent activities during construction and operational phases. Health and safety measures will have to be maintained with the proximity to affected rivers. The proponent will also ensure that any affected land owner is promptly compensated
4.	National Climate Change Response Strategy, 2010	The strategy paper recognizes that Kenya is a water scarce Country and offers a variety of strategies for ensuring that the resource is utilized in ways that recognize that it is a finite resource. The paper also argues that interventions in the water sector should take a participatory approach involving different water users including gender groups, socioeconomic groups, planners and policy makers in water resource management (Kenya, 2010: 53). **Relevance** These principles will also apply to the sanitation initiatives discussed in this ESIA.
5.	The National Environment Policy, 2013	The goal of the policy is to ensure a better quality of life for present and future generations through sustainable management and use of the environment and natural resources. The objectives of the Policy are *inter alia* to: • Provide a framework for an integrated approach to planning and sustainable management of Kenya's environment and natural resources; • Strengthen the legal and institutional framework for good governance, effective coordination and management of the environment and natural resources; and • Ensure sustainable management of the environment and natural resources, such as unique terrestrial and aquatic ecosystems, for national economic growth and improved livelihoods. Some of the guiding principles in the implementation of the policy include: • **Environmental Right**: Every person in Kenya has a right to a clean and healthy environment and a duty to safeguard and enhance the environment;

No	Policy	Applicability
		• **Right to Development**: The right to development will be exercised taking into consideration sustainability, resource efficiency and economic, social and environmental needs; • **Sustainable Resource Use**: Environmental resources will be utilized in a manner that does not compromise the quality and value of the resource or decrease the carrying capacity of supporting ecosystems; and • **Public Participation**: A coordinated and participatory approach to environmental protection and management will be enhanced to ensure that the relevant government agencies, county governments, private sector, civil society and communities are involved in planning, implementation and decision making processes. ***Relevance*** In chapter 8 an ESMMP is provided, the proponent and contractor should ensure it is implemented in order to ensure that the ecosystems are not destabilized by the subsequent project activities.
6.	Kenya National Youth Policy 2006	This Policy aims at ensuring that the youth play their role alongside adults in the development of the Country. The National Youth Policy visualizes a society where youth have an equal opportunity as other citizens to realize their fullest potential. ***Relevance*** Proposed Sanitation projects will provide direct employment to the youth as required by the Policy.
7.	The National Environmental Sanitation and Hygiene Policy-July 2007	The Policy is devoted to environmental sanitation and hygiene in Kenya as a major contribution to the dignity, health, welfare, social well-being and prosperity of all Kenyan residents. The Policy recognizes that healthy and hygienic behavior and practices begin with the individual. The implementation of the Policy will greatly increase the demand for sanitation, hygiene, food safety, improved housing, use of safe drinking water, waste management, vector control at the household level and encourage communities to take responsibility for improving the sanitary conditions of their immediate environment

No	Policy	Applicability
		Relevance Implementing the project will directly contribute to achievement of the Policy

5.3 Kenyan Legislations

The proposed investment will be implemented within provisions of various Acts of Parliament and Local Legislations as summarized in **Table 5-2** below:

Table 5-2: Acts of Parliament

No	Policy	Applicability
1.	EMCA 2015 with 2015 amendments	The Act provides for the establishment of a legal and institutional framework for the management of the environment. This is achieved through various regulations. **Relevance** The following EMCA Regulations will be applicable: • EMCA (Waste Management) Regulations, 2006 Legal Notice No. 121; • EMCA (Water Quality) Regulations, 2006 Legal Notice No. 120; • EMCA (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 Legal Notice No. 61; EMCA (Air Quality Regulations 2014) • The Environmental Management and Coordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006 Legal Notice No. 160
2.	Environmental (Impact Assessment and Audit) (amendment) Regulations, 2019	The Environmental Impact Assessment and Audit Regulations, Regulation 3 states that "*the Regulations should apply to all policies, plans, programmes, projects and activities specified in Part IV, Part V and the Second Schedule of the Act*. Part III of the Regulations indicates the procedures to be taken during preparation, submission and approval of the environmental project report. Part 4(1) of the Regulation further states that: "no Proponent shall implement a project" (a) Likely to have a negative environmental impact; or (b) For which an environmental impact assessment is required under the Act or these Regulations, unless an environmental

No	Policy	Applicability
		impact assessment has been concluded and approved in accordance with these Regulation. **Relevance** This EIA report has been compiled to comply with EMCA and the Environmental (Impact Assessment and Audit) (amendment) Regulations, 2019.
3.	Environmental Management and Coordination (Water Quality) Regulations, 2006	These Regulations were published in the Kenya Gazette Supplement No. 68, Legislative Supplement No. 36, and Legal Notice No. 120 of 29th September, 2006. The Regulations provides for sustainable management of water resources including prevention of water pollution and protection of water sources (lakes, rivers, streams, springs, wells and other water sources). It is an offence under Regulation No. 4 (2), for any person to throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such substance in or near it, as to cause pollution. Regulation No. 11 further makes it an offence for any person to discharge or apply any poison, toxic, noxious or obstructing matter, radioactive waste or other pollutants or permit the dumping or discharge of such matter into the aquatic environment unless such discharge, poison, toxic, noxious or obstructing matter, radioactive waste or pollutant complies with the standards for effluent discharge into the environment. **Relevance** The proponent should ensure that waste is handled, stored, transported and disposed as per this regulation.
4.	(Waste Management Regulations, 2006	Regulation 4 (1) states that “no person shall dispose of any waste on a public highway, street, road, recreational area or in any place except in a designated receptacle”. Regulation 4 (2) further states that “a waste generator shall collect, segregate and dispose such waste in the manner provided for under these regulations”. Regulation 6 requires waste generators to segregate waste by separating hazardous waste from non-hazardous waste for appropriate disposal. Regulation 15 prohibits any industry from discharging or disposing of any untreated waste in any state into the environment. Regulation 17 (1) makes it an offence for any

No	Policy	Applicability
		person to engage in any activity likely to generate any hazardous waste without a valid Environmental Impact Assessment license issued by NEMA. **Relevance** The proposed project, during construction phases will generate wastes which will need to be disposed of as per the guidelines in the regulations.
5.	Noise and Excessive Vibration Pollution (Control) Regulations, 2009	These regulations were published as legal Notice No. 61 being a subsidiary legislation to the Environmental Management and Co-ordination Act, 1999. The regulations provide information on the following: • Prohibition of excessive noise and vibration; • Provisions relating to noise from certain sources; • Provisions relating to licensing procedures for certain activities with a potential of emitting excessive noise and/or vibrations and • Noise and excessive vibrations mapping. According to regulation 3 (1), no person shall make or cause 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. Regulation 4 prohibits any person to (a) make or cause to be made excessive vibrations which annoy, disturb, injure or endanger the comfort, repose, health or safety of others and the environment; or (b) cause to be made excessive vibrations which exceed 0.5 centimeters per second beyond any source property boundary or 30 meters from any moving source. Regulation 5 further makes it an offence for any person to make, continue or cause to be made or continued any noise in excess of the noise levels set in the First Schedule to these Regulations, unless such noise is reasonably necessary to the preservation of life, health, safety or property. Regulation 12 (1) makes it an offence for any person to operate a motor vehicle which (a) produces any loud and unusual sound; and (b) exceeds 84 dB(A) when accelerating. According to sub-

No	Policy	Applicability
		regulation 2 of this regulation, No person shall at any time sound the horn or other warning device of a vehicle except when necessary to prevent an accident or an incident. Regulation 13 (1) provides that except for the purposes specified in sub-Regulation (2) there under, no person shall operate construction equipment (including but not limited to any pile driver, steam shovel, pneumatic hammer, derrick or steam or electric hoist) or perform any outside construction or repair work so as to emit noise in excess of the permissible levels as set out in the Second Schedule to these Regulations. Regulation 19 (1) prohibits any person to carry out activities relating to fireworks, demolitions, firing ranges or specific heavy industry without a valid permit issued by the Authority. According to sub-regulation 4, such permit shall be valid for a period not exceeding three months. **Relevance** The contractor for civil works will be required to ensure compliance with the above regulations in order to promote a healthy and safe working environment throughout the construction phase. This shall include regular inspection and maintenance of equipment and prohibition of unnecessary hooting by vehicles.
6.	The Environmental Management and Coordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006 Legal Notice No. 160	Part II of Regulations, section 4 states that no person shall engage in any activity that may have adverse impacts on ecosystems, lead to introduction of exotic species or lead to unsustainable use of natural resources without an EIA license. The regulation puts in place measures to control and regulate access and utilization of biological diversity that include among others banning and restricting access to threatened species for regeneration purposes. It also provides for protection of land, sea. Lake or river declared to be a protected natural environmental system in accordance to section 54 of EMCA, 1999. **Relevance** During the construction phase of proposed project, there will be removal of the existing natural vegetation. For this to occur, the

No	Policy	Applicability
		relevant authority, NEMA in this case, will require updating of this ESIA including anticipated impacts before commencement of construction works. **Other relevant EMCA 1999 with 2015 amendments to be considered during construction and operation of the project are;** • Environmental Management and Coordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulation, 2009. • Environmental Management and Coordination (Fossil Fuel Emission Control) Regulations, 2006 • The Environmental Management and Coordination (Controlled Substances) Regulations, 2007 Legal Notice No. 73. **Relevance** EMCA 2015 and above listed regulations shall form the main statutory instruments which will guide the implementation of the project so that any likely adverse impacts that could be caused by the project are promptly mitigated as recommended in this assessment. This report is also in compliance with the requirement of the EIA/EA regulations.
7.	The Physical and Land Use Planning Act, 2019	The Physical and Land Use Planning Act, 2019 is an act of Parliament to make provision for the planning, use, regulation and development of land and for connected purposes. The Act provides a vital link with the Environment Management and Co-ordination Act. For example, Section 36 of the Act states that "In connection with a development application a local authority is of the opinion that proposals for industrial location, dumping sites, sewerage treatment, quarries or any other development activity will have injurious impact on the environment, the applicant will be required to submit together with the application an Environmental Impact Assessment report". This reinforces EIA requirements under EMCA (Amendment), 2015. **Relevance** The Act directs, regulates and harmonizes development and use of land over the Country. The trunk sewers will transverse private

No	Policy	Applicability
		land while the STP is proposed on a private land. The client will need to engage NLC to acquire land for the proposed interventions. The proponent will need to compensate Land owners for the affected parcels.
8.	Land Act, 2012	It is the substantive law governing land in Kenya and provides legal regime over administration of public and private lands. It also provides for the acquisition of land for public benefit. The government has the powers under this Act to acquire land for projects, which are intended to benefit the general public. **Relevance** AWWDA will request NLC to undertake Compulsory acquisition of land that will be required for development of the project. Just compensation will be provided for all whose land will be acquired; and creation of ROW will be necessary where the proposed sewer lines passes through private land.
9.	Water Act, 2016	The Water Act, 2002 was amended in the year 2016 to align to the Kenyan Constitution 2010. The Act vests the responsibility of developing water and sanitation infrastructure (sewerage and water supply services) The Act vests the responsibility of developing water and Sanitation infrastructure (sewerage and water supply) to Water Works Development Agency, in this case represented by Athi Water Works Development Agency. 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 authorized 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 75 and sub-section 1 allows a licensee for water supply to construct and maintain drains, sewers and other works for intercepting, treating or disposing of any foul water arising or flowing upon land for preventing water belonging to the licensee or which he is authorized to take for supply from being polluted. However, if the proposed works will affect or is likely to affect any

No	Policy	Applicability
		body of water in the catchment, the licensee shall obtain consent from the Water Resources Authority. **Relevance to the Project** This Act shall be relevant during both construction and operation phases of the project whereby the contractor and proponent shall ensure that all relevant water resources are not polluted from both liquid and solid waste.
10.	Water Rules 2007	One of the outcomes of the water sector reforms has been improved regulatory framework for water resource management and use. In addition to the Water Act 2002 now Water Act 2016, the main document outlining the regulations is the Water Resource Management Rules 2007. The rules provides that no person : • Shall discharge or apply any poisonous, toxic, noxious or obstructing matter, radioactive waste or other pollutants or permit any person to dump or discharge such matter into any water resource unless the discharge of such poisonous, toxic, noxious or obstructing matter, radioactive waste or pollutant is treated to permissible standards as authorized by the Authority • Shall discharge effluent into a water resource without a valid discharge permit issued by the Authority. • Shall discharge wastewater or effluent, which does not meet the water quality requirements stipulated in the effluent discharge permit. • Shall generate and discharge effluent onto land or into any water resource without compliance with an approved Effluent Discharge Control Plan. • Shall discharge into any water resource effluent from a sewage treatment plant, trade or industrial facility without a calibrated flow measuring device approved by the Authority. The rules also require that developers: • Provides that an application for water resource use with respect to an effluent discharge point

No	Policy	Applicability
		• Provides for maintenance of records of all water discharged giving the date, time quality, quantity and methods of discharge • Provides Guidelines for Effluent Discharge into surface water resources **Relevance** Waste water from the STP to be treated to acceptable standards before discharge into Karuchu stream. An application for a discharge permit to be made and obtained for treated effluent discharge into Karuchu stream. Discharge Control Plans to be prepared for the STP and records of the discharge into Karuchu stream to be maintained.
11.	County Government Act No. 17 of 2012	Part II of the Act empowers the county government to be in charge of functions described in Article 186 of the constitution, (county roads, water and Sanitation, Health). Part XI of the Act vest the responsibility of planning and development facilitation to the county government with collaboration with national government. This arrangement has been adopted for interventions in order not to conflict with provisions of the Kenyan Constitution. **Relevance** The project once commissioned shall be handed over to MUSWASCO which is a water utility company, wholly owned by Murang'a County Government for operation and maintenance in accordance to the Act.
12.	Occupational Health and Safety Act (OSHA 2007)	This legislation provides for protection of workers during construction and operation phases. It is tailored at implementation of the OHS plan in compliance with the relevant sections of this Act. The EMP prepared under this assessment has provided for specific health and safety aspects to be complied with during implementation of the project. **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,

No	Policy	Applicability
		such conveniences shall afford proper separate accommodation for persons of each sex. **Subsection 21 – Prime movers** Every flywheel directly connected to any prime mover and every moving part of any prime mover, shall be securely fenced, whether the flywheel or prime mover is to be situated in an engine –house or not. Head and tailrace of every water wheel and of every water turbine shall be securely fenced. Every part of electric generators, motors and rotary converters and every flywheel directly connected thereto shall be securely fenced unless it is in such a position or of such construction as to be safe to every person employed or working in the premises as it would be if securely fenced. **Subsection 22 -Transmission Machinery** (1) Every part of transmission machinery shall be securely fenced unless it is in such a position or of such construction as to be safe to every person employed or working in the premises, as it would be if securely fenced. (2) Efficient devices or appliances shall be provided and maintained in every room or place where work is carried on by which the power can promptly be cut-off from transmission machinery in that room or place. (3) Every machine intended to be driven by mechanical power shall be provided with an efficient starting and stopping appliance, the control of which shall be in such a position as to be readily and conveniently operated by the person operating the machine. **Subsection 25 - Construction and maintenance of fencing** All fencing or other safeguards provided in pursuance of a foregoing provisions shall be of substantial construction, constantly maintained, and kept in position while the parts required to be fenced or safe guarded are in motion or in use except when any such parts are necessarily exposed for examination and for any lubrication or adjustments shown by such examination to be immediately necessary. **Subsection 13 – Cleanliness**

No	Policy	Applicability
		Every factory/work place shall be kept in a clean state and free from effluent arising from any drain, sanitary convenience or nuisance. **Subsection 14 – Overcrowding** A factory/ work place shall not while work is carried on be so overcrowded as to cause risk of injury to the health of the persons employed therein. Standard cubic space allowed for every person in a workroom should not be less than three hundred and fifty cubic feet. **Section 51- Air pollution** Preventive measures shall be put in place during operation of the project to prevent fumes and exhaust gases from entering into the atmosphere. **Relevance** The Act provides EHS Guidelines which shall be followed by both the Contractor and Supervising Consultant during implementation of the project to avoid injuries and even loss of life to workers and neighboring community.
13.	The Public Health Act (CAP.242)	Part IX section 115 of the Act states that no person/institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 requires Local Authorities to take all lawful, necessary and reasonably practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable for injurious or dangerous to human health. Such nuisance or conditions are defined under section 118 and include nuisance caused by accumulation of materials or refuse which in the opinion of the medical officer of health is likely to harbor rats or other vermin. **Relevance** The Act provides Guidelines to the Contractor on how he shall manage all wastes (Liquid and Solid Wastes) emanating from the project in a way not to cause nuisance to the community. This Act, during construction shall be read alongside the Waste Management Regulations of EMCA 2015 for utmost compliance.

