ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT

Detailed design, Tendering and Supervision of Last Mile Connectivity Works for Eldoret Town Sewerage System

April, 2020

DECLARATION

I, **Charles Lwanga Muyembe** on behalf of SMEC, submit the **Environmental And Social Impact Assessment (ESIA) Study report for the Proposed detailed design, Tendering and Supervision of Last Mile Connectivity Works for Eldoret Town**. The ESIA has been prepared in accordance with the Client Guidelines Environmental Management and Coordination Act, Cap 387, and the Environmental (Impact Assessment and Audit) Regulations, 2003 (and the amendment Regulations of 2016).

Signed at NAIROBI on this .....**24th**.....day of .....**April**.....2020

Signature:..... Muyembe. .....

Designation: EIA/AUDIT LEAD EXPERT REG. NO.1283

I, Eng. Hosea K. Wendot.....on behalf of Rift Valley Water Works Development Agency submit the **the Environmental And Social Impact Assessment (ESIA) Study of the Proposed detailed design, Tendering and Supervision of Last Mile Connectivity Works for Eldoret Town**. The ESIA has been prepared in accordance with the Client Guidelines Environmental Management and Coordination Act, Cap 387, and the Environmental (Impact Assessment and Audit) Regulations, 2003 (and the amendment Regulations of 2016)

Signed at ~~30TH~~ NAKURU 30TH on this .....Day of APRIL 2020

Signature.....

Designation: CHIEF EXECUTIVE OFFICER

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ABBREVIATIONS AND ACRONYMS

AfDB	African Development Bank
ADF	Africa Development Fund
ELDOWAS	Eldoret Water and Sanitation Company Ltd
ESMMP	Environmental and Social Monitoring and Management Plan
KTSWSSP	Kenya Towns Sustainable Water Supply and Sanitation Programme
GoK	Government of Kenya
LVNWNDA	Lake Victoria North Water Works Development Agency
PAPs	Project Affected Persons
SMEC	Snowy Mountains Engineering Corporation
EHS	Environmental Health and Safety
EMCA	Environmental Management and Coordination Act
EMP	Environmental Management Plan
ESIA	Environmental and Social Impact Assessment
FOSI	Finding of Significant Impact
H&S	Health and Safety
KPC	Kenya Power Company
NEAP	National Environmental Action Plan
NEMA	National Environmental Management Authority
OHS	Occupational Health and Safety
TOR	Terms of Reference
WRA	Water Resources Authority

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EXECUTIVE SUMMARY

Project background

The Government of Kenya has received financing from the Africa Development Fund (AfDF) to support the Kenya Sustainable Towns Water Supply and Sanitation Programme. The programme aims at contributing to the quality health of life and reducing poverty levels of the population of Kenya through provision of water and sanitation services on a suitable basis.

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

To achieve this objective, the Rift Valley WWDA has on behalf of Lake Victoria North WWDA, prioritized water and sewerage network expansions and interconnections for Eldoret and Kakamega Towns.

The objective of the assignment is to evaluate the existing systems, recommend best alternatives for improvement/enhance connectivity, carry out detailed designs, prepare tender documents, assist the Client in Tendering and Supervise Construction of the Works.

The Rift Valley Water Works Development Agency (hereafter referred to as the Client) has engaged SMEC Kenya in Association with SMEC South Africa (hereafter referred to as the Consultant) to conduct the Consultancy Services for the Detailed Design, Tendering and Supervision of Last Mile Connectivity Works for Eldoret and Kakamega Towns (hereafter referred to as the Project) after the Consultant responded to a Request for Proposal dated August 2018, and awarded the contract on 20 March 2019.

SMEC therefore carried out the ESIA study as required by the Client Guidelines and Environmental Management and Co-ordination Act (EMCA), Act, Cap 387, and the Environmental (Impact Assessment and Audit) Regulations, 2003 (and the amendment Regulations of 2016).

Purpose of the ESIA

Environmental and Social Impact Assessment (ESIA) is designed to establish a triangular relationship between the proposed Project, natural ecosystems, social setting and co-existence. The study, therefore, will relate the project and key environmental, social and economic areas and related linkages for ease of integration in the implementation of the project right from the planning stage through construction, commissioning and eventually long term use.

The overall study objective of the assignment is to develop the most cost-effective system to address collection, treatment and disposal with design output that is focused on the following:

- ✓ Capable of performing the intended functions throughout the design life;
- ✓ Environmentally acceptable, both during construction and in the long term;
- ✓ Economical in terms of both capital and recurrent costs.