No	Policy	Applicability
14.	Employment Act	This is an Act of parliament that applies to all employees employed by any employer under a contract of service. The Act came in operation in June 2008. Employment of children in the following forms is prohibited in the following sections of the Act: 53. (1) notwithstanding any provision of any written law, no person shall employ a child in any activity that constitutes worst form of child labour. 56. (1) No person shall employ a child who has not attained the age of thirteen years whether gainfully or otherwise in any undertaking. (2) A child of between thirteen years of age and sixteen years of age may be employed to perform light work which is (a) Not likely to be harmful to the child's health or development; and (b) Not such as to prejudice the child's attendance at school, his participation in vocational orientation or training Programs approved by Minister or his capacity to benefit from the instructions received. **Relevance** AWWDA and the contractor will need to understand the requirements of the Act during employment. Equal opportunity should be given to all both men and women so as to ensure equity. Child labour will be prohibited.
15.	HIV and AIDS Prevention and Control Act 2011	The object and purpose of this Act is to (a) promote public awareness about the causes, modes of transmission, consequences, means of prevention and control of HIV and AIDS; (b) extend to every person suspected or known to be infected with HIV and AIDS full protection of his human rights and civil liberties. **Relevance** The Act provisions will be applied during project implementation phase where the contractor will be required to create awareness among workers and community at large
16.	Sexual Offences Act 2006	An Act of Parliament that makes provision about sexual offences aims at prevention and the protection of all persons from harm

No	Policy	Applicability
		from unlawful sexual acts and for connected purposes. Section 15, 17 and 18 focuses mainly on sexual offenses on minor (children).
17.	Child Rights Act (Amendment Bill) 2014	This Act of Parliament makes provision for parental responsibility, fostering, adoption, custody, maintenance, guardianship, care and protection of children. It also makes provision for the administration of children's institutions, gives effect to the principles of the Convention on the Rights of the Child and the African Charter on the Rights and Welfare of the Child. **Relevance** The contractor under this project will be required to comply to provisions of the Act during project implementation
18.	Work Injury Benefits Act (WIBA)	It is an act of Parliament to provide for compensation to workers for injuries suffered in the course of their employment. It outlines the following: • Employer's liability for compensation for death or incapacity resulting from accident; • Compensation in fatal cases; • Compensation in case of permanent partial incapacity; • Persons entitled to compensation and methods of calculating the earnings; • No compensation shall be payable under this Act in respect of any incapacity or death resulting from a deliberate self-injury; • Notice of an accident, causing injury to a workman, of such a nature as would entitle him for compensation shall be given in the prescribed form to the director. **Relevance** The contractor will need to abide by all the provisions of WIBA.
19.	Labour Relations Act 2012	An Act of Parliament to consolidate the law relating to trade unions and trade disputes, to provide for the registration, regulation, management and democratization of trade unions and employers organizations or federations, to promote sound labour relations through the protection and promotion of freedom of association. **Relevance**

No	Policy	Applicability
		This act will be applied by labour force on site in addressing disputes related to working conditions.
20.	National Gender and Equality Commission Act 2011	The over-arching goal for NGEC is to contribute to the reduction of gender inequalities and the discrimination against all; women, men, persons with disabilities, the youth, children, the elderly, minorities and marginalized communities. **Relevance** This Act will be applied during hiring of workforce on site
21.	Public Participation Bill of 2016	The Bill is an Act of Parliament that provides a general framework for effective public participation and to give effect for the constitutional principles of democracy. The purpose of the act includes promotion of democracy and public participation of the people according to Article 10 of the Constitution, promote community ownership for public decisions and promote public participation and collaboration in governance processes. **Relevance** In adherence to the Bill, public consultation, though interviews were carried out during project ESIA study and in the full ESIA study. Consultations will continue throughout the project construction phase.
22.	Permits and Licenses	The Proponent should demonstrate compliance to the legislation through acquisition of the appropriate licenses and permits. Furthermore, all contractors and consultants who will be engaged during the planning and design, construction, operation and maintenance and decommissioning should demonstrate compliance to the necessary pieces of legislation. These includes: NEMA registration certificates, collection of waste by a NEMA licensed handler among others. AWWDA will before project operation apply for license to discharge into the environment.

5.4 African Development Bank Policy Provisions

The African Development Bank's environmental policy framework is strongly anchored in the concept of sustainable development. This concept defines sustainability as "development that meets the needs of the present without compromising the needs of the future".

The AfDB Operational Safeguards (OS) include:

5.4.1 OS 1: Environmental and Social Assessment.

This OS governs the process of determining a project 's environmental and social category and the resulting Environmental and Social Assessment requirements. The requirements cover the scope of application, categorization, use of Strategic Environmental and Social Assessment (SESA) and Environmental and Social Impact Assessment (ESIA) where appropriate, Environmental and Social Management Plans, climate-change vulnerability, public consultation, community impacts, treatment of vulnerable groups, including indigenous peoples, and grievance procedures.

The OS requires:

- Screening of the project for environmental and social impacts including climate change impacts, potential adaptation and mitigation measures, and the vulnerability of populations and their livelihoods—to determine the specific type and level of environmental and social assessment;
- Scoping of the project's components, including delineating the project's geographic and temporal area of influence, consideration of alternatives, and assessment of cumulative impacts, where relevant. Scoping activities also determine the range of likely potential risks and impacts and also determines whether specific requirements of the Bank's OSs apply. All relevant direct and indirect environmental and social risks and impacts, including those specifically covered the other Operational Safeguards would be addressed in an integrated manner;
- Consideration of real alternatives to the project's location and/or design to avoid adverse impacts. The mitigation hierarchy to be applied includes: if avoidance is not possible, reduce and minimize potential adverse impacts; if reduction or minimization is not sufficient, mitigate and/or restore; and as a last resort compensate for and offset;
- Assessment to comply with the relevant legislation and standards applicable in the local jurisdiction, bearing in mind the equivalence of standards with those of the Bank. Assessment to also take into consideration national or regional- level programming documents that are under implementation or in preparation;
- Assessment process to support and strengthen existing country systems for environmental, climate, and social risk management, including those specifically related to OS 2-5, such as systems and institutions covering resettlement, biodiversity protection, pollution control, and labor standards;
- The assessment to be conducted according to the principles of proportionality and adaptive management. The level of assessment and management required should be proportionate to the level of risk that the project poses as identified during categorization

and scoping—and the management measures adopted should be capable of being adapted to changing circumstances during the full project cycle;

- Assessment to include the development of a comprehensive and implementable ESMP with a realistic timeframe, incorporating the necessary organizational capacity (including further training requirements) and financial resources to address and manage the environmental and social risks that may occur during the full project cycle;

Categorization of projects based on the principle of appropriate type and level of environmental and social assessment for the type of operation. The categories include:

- **Category 1-** projects likely to induce significant and/or irreversible adverse environmental and/or social impacts, or to significantly affect environmental or social components that the Bank or the borrowing country considers sensitive
- **Category 2:** Projects likely to have detrimental site-specific environmental and/or social impacts that are less adverse than those of Category 1 projects. Likely impacts are few in number, site specific, largely reversible, and readily minimized by applying appropriate management and mitigation measures or incorporating internationally recognized design criteria and standards
- **Category 3:** Projects which do not directly or indirectly affect the environment adversely and are unlikely to induce adverse social impacts. They do not require an environmental and social assessment. Beyond categorization, no action is required.
- **Category 4:** Projects which involve Bank lending to financial intermediaries that on-lend or invest in subprojects that may produce adverse environmental and social impacts

- The Proposed Project component will trigger this safeguard. The project is Category 1 due to the interaction with the physical, biological and social setting within the immediate surroundings. It also leads to resettlement.

5.4.2 OS 2: Involuntary Resettlement: Land Acquisition, Population Displacement and Compensation.

This safeguard consolidates the policy commitments and requirements set out in the Bank's policy on involuntary resettlement, and incorporates a number of refinements designed to improve the operational effectiveness of those requirements. In particular, the OS embraces comprehensive and forward-looking notions of livelihood and assets, to account for their social and cultural dimensions, as well as their economic ones. It also adopts a progressive understanding of community and common property that emphasizes the crucial need to maintain social cohesion, community structures and the social inter- linkages that common property provides.

- The proposed project will transverse through private land. In addition, the STP will be constructed on privately owned land. This policy is therefore triggered.

5.4.3 OS 3: Biodiversity and Ecosystem Services

This safeguard aims to conserve biological diversity and promote the sustainable use of natural resources. It also translates the commitments in the Bank's policy on integrated water resources management into operational requirements. It reflects the importance of biodiversity in the African continent and the value to the population of key ecosystems. Its content has benefited from recent joint work among the Multilateral Development Banks (MDBs) to improve their approach to assessing how the potential impacts of projects on different types of habitats can be avoided, minimized or offset.

- Project activities have no direct linkage to biological diversity and ecosystem services. OS 3 shall be applied in isolated minor cases of biodiversity and ecosystem services.

5.4.4 OS 4: Pollution prevention and control, hazardous materials and resource efficiency.

This safeguard covers the range of key impacts of pollution, waste, and hazardous materials for which there are agreed international conventions, as well as comprehensive industry-specific and regional standards, including greenhouse gas accounting, that other multilateral development banks follow. It also introduces a GHG emission threshold for projects to trigger a detailed analysis of feasible reduction or offset measures and reporting on emission levels. Borrowers or clients are required to consider measures to improve resource efficiency.

- The project shall utilize raw materials both during construction and operation phase that could result to pollution of biophysical environment if not handled appropriately. Project activities shall not result to significant amount of greenhouse gases. The EMSP has proposed measures of ensuring that any greenhouse gas generated shall be collected and flared appropriately. The project triggers OS 4.

5.4.5 OS 5: Labour conditions, health and safety

This safeguard establishes the Bank's requirements for its borrowers or clients concerning workers' conditions, rights and protection from abuse or exploitation. It also ensures greater harmonization with most other multilateral development. It also covers workers' organizations, and avoidance of child or forced labour and occupational health and safety.

The project shall involve workers both during construction and operation phases of the project. This policy reads together with OSHA 2007 and IFC Performance Standards. Labour and Working Conditions shall form integral instruments to be used in ensuring that health, safety and working conditions of both workers and community is maintained. The project triggers OS 5.

Table 5-3 summarizes the project activities checked against the operational safeguards, and how the project activities are likely to trigger each of the operational safeguards.

Table 5-3: Analysis of potential impacts to African Development Bank Operating standards Policies

OS	Title	Comments/Impact
OS 1:	Environmental and Social Assessment.	Applicable. The project components will trigger EA safeguards and is Category 1 due to the interaction with the physical, biological and social setting within the immediate surroundings.
OS 2:	Involuntary Resettlement: Land Acquisition, Population Displacement and Compensation.	Applicable. The trunks will transverse via private land and the STP will be constructed within private land.
OS 3	Biodiversity and Ecosystem Services.	Applicable. Project activities have no direct linkage to biological diversity and ecosystem services OS 1 shall be applied in isolated minor cases of biodiversity and ecosystem services.
OS 4:	Pollution Prevention and Control, Greenhouse Gases, Hazardous Materials and Resource Efficiency.	Applicable. The project shall utilize raw materials both during construction and operation phase that could result to pollution of biophysical environment if not handled appropriately. Project activities shall not result to significant amount of greenhouse gases, EMSP has proposed measures of ensuring that any greenhouse gas produced is collected and flared appropriately. The project design has ensured that the both clean water and sewer flows through the distribution lines by gravity hence reducing the need for pumping.
OS 5:	Labour Conditions, Health and Safety.	Applicable. Project shall involve workers both during construction and operation phases of the project. This policy read together with OSHA and IFC Performance Standards 2 Labor and Working Conditions Shall form integral instruments to be used in securing that health, safety and working conditions of both workers and community is maintained.

5.5 Institutional Structure of the water sector

The National Policy on Water Resources Management and Development and the Water Act 2016, presently guides water resources management. The Water Act 2016 has realigned this arrangement slightly to comply with the requirements of the new constitution 2010 The overall goal of the National Water Development Policy is to facilitate the provision of water in sufficient quantity and quality and within a reasonable distance to meet all competing uses in a sustainable, rational and economical way.

The Ministry of Water, Sanitation and Irrigation is responsible for policy development, sector co-ordination, monitoring and supervision to ensure effective Water and Sewerage Services in the Country, sustainability of Water Resources and development of Water resources for domestic, irrigation, commercial, industrial, power generation and other uses. The Ministry executes its mandate through the following sector institutions:

5.5.1 Water Resource Authority (WRA)

WRA is responsible for regulation of water resources issues such as water allocation, source protection and conservation, water quality management and pollution control and international waters. Its roles and responsibilities are as follows:

- Planning, management, protection and conservation of water resources;
- Planning, allocation, apportionment, assessment and monitoring of water resources;
- Issuance of water permits;
- Water rights and enforcement of permit conditions;
- Regulation of conservation and abstraction structures;
- Catchment and water quality management;
- Regulation and control of water use; and
- Coordination of the Integrated Water Resource Management (IWRM) Plan.

5.5.2 Water Services Regulatory Board (WASREB)

The regulatory Board is responsible for the regulation of the water and sewerage services in partnership with the people of Kenya. The mandate of the regulator covers the following key areas:

- Regulating the provision of water and sewerage services including licensing, quality assurance, and issuance of guidelines for tariffs, prices and disputes resolution.
- Overseeing the implementation of policies and strategies relating to provision of water services licensing of Water Services Boards and approving their appointed Water Services Providers,

- Monitoring the performance of the Water Services Boards and Water Services Providers,
- Establish the procedure of customer complaints,
- Inform the public on the sector performance,
- Gives advice to the Minister in charge of water affairs.

5.5.3 Water Works Development Agencies

The WWDAs are responsible for the efficient and economical provision of water and sewerage services in their areas of jurisdiction. AWWDA is among the nine agencies established under the Water Act, 2016 and is mandated to:

- Plan and develop National Public Water Works for bulk water supply;
- Formulate Development and Investment Plans in liaison with county governments;
- Provide input to the national development and financing plan; and
- Provide technical assistance to Water Service Providers for county asset development AWWDA is the implementing Agency in this proposed project.

5.5.4 Water Service Providers

Water Service Providers are the utilities or water companies. They are under the leadership of the County Governments but have been commercialized to improve performance and run like business within a context of efficiency, operational and financial autonomy, accountability and strategic, but minor investment. MUSWASCO is the WSP that will be in charge of the proposed project.

5.6 Project Implementation Institution Structure

AWWDA has established implementation units for the project with project engineers in charge for various county projects, the Agency hires on case by case basis the services of environment specialist to oversee implementation of the EMSP developed for projects.

I. The Contractor

The contractor will be required to establish an environmental office to continuously advise on environmental components of the project implementation. Elements in the environmental and social management plan are expected to be integrated in the project with appropriate consultations with AWWDA through the supervising environmental expert. The environmental officer of the contractor is also expected to fully understand the engineering and management aspects of the project for effective coordination of relevant issues.

II. The Supervisor

The supervisor will be engaged by AWWDA (as the project proponent) to ensure effective implementation of the environmental management plan. It is expected that the supervisor engages the services of an environmental expert who should in return understand the details of the recommendations on environment management and especially the proposed action plans, timeframes and expected targets of the management plan. The environmental expert should also be the liaison person between the contractor and AWWDA on the implementation of environmental concerns as well as issues of social nature associated with the project.

CHAPTER 6 : PUBLIC PARTICIPATION AND CONSULTATION

6.1 Introduction

Public consultation is useful for gathering environmental data, understanding likely impacts, determining community and individual preferences, selecting project alternatives and designing viable and sustainable mitigation and compensation plans.

Public consultation process for the Kangari Town Sewerage Project took place at the scoping stage and the ESIA stage. The main objective for the consultation process was to involve the community at the very early stages so as to identify likely negative impacts and find ways to minimise negative impacts and enhance positive impacts of the project.

6.2 AfDB Operational Safeguard 1 – Environmental and social assessment

The AfDB Environmental and Social Assessment safeguard policy, provides for stakeholders' participation during the consultation process so that affected communities and stakeholders have timely access to information in suitable forms about the Bank operations, and are consulted meaningfully about issues that may affect them. In line with this, the ESIA for the project is mandatory and it is regulated in line with the Banks policy OS 1.

6.2.1 Objectives of the Public Consultations

The overall goal of the consultation process is to disseminate project information and to incorporate the views of the project beneficiaries and project Affected Persons (PAPs) in the design of the mitigation measures and a management plan.

The specific aims of the consultation process are to:

- Improve project design and, thereby, minimize conflicts and delays in implementation;
- Facilitate the development of appropriate and acceptable entitlement options;
- Increase long term project sustainability and ownership;
- Reduce problems of institutional coordination;
- Make the resettlement process transparent; and
- Increase the effectiveness and sustainability of income restoration strategies, and improve coping mechanisms.

An important element in the process of impact assessment is consulting with stakeholders to gather the information needed to complete the assessment. The main objectives of community consultations were to:

- Provide clear and accurate information about the project to the beneficiary community;
- Obtain the main concerns and perceptions of the population and their representatives regarding the project;

- Obtain opinions and suggestions directly from the affected communities on their preferred mitigation measures; and
- Identify local leaders with whom further dialogue can be continued in subsequent stages of the project.

6.3 Stakeholders' consultation

A stakeholders workshop and Key informant interviews were held with several leaders within Kigumo sub county and Murang'a County. Minutes of the stakeholder's meetings are part of the annexure (Annex 3). A summary of the discussions are as shown in **Table 6-1** below. The consultation-filled questionnaires are annexed (annex 4).

Table 6-1: Summary of findings from key stakeholder's consultations

No	Name	Designation	Comment	Response
•	Elias K. Gachau	Chief Public Health Officer	• Concern about involvement of all the stakeholders in the implementation of the project.	• All the stakeholders are being fully engaged by interviewing them and holding public barazas. Public barazas have been held to inform the public about the sewerage. Benefits of a sewerage treatment plant will be mentioned and they will be informed on why it's advisable to connect to a sewer line
			• Environmental Impact Assessment should be done before project implementation.	• EIA has been carried out and the purpose of the interviews and engagement of the stakeholders is to incorporate their views for the finalization of the ESIA report
			Positive impacts of the project • The project will promote the reduction of river contamination. • The project will result in improvement in socio-economic	

No	Name	Designation	Comment	Response
			status of the catchment population. • The project will bring about reduction of open defecation thus reducing environmental pollution. • The project will contribute in the reduction of sanitation related diseases like diarrhea to the catchment population.	
•	Simon Wainana Ng'ang'a	Physical Planner Kigumo Sub County	• Concern if an Environmental Impact Assessment • Concern about public participation and sensitization. • Ensure job opportunities are given to the local people.	• EIA has been carried out and the purpose of the interviews and engagement of the stakeholders is to incorporate their views for the finalization of the ESIA report • All the stakeholders were being fully engaged by interviewing them and holding public barazas. Public barazas will be held to inform the public about the sewerage. Benefits of a sewerage treatment plant will be mentioned and they will be informed on why it's advisable to connect to a sewer line • A committee will be formed and the chief will be fully engaged to choose qualified personnel.

No	Name	Designation	Comment	Response
			• Concern about vectors and bad smell from the disposal site	• The project will be computerized and the Water Service Provider (MUSWASCO) offices will be constructed at the STP site for maintenance and operation. Planting of trees will be done in the areas to purify the air.
			• Concern about bust of pipes and seepages.	• The project will be computerized and the Water Service Provider (MUSWASCO) offices will be constructed at the STP site for maintenance and operation. • The pipes to be used are of high quality and up to standard. They don't wear out easily unless they are subjected to illegal connections from the members of the community
			• Recommendation for dust control during trench digging	• Workers shall be trained on management of air pollution from vehicles and machinery. All construction machinery shall be maintained and serviced in accordance with the contractor's specifications • Water sprays shall be used on all earthworks areas within 200 meters of human

No	Name	Designation	Comment	Response
				settlement especially during the dry season.
			• Recommendation to provide protective gear for the worker	• Personal Protective Equipment including gloves, gum boots, overalls and helmets to workers, use of PPEs will be enforced by the Supervising Engineer.
			• Recommendation that there be coordination between the physical planning department and Athi Water Works Development Agency to ensure smooth operations.	• There will be maximum engagement and coordination among all stakeholders involved.
			• The project will create employment for the local people. • The project will promote pollution management for the town. **Positive impacts of the project** • The project will promote health management. Sanitation and vector borne related diseases will be reduced. • The project will promote cost cutting for developers.	• Local people both skilled and non-skilled will be given first priorities during labor recruitment.
•	Beatrice Gicheha	Sub County Administrator Murang'a County Government.	• Concern if there is adequate engagement of the local labor during project implementation. • Concern about smell coming from the sewerage plant.	• First priority in the employment of non-skilled labor will be given the to the local people. • Trees will be planted at the STP site that will assist in the purification of the air. MUSWASCO offices (WSP)

No	Name	Designation	Comment	Response
				will be constructed at the STP site for the operation and maintenance of the system.
			• Concern about disruption of road network especially where the pipework has to cut across the road.	• Adequate and appropriate road signs will be erected to warn road users of the construction activities. This should be done in conjunction with the NTSA • The movement of equipment (trucks) during the construction of the facility will be limited to the working hours 8:00 am - 5:00 pm every day. All equipment will be transported early morning with proper care being taken to reduce inconveniences to locals.
			• Ensure the work is done perfectly well to avoid incidents of sewerage pipe leakage	• All materials to be used are of good quality and will be up to KEBS standards. Workers will be fully trained on how to perform their work diligently. The Water Service Providers MUSWASCO will be responsible for operations and maintenance of the sewerage pipes.
			• Kindly ensure mutual engagement with County Government of Murang'a through the office of the Sub County Administrator of the	• All stakeholders are being fully and will continue been engaged fully to ensure smooth running of the project.

No	Name	Designation	Comment	Response
			areas the project being implemented. • The project will lead to increased access to clean and safe drinking water. **Positive impacts of the project** • The project will result in appropriate waste and drainage disposal. • The project will lead to growth of the local economy through engagement of local labor. • Ablution block in Kangari Market will help in keeping the town clean.	• With an improved sewer system in the area, there will be less contamination of the existing water sources thus ensuring access to clean and safe water.
•	Joseph Mwangi	Sub County Agriculture Officer.	• Concern about air pollution and if there will be regular watering during construction to reduce air pollution from dust that may affect crops and people. • Concern about displacement of people and adequate compensation of displaced people. • Concern about interruption of domestic water supply during construction.	• Water sprays shall be used on all earthworks areas within 200 meters of human settlement especially during the dry season. • The contractor shall comply to the provisions of EMCA 1999 amended in 2015 (Air Quality Regulations 2014) • Compensation will be made fully for those people that might be relocated. • We shall work closely with water service providers of the area(MUSWASCO) to ensure no pipes are destroyed. Setting out will be done to mark the areas that

No	Name	Designation	Comment	Response
			• Ensure liaison with water and irrigation department to reduce water pipe destruction. **Positive impacts of the project** • The project is good since it will improve waste management in the sub county and reduce water pollution. • The project will create employment. • The project will reduce river pollution • It will reduce air pollution • The project will reduce waterborne diseases.	will be trenched and also identifying crucial infrastructure along the route. • All stakeholders will be fully engaged through the project implementation period. The Water Service Providers (MUSWASCO) will work closely with the team during repairs of damaged water pipes.
•	Peter Waiguru	C.O. Ministry of Livestock	• Irrigation water shall be more profitable to the residents of the sub county simply because many are farmers and this shall improve the lives of many residents. Recommendation for irrigation water project rather than sewerage project because of the good drainage system in the Sub County	• AWWDA is one of the Development Agencies under the Ministry of Water, Sanitation and Irrigation responsible for the development of water and sewerage infrastructure. After implementation, the projects are handed over to the Water Service Providers

No	Name	Designation	Comment	Response
			• Both sewerage and irrigation projects are of value to the residents and if it can be implemented, they shall impact their lives positively. • Many unemployed youths shall benefit from this project. • The project shall improve the drainage of the area. • It shall improve human health since sanitation related diseases shall reduce.	for operation and maintenance. AWWDA is responsible for implementation and construction of water pipelines, water tanks and sewer lines projects
•	Abigael Wangari	Sub-County Public Health Officer(Kangari)	• Concern about the siting of the sewerage treatment plant that is wind direction. • Concern about heavy traffic flow • Concern about displacement of people and destruction of property • Concern about air and noise pollution	• Trees will be planted at the sewerage treatment plant to act as buffer zones and wind breakers. • The movement of equipment (trucks) during the construction of the facility should be limited to the working hours 8:00 am - 5:00 pm every day. • Compensation will be fully given to the affected person • Workers shall be trained on management of air pollution from vehicles and machinery. All construction machinery shall be maintained and serviced in accordance with the

No	Name	Designation	Comment	Response
				contractor's specifications use equipment that has low noise emissions as stated by the manufacturers. • Use equipment that is properly fitted with noise reduction devices such as mufflers.
			• Concern about safety of the works	• Personal protective equipment will be provided to workers. • Workers will also be trained about safety measures to be applied at the workplace.
			• Concern about spread of communicable diseases, sexually transmitted diseases and covid19	• HIV/AIDS awareness program will be instituted and implemented as part of the contractor's health and safety management plan and to be enforced by the supervising team. COVID 19 measures will be fully adhered to, provision of face masks and handwashing water and soap will be done.
			• Concern about the efficiency of the sewerage treatment works.	• The system that will be used is the sequential batch reactors a modernized, very efficient system. There will be MUSWASCO personnel responsible for maintenance and operations.

No	Name	Designation	Comment	Response
			• Concern if the effluents been released back to the water bodies will be safe. • Concern about the terrain and cases of erosion. • Recommendations to ensure workers are given protective clothing and also ensuring regular sprinkling of roads to minimize dust. • Suggestion to ensure frequent sampling and testing of effluents B.O.D before releasing it to the environment. **Positive impacts of the project** • The project will create employment to the community • The project will result in the upgrading of life through abating nuisance. • The project will result in reduction of oral fecal and waterborne diseases. • There will be a reduction in environmental pollution.	• After treatment the water will be thoroughly tested to ensure there are no microorganisms or heavy metals. • Soil protective mechanisms will be implemented like building of gabions. • Workers will be provided with appropriate protective clothing such as dust masks, gloves and also regular sprinkling of roads to minimize dust will be done. • Regular testing of the treated water will be done and after treatment the water will be thoroughly tested to ensure there are no microorganisms or heavy metals.

No	Name	Designation	Comment	Response
			• It will maintain sustainable development meeting the needs of today without affecting the needs of future generations • The project will enable students and other people gain experience • The project is essential especially due to the high population growth rate.	

6.4 Public Consultations during the Scoping Stage

Public participation was done through administration of open-ended questionnaire aimed at introducing the project to the Kangari key stakeholders and residents, gathering their views and concerns related to the project and incorporating their views into the project. 81 questionnaires were fully filled and collected. The completion of such questionnaires subsequently allowed for the synthesis and analysis of issues that arose which provided basis upon which the social aspect of the ESIA was undertaken.

6.5 Consultations during the Full ESIA Stage

Stakeholder's workshop was the initial meeting that was held with the key informants at the beginning of the ESIA studies. Key informant stakeholder and public consultations were held during the full ESIA stage via one and one interviews using standard questionnaires.

6.6 Public Consultation during full ESIA Stage

Public sensitization meetings were held within the project area in February 2021 with the help of the respective local administration more so the area chiefs and assistant chiefs. A total of 2 meetings were held as shown in Table 6-2 below. The attendance lists and minutes of meetings are presented in Annex 3. Interviews using standard questionnaires were also conducted (Annex 4)

Table 6-2: Public participation meeting schedule

No	Date	Venue	Location
•	19.03.2021	Ikumbi Markat	Marira
•	19.03.2021	Kangari town	Kangari

6.7 Summary of Comments from Public Sensitization Meetings

- The residents were concerned that the proposed sewerage would displace people. They also stated there is limited land space in the area. The residents further stated that they wanted the proposed STP to be constructed on public land and not in their private lands The residents were informed there would be compensation given for those that would be affected by the project. They were further informed that the proposed STP site was determined based on the costs of implementation and operation and also it took into consideration the large population that would be served by the STP hence it would be a challenge if the proposed site was to be changed.
- The community wanted to know how and who will be responsible for ensuring the STP does not result in air pollution especially through smell. They were informed there would be offices built at the proposed STP that will be run by the Water Service Providers of the area (MUSWASCO) to ensure easy monitoring and maintenance of the system. They were further informed that trees will be planted around the area and act as buffer zones to purify the air around the Sewerage Treatment Plant.
- The residents wanted to know who will be the responsible person/s in managing pipe bursts after project implementation. They were informed that it will be the responsibility of the Water Service Provider MUSWASCO.
- The residents wanted to know the depth that would be dug for laying of the pipes. They further enquired if they will be able to continue planting crops after project implementation. The Consultant informed the meeting that the project involved digging trenches approximately 3 meters deep and cover up the area. They were further informed they would continue planting their crops excluding the planting of trees and building houses once project implementation is complete
- The community wanted to know whether job opportunities will be given to the local people. They were informed job opportunities will be available and the Contractor will be advised to liaise with the Chief to identify the area residents who will be considered for such opportunities. A committee will be formed to choose viable candidates.
- The residents were concerned that the sewerage treatment plant would result in air and water pollution. They were informed the system been used that is a modern system which ensures efficient treatment and results in minimal bad odor.
- One of the residents was concerned that the sewerage treatment would affect the tea Factory-Consultant informed the meeting that many factors are considered before setting up an STP. The factory being a food processing service, all precautions have been put in place to ensure it is not affected

- The residents wanted the construction of Kangari market ablution block be given first priority since they did not have any sanitary facilities they could access after the existing one was demolished- The Consultant informed the residents that the construction of modern ablution block was under construction under the modern market project.
- The residents wanted to know if there would be compensation for the people that would be affected by the project. - The Consultant informed the residents that compensation will be fully given for the affected persons

Consultant briefing participants on the project scope

MUSWASCO Representative

Residents at the meeting

Residents filling the questionnaires

Figure 6-1: Photographs during meeting session

CHAPTER 7 : ENVIRONMENTAL AND SOCIAL IMPACTS & MITIGATION MEASURES

7.1 Introduction

This ESIA assessment has been systematically conducted to determine whether the proposed project will have a diverse impact on the environment. The Environmental Management and Co-Ordination Act (EMCA) No .8 of 2015 provide the legal and statutory guideline for the Environment and Social Impact Assessment process in Kenya.

The impacts in this Chapter have been generated based on the analysis of the proposed environment in relation to the proposed project. The impacts arising during each of the phases of the proposed development namely construction, operation and decommissioning, can be categorized into:

- Impacts on biophysical environment;
- Health and safety impacts
- Social-economic impacts

7.2 Definition and Classification of Environment Impact

An environmental impact is any change to the existing condition of the environment caused by human activity or an external influence. Impacts may be:

- Positive (beneficial) or negative (adverse);
- Direct or indirect, long-term or short-term in duration, and wide-spread or local in the extent of their effect.

Impacts are termed cumulative when they add incrementally to existing impacts. In the case of the project, potential environmental impacts would arise during the construction and the operations phases of the project and at both stages, positive and negative impacts would occur.

7.2.1 Impact Assessment and Scoring

The impact analysis were done using the Leopold matrix which is a grid that is used to identify the interaction between project activities, which are displayed along one axis, and environmental characteristics, which are displayed along the other axis. For the identification of impacts, a breakdown of the environment into elements or factors that may be affected and a breakdown of the various actions or activities of the project under study were done.

Precautionary principle was used to establish the significance of impacts and their management and mitigation i.e., information, the Environmentalist erred on the side of caution.

7.3 Positive Impacts during Construction Phase

Construction Phase normally includes Pre-Construction Phase and Construction Phase. Construction period depends on the nature of the project activities and normally vary from one year to three years. The positive impacts are summarized below:

7.3.1 Employment Opportunities

With the construction of the proposed project, there will be employment opportunities for both professionals and unskilled workers, earnings from the wages will improve their living standards. The workers will include casual laborers, plumbers and engineers who are expected to work on the site for a period of time. Semi- skilled, unskilled laborers and formal employees are expected to obtain gainful employment during the period of construction. With labour intensive construction technologies, the project will provide employment for youth and provide support to the GoK initiatives on creation of jobs.

7.3.2 Creation of Wealth

The proposed development brings many opportunities in investment and procurement where the youth and people from Kangari Sub County can compete to provide different goods and services to the proponent during construction of the tank and distribution pipelines. This in turn creates opportunities for entrepreneurship and wealth creation for the youth of Kangari Sub County and Murang'a County in general. The construction phase will attract temporary business such as food vendors who will benefit from the trade by selling the food to the construction workers. This will improve their living standards from their earnings.

7.3.3 Injection of money into the Local Economy

A large sum of the project money shall be released into the local economy due to the construction activities. It is envisaged that during construction a large number of activities shall take place including but not limited to the following listed below;

- Payments for skilled and unskilled labour;
- Purchases of construction materials; and
- Payments for local provisions including fuel, foods and accommodation

7.3.4 Creation of Market for Construction Materials

The project will require materials, some of which will be sourced locally and some internationally. These include plant steel and plastic pipes, valves, cement, sand, hardcore and chemicals. This will provide a ready market for suppliers in and outside the project area.

7.3.5 Technology Transfer

The project will be associated with technological and knowledge transfer to the local sector, this will be through the artisan who will be employed and trained by the project.

7.4 Negative Impacts during Construction Phase

The following negative impacts are associated with the Construction Phase of the project:

7.4.1 Impact on Vegetation

The assessment identified that construction activities could lead to clearance of vegetation and consequently disruption of soil structure within the sewer easement. The lose soils eventually are washed down into the lower areas into Karuchu stream.