Study methodology

The Environmental and Social Impact Assessment followed the following procedure; screening, scoping, site assessment, baseline studies, impact analysis and provision of mitigation measures, project alternatives, Environmental and Social Management Plan and the Environmental Monitoring Plan

Baseline

The proposed project location is within residential areas in Eldoret town, Uasin Gishu County. The specific areas selected for new alignments and rehabilitation works include annex, sukunanga, racecourse, elgon view, kenmosa, upper hill, hillside, huruma, langas and kipkorgot.

Project description

It is proposed that the whole process will dwell on extension and rehabilitation of sewer system in eldoret town. Apart from the proposed rehabilitation of existing sewer lines, new sewer lines will be constructed with a total length of 45.8 km.

- ✓ The following existing lines are set for rehabilitation ; langas, huruma and elgon view
- ✓ construction of new sewerlines will be done in; upperhil, kenmosa, hillside, kipkorgot, annex, sugunanga, racecourse, and elgon view
- ✓ rehabilitation works will also be done for quarry and boundary waste water treatment plants.

Policy legal and regulatory framework

Some of the Policies reviewed include the Kenya Vision 2030, Sessional Paper No. 10 of 2014 on the National Environment Policy, National Water Policy, 2012, the public health policy of 2014, Kenya National Policy on Gender and Development, 2000 and the draft National Land Use Policy, 2016.

Institutional framework reviewed includes; Ministry of Water and Irrigation, Ministry of Environment and Forestry, EMCA, CAP 387 Administrative Framework, National Environment Action Plan Committee, County Environment Committees and the National Environment Restoration Fund.

Legal framework reviewed include; Environmental Management and Coordination Act CAP 397, the Environment and Land Court Act, 2011, the Water Act, 2016, The land Act, 2012, The Agriculture, Fisheries and Food Authority Act, 2013, the Energy Act 2006, Penal Code Act CAP 63, County Government Act 2012, Occupational Health and Safety Act 2007, Public Health Act CAP 242, and the Physical Planning Act 1996.

AfDB safeguards triggered by the project include: Environmental Assessment (OS1), Involuntary Resettlement: Land Acquisition, Population Displacement and Compensation (OS 2); Biodiversity and Ecosystem Services (OS 3); Pollution Prevention and Control, Greenhouse Gases, Hazardous Materials and Resource efficiency (OS 4); and Labor Conditions, Health and Safety (OS 5)

International conventions and treaties were also reviewed

Potential impacts and mitigation measures

Some of the main potential positive impacts of the proposed project nclude greater sewerage coverage in the town, improved health and sanitation as pollution from septic tank/pit latrines (onsite sanitation) leakages will be eliminated, elimination of discharges of untreated sewage to sosiani river, provision of employment, environmental protection, employment opportunities, improved living conditions, redused soil erosion, improved underground water quality, increased revenue for service providers, land value will go up, improved business in the area among others.

Negative impacts identified for both the construction and operation phase have been outlined in the table below;

Table 1: potential negative impacts and mitigation measures

Impact	Mitigation measures
Construction phase	
Air pollution	✓ Drivers should be instructed on the benefits of driving practices that reduce both the risk of accidents and fuel consumption, including measured acceleration and driving within safe speed limits; ✓ Contractors should consider additional ways to reduce potential impacts including implementing a regular vehicle maintenance and repair program. ✓ Ensure that all vehicles involved in the transport of construction material and staff, and machinery involved in the construction is properly maintained and serviced. ✓ Machines must not be left idling for unnecessary periods of time; this will save fuel and reduce emissions. ✓ Use of dust control methods, such as covers water suppression ✓ Ensure that all trucks carrying aggregate and sand are covered during delivery to the site. ✓ Ensure that all material (sand and aggregate) stockpiled on the site to be used in construction activities are regularly sprayed to reduce the effects of wind whipping ✓ Care must be taken in the unloading construction materials (aggregate, sand and cement) to prevent spillage. If a spill occurs, this should be cleaned up as soon as possible thereafter. ✓ Extra care must be taken to reduce dust in periods when wind speed is greatest and the rainfall amounts are lowest. This will involve extra wetting of the construction area to suppress dust particles. ✓ Retain a buffer area of trees and other vegetation generally around the perimeter of the development site which will serve as a natural windbreaks which may reduce the level of dispersion of dust particles generated during this phases of the development. ✓ All raw materials must be sourced as close as possible to the construction site thus reducing the emissions from vehicular traffic. ✓ All waste must be transported off-site for processing, not burnt or stored for any longer than is absolutely necessary.
Water pollution	✓ If diesel and motor oil are to be stored on site, ensure that they are properly contained in a bunded area (With capacity to contain 1½ times the amount of substances stored). This area must have signs indicating the storage of these substances erected. ✓ Provide workers at the development site with chemical toilets during this phase of the development. A reasonable ratio would be fifteen (15) workers per toilet. ✓ Store all raw materials away from the vicinity of water bodies located on the property to avoid contamination in these areas. ✓ General refuse generated during these phases of the development must be stockpiled in one central area of the development site, away from existing water bodies and collected, transported and disposed of appropriately at the designated disposal site. ✓ Clearance of vegetation must be avoided in periods of heavy rainfall
Solid wastes	✓ Use an integrated wastes management system observing the following hierarchy of options: a. Reduction at source b. Recycling c. Reuse d. Combustion