Mitigation Measures

The following is proposed to mitigate against soil erosion and its effects and enhance vegetation cover:

- Compensatory planting of trees i.e., plant at least twice the number of trees, about 900 in total either on farmers land or in public land within the project area.
- Vegetation should only be cleared along the project corridor and where it will interfere with Project construction and/or present a hazard.
- The local community should be given a chance to harvest the targeted vegetation if they so wish.
- Areas to be cleared should be agreed and demarcated before the start of the clearing operations to minimize exposure.
- Also, stage vegetation clearance is recommended so as not to clear the entire corridor all at once.
- The use of existing cleared or disturbed areas for the Contractor's Camp, stockpiling of materials etc. shall be encouraged.

7.4.2 Air Quality Pollution

Potential air pollution caused by emissions from construction equipment (carbon, hydrocarbons, particulate matter,) earth movers and excavators, vehicles, concrete and cement batching plants and trucks, emission of dust from trucks and vehicles accessing the construction areas and camp sites as well as material piling (sand and aggregate).

Odour from temporary disruption of accumulated solid waste materials at locations of construction, such impacts may affect the immediate residential houses and commercial premises.

Mitigation Measures

- Maintain construction equipment at high operational conditions such as to control emissions into the air.
- Earth moving be done under dump conditions as much as possible to prevent emission of dust into the air,
- Similarly, piled materials (sand and aggregate) should be maintained dump to prevent dust emissions,
- It will be necessary to notify the immediate neighborhoods on the potential odours during the excavations. The period should, however, be kept as short as possible (odour generation may not be fully eliminated during the period),
- Use of sprinklers to regularly water construction site, this suppresses the dust menace at construction sites,
- People working in the sites with dust emissions to use dust masks to prevent respiratory infections.

7.4.3 Excessive Vibration and Noise Pollution

Construction Phase for the proposed project will most likely result in noise emissions as a result of the machines that will be used (excavation equipment among others) and construction vehicles delivering materials to site. Noise and excessive vibration can be a nuisance to the local community if construction works begin too early in the day and continues into the night. Noise generating activities such as equipment operations and the workers themselves could be a public nuisance to nearby settlements and commercial centres, health centres and schools especially those within 200 m of the project site. As required, OSHA 2007 and EMCA 2015 Noise and Excessive Vibration 2009 should be adhered to. **Table 7-1** below provides permissible noise levels for residential and construction sites.

Table 7-1-: Permissible Noise levels

MAXIMUM PERMISSIBLE NOISE LEVELS FOR CONSTRUCTION SITES (Measurement taken within the facility)			
		Day	**Night**
i.	Health facilities, educational institutions, homes for disabled etc.	60	35
ii.	Residential	60	35
iii.	Areas other than those prescribed in (i) and (ii)	75	65

Mitigation Measures

To control noise pollution:

- Avoid night time construction when noise is loudest;
- Conduct periodic noise measuring and monitoring to determine levels and extent of harmful noise;
- Clearly label the high noise areas;
- Provide ear muffs to persons operating within or visit identified high noise areas.
- In order to meet noise level requirements, the equipment should be equipped with standard noise attenuation features. Machines that exceed acceptable noise limits should be equipped with silencers or lagging materials or specially designed acoustic enclosures;
- Inform local residents when construction activities are likely to generate excessive noise in order to minimize disruption to local residents through posters along construction sites.
- Sensitize truck drivers to avoid hooting especially when passing through sensitive areas such as churches, residential areas and hospitals

7.4.4 Impact on soil resources

Kangari project area experiences high riverine erosion and is prone to landslides due to its hilly landscape.

The impacts therefore likely to be triggered by the project activities on soil resource include;

(i) Destruction of soil structure due to top soil excavation.
(ii) Soil contamination caused by oils and fuel leaks from construction equipment
(iii) Soil erosion due to clearing of vegetation cover and trenching activities.

Removal of vegetation cover during site clearance will further expose soil to water and wind which are agents of erosion. Excavation and ground clearance works will also have the direct effect of loosening the soils making them easier to be washed away by water and wind. Soil erosion will be more pronounced if earth works coincide with the rainy season since runoff will enhance soil erosion.

Mitigation measures

a) Soil Erosion due to Clearing of Vegetation Cover

- Earthworks should be controlled so that land that is not required for the project works is not disturbed;
- Wherever possible, earthworks should be carried out during the dry season to prevent soil from being washed away by the rain.

- Excavated materials and excess earth should be kept at appropriate sites approved by the Supervising Engineer.
- The contractor should adhere to specified cut and fill gradients and planting embankments with shrubs and grass to reduce erosion and take care of stability problems of project trenches once reinstated. Areas cleared for improving sight distance should be planted with grass to reduce erosion;
- Areas affected by construction related activities and/or susceptible to erosion must be monitored regularly for evidence of erosion, these include: areas stripped of topsoil, Soil stockpiles, Spoil sites, Borrow pits, Sites for bridges and drainage structures.
- Monitoring should also be done during the operation phase to prevent road degradation by erosion caused by flash floods.
- In sections where the risk of erosion is evident as identified above, special measures may be necessary to stabilize the areas and prevent further erosion. These may include, but not be limited to: confining construction activities, using cut off drains, using mechanical cover or packing structures such as geo-fabric to stabilized steep slopes or hessian, gabions and mattress and retaining walls, constructing anti-erosion berms and planting of appropriate vegetation.
- Any work along watercourses will be isolated to prevent silt propagating downstream;
- Debris and other material will be prevented from entering streams and shallow wells; Construction settlement lagoons or other temporary attenuation to be used during construction if necessary; Diversion of minor watercourses will be carefully managed to prevent suspension of silt (or contamination by other pollutants);
- Where possible, sieves should be placed next to water bodies so as to prevent silt and any other sediments from getting into the resources.

b) Civil Works Resulting to Soil Compaction

- Split compacted area to reduce runoff & re-vegetate where necessary
- Vehicles to be kept in designated access roads.
- Minimize compaction during stockpiling by working the soil in dry state.

c) Civil Works Resulting to Soil Pollution

- The contractor should develop an emergency response plan that includes spill response strategy.
- Spills should be immediately addressed as per the appropriate spill management plan and initiate soil clean up and soil removal if needed. Spill kits should be availed to aid this

- Spill prevention practices and response actions should be applied in refueling and vehicle use areas to minimize accidental contamination
- Containment around the garage, fuel store and fuelling station should be ensured so that these potentially polluting substances can be properly handled and any intended escape of material from that area can be contained until such time as remedial action can be taken
- Proper handling of material through use of dip trays, directing spills to an oil sump which should be emptied into a designated disposal site
- Refuel in designated refueling areas that include a temporary berm to limit the spread of any spill.
- Proper maintenance of machinery and equipment to avoid or minimize leakages from machines

7.4.5 Impact on water Resources

The project excavation activities will trigger limited discharge of silt into rivers and other local drainage systems from earth moving during construction, potential discharge of oil residuals into the same rivers and open drains from the construction equipment and disruption of accumulated solid wastes from work areas washed down into the river and other drains

For the proposed Kangari sewerage project, the focus will be on the quality of effluent that will be released into Karuchu Stream, EMCA 2015 water Quality Regulations provide that BOD for treated effluent should be less that 30mg/litre. The treatment method proposed “water stabilization ponds” will ensure the effluent is treated to the required BOD levels; the measure will be adhered to so that the quality of water is guaranteed for downstream users and aquatic ecosystem.

Mitigation Measures

- No grey water runoff or uncontrolled discharges from the site/working areas (including wash down areas) to adjacent Karuchu Stream shall be permitted;
- Water containing such pollutants as cements, concrete, lime, chemicals and fuels shall be discharged into a conservancy tank for removal from site where applicable
- The Contractor shall also prevent runoff loaded with sediment and other suspended materials from the site/working areas from discharging to Karuchu Stream
- Works that are likely to generate silt-laden runoff (e.g., earthworks and excavations) will be undertaken preferentially during the drier months of the year; November to April;
- Site compounds and stockpiles will be located away from Karuchu Stream;

- The drainage system will be developed to prevent silt-laden runoff from entering surface water drains and streams without treatment (e.g., earth bunds, silt fences, straw bales, or proprietary treatment) under any circumstances;
- Where possible an 8m buffer strip of existing vegetation will be maintained alongside Karuchu Stream
- Earth stockpiles will be seeded as soon as possible, covered with geotextile mats or surrounded by a bund to minimize the risk of sediment-rich runoff;
- Tools and plant to be washed out and cleaned in designated areas within the site compound where runoff can be isolated for treatment before discharge to Karuchu Stream
- Debris and other material will be prevented from entering watercourses; Construction sites (such as settlement lagoons or other temporary attenuation) to be used during construction if necessary; Diversion of minor watercourses will be carefully managed to prevent suspension of silt (or contamination by other pollutants); and
- Discharges to watercourses and water bodies will only be carried out under consent of the relevant governing bodies such as WRA.

7.4.6 Waste Generation Impacts (Liquid and Solid)

During construction, solid waste will be generated from a wide range of project activities. Some of the waste includes earth spoils, wrapping materials discarded by the workers on site, food waste from kitchens, waste from the workshops and offices consisting of waste papers, and containers, steel, timber, etc.

Also, during construction various types of liquid waste will be produced such as concrete washings, and runoff from workshops.

To minimize pollution and visual intrusion, the waste will have to be managed appropriately as provided by Waste Management Regulation of 2006.

Waste Management Mitigation measures are summarized below.

Solid Wastes Impacts Mitigation Measures

(i) The contractor shall develop a comprehensive waste management plan prior to commencement of works
(ii) Properly labelled and strategically placed waste disposal containers shall be provided at all places of work
(iii) Litter bins should have secured lids to prevent animals and birds from scavenging
(iv) All personnel shall be instructed to dispose of all waste in a proper manner

(v) Recycling of construction material shall be practiced where feasible e.g., containers and cartons

(vi) Earth spoils shall be disposed of in pre identified sites

Liquids Wastes Impacts Mitigation Measures

(i) Water containing pollutants such as concrete or chemicals should be directed to a conservancy tank for removal from the site where applicable

(ii) Potential pollutants of any kind and form shall be kept, stored and used in such a manner that any escape can be contained

(iii) In case of any form of pollution the contractor should notify the Supervising Engineer

(iv) Wash areas shall be placed and constructed in such a manner so as to ensure that the surrounding areas including groundwater are not polluted.

(v) No grey water runoff or uncontrolled discharges from the site or working area will be directed to water sources

Hazardous wastes Impacts Mitigation Measures

i. The contractor shall ensure that the machines and equipment are in good condition
ii. Ensure proper handling of lubricants, fuels and solvents while maintaining the equipment
iii. Any chemical or fuel spills shall be cleaned up immediately. The spilt liquid and clean-up material shall be removed, treated and transported to an appropriate site licensed for its disposal.
iv. A safety and emergency response plan will need to be developed for all operations with emphasis on the protection of the environment prior to start up.
v. Any chemical or fuel spills shall be cleaned up immediately. The spilt liquid and clean-up material shall be removed, treated and transported to an appropriate site licensed for its disposal;
vi. Storm water shall be diverted away from the fuel handling and storage areas. An oil water interceptor shall be provided to treat any rainwater from fuel storage and handling areas;
vii. Measures should be taken to ensure proper storage of fuel, oil and bitumen. Oil-water interceptors or sumps should be constructed to capture discharge of oils, fats and other polluting liquids from maintenance workshops, vehicle and equipment washing bays and kitchen drains;
viii. At the work sites the contractor will be expected to maintain strict surveillance particularly when working within the vicinity of water supply points and the rivers within the project area;
ix. Tank equipment such as dispensing hoses, valves, meters, pumps, and gauges shall be located within the containment or provided with own containment

7.4.7 Land Take

The project's infrastructure - STP, trunk sewers, lateral sewers - will have a significant footprint, 29 acres. The STP is proposed on a private land while most of the trunk sewer lines will transverse through the private land. The details of these discussions will be provided in the Resettlement Action Plan. This will then be handed over to NLC for implementation.

To minimize impact and conflict associated with land acquisitions, the process will have to be managed appropriately as provided in the RAP Report.

Land take **Mitigation measures** are summarized below.

- Undertake a Resettlement Action Plan which will act as guide during implementation of the project.

7.4.8 Project Social Risks

The project activities as described in the report have the potential of triggering various social risks both at project Construction Phase and Operation Phase. This assessment has identified potential social risks associated with the project as listed below

(i) Labor Influx and sexual Offences to Minors Impacts
(ii) Human Rights and gender inclusivity
(iii) Increased Transmission of communicable diseases including HIV/AIDS
(iv) Disturbance of traffic and difficult of access
(v) Community accidents

Labour Influx Effects

This impact is triggered during project Construction Phase due to the project attracting various categories of workers from local, national and international markets. This therefore leads to concentration of people in one area drawn from diverse social and cultural backgrounds often resulting to a number of issues as listed below;

i. Strain on various resources especially for the civil works
ii. Grievances from local community members over job opportunities.
iii. Sexual Offences
iv. Teenage Pregnancies
v. Gender based violence

Mitigation Measures to Labour Influx Impacts

i. Effective community engagement and strong grievance mechanisms on matters related to labour

ii. Effective contractual obligations for the contractor to adhere to the mitigation of risks against labour influx, the contractor should engage a local community liaison person
iii. Proper records of labour force on site while avoiding child and forced labour
iv. Comply to provisions of WIBA 2007
v. Develop and implement a children Protection Strategy, this strategy will ensure that no child under the legal age of 18 years in employed to the project.
vi. Contractor should give priority to the local people in the project area for employment opportunities

Human Right and Gender Inclusivity

This impact is triggered during Project Construction Phase due to the potential of the Contractor's failure to comply with the following provisions;

i. Gender Inclusivity requirements in hiring of workers and entire Project Management as required by Gender Policy 2011 and 2/3 gender rule.
ii. failure to protect Human Risk Areas Associated with, Disadvantaged Groups, Interfering with Participation Rights, and interfering with Labour Rights

Mitigation Measures of Human Rights and Gender Requirements

i. Mainstream Gender Inclusivity in hiring of workers and entire Project Management as required by Gender Policy 2011 and 2/3 Gender Rule.
ii. The existing community structures headed by location chiefs should be involved in local labour hire, emphasize the requirement of hiring women, youth and people with disability.
iii. Protecting Human Risk Areas Associated with, Disadvantaged Groups, interfering with Participation Rights and interfering with Labour Rights

Child Protection

Children abuse may result if workers below the age of 18 are hired or sexual advances are offered that could lead to early pregnancies and school dropout including exposure to sexually transmitted diseases such as HIV and AIDS. The contractor will undertake the below listed mitigation measures.

Mitigation Measures to child protection

i. The contractor will develop and implement a Children Protection Strategy that will ensure that minors are protected against negative impacts associated by the Project including SEA.
ii. All staff of the contractor must sign, committing themselves towards protecting children, which clearly defines what is and is not acceptable behaviour
iii. Children under the age of 18 years should be hired on site as provided by Child Rights Act (Amendment Bill) 2014

iv. Wherever possible, ensure that another adult is present when working in the proximity of children.
v. Not invite unaccompanied children to worker's home, unless they are at immediate risk of injury or in physical danger.
vi. Refrain from physical punishment or discipline of children
vii. Refrain from hiring children for domestic or other labor, which is inappropriate given their age, or developmental stage, which interferes with their time available for education and recreational activities, or which places them at significant risk of injury.
viii. Comply with all relevant local legislation, including labor laws in relation to child labor specifically provisions of Kenya's Employment Act Cap 226 of 2007 Part VII on protection of children against exploitation

Increase in Transmission of HIV /AIDS

The project will attract new people to the project area seeking employment during the construction period and this can lead to increased transmission of HIV/AIDS and or the other sexually transmitted diseases (STDs). This may result from increased incomes of workers whereby some may try to seek for sexual favours using their incomes. The fact that some of the construction workers will be away from their homes may lead them to seek for sexual satisfaction from the area residents.

Mitigation Measures for Increased HIV transmission

- Sensitize workers and the surrounding communities on awareness, prevention and management of HIV/AIDS and sexual health and rights through staff training, awareness campaigns, multimedia and workshops or during community Barazas.
- Use existing clinics to provide VCT services to construction crew and provision of ARVs for vulnerable community members
- Ensure safety of women and girls in provision of VCT services.

Health Impact – Spread of Covid -19 among construction workers

The World Health Organization declared COVID-19 a global pandemic after assessing both its alarming levels of spread and severity levels of spread and severity, and the alarming deaths. Consequentially, WHO issued various guidance and measures to prevent the spread of the virus. The measures have been adopted worldwide. Similarly, the Kenyan government has since then issued several guidance and directives after the first case was registered on March 13th 2020. These included complete cessation of movement to and from areas considered hot spots and night curfew, social distancing guidelines, closure on non – critical and essential enterprises, closure of places of worship and public gatherings, mandatory use of masks in public places, among others.