Impact	Mitigation measures
	e. Land filling. ✓ Incorporation of waste management commitments contained in the Waste Management Guidelines ✓ Agreement with suppliers to accept the return of unused materials. ✓ Agreement with and license details of companies to be used for the off-site transport of wastes ✓ Workforce training programs in waste minimization practices ✓ Where practical any excess materials will be returned to the supplier ✓ Waste oil will be collected for transport and off-site disposal Littering, specifically of the natural areas, should be prevented. Adequate containers for litter removal should be supplied on site. These containers should be emptied on a regular basis and the contents removed to an appropriate and licensed waste disposal site. ✓ The Contractor shall set up a solid waste control and removal system. ✓ Bins shall be emptied on a daily basis. ✓ Waste and litter shall be disposed of into scavenger – and weather proof bins. The contractor shall then remove the refuse collected from the working areas, from site at least once a week.
Noise and vibration	✓ Best available work practices will be employed on-site to minimize occupational noise levels. All construction equipment will be regularly inspected and maintained in good working condition. ✓ Combine noisy operations so that they occur at the same time. The total noise level will not be significantly louder than the level produced if the operations were to be undertaken separately. ✓ Noisy operations will be carried out strictly during the day time. ✓ Switch off engines when not in use. ✓ Access roads should be cut that are exclusively used for the transportation of workers, goods and materials. These roads should be sited in such a way that the noise from this movement affects as few of the existing residents as possible. ✓ Where possible silenced machinery and instruments should be employed to reduce the impact of noise on the existing residents and workers. ✓ Machinery, vehicles and instruments that emit high levels of noise should be used on a phased basis to reduce the overall impact. These pieces of equipment such as drills, graders and cement mixers should also be used when the least number of residents can be expected to be affected, for example during periods where most residents are at work or school. ✓ Temporary barriers such as earth berms, zinc fencing and sound dampening fencing such as acoustic screens should be employed to reduce the impact of noise to the existing residents; ✓ Ensure that construction activities for the development of the project are staggered to decrease the levels of noise and vibration in the area; ✓ Construction hours should be limited to the hours of 8:00 a.m. and 6:00 p.m. daily. ✓ The delivery of raw materials must be limited to 8:00 a.m. and 6:00 p.m daily.
Biodiversity loss	✓ Only clear vegetation that is absolutely necessary for the construction activities; ✓ Avoid the use of Invasive Alien Species in the landscaping activities ✓ Determine Access roads which are to be used by machinery used in the construction and site clearance phase development to avoid the unnecessary trampling of vegetation that will be maintained within the development area. ✓ Ensure that green belts' which have been proposed for the STW are large as possible as small patches may not be able to support viable populations