During project execution (civil works), large numbers of workers will be required to assemble together in meetings, toolbox talks and even at work sites; varied number of workforce including suppliers of material and services are also expected to come in from various places in the country which may be COVID-19 hot spots; and interaction of workers with the project host community will happen as workers find accommodation close to work sites, and/or return to their homes after works. The potential for the spread of any infectious disease like COVID-19 by projects is high. There is also the risk that the project may experience large numbers of its workforce becoming ill and will need to consider how they will receive treatment, and whether this will impact on local healthcare services including the project host community. The presence of international workers, especially if they come from countries with high infection rates, may also cause social tension between the foreign workers and the local populations.

Recently, the WHO has warned that the virus is here to stay for a long time and might persist and become our new way. The Government of Kenya has also lifted some of the initial movement controls and allowed the resumption of business, with certain industry specific guidelines being enforced. The duty of care has now been transferred to individual citizens and enterprises. Recognizing the potent risk this may present, it is difficult to clearly outline exhaustive mitigation measures under the mitigation impacts. As such, there is need for the client and the contractor to develop and adopt COVID-19 Standard Operating Procedure (SOPs) in line with the World Bank guidance, Ministry of Health Directives and site-specific project conditions. These SOPs need to be communicated to all workers and enforced to the latter without fail. In addition to the requirement of the SOPs, the following mitigation measure shall also be adopted:

COVID-19 – Mitigation Measures against spread of COVID-19 amongst workers:

- The Contractors will develop SOPs for managing the spread of Covid-19 during project execution and submit them for the approval of the Supervision Engineer and the Client before mobilizing to site. The SOPs shall be in line with the World Bank guidance on COVID-19, Ministry of Health Directives and site-specific project conditions;
- Mandatory provision and use of appropriate Personal Protective Equipment (PPE) shall be required for all project personnel including workers and visitors;
- Avoid concentration of more than 15 workers at one location. Where there are two or more people gathered, maintain social distancing of at least 2 meters;
- All workers and visitors accessing worksites every day or attending meetings shall be subjected to rapid Covid-19 screening which may include temperature check and other vital signs;
- The project shall put in place means to support rapid testing of suspected workers for covid-19;

- Install hand washing facilities with adequate running water and soap, or sanitizing facilities at entrance to work sites including consultation venues and meetings and ensure they are used;
- Ensure routine sanitization of shared social facilities and other communal places routinely including wiping of workstations, door knobs, hand rails etc.;

Social risk – spread of COVID -19 amongst community members during consultation

During implementation of the ESIA, various consultative activities will be undertaken. For efficient and meaningful engagement, a wide range of individual participants, groups in the local community and other stakeholders will be involved. The types of consultations to be used to pass information shall be through public Baraza's, electronic means shall be used where possible and one-on-one basis meetings while observing the COVID-19 mitigation measures to ensure safety stakeholders involved, the community at large and the client. The consultations will involve verification of PAPs covering the occupants of the affected area and vulnerable persons and groups; awareness raising, sensitization of PAPs and gauging attitude to the project; training and capacity building for livelihoods restoration, grievance redress, and execution of site - specific surveys among others. If carried out conventionally, these activities would lead to close interaction between the proponent and the community members leading to a high risk of spreading COVID-19 amongst community members during the consultation process.

To minimize the risk of spread of COVID-19 amongst community members, alternative means of consultation will be required as mitigation measures to ensure social distancing and appropriate communication measures. The mitigation measures will be supervised by a communications/ stakeholder engagement / social safeguards expert in the project proponent's team.

Mitigation measures against spread of COVID-19 amongst community members

- Electronic means of consulting stakeholders and holding meetings shall be encouraged whenever feasible. One-on-one engagements for the PAPs while observing social distance and adhering to PPE wearing shall be enforced;
- Avoid concentrating of more than 15 community members at one location. Where two or more people are gathered, maintain social distancing of at least 2 meters;
- The team carrying out engagements within the communities on one-on-one basis will be provided with appropriate PPE for the number of people they intend to meet;
- Use traditional channels of communications (TV, newspaper, radio, dedicated phone-lines, public announcements and mail) when stakeholders do not have access to online channels or do not use them frequently. Allow participants to provide feedback and suggestions
- Hold meetings in small groups, mainly in form of FGDs if permitted depending on restrictions in place and subject to strict observance of physical distancing and limited duration. In

situations where online interaction is challenging, disseminate information through digital platform (where available) like Facebook and Whats App & Chart groups.

- Ensure online registration of participants, distribution of consultation materials and share feedback electronically with participants.

Disturbance of traffic and difficulty of access

The main impact on road traffic will be during possible laying of sewer lines along, or across main roads. Longitudinal excavation will cause narrowing of the road for relatively long periods, while micro tunneling of roads may cause blocking of the road but for a relatively short period, probably few hours. Excavation in residential areas will cause access problems to pedestrians, and possibly to riders of bicycles and motorcycles. This access difficulty will have more impact on elderly people, handicapped and children, who may accidentally fall in open trenches or make tedious long cycles before they reach their targeted locations.

Mitigation measures to Disturbance of traffic and difficulty of access

- The contractor shall develop a traffic management plan;
- The Contractor should provide temporary road signs or notices to indicate ongoing works;
- The Contractor together with the Resident Engineer Should Plan itineraries for site traffic on a daily basis and avoid peak traffic periods;
- The Contractor should effect traffic controls and cleanliness to avoid congestion and truck accidents on roads;
- For the site traffic the Contractor has to ensure that they
  - ✓ Only park in designated parking areas;
  - ✓ Don't block pedestrian routes;
  - ✓ Don't block traffic routes;
  - ✓ Obey the speed limit
  - ✓ The resident Engineer has to ensure that the Contractor:
    - Introduces segregated pedestrian walkways;
    - Introduces speed limits;
    - Reduces the need for reversing vehicles, by introducing a one-way system;
    - Uses a qualified BANKSMAN to control deliveries and reversing vehicles;
    - Designates loading/unloading areas.

Community accidents

Use of heavy machinery in site clearing and construction presents safety hazards. Vehicular movements can cause accidents to community members resulting in injuries and probably death.

Mitigation measures to Disturbance of Community accidents

- Ensuring that the drivers and machine operators hired to work on the site are qualified.

- Establish and enforce a strict code of conduct for all project drivers including outside suppliers delivering materials. The code should focus on safety, especially speed, and loading, especially banning all carriage of staff, workers and passengers except in seats.
- Appropriate signs must be erected on the site to warn workers and community members.
- The surrounding community should be sensitized on health and safety.

7.4.9 Gender Based Violence

GBV constitutes acts of gross misconduct and are therefore grounds for sanctions, penalties and/or termination of employment. All forms of GBV including grooming (set of manipulative behaviors used by people who abuse) are unacceptable be it on the work site, the work site surroundings, or at workers' camps. Prosecution of those who commit this to be pursued.

This impact is triggered during Project Construction Phase and is likely to occur. Therefore, below listed provisions are provided in order to mitigate against such GBV and SH related Project induced impacts.

Mitigation measures for GBV

- The contractor will mainstream Gender Inclusivity in hiring of workers and entire Project Management as required by Gender Policy 2011 and 2/3 Gender Rule.
- The existing community structures headed by location chiefs should be involved in local labour hire, emphasize the requirement of hiring women, youth and people with disability and VMGs
- Protecting Human Risk Areas Associated with, Disadvantaged Groups, interfering with Participation Rights and interfering with Labour Rights:
- Treat women and children (persons under the age of 18) with respect regardless of race, color, language, religion, political or other opinion, national, ethnic or social origin, property, disability, birth or other status.
- Do not use language or behavior towards women or children that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate.
- Sexual activity with children under 18—including through digital media is prohibited. Mistaken belief regarding the age of a child and consent from the child is not a defense.
- Exchange of money, employment, goods, or services for sex, including sexual favors or other forms of humiliating, degrading or exploitative behavior is prohibited.
- Sexual interactions between contractor's and consultant's employees at any level and member of the communities surrounding the workplace that are not agreed to with full consent by all parties involved in the sexual act are prohibited. This includes relationships involving the withholding, promise of actual provision of benefit (monetary or non-monetary)

to community members in exchange for sex – such sexual activity is considered "non-consensual" within the scope of this Code.

- Where an employee develops concerns or suspicions regarding acts of GBV by a fellow worker, whether in the same contracting firm or not, he or she must report such concerns in accordance with Standard Reporting Procedures.
- All employees are required to attend an induction-training course prior to commencing work on site to ensure they are familiar with the GBV Code of Conduct.
- All employees must attend a mandatory training course once a month for the duration of the contract starting from the first induction training prior to commencement of work to reinforce the understanding of the institutional GBV Code of Conduct.

7.4.10 Sexual Exploitation and Abuse (SEA)

This impact refers to sexual exploitation and abuse committed by Project staff against communities and represents a risk at all stages of the Project, especially when employees and community members are not clear about prohibitions against SEA in the Project.

Mitigation Measures

- Develop and implement a SEA action plan with an Accountability and Response Framework as part of the C-ESMP
- The SEA action plan will include how the project will ensure necessary steps are in place for:
  - Prevention of SEA: including COCs and ongoing sensitization of staff on responsibilities related to the COC and consequences of non-compliance; project-level IEC materials;
  - Response to SEA: including survivor-centered coordinated multi-sectoral referral and assistance to complainants according to standard operating procedures; staff reporting mechanisms; written procedures related to case oversight, investigation and disciplinary procedures at the project level, including confidential data management;
  - Engagement with the community: including development of confidential community-based complaints mechanisms discrete from the standard GRM; mainstreaming of Sexual Exploitation and Abuse (SEA) awareness-raising in all community engagement activities; community-level IEC materials; regular community outreach to women and girls about social risks and their SEA-related rights;

Management and Coordination: including integration of SEA in job descriptions, employments contracts, performance appraisal systems, etc.; development of contract policies related to SEA, including whistle-blower protection and investigation and disciplinary procedures; training for all project management; management of coordination mechanism for case oversight, investigations and disciplinary procedures; supervision of dedicated PSEA focal points in the project and trained community liaison officers.

7.5 Positive Impacts during Operational Phase

The project main objective is to improve the quality of life of people within Kangari, Murang'a County and their surrounding environs through provision of improved Sewerage Services. The positive impacts associated with the project operation phase are summarized below.

- Reduced cases of water borne diseases associated with pollution of water resources
- Creation of job opportunities especially, for those who will be employed to manage and maintain the STP. This will improve the living standards of these employees. MUSWASCO will also employ more staff to assist in connecting its customers to the sewer system and repair works.
- Improved Health and Sanitation status of Kangari, Murang'a County Towns and their surrounding environs
- Reduced pollution of natural river systems which include Karuchu stream and River Chathanda and numerous springs within the project area.
- Trigger development of modern infrastructure within Kangari a, Murang'a County and their surrounding environs due to availability of sewage treatment infrastructure
- Reduce distances covered by exhausters to sludge discharge points eventually reducing costs.
- Residents will decommission pit latrines which are expensive to construct and unsustainable due to short fill-up duration.
- Improve aesthetic outlook of Kangari Town, Murang'a County and their surrounding environs

7.6 Negative Impacts during Operation Phase

The project operation phase will have potential negative impacts which are less significant and can easily be mitigated as described in **sub-sections 7.6.1 to 7.6.10**.

7.6.1 Odour Menace from Wastewater Treatment Works

The process of wastewater collection, conveying or treatment has the potential to generate and release odours to the surrounding area. Most odour problems occur in the collection system, in primary treatment facilities and in solid handling facilities as well as the sludge drying beds. The most frequently reported symptoms attributed to odours from treatment plants include headache, nausea, hoarseness, cough, nasal congestion, palpitations shortness of breath, stress, drowsiness, alterations in mood, and eye, nose, and throat irritation. Hydrogen Sulphide (H2S) is the most prevalent gas associated with domestic wastewater collection and treatment.

The conditions leading to H2S formation usually favour the production of other odorous gases such as ammonia which may have considerably higher detectable odour thresholds, and

consequently H_2S may be an indicator of their presence. Exposure of receptors to levels of hydrogen sulphide above 5ppb can lead to odour nuisance.

Mitigation Measures

- Ensure appropriate covering/ventilation of the pre-treatment unit;
- Ensure appropriate handling and removal of grit/grease;
- Ensure proper sizing and alignment of the plant;
- Ensure scum is appropriately disposed off or properly stabilized;
- Ensure adequate water flow through the plant to reduce the potential of odour formation;
- The perimeter of the proposed site should be vegetated with trees and plants of varying heights thereby forming windbreaker and reduce dispersion of odour;
- Repair the roofs of the sludge drying beds to ensure quick drying of sludge and appropriate disposal to reduce odour emanating from wet sludge.

7.6.2 Waste Generation and Disposal

The operation of the development has the potential of significantly increasing the solid waste at the site. There will be a need to remove the screenings and grit from the site on need basis. This material can be handled with the same care as county solid waste and should be carried to the designated dumpsite for proper disposal. The volume of solid waste is anticipated to be medium; hence, it must be well disposed or used as fertilizer. The removal of sludge from the system will require that sludge be removed frequently on schedule.

Mitigation Measures

- Sludge drying beds should be incorporated in the design
- Provision of solid waste storage bins.
- Provision of adequately designed bins to prevent access by vermin.
- Monitor exhauster trucks so that they do not become overfilled and spill waste enroute to the site.
- Ensure that the solid waste generated is disposed of in an approved dumpsite or landfill.

7.6.3 Transportation/Traffic

The project is expected to increase the traffic along the access roads marginally, as there will be trucks driving to the site each day.

Mitigation Measures

- Limit septage delivery to the site between the hours of 8 am and 5 pm. This will limit the noise nuisance to residents and possibly reduce the population exposed to potential accidents, as most persons would have already left their homes to go to work and schools.
- Add adequate and appropriate signs including speed limits along the access roads.

7.6.4 Inversion of Birds and Reptiles to the Waste Water Treatment Works

There is a possibility of birds' attraction to the sewage treatment plants arising from proliferation of insects and aquatic flora suitable for birds' food. Certain species and population of birds at Sewage treatment plant could become a safety risk to aviation sector; however, no flight corridor was identified within the vicinity. Certain animals including crocodiles and hippos may encroach the sewage treatment plants and other areas arising from overgrown vegetation. This will not only be a nuisance to the plants' operations but also pose safety threats to the immediate residents and commercial premises.

The sewage discharging from the treatment plants (as well as other discharges from sources) are a determinant of the macro and micro flora and fauna in rivers. Excessive nutrients will lead into increased eutrophication of the river waters while chemical and organic loading will reduce the capacity for the river waters to support life (low oxygen levels and toxic conditions).

Mitigation Measures

- The sewage treatment plants should be protected from wildlife encroachments by providing secure barriers to keep off the animals from interfering with the plant operations and safety. This will also ensure safety of the residents,
- The quality of the discharging sewage into the river will be an important parameter on the regional control of the river eutrophication. Continuous generation and sharing of sewage quality data on pre-scheduled monitoring programmes will be necessary.

7.6.5 Health and Safety Risks from Burst Sewers

Poorly maintained and designed sewers can lead to dispersal of raw sewage particularly at manholes and burst areas into the environment. These can cause outbreaks of water borne related diseases like cholera and typhoid from contamination of water sources by raw sewage.

Mitigation Measures

Ensure proper and periodic maintenance of sewer lines

- Activate a community watch group for information sharing on the status of the sewer line

- Awareness rising among community members not to dump solids in manholes.
- Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups
- Development of an inventory of system components, with information including age, construction materials, and drainage areas served elevations.
- Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replaced if broken to minimize entry of garbage and silt into the system
- Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent build-up of solids and hydrogen sulphide generation.

7.6.6 Risks of Overflowing Manholes due to Blockage of Sewers

There is a possibility of contaminating the nearby rivers from the overflowing manholes as a result of blocked sewer trunks during operation phase.

Mitigation measures for overflowed Manholes

Regular inspection of the system to ensure performance is maintained at high levels;

- Blockages should be detected and promptly replaced;
- Regular monitoring and sampling of the waste water at influent and effluent points as well as in the receiving water bodies;
- Communities living within the river basins where the trunk sewers will be constructed should be enlightened on dangers of using raw sewerage to irrigate farmlands.

7.6.7 Visual and landscape impact management

Once the temporary working areas have been reinstated, much of the landscape will return to its former condition. The only persistent visual impacts will take the form of manholes and inspection chambers along the sewer lines required for maintenance. The buried sewer line will therefore have minor visual impacts during its operational life. The treatment plant site will be permanent and visible features of the project. Although landscaping plans such as establishment of berms and planting of trees around the site boundaries are proposed, these facilities may not be entirely out of sight for the public.

Mitigation measures

- Elaborate landscaping and maintenance of these sites can limit the viewpoints to the facilities and thus reduce their visual impact.

7.6.8 Grit, sludge and other solid wastes

The pre-treatment process of screening at the sewerage treatment plant will generate solids such as grit and other coarse screenings (such as polythene etc.) which will require regular removal and disposal. These will be hand raked and collected for disposal at a designated landfill site. Although the wastes are not expected to be in significant quantities, inappropriate handling, storage and disposal is likely to cause environmental pollution and health hazards to both workers and the neighboring public. The proposed treatment plant will also generate biological sludge. Poor handling and disposal of wet and dried sludge may result in health hazards to both site workers and the neighboring public. Dried sludge is however a good soil improver due to its content of phosphorus and nitrogen and, in particular, due to the amendment of organic matter.

Mitigation Measures

- The sludge will be temporarily held in sludge drying beds for sludge digestion and the dry cake will be safe for disposal. The dry cake can then be sold off/collected for disposal as organic fertilizer for use in local farms. Alternatively, in the event that uptake by local farmers is low, the dried sludge can be landfilled and covered with lime/earth at an appropriate location.
- Sludge quality will need to be monitored to ensure that human health is protected

7.6.9 Pollution of Karuchu stream

The sewage discharging from the treatment plant (as well as other discharges from sources) are a determinant of the macro and micro flora and fauna in rivers especially Karuchu stream where the treated waste water will be discharged into. Excessive nutrients will lead into increased eutrophication of the river waters while chemical and organic loading will reduce the capacity for the rivers waters to support life (low oxygen levels and toxic conditions).

Mitigation measures

- Continuous generation and sharing of sewage quality data on pre-scheduled monitoring programmes will be necessary

7.6.10 Increase in Social Vices

There is high likelihood of vandalism of the sewer equipment during the operational stage if proper security measures are not put in place. This vandalism is common where manhole covers and step irons are made of iron are stolen by metal scrap dealers.

Mitigation Measures

- A security chain link fence including a gate and guard house should be erected at sewer treatment plant to protect the site from theft and vandalism.
- Design manholes and manhole step iron from material which do not have any value in the scrap metal industry.
- Proper security measures should be put in place to guard the equipment 24 hours to reduce cases of vandalism.

7.7 Positive Impacts during Decommissioning Phase

- Employment opportunities where both skilled and unskilled personnel will be recruited
- Rehabilitation of site to ensure the site is left as natural as possible close or better than before

7.8 Negative impact of Decommissioning

7.8.1 Loss of Jobs and Income

The people that will be employed to operate and maintain the STP will lose their jobs immediately after the closure of the project. The loss of jobs will have far reaching impacts as it will lead to loss of income and social stress. MUSWASCO will also lose revenue from the connected customers.

Mitigation measures include:

- Notify the employees in advance on the project closure date and adequately compensate them;
- Dismissal procedures to be compliant with Employment Act, 2007;
- Provide counseling and alternative skills for alternative activities;
- Employer should find alternative means of livelihood for the staff who were employed at the treatment plant.
- Customers to be notified in advance of the proposed decommissioning.

7.8.2 Noise Pollution

Activities likely to produce noise during decommissioning include removal of STP infrastructure, demolition of structures and excavation of sewer lines as well as demolition of any staff offices and quarters built on site.

Mitigation Measures:

- Schedule noisy activities during the day time period;
- Use silencers on machines where possible;
- Ensure machinery is well maintained to reduce noise emitted.

7.8.3 Solid Waste Material

It is expected that large amounts of solid waste material arising during decommissioning will include: glass panels, stones, pipes, wood, metal, paper, plastic, equipment, vegetation, etc. The proper disposal of these materials is critical. 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.

Mitigation Measures:

- Disposal of solid waste in compliance with EMCA 2006 Waste Management Regulations;
- Segregation of waste to encourage reuse and recycling;
- Ensuring that the contracted waste collector is registered with NEMA to collect and dispose wastes.

7.8.4 Occupational Health and Safety

If not handled with care the demolition may lead to exposure of hazardous chemicals to workers and surrounding communities which poses as health risks to them. Machinery and equipment used for the same also possess as danger to the workers if not handled well and with the correct PPEs.

Mitigation Measures:

- Provide the correct PPE for the workers when conducting the demolition activities;
- Conduct training on health and safety procedures to the workers prior to commencement of demolition;
- Proper plans should be made prior to demolition so as to contain the raw sewage and other waste water that poses as health risk to human beings and the environment, to prevent the workers and surrounding communities from getting into contact with it.

The Decommissioning Management Plan is included in the ESMMP in Chapter 8.

CHAPTER 8 : ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN (ESMMP)

8.1 Purpose and Objectives of ESMMP

The specific objectives of the ESMMP are to:

- Serve as a commitment and reference for the contractor to implement the ESMMP including conditions of approval from NEMA.
- Serve as a guiding document for the environmental and social monitoring activities for the supervising consultant, contractor and the client management including requisite progress reports.
- Provide detailed specifications for the management and mitigation of activities that have the potential to impact negatively on the environment.
- Provide instructions to relevant project personnel regarding procedures for protecting the environment and minimizing environmental effects, thereby supporting the project goal of minimal or zero incidents.
- Document environmental concerns and appropriate protection measures; while ensuring that corrective actions are completed in a timely manner.

8.2 Auditing of ESMMP

AWWDA and the supervising consultant shall conduct regular audits to the ESMMP to ensure that the system for implementation of the ESMMP is operating effectively. The audit shall check that a procedure is in place to ensure that:

- The ESMMP being used is the up to date version;
- Variations to the ESMMP and non-compliance and corrective action are documented;
- Appropriate environmental training of personnel is undertaken;
- Emergency procedures are in place and effectively communicated to personnel;
- A register of major incidents (spills, injuries, complaints) is in place and other documentation related to the ESMMP
- Ensure that appropriate corrective and preventive action is taken by the Contractor once instructions have been issued

8.3 Management Responsibility of ESMMP

In order to ensure the sound development and effective implementation of the ESMMP, it will be necessary to identify and define the responsibilities and authority of the various persons and Organizations that will be involved in the project. The following entities should be involved in the implementation of this ESMMP:

- AWWDA

- MUSWASCO
- NEMA;
- Contractor;
- Supervising Engineer;
- County Government of Murang'a

a) AWWDA/MUSWASCO

AWWDA in conjunction with MUSWASCO will be charged with the responsibility of ensuring that the proposed development has been put up in an environmentally sound manner. This can be achieved by inclusion of environmental specifications in the tender documents, selection of renowned environmentally conscious contractors and supervision to ensure that the objectives of this ESMMP are met.

b) National Environment Management Authority (NEMA)

The responsibility of NEMA is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of Government of Kenya in the implementation of all policies relating to the environment.

c) The Contractor

The persons/firms contracted to put up the proposed decentralized Treatment Facility will be required to comply with the requirements of the ESMMP within this report. To ensure strict compliance environmental specifications of this ESMMP should form part of the contract documents.

d) Consultant

The sourced consultant will have to ensure that the proposed ESMMP is up to date and is being used by the contractor. Periodic audits of the ESMMP will have to be done to ensure that its performance is as expected.

e) County Government of Murang'a

The relevant departmental officers in the above local authorities should be called upon where necessary during project implementation to provide the necessary permits and advisory services to the project implementers.

Tables 8-1, 8-2 and 8-3 present the ESMMP for the proposed Project during construction, operation and decommissioning phases respectively

Table 8-1: Construction Phase: Environmental and Social Management and Monitoring Plan

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
Vegetation Clearing	Low to Medium	• Compensatory planting of trees • Vegetation should only be cleared along the Project corridor and where it will interfere with Project construction and/or present hazards. • The local community should be given a chance to harvest the targeted vegetation if they so wish. • Areas to be cleared should be agreed and demarcated before the start of the clearing operations to minimize exposure. • Also, stage vegetation clearance is recommended • The use of existing cleared or disturbed areas for the Contractor's Camp, stockpiling of materials etc. shall be encouraged	STP and along the trunks <u>Responsibility</u> Contractor(s)	• Soil erosion extend and intensity on site	No direct cost associated
Air Quality Pollution	Medium	• Maintain construction equipment at high operational conditions such as to control emissions into the air. • Earth moving be done under dump conditions as much as possible to prevent emission of dust into the air,	All Workers and surrounding neighborhood <u>Responsibility</u> Contractor(s)	• Cases of respiratory complication at nearby health centre	No direct cost associated

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
		• Similarly, piled materials (sand and aggregate) should be maintained dump to prevent dust emissions, • Notify the immediate neighborhoods on the potential odours during the excavations. • Use of sprinklers to regularly water construction site, this suppresses the dust menace at construction sites • People working in the sites with dust emissions to use dust masks to prevent respiratory infections. •			
Excessive Vibration and Noise Pollution	Low to Medium	• Avoid night time construction when noise is loudest; • Conduct periodic noise measuring and monitoring to determine levels and extent of harmful noise; • Clearly label the high noise areas; • Provide personal protective equipment (PPE) including masks, goggles, scarfs, boots and overalls among other protective clothing to persons operating within or visit identified high noise areas.	All Workers and surrounding neighborhood <u>Responsibility</u> Contractor(s)	• Reported complaints from neighbours' community and institutions	No direct cost associated

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
		• In order to meet noise level requirements, the equipment should be equipped with standard noise attenuation features. Machines that exceed acceptable noise limits should be equipped with silencers or lagging materials or specially designed acoustic enclosures; • Inform local residents when construction activities are likely to generate excessive noise in order to minimize disruption to local residents through posters along construction sites. • Sensitize truck drivers to avoid hooting especially when passing through sensitive areas such as churches, residential areas and hospitals			
Impact on soil resources	low	• Earthworks should be controlled so that land that is not required for the Project works is not disturbed; • Wherever possible, earthworks should be carried out during the dry season to prevent soil from being washed away by the rain.	All the Project area <u>Responsibility</u> Contractor	• Soil erosion extend and intensity on site	No direct costs associated

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
		• Excavated materials and excess earth should be kept at appropriate sites approved by the Supervising Engineer. • The contractor should adhere to specified cut and fill gradients and planting embankments with shrubs and grass to reduce erosion and take care of stability problems of Project trenches once reinstated. • Areas cleared for improving sight distance should be planted with grass to reduce erosion.			
Impact on water Resources	Low to Medium	• No grey water runoff or uncontrolled discharges from the site/working areas (including wash down areas) to adjacent Karuchu stream shall be permitted; • Water containing such pollutants as cements, concrete, lime, chemicals and fuels shall be discharged into a conservancy tank for removal from site where applicable; • The Contractor shall also prevent runoff loaded with sediment and other suspended materials from the	All the Project Components <u>Responsibility</u> Contractor	• No of water related diseases reported within the construction period • No of complains regarding pollution of the river	No direct associated costs

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
		site/working areas from discharging to Karuchu stream • Works that are likely to generate silt-laden runoff (e.g., earthworks and excavations) will be undertaken preferentially during the drier months of the year; November to April; • Site compounds and stockpiles will be located away from Karuchu stream.			
Risks of solid waste mismanagement leading to pollution	• Medium	• Contouring of spoil site to approximate natural topography and drainage and/or reduce erosion impacts on the site • The Contractor shall ensure that the placement of spoil is done in such a manner to minimize the spread of materials and the impact on surrounding vegetation and that no materials' creep' into' no-go 'areas	Construction areas <u>Responsibility</u> Contractor(s) Supervision	• Number of complaints from community not happy with waste management of spoil material	Contractor best management practice
Land Take	• Medium to high	• Undertake a Resettlement Action Plan which will act as guide for the compensation activities.	STP and along the trunks AWWDA/ NLC	• No. of Project Affected Persons compensated No. of	As per the RAP budget

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
				complains received	
Labour Influx Impacts	• LOW	• Effective community engagement and strong grievance mechanisms on matters related to labour • Effective contractual obligations for the contractor to adhere to the mitigation of risks against labour influx, the contractor should engage a local community liaison person as provided for in chapter 6 • Proper records of labour force on site while avoiding child and forced labour • Comply to provisions of WIBA 2007 • Develop and implement a children Protection Strategy, this strategy will ensure that no child under the legal age of 18 years in employed to the Project. • Contractor should give priority to the local people in the project area for employment opportunities	All Workers Contractor Ministry of Health	• Available grievance mechanisms • No of locals recruited • Record of workers on site	shs. 500,000
Human Right and Gender Inclusivity	• Low	• Mainstream Gender Inclusivity in hiring of workers and entire Project Management	All workers	• No of women recruited	No direct cost associated

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
		as required by Gender Policy 2011 and 2/3 Gender Rule. • The existing community structures headed by location chiefs should be involved in local labour hire, emphasize the requirement of hiring women, youth and people with disability. • Protecting Human Risk Areas Associated with, Disadvantaged Groups, Interfering with Participation Rights and interfering with Labour Rights	Responsibility Contractor		
Child protection	• Low	• The contractor will develop and implement a Children Protection Strategy that will ensures minors are protected against negative impacts associated by the Project including Sexual Exploitation and Abuse (SEA). • All staff of the contractor must sign, committing themselves towards protecting children, which clearly defines what is and is not acceptable behaviour • Children under the age of 18 years should be hired on site as provided by Child Rights Act (Amendment Bill) 2014	All workers Responsibility Contractor	• No of Complaints received	No direct cost associated

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
		• Wherever possible, ensure that another adult is present when working in the proximity of children. • Not invite unaccompanied children to worker's home, unless they are at immediate risk of injury or in physical danger. • Refrain from physical punishment or discipline of children • Refrain from hiring children for domestic or other labor, which is inappropriate given their age, or developmental stage, which interferes with their time available for education and recreational activities, or which places them at significant risk of injury. • Comply with all relevant local legislation, including labor laws in relation to child labor specifically provisions of Kenya's Employment Act Cap 226 of 2007 Part VII on protection of children against exploitation			

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
Increase in Transmission of HIV /AIDS	•	• Sensitize workers and the surrounding communities on awareness, prevention and management of HIV/AIDS and sexual health and rights through staff training, awareness campaigns, multimedia and workshops or during community Barazas. • Use existing clinics to provide VCT services to construction crew and provision of ARVs for vulnerable community members • Ensure safety of women and girls in provision of VCT services. • Work to minimize or altogether eliminate mosquito-breeding sites.	<u>All workers</u> <u>Responsibility</u> Contractor	• Number of cases of diseases reported • Rate of absenteeism due to diseases • No of workers trained on HIV/ AIDS • Number of gender-disaggregated toilets constructed	~Kshs 300,000
Health Impact – Spread of Covid -19 among construction workers	•	• The Contractors will develop SOPs for managing the spread of Covid-19 during project execution and submit them for the approval of the Supervision Engineer and the Client before mobilizing to site. The SOPs shall be in line with the AfDB guidance on COVID-19, Ministry of Health Directives and site-specific project conditions;	<u>All workers</u> <u>Responsibility</u> Contractor	• Availability of SOP(s), Training material, PPE, sanitizing facilities • No of workers sensitized on COVID-19	Contractor to include these costs in his rates

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
		• Mandatory provision and use of appropriate Personal Protective Equipment (PPE) shall be required for all project personnel including workers and visitors; • Avoid concentration of more than 15 workers at one location. Where there are two or more people gathered, maintain social distancing of at least 2 meters; • All workers and visitors accessing worksites every day or attending meetings shall be subjected to rapid Covid-19 screening which may include temperature check and other vital signs; • The project shall put in place means to support rapid testing of suspected workers for covid-19; • Install hand washing facilities with adequate running water and soap, or sanitizing facilities at entrance to work sites including consultation venues and meetings and ensure they are used; • Ensure routine sanitization of shared social facilities and other communal places		• No of hand-washing facilities installed; facemasks and temperature monitors secured, etc.	

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
		routinely including wiping of workstations, door knobs, hand rails etc.;			
Social risk – spread of COVID -19 amongst community members during consultation	•	• Electronic means of consulting stakeholders and holding meetings shall be encouraged whenever feasible. One-on-one engagements for the PAPs while observing social distance and adhering to PPE wearing shall be enforced; • Avoid concentrating of more than 15 community members at one location. Where two or more people are gathered, maintain social distancing of at least 2 meters; • The team carrying out engagements within the communities on one-on-one basis will be provided with appropriate PPE for the number of people they intend to meet; • Use traditional channels of communications (TV, newspaper, radio, dedicated phone-lines, public announcements and mail) when stakeholders do not have access to online	Communication / stakeholder engagement expert in the Team/ Stakeholder engagement expert Responsibility Contractor Supervising Eng. & Contractor	• Availability of SOP(s), Training material, PPE, sanitizing facilities • Availability of SOP(s), Training material, PPE, sanitizing facilities • No. of participants registered online. • Attendance registers of all meetings held • Evidence of use of electronic media for information	No direct cost

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
		channels or do not use them frequently. Allow participants to provide feedback and suggestions • Hold meetings in small groups, mainly in form of FGDs if permitted depending on restrictions in place and subject to strict observance of physical distancing and limited duration. In situations where online interaction is challenging, disseminate information through digital platform (where available) like Facebook and Whats App & Chart groups. • Ensure online registration of participants, distribution of consultation materials and share feedback electronically with participants.		dissemination/ engagement	
Disruption of amenities access roads, services lines and driveways) causing inconvenienc	• Medium	• The contractor shall develop a traffic management plan; • The Contractor should provide temporary road signs or notices to indicate ongoing works; • The Contractor together with the Resident Engineer Should Plan itineraries for site	Civil works areas <u>Responsibility</u> Contractor(s) Supervision	• Number of complaints from community due to lack of certain services	No direct costs

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
es to the community		traffic on a daily basis and avoid peak traffic periods; • The Contractor should effect traffic controls and cleanliness to avoid congestion and truck accidents on roads; • For the site traffic the Contractor has to ensure that they: o Only park in designated parking areas; o Don't block pedestrian routes; o Don't block traffic routes; o Obey the speed limit • The resident Engineer has to ensure that the Contractor: o Introduces segregated pedestrian walkways; o Introduces speed limits; o Reduces the need for reversing vehicles, by introducing a one-way system; o Uses a qualified BANKSMAN to control deliveries and reversing vehicles; • Designates loading/unloading areas.			