Impact	Mitigation measures
	of some species and these small patches tend to more susceptible to edge effect. It possible position these green belts in adjacent to existing vegetated areas. In addition species richness tends to increase with area, which would be the desired outcome of the incorporation of green belts.
Disturbance of traffic and difficulty of access	✓ Provide diversion routes where possible. ✓ Give a construction itinerary in advance ✓ Erect warning signs of ongoing works. ✓ Expedite construction works so as to reduce the times where roads are blocked. ✓ Traffic department should approve crossing plan prior to construction, and should approve obstruction times during construction Access of residents should be facilitated by installing appropriate temporary bridges over the pipeline trenches. ✓ Suitable warning signs should be placed at near locations and should be visible at night. ✓ A guard should be available 24 hours to help people access across pipeline trenches. ✓ Alternatives access ways should be communicated to the community.
Damage of underground infrastructure	✓ Get maps of the underground infrastructure from the relevant institutions. ✓ Sensitise workers carrying out Excavations so that they exercise caution to minimize chances of underground infrastructure damage. ✓ Work closely with the responsible institutions o that incase of damage, the services are restored within the shortest time. Reroute sensitive infrastructure where possible. ✓ Notify affected parties if service needs to be temporarily relocated or was affected by the project works
Soil erosion	✓ Re vegetation of disturbed surfaces should be done as soon as possible
Occupational accidents	✓ Ensuring that the drivers and machine operators hired to work on the site are qualified. ✓ Workers on site must be provided with appropriate PPE. ✓ Appropriate signs must be erected on the site to warn workers and visitors. ✓ There should be safety policy clearly displayed on the site. ✓ Machines should be properly maintained. ✓ A first aid kit should be provided and a trained first aider should always be on site. ✓ Fire extinguishers should be provided. ✓ Proper scheduling of activities to avoid workers being overworked. ✓ Machines/equipment for the intended purpose. ✓ No worker should be allowed on site while under the influence of alcohol or other inebriating substances. ✓ Only the Blaster licensed by the Mines and Geology should carry out blasting on the site. ✓ Blasting should only be carried out as per the provisions of the blasting license away from house and power lines. ✓ All charged holes must be covered with appropriat medium to arrest fly rocks. ✓ Inspection of workers to ensure they are using the PPE at all times when necessary. ✓ Provide a fully stocked First Aid box on the site ✓ Display at prominent places occupational health and safety rules.

Impact	Mitigation measures
	✓ Test and approve equipment such as ladders before use. ✓ Training workers on how to use various PPE and proper use of machinery. ✓ Have a trained First Aider on the site. Registration of the premises as required by Law. ✓ Appropriate insurance should be acquired as required by law ✓ Medical examination of all workers before engagement and after the project is over. ✓ Display an emergency evacuation procedure. ✓ Moving parts of machines should be guarded to protect workers from injuries. Should an accident occur: ✓ The injured worker should be given first aid and immediately taken to the hospital. ✓ An investigation should be initiated immediately to ascertain the cause of the accident and preliminary findings released within 12 hours
Social conflicts	✓ Immediate action undertaken as soon as possible and within 24 hours of receipt of a complaint ✓ Investigations completed within seven days of receipt of complaint. ✓ All corrective actions implemented by due date ✓ All incidents or complaints about either environmental or social issues will be managed in accordance to the existing procedure in line with the legal framework. ✓ All incidents and complaints will be recorded in the contractors incident reporting system Additional environmental awareness training of the workforce with respect to procedures to be followed for environmental incidents or complaints ✓ Sensitize workforce on cultural sensitivities
Spread of HIV/ aids	✓ Sensitize the migrant workers on dangers of risky sexual behaviour. ✓ Have VCT services on site and encourage workers to undergo the same. ✓ Uptake of VCT by project workers and the host community. ✓ Provision of condoms to the workers. ✓ Preference for hiring workers from local community to minimize influx of migrant workers.
Employment	✓ As a priority offer employment opportunities to the local residents ✓ Employed persons with credible skills ✓ Ensure workers have an Insurance Cover. ✓ Working hours should be as per the Kenyan Labour laws
Access to public & private properties	✓ Monitoring impact of project on dwelling and business in the project area ✓ Monitor construction activities to ensure public and private property is not damage
Displacement	✓ Avoid displacement as much as possible Prompt and fair compensation of all the PAPs in full prior to beginning of construction works at the site.. ✓ Pre and post resettlement counseling's support.