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
Community accidents	• Medium	• Provide notices, signage and information to the public for their safety at all locations • Install barriers along walkways, crossings and public places affected by the works for public safety • Where there is potential for nuisance from dust generation, ensure earth moving is under dump conditions (consider watering where necessary) • Inform immediate communities or stakeholders of the activities.	All work areas <u>Responsibility</u> Contractor(s)	• Accident's occurrence incidences • Cases of respiratory complication at nearby health center	~KShs. 0.5M
Gender Based Violence	• Low	• The contractor will mainstream Gender Inclusivity in hiring of workers and entire Project Management as required by Gender Policy 2011 and 2/3 Gender Rule. • The existing community structures headed by location chiefs should be involved in local labour hire, emphasize the requirement of hiring women, youth and people with disability and VMGs • Protecting Human Risk Areas Associated with, Disadvantaged Groups, interfering with Participation Rights and interfering with Labour Rights:	<u>All workers</u> <u>Responsibility</u> Contractor Local CBO Local NGO	• The Contractor shall require his employees, sub-contractors, sub-consultants, and any personnel thereof engaged in construction works to	• No direct cost associated

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
		• Treat women and children (persons under the age of 18) with respect regardless of race, color, language, religion, political or other opinion, national, ethnic or social origin, property, disability, birth or other status. • Do not use language or behavior towards women or children that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate. • Sexual activity with children under 18—including through digital media is prohibited. Mistaken belief regarding the age of a child and consent from the child is not a defense. • Exchange of money, employment, goods, or services for sex, including sexual favors or other forms of humiliating, degrading or exploitative behavior is prohibited. • Sexual interactions between contractor's and consultant's employees at any level and member of the communities surrounding the workplace that are not agreed to with full consent by all parties		individually sign and comply with a Code of Conduct with specific provisions on protection from sexual exploitation and abuse • The contractor will implement provisions that ensure that gender-based violence at the community level is not triggered by the Project, • Ensure clear human resources policy against	

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
		involved in the sexual act are prohibited. This includes relationships involving the withholding, promise of actual provision of benefit (monetary or non-monetary) to community members in exchange for sex – such sexual activity is considered "non-consensual". • Where an employee develops concerns or suspicions regarding acts of GBV by a fellow worker, whether in the same contracting firm or not, he or she must report such concerns in accordance with Standard Reporting Procedures. • A GBV code of conduct to be prepared and given to the workers during recruitment • All employees are required to attend an induction-training course prior to commencing work on site to ensure they are familiar with the GBV Code of Conduct. All employees must attend a mandatory training course once a month for the duration of the contract starting from the first induction training prior to commencement of		sexual harassment that is aligned with national law • Integrate provisions related to sexual harassment in the employee COC • Ensure appointed human resources personnel to manage reports of sexual harassment according to policy	

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
		work to reinforce the understanding of the institutional GBV Code of Conduct.		• the contractor shall develop specific plan for mitigating these known risks, e.g. sensitization around gender-equitable approaches to compensation and employment; etc.	
Sexual Exploitation and Abuse (SEA)	• Low	• Develop and implement a SEA action plan with an Accountability and Response Framework as part of the C-ESMP. The SEA action plan will follow guidance on the AfDB Good Practice Note for Addressing Gender-based Violence in Investment Project Financing involving Major Civil Works (Sept 2018).	<u>All workers</u> <u>Responsibility</u> Contractor Local CBO Local NGO	• Availability of SEA Action Plan • Signed COC • Identified SEA referrals • Presence of community complains redress mechanism	• No direct cost associated

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
		• The SEA action plan will include how the project will ensure necessary steps are in place for: • Prevention of SEA: including COCs and ongoing sensitization of staff on responsibilities related to the COC and consequences of non-compliance; project-level IEC materials; • Response to SEA: including survivor-centered coordinated multi-sectoral referral and assistance to complainants according to standard operating procedures; staff reporting mechanisms; written procedures related to case oversight, investigation and disciplinary procedures at the project level, including confidential data management; • Engagement with the community: including development of confidential community-based complaints mechanisms discrete from the standard GRM; mainstreaming of Sexual Exploitation and Abuse (SEA) awareness-raising in all community engagement			

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
		activities; community-level IEC materials; regular community outreach to women and girls about social risks and their SEA-related rights;			
Public Health and safety risks Worker Occupational safety risks	• Medium	• Notify public the intent to cut sections of the road for safety precautions • Provide signage and safety information in all work areas • Ensure compliance by workers with safety safeguards including the OHS, provision of safety gear and enforcement of application	civil works areas <u>Responsibility</u> Contractor(s) Supervision	• Accidents occurrence incidences •	• • KShs.0 .5M
Risks of Accidents, Injuries or death of workers or community member	High	• Provide construction workers with personal protective gear (gloves, gum boots, overalls and helmets), • Provide temporary toilets and bathrooms for the construction workers at the work sites • Provide onsite first aid kit accessible by the workers in need, • Isolate the site for access by the local communities during the construction for their safety and health	• All work areas • Responsibility Contractor(s) Supervision	• Accident's occurrence incidences	• KShs.0 .5M

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
		• Contractor to provide a Healthy and Safety Plan prior to the commencement of works to be approved by the resident engineer.			
Hazards of fire outbreak, oil and chemical spills.	High	• Follow specifications of the Occupational Health and Safety Act, EMCA, 1999 and others in the development and operation of stores.	• All work areas • Responsibility Contractor(s) Supervision	• Incidence of reported cases of fuel leaks and fire incidences	• No direct cost associated
Risk to health and safety of community and workers	Medium	• The Contractor shall keep noise level within acceptable limits and construction activities shall, where possible, be confined to normal working hours in the residential areas • hospitals and other noise sensitive areas shall be notified by the Contractor at least 5 days before construction is due to commence in their vicinity • Any complaints received by the Contractor regarding noise will be recorded and communicated to the RE • The Contractor must adhere to Noise Prevention and Control Rules of April 2005	• civil works areas and access roads • Responsibility Contractor(s) Supervision engineer	• Reported complaints from neighbor community and institutions	• No direct cost associated •

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
ESMMP	**KES 2.2M**				

Table 8-2: Operational Phase: Environmental and Social Management and Monitoring Plan

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
Odour Menace from Wastewater Treatment Works	Low to Medium	• Ensure appropriate covering/ventilation of the pre-treatment unit; • Ensure appropriate handling and removal of grit/grease; • Ensure proper sizing and alignment of the plant; • Ensure scum is appropriately disposed off or properly stabilized; • Ensure adequate water flow through the plant to reduce the potential of odour formation; • The perimeter of the proposed site should be vegetated with trees and plants of varying heights thereby forming windbreaker and reduce dispersion of odour; • Maintenance the roofs of the sludge drying beds to ensure quick drying of sludge and appropriate	MUSWASCO	• No of complains received from community members	To be established at operation phase and included in the operation of the projects

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
		disposal to reduce odour emanating from wet sludge.			
Waste Generation and Disposal	Low to Medium	• Sludge drying beds should be incorporated in the design • Provision of solid waste storage bins. • Provision of adequately designed bins to prevent access by vermin. • Monitor exhauster trucks so that they do not become overfilled and spill waste enroute to the site. Ensure that the solid waste generated is disposed of in an approved dumpsite or landfill.	MUSWASCO NEMA COUNTY GOVERNMENT	• Waste bins Onsite • Disposal of grit/sludge in • licensed dump sites	
Increase in traffic along the access road	Low	• Limit septage delivery to the site between the hours of 8 and 5 pm. This will limit the noise nuisance to residents and possibly reduce the population exposed to potential accidents, as most persons would have already left their homes to go to work or and schools. • Add adequate and appropriate signs including speed limits along the road in proximity to the access roads.	MUSWASCO	• Regulated transport • hours and times • Noise levels generated en route by vehicles • minimization • Signs posted	

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
				• En route	
Inversion of Birds and Reptiles to the Waste Water Treatment Works	Low	• The sewage treatment plants should be protected from wildlife encroachments by providing secure barriers to keep off the animals from interfering with the plant operations and safety. This will also ensure safety of the residents, • The quality of the discharging sewage into the river will be an important parameter on the regional control of the river eutrophication. Continuous generation and sharing of sewage quality data on pre-scheduled monitoring programmes will be necessary	MUSWASCO	• New species of of animals and birds observed a the STP	
Health and Safety Risks from Burst Sewers	Low	• Activate a community watch group for information sharing on the status of the sewer line • Awareness raising among community members not to dump solids in manholes. • Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups	MUSWASCO	• Number of complaints received from community members	

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
		• Development of an inventory of system components, with information including age, construction materials, and drainage areas served elevations. • Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replaced if broken to minimize entry of garbage and silt into the system • Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent build-up of solids and hydrogen sulphide generation			
Risks of Overflowing Manholes due to Blockage of Sewers	Low	• Blockages should be detected and promptly replaced; • Regular monitoring and sampling of the waste water at influent and effluent points as well as in the receiving water bodies; • Communities living within the river basins where the trunk sewers will be constructed should be enlightened on dangers of using raw sewerage to irrigate farmlands.	MUSWASCO	• Number of complaints received from community members	

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
Visual and landscape impact management	Low	• Elaborate landscaping and maintenance of these sites can limit the viewpoints to the facilities and thus reduce their visual impact	MUSWASCO	•	
Grit, sludge and other solid wastes	Low	• The sludge will be temporarily held in sludge drying beds for sludge digestion and the dry cake will be safe for disposal. • Sludge quality will need to be monitored to ensure that human health is protected	MUSWASCO	• Quality of the sludge	
Pollution of Karuchu stream	Low	• Follow the NEMA waste water quality guidelines strictly • The quality of the discharging sewage into the river will be an important parameter on the regional control of the river eutrophication. • Continuous generation and sharing of sewage quality data on pre-scheduled monitoring programmes will be necessary	MUSWASCO	• Quality of wate rafter the discharge point of the effluent	
Increase in Social Vices	Low	• A security chain link fence including a gate and guard house should be erected at sewer treatment plant to protect the site from theft and vandalism.	MUSWASCO	• No of vandalism reported cases	

Associated Impacts	Impact Levels	Management Actions	Target Areas& Responsibilities	Monitoring Indicator	Budget
		• Design manholes and manhole step iron from material which do not have any value in the scrap metal industry. • Proper security measures should be put in place to guard the equipment 24 hours to reduce cases of vandalism.			

8.4 Decommissioning Phase

The decommissioning phase of a project includes restoring the environment to its original form once all the operational activities of the project have ceased. The project has been designed to operate effectively for over 20years. The necessary activities, mitigation measures, allocation of responsibilities, time frames and costs pertaining to prevention, minimization and monitoring of all potential impacts associated with the decommissioning and closure phase of the project are outlined in the table below.

Table 8-3: Decommissioning Phase ESMP

Associated Impacts	Impact Levels	Management Actions	Responsibilities	Budget
Loss of Jobs and Income	Low	• Notify the employees in advance on the project closure date and adequately compensate them; • Dismissal procedures to be compliant with Employment Act, 2007; • Provide counseling and alternative skills for alternative activities; • Employer should find alternative means of livelihood for the staff who were employed at the treatment plant. • Customers to be notified in advance of the proposed decommissioning	Contractor	To be established at decommissioning phase
Noise Pollution	Low	• Schedule noisy activities during the day time period; • Use silencers on machines where possible; • Ensure machinery is well maintained to reduce noise emitted	Contractor	
Solid Waste Material	Low	• Disposal of solid waste in compliance with EMCA 2006 Waste Management Regulations; • Segregation of waste to encourage reuse and recycling; • Ensuring that the contracted waste collector is registered with NEMA to collect and dispose wastes.	Contractor	

Associated Impacts	Impact Levels	Management Actions	Responsibilities	Budget
Occupational Health and Safety	Low	• Conduct training on health and safety procedures to the workers prior to commencement of demolition; • Proper plans should be made prior to demolition so as to contain the raw sewage and other waste water that poses as health risk to human beings and the environment, to prevent the workers and surrounding communities from getting into contact with it.	Contractor	

CHAPTER 9 : CONCLUSION AND RECOMMENDATION

9.1 Conclusion

The Environmental and Social Impact Assessment undertaken for the project indicates that the project will have the following impacts:

i. The Project area is located within in Kigumo sub-county in Murang'a County and their surrounding environment, the project area is away from any sensitive environment ecosystems. The assessment identified that there will be no direct interaction of the project activities at the time of construction with the natural sensitive ecosystems.
ii. The Environment impacts will be less significant impacts as discussed in Chapter 7 of this assessment. However, it could result to significant water pollution impacts to Karuchu stream if not appropriately operated and maintained.

9.2 Recommendations

This assessment recommends the following provisions:

i. The Bid documents prepared for the project incorporate the Environment, Social Health and Safety Provisions discussed under Chapter 7 (Environment and Social Impact Assessment and Mitigation Measures).
ii. The proponent should be given all the available support to implement the project
iii. Necessary permits should issued by the licensing authority so that the work can commence
iv. Contractor will be required to commit to implementing the Environment, Social Health and Safety (ESHS) Provisions by developing site-specific (ESHS) plans.
v. At project implementation stage, the Contractor to report to the project management team comprising of the Consultant and the project proponent on a monthly basis on how ESHS provision detailed in this ESIA are addressed
vi. On completion of the Civil Works, MUSWASCO to commission an independent Consultant to undertake an initial Environment, Social, Health and Safety Audit as required by Environmental (Impact Assessment and Audit) Regulations 2003 with 2019 amendments. The audit will identify nonconformities which the Contractor together with MUSWASCO will address through the defects liability period of the project. This audit will also form basis of annual project self-audits by MUSWASCO.

ANNEXES

Annex 1: Lead Expert NEMA License

FORM 7 (r.15(2))

nema

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/17415

Application Reference No: NEMA/EIA/EL/22511

M/S **Losai Management Limited**
(individual or firm) of address

P.O. Box 63048-00100 NAIROBI

is licensed to practice in the

capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Firm of Experts**
registration number **11481**

in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

Issued Date: **4/28/2022** Expiry Date: **12/31/2022**

Signature.....

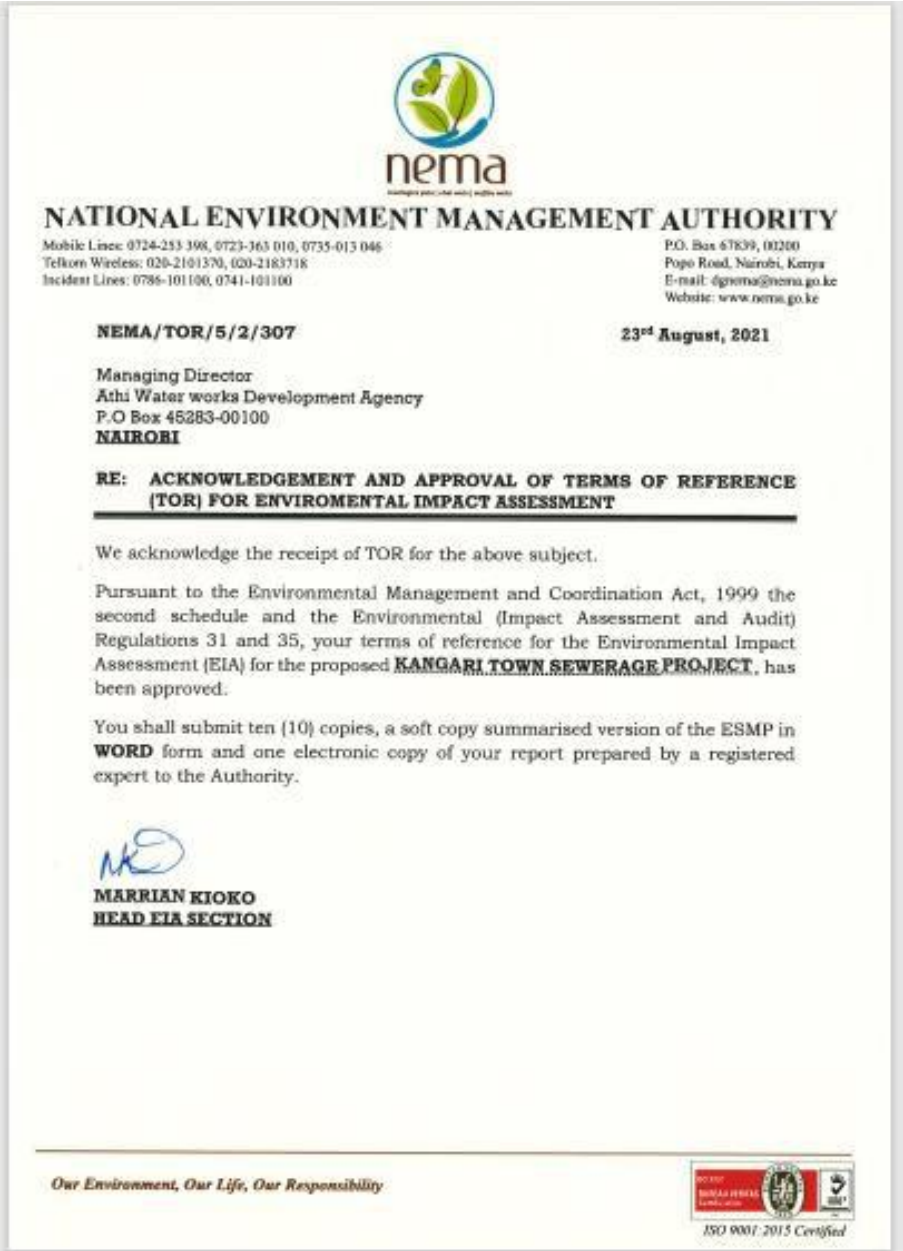
(Seal)

Director General
The National Environment Management Authority

P.T.O.