Impact	Mitigation measures
of people	✓ Financial education for the recipients of compensation funds. ✓ Identification and full resettlement assistance for vulnerable PAPs.
Operational phase	
Water and soil pollution from leaks and sewage overflow and leaks	✓ Consider the installation of Separate sewer systems for domestic wastewater and storm water runoff in the overall planning and design of new sewerage systems; ✓ When on-site sanitation systems where excreta are mixed with water predominate, consider use of small-diameter sewerage system to collect water effluent from septic systems or interceptor tanks; ✓ Limit the sewer depth where possible (e.g., by avoiding routes under streets with heavy traffic). For shallower sewers, small inspection chambers can be used in lieu of manholes; ✓ Use appropriate locally available materials for sewer construction. Spun concrete pipes can be appropriate in some circumstances but can suffer corrosion from hydrogen sulphide if there are blockages and/or insufficient slope; ✓ Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent buildup of solids and hydrogen sulphide generation; ✓ 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; ✓ Equip pumping stations with a backup power supply, such as a diesel generator, to ensure uninterrupted operation during power outages, and conduct regular maintenance to minimize service interruptions Consider redundant pump capacity in critical areas; ✓ Development of an inventory of system components, with information including age, construction materials, drainage areas served, elevations, etc ✓ Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas. ✓ Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. ✓ Monitoring of sewer flow to identify potential inflows and outflows ✓ Immediate clearing of blockage or repairs warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow
Accidents and inhiries	✓ Install railing around all process tanks and pits. Require use of a life line and personal flotation device (PFD) when workers are inside the railing, and ensure rescue buoys and throw bags are readily available; ✓ Use PFDs when working near waterways; ✓ Implement a confined spaces entry program that is consistent with applicable national requirements and internationally accepted standards. ✓ Valves to process tanks should be locked to prevent accidental flooding during maintenance; Use fall protection equipment when working at heights; ✓ Maintain work areas to minimize slipping and tripping hazards; Use proper techniques for trenching and shoring; Implement fire and explosion prevention measures in accordance with internationally accepted standards; ✓ When installing or repairing mains adjacent to roadways, implement procedures and traffic controls, such as: ✓ Establishment of work zones so as to separate workers from traffic and from equipment as much as possible ✓ Reduction of allowed vehicle speeds in work zones;

Impact	Mitigation measures
	✓ Use of high-visibility safety apparel for workers in the vicinity of traffic ✓ For night work, provision of proper illumination for the work space while controlling glare so as not to blind workers and passing motorists ✓ Locate all underground utilities before digging
Offensive odours	✓ Provide adequate buffer area, such as trees, or fences, between processing areas and potential receptors; ✓ Avoid siting facilities near densely populated neighbourhoods and installations with potentially sensitive receptors, such as hospitals and schools. Site facilities down-wind from potential receptors, if possible. ✓ Cover emission points (e.g., aeration basins, clarifiers, sludge thickeners, tanks, and channels), and vent emissions to control systems (e.g., compost beds, biofilters, chemical scrubbers, etc.) as needed to reduce odours and otherwise meet applicable national requirements and internationally accepted guidelines
Public health issues related to irrigation with treated sewage	✓ Consider use of drip irrigation of treated wastewater, which minimizes worker exposure and the amount of water needed. ✓ Avoid use of spray irrigation of treated wastewater, if possible; ✓ Provide field workers with personal protective equipment, such as rubber gloves and waterproof shoes; ✓ Provide access to safe drinking water and sanitation (including hand washing) facilities; ✓ Provide worker health monitoring, including regular physical examinations; ✓ Control vectors and intermediate hosts of diseasecausing micro- organisms. ✓ Treat wastewater and sludge used for land application in a manner consistent with WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater and applicable national requirements; ✓ Stop irrigation with treated wastewater two weeks prior to harvesting; ✓ Limit irrigation with treated wastewater to crops that are cooked before eating; ✓ Restrict public access to hydraulic structures carrying wastewater and to fields irrigated with treated wastewater.
Scavengers birds and other animals	✓ Proper fencing of the Plant to keep off wildlife is recommended ✓ Maintaining high standards of hygiene at the site throughout the operation phase of the facility ✓ Constant consultations with KWS in event that wildlife is spotted in the area. ✓ The inlet works should be enclosed in a building to avoid exposure to birds ✓ Daily burying of the wastes in appropriate solid Waste disposal section covering with soil, this reduces the tonnage of wastes on site and exposing the wastes to scavenging birds
Decommissioning phase	
Scraps material and other debris	✓ Use of an integrated solid waste management system i.e. through a hierarchy of options. ✓ Wastes generated as a result of facility decommissioning activities will characterized in compliance with standard waste management procedures. ✓ The contractor will select disposal locations and the local council based on the properties of the particular waste generated ✓ All buildings, machinery, equipment, structures and partitions that will not be used for other purposes should be removed and reused or rather sold/given to scrap material dealers

Impact	Mitigation measures
	✓ Where recycling/reuse of the machinery, equipment, structures and other waste materials is not possible the materials should be taken to approved dumpsites by a duly registered waste transporter.
Vegetation disturbance Land deformation: soil erosion, drainage problems	✓ Implement an appropriate re-vegetation programme to restore the site to its original status. During the re-vegetation period, appropriate surface water runoff controls will be taken to prevent surface erosion; ✓ Monitoring and inspection of the area for indications of erosion will be conducted and appropriate measures taken to correct any occurrences; ✓ Fencing and signs restricting access will be posted to minimize disturbance to newly-vegetated areas;

Environmental and social management plan.

Environmental and Social Management Plan (ESMP) for developing projects is given to provide a logical framework within which identified negative environmental impacts can be mitigated and monitored. In addition, the ESMP assigns responsibilities of actions to various actors and provides a timeframe within which mitigation measures and monitoring can be done and their budgetary element.

Conclusions and recommendations

During the preparation of this report, it is observed and established that most of the negative impacts on the environment are rated low and short term with no significant effect other than those mentioned with mitigation measures that accompanies any development. The project upon completion would realize several positive impacts which are highly rated and will benefit all the stakeholders. These include elimination of discharges of untreated sewage to sosiani river, lead to environmental conservation and management as pollution from septic tank/pit latrines (onsite sanitation) leakages will be eliminated, greater sewerage coverage in the town, provision of employment, and most significant of which being reduction of public health hazard as result of improved sanitation conditions in the service area. The positive environmental impacts the project will realize far out-scales the negative ones, which can be contained by the prescribed EMMP. The project has been planned in full cognizance of the requirements of the neighbourhood where it is to be implemented and all standard planning considerations have been taken into account and given the attention they deserve

It is therefore concluded that the proposed project will not compromise the wellbeing of the neighbours, area ecological and environmental conditions and will improve economic wellbeing of resident of Eldoret Town. It is therefore recommended that the proposed project be approved subject to the following recommendations:-

- ✓ RVWWDA/ELDOWAS should make all the necessary efforts to comply with conditions set in the various approvals and licenses issued by various authorities including Ministry of Lands, Physical Planning, Health Department, Uasin Gishu County Government and National Construction Authority
- ✓ Ensure implementation of the proposed mitigation measures and compliance with the ESMP during the project cycle.

1 INTRODUCTION

1.1 Project Background

The Government of Kenya has received financing from the Africa Development Fund (AfDF) to support the Kenya Sustainable Towns Water Supply and Sanitation Programme. The programme aims at contributing to the quality health of life and reducing poverty levels of the population of Kenya through provision of water and sanitation services on a suitable basis.

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

To achieve this objective, the Rift Valley WWDA has on behalf of Lake Victoria North WWDA, prioritized water and sewerage network expansions and interconnections for Eldoret and Kakamega Towns.

The Rift Valley Water Services Board (hereafter referred to as the Client) has engaged SMEC Kenya in Association with SMEC South Africa (hereafter referred to as the Consultant) to conduct the Consultancy Services for the Detailed Design, Tendering and Supervision of Last Mile Connectivity Works for Eldoret and Kakamega Towns (hereafter referred to as the Project) after the Consultant responded to a Request for Proposal dated August 2018, and awarded the contract on 20 March 2019. SMEC therefore carried out the ESIA study as required by the Client Guidelines and Environmental Management and Co-ordination Act (EMCA), Act, Cap 387, and the Environmental (Impact Assessment and Audit) Regulations, 2003 (and the amendment Regulations of 2016).

The project entails extension and rehabilitation of a sewerage system in Eldoret Town and is aimed at improving sanitation of eldoret and its environs. The proposed project works will entail; Site clearance, Earthworks, Installation of main truck sewerage lines, Landscaping including top soiling and grassing and any other activity not listed above in either category but deemed to be necessary by the Engineer.

1.2 Key Objective of Environmental and Social Impact Assessment (ESIA)

The main objective of the ESIA study is to predict, assess, and analyse the possible positive and negative environmental and social impacts that are expected during the construction, operation and decommissioning phases of the project. This will be done with the aim of proposing the possible mitigation measures for the highlighted negative impacts. This is in line with ensuring that the development does not impact negatively on the environment in terms of social, health, economic and physical (soil, water, plant and animals) state of the project site.

The specific objectives are:

- Prediction and evaluation of potential environmental impacts of the project, and propose workable mitigation measures for the significant negative impacts of the project on the environment.
- Facilitation of consultative public participation and incorporate expressed views into the study report.
- Preparation of a detailed Environmental Monitoring Plan for the proposed project.
- Preparation of a detailed Environmental and Social Management Plan (ESMP) for the proposed project.