ISO 9001:2015 Certified

Annex 2: Letter of acknowledgment of approval for the TOR



nema

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

Mobile Lines: 0724-253 398, 0723-363 010, 0735-013 046
Telkom Wireless: 020-2101370, 020-2183718
Incident Lines: 0786-101100, 0741-101100

P.O. Box 67839, 00200
Popo Road, Nairobi, Kenya
E-mail: dgnema@nema.go.ke
Website: www.nema.go.ke

NEMA/TOR/5/2/307 **23rd August, 2021**

Managing Director
Athi Water works Development Agency
P.O Box 45283-00100
NAIROBI

RE: ACKNOWLEDGEMENT AND APPROVAL OF TERMS OF REFERENCE (TOR) FOR ENVIROMENTAL IMPACT ASSESSMENT

We acknowledge the receipt of TOR for the above subject.

Pursuant to the Environmental Management and Coordination Act, 1999 the second schedule and the Environmental (Impact Assessment and Audit) Regulations 31 and 35, your terms of reference for the Environmental Impact Assessment (EIA) for the proposed **KANGARI TOWN SEWERAGE PROJECT**, has been approved.

You shall submit ten (10) copies, a soft copy summarised version of the ESMP in **WORD** form and one electronic copy of your report prepared by a registered expert to the Authority.

MARRIAN KIOKO
HEAD EIA SECTION

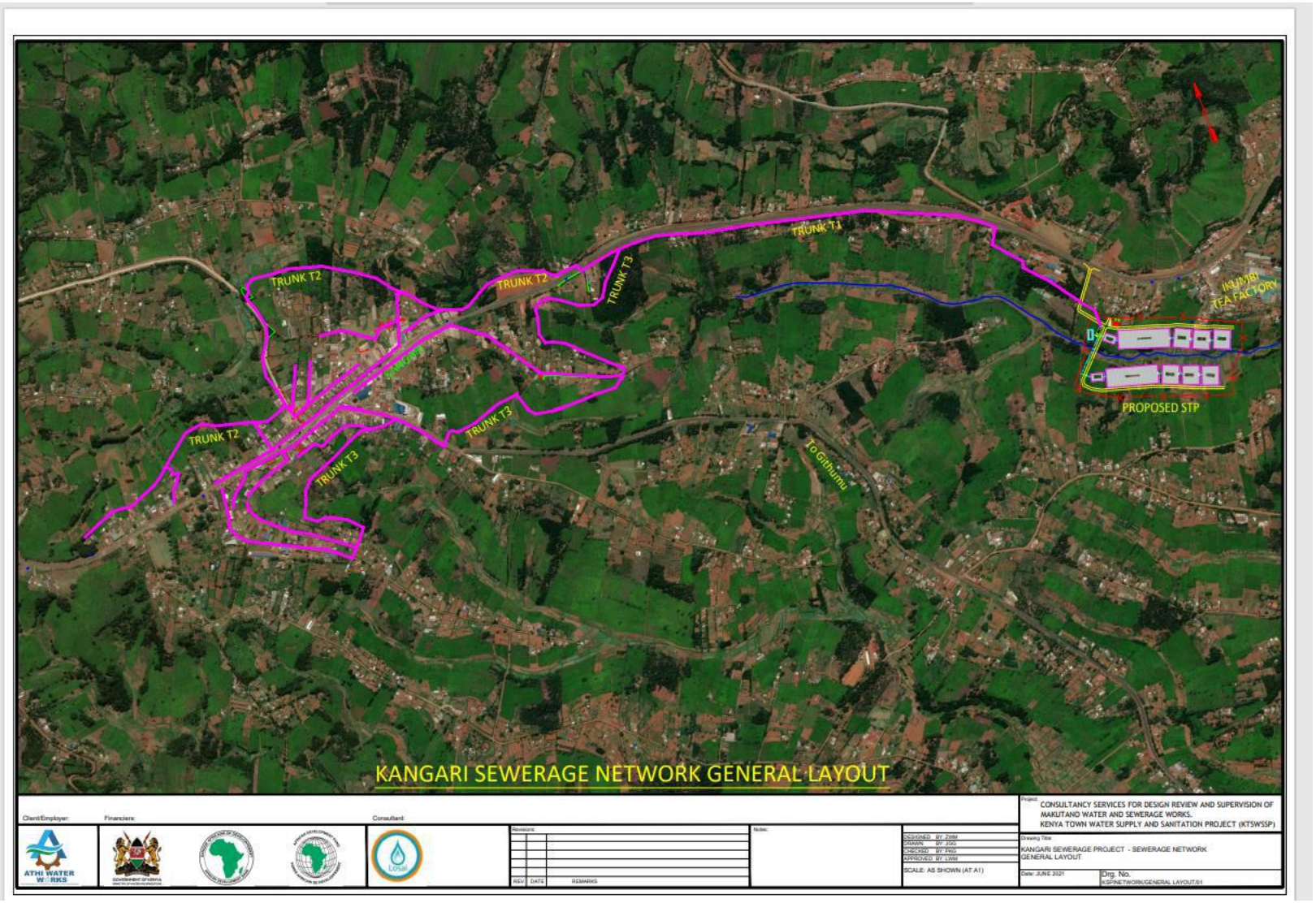
Our Environment, Our Life, Our Responsibility

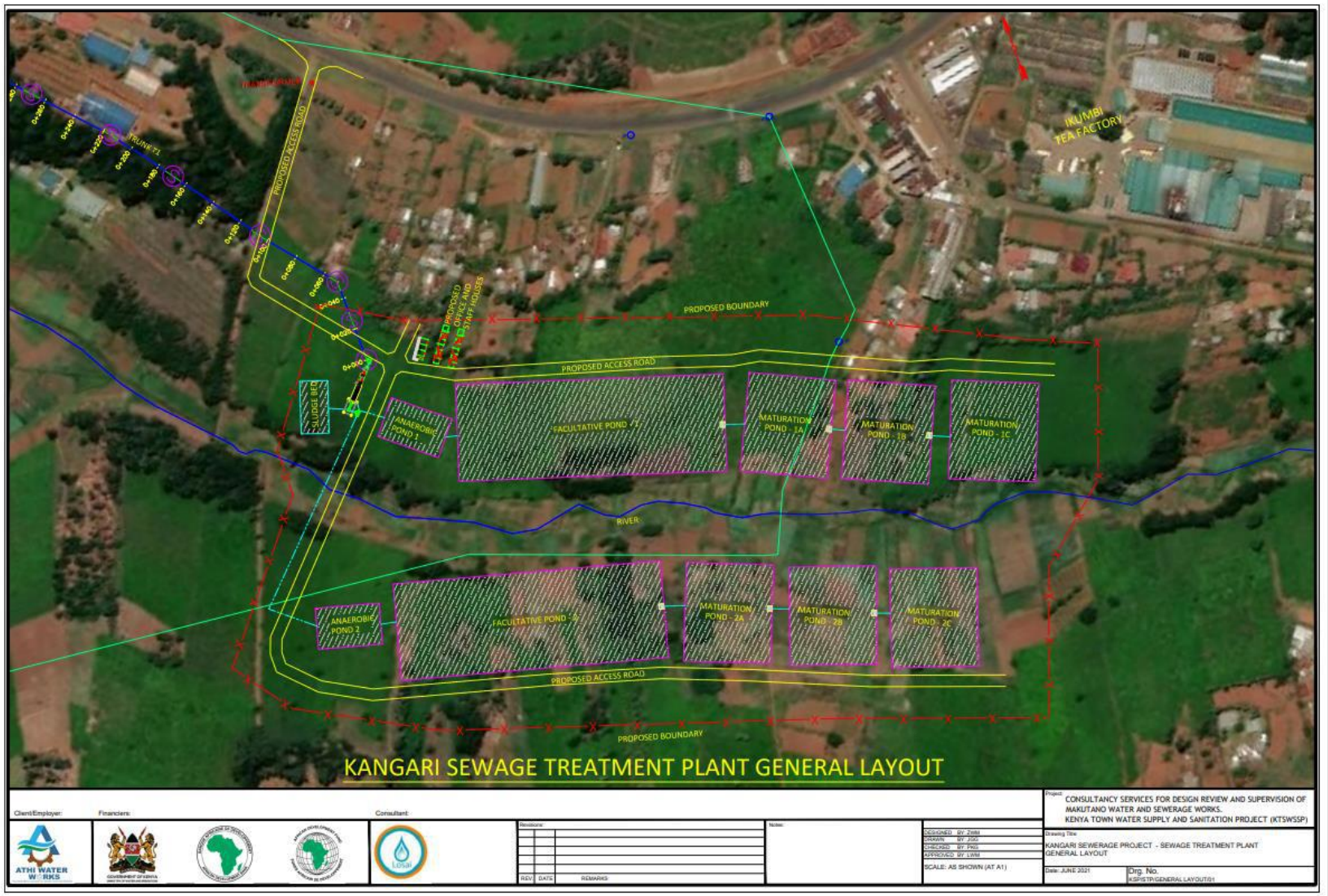
ISO 9001:2015 Certified

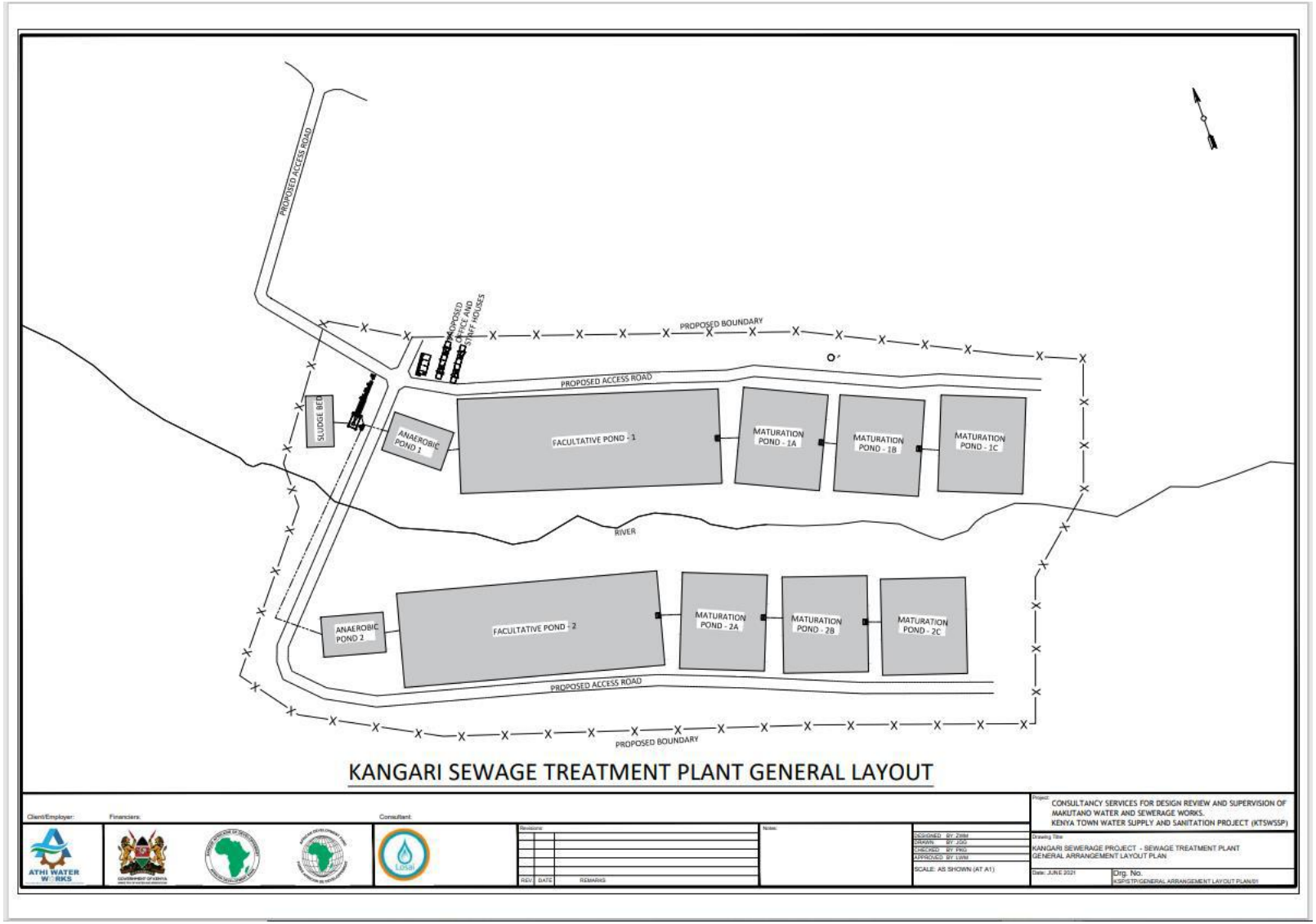
Annex 3: Minutes and Attendance Sheet

Annex 4: Sample Filled Questionnaire's:

Annex 5: Layout Plan




KANGARI SEWAGE TREATMENT PLANT GENERAL LAYOUT
PROPOSED ACCESS ROAD
PROPOSED BOUNDARY
PROPOSED OFFICE AND STAFF HOUSES
ANAEROBIC POND 1
FACULTATIVE POND - 1
MATURATION POND - 1A
MATURATION POND - 1B
MATURATION POND - 1C
ANAEROBIC POND 2
FACULTATIVE POND - 2
MATURATION POND - 2A
MATURATION POND - 2B
MATURATION POND - 2C
RIVER
IKUMBI TEA FACTORY
CONSULTANCY SERVICES FOR DESIGN REVIEW AND SUPERVISION OF MAKUTANO WATER AND SEWERAGE WORKS.
KENYA TOWN WATER SUPPLY AND SANITATION PROJECT (KTSWSSP)
KANGARI SEWERAGE PROJECT - SEWAGE TREATMENT PLANT GENERAL LAYOUT


PROPOSED ACCESS ROAD
PROPOSED OFFICE AND STAFF HOUSES
PROPOSED BOUNDARY
PROPOSED ACCESS ROAD
SLUDGE BED
ANAEROBIC POND 1
FACULTATIVE POND - 1
MATURATION POND - 1A
MATURATION POND - 1B
MATURATION POND - 1C
RIVER
ANAEROBIC POND 2
FACULTATIVE POND - 2
MATURATION POND - 2A
MATURATION POND - 2B
MATURATION POND - 2C
PROPOSED ACCESS ROAD
PROPOSED BOUNDARY
KANGARI SEWAGE TREATMENT PLANT GENERAL LAYOUT
Client/Employer:
Financiers:
Consultant:
CONSULTANCY SERVICES FOR DESIGN REVIEW AND SUPERVISION OF MAKUTANO WATER AND SEWERAGE WORKS.
KENYA TOWN WATER SUPPLY AND SANITATION PROJECT (KTSWSSP)
KANGARI SEWERAGE PROJECT - SEWAGE TREATMENT PLANT
GENERAL ARRANGEMENT LAYOUT PLAN
SCALE: AS SHOWN (AT A1)
Date: JUNE 2021
Drg. No.
KSPSTP/GENERAL ARRANGEMENT LAYOUT PLAN/01