1.3 Justification of the Project

The programme aims at contributing to the quality health of life and reducing poverty levels of the population of Kenya through provision of water and sanitation services on a suitable basis.

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

To achieve this objective, the Rift Valley WWDA has on behalf of Lake Victoria North WWDA, prioritized sewerage network expansions and interconnections for Eldoret Town.

Currently, Eldoret town has an existing sewerage coverage of about 30% which is too small for the rapidly growing city and given that the water table of the area is too high, there is need for expansion of the sewer system in order to minimise contamination of water sources from onsite sanitation.

1.4 Justification of the ESIA

The implementation of the proposed project will have both socio-economic and environmental impacts on the project area. In order to alleviate any detrimental effects of the project, there is need to assess possible impacts of the development on the environment and the socio-economic attributes of the project area. Environmental Impact Assessment was conducted in accordance with the Client Guidelines and Environmental Management and Co-ordination Act (EMCA), Act, Cap 387, and the Environmental (Impact Assessment and Audit) Regulations, 2003 (and the amendment Regulations of 2016).

Due to the likely socio-economic impacts of the project, our Environmental Specialist and Socio-Economic Specialist has done socio-economic data survey to support the Environmental Impact Assessment and also to be used for Economic Evaluation of the Project. They were assisted by Field Assistants and a group of Enumerators in the process of acquiring the primary data in the field.

The execution of the assignment will be carried out during the preliminary design of the Project to ensure that the designs produced comply with environmental requirements and take into account socio-economic status in the areas. The outcome of the Environmental Impact Assessment will be used to moderate the Engineers' Designs to ensure that they are in harmony with the environmental and socio-economic attributes of the project area. This approach will enhance the protection of the environment and the local community from negative effects of development.

1.5 Terms of Reference

The following broad terms of reference applies to the project:

- Description of the proposed location of the project;
- A concise description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project;
- The objectives of the project;
- The technology, procedures and processes to be used, in the implementation of the Project;
- The materials to be used in the construction and implementation of the project;
- The products, by-products and waste generated by the project;
- A description of the potentially affected environment;
- The environmental effects of the Project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated;
- Alternative technologies and processes available and reasons for preferring the chosen technology and processes;
- Analysis of alternatives including project site, design and technologies and reasons for preferring the proposed site, design and technologies;
- An environmental management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment, including the cost, time frame and responsibility to implement the measures;
- Provision of an action plan for the prevention and management of foreseeable accidents and hazardous activities in the course of carrying out activities or major industrial and other development projects;
- The measures to prevent health hazards and to ensure security in the working environment for the construction workers in case of emergencies;
- An identification of gaps in knowledge and uncertainties which were encountered in compiling the information;
- An economic and social analysis of the project;
- An indication of whether the environment of any other state is likely to be affected and the available alternatives and mitigating measures; and
- Such other matters as the Authority may require.

1.6 Methodology

1.6.1 Screening and Scoping

At the screening stage, the consultant determined the potential magnitude of impacts and hence the depth of study required. This was the first stage in incorporating environmental considerations into a Sewerage system project.

a) Scoping is a process used for defining what can and what cannot be accomplished during a particular environmental study. This process will include the following:
b) defining the geographic boundary of the study in relation to possible impacts;
c) identifying the time constraints and time horizons of the study (i.e. project time limits and how far into the future one should predict project effects); and,
d) Identifying the skills and human resources needed to undertake the project.

After completing this process, the consultant had the full understanding of the proposed project in the context of its environment and in relation to other engineering solutions.

1.6.2 Description of Baseline Conditions

An assessment of the prevailing baseline conditions was conducted. The environmental and socio-economic baseline is intended to provide a measure of the existing environmental and socio-economic situation against which future changes due to the projects can be monitored. The study began by carrying out a desk study to comprehensively review both secondary data, planning and development reports on Uasin Gishu County and the targeted region of Eldoret Sub Counties and Township. The team undertook a thorough desk review of all the relevant documents, policies, strategies and other related sector documents with an objective of having a clear background understanding of the assignment.

1.6.3 Site assessment

The study involved survey of Bio- Physical Environment, Flora and Fauna (Ecological Study), socio- Economic and Public Awareness Survey, Extensive public consultation were also conducted to understand and address the concerns from the project affected public.

The study collected information at household level, community level and from stakeholders for the purposes of Socio economic survey and collection of Baseline information for the water supply and wastewater management services project. The socio-economic survey was paramount in knowing the status of the people in Eldoret Town

1.6.4 Impact prediction evaluation and mitigation

The impacts identified during scoping and baseline studies were analysed to determine their nature, temporal and spatial scale, reversibility, magnitude, likelihood, extent and effect. Appropriate mitigation measures were then proposed.

1.6.5 Public participation

Public participation by conducting interviews, discussions and public meetings with key stakeholders including members of the community in the project area to obtain their views on the impacts of the project and possible mitigation measures. This is as per the Kenyan Constitution and EMCA Cap 387. The public consultation and participation was conducted through:

- ✓ Household socio-economic survey;
- ✓ Key stakeholder interviews;
- ✓ Focus group discussions
- ✓ Public Meetings

Data Collection Tools

The socio-economic survey used both the quantitative and qualitative tools. Three quantitative tools namely; household survey questionnaire, education institutions questionnaire and health institution survey questionnaire were used. Qualitative tools included; Focused Group Discussion (FGD) guide, Waste handlers guide and Industries guide. Samples of both quantitative and qualitative tools are appended in this report.

Digitization of Data Collection Tools

An Open Data Kit (ODK) collect server subscription was secured until data collection was completed and beyond. The household survey questionnaire, education and health survey questionnaires developed in word format were coded in to digital format using the (ODK) coding language. The coded survey forms were pre-tested and improved further before deployment for field data collection.

The process is designed to allow feedback loops. The starting point is the design/coding of the questionnaire. In ODK this can be done using the online inter-phase or through spreadsheets. The later was used for this exercise. The forms were then sent to the server ready for download to the mobile data collection devices.

Mobile Data Collection Process

Data collection used android-based devices from version 7.0 and above. The ODK collector application/inter-phase was installed in the gadgets. The gadgets were configured with the correct credentials for data collection. This enabled the enumerators to access the server and download the forms and upload/submit the completed interviews in real time. The submitted data was used to communicate data quality issues to field teams and also improve any technical data collection issues identified in the forms.

Key Stakeholder Meetings

Key Stakeholder Interviews/ meetings were conducted Uasin Gishu County Commissioner's office. The key stakeholder engagements were conducted to follow protocol on publisize the public barazas via Deputy County Commissioners, foster better mutual understanding of public concerns as well as incorporate key stakeholders' opinions regarding the proposed project.

Public Meetings

Six (7) public participation meetings were conducted within Eldoret town proposed sites. The local Chiefs, Sub-chiefs, Members of County Assemblies and ward administrators were used to mobilize the public to attend the meetings. The announcements for the meetings were made by phone calls, announcement at centres and settlements, in places of worship and chiefs barazas

Socio-economic/Household survey

A total of 525 Household Socio-economic survey questionnaires were administered within the proposed project areas to assess the socio-economic status of the project area.

Focus group discusions

Three (3) focus group discussions were held within the proposed project areas. Participants were the opinion leaders including the chiefs, village elders, men and women,youth representative and PWD representative.

1.6.6. Project alternatives

A comparison of alternatives was done to allow identification of the least damaging option

1.6.7. Project Impacts Assessment

The Project impacts during the assessment will be generated based on the analysis of the proposed project activities in relation to the Project area environment. The impacts arising during each of the phases of the proposed development namely; construction, operation and decommissioning, will categorized into:

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

1.6.8. Positive environmental and social impacts during construction phase

The following are the expected positive environmental and social impacts during the construction phase:

- ✓ Creation of employment opportunities
- ✓ Gains in the local and national economy
- ✓ Transfer of skills
- ✓ Provision of market and supply for building materials
- ✓ Injection of money into the local economy;

- ✓ Creation of wealth to residents through direct and indirect business
- ✓ Interaction of people from different communities

1.6.9. Negative environmental and social impacts during construction phase

The likely negative environmental and social impacts during the construction phase of the project are:

- ✓ Disruption and loss of businesses
- ✓ Vegetation clearing, soil erosion and siltation;
- ✓ Air quality pollution
- ✓ Noise and excessive vibration
- ✓ Water quality pollution
- ✓ Hydrology within Project site
- ✓ Interruption of existing infrastructure
- ✓ Solid waste generation
- ✓ Extraction and Use of Construction Materials
- ✓ Occupational health and safety risks
- ✓ Spread of communicable diseases and HIV/AIDS infection;
- ✓ Gender Based Violence
- ✓ Cultural changes
- ✓ Gender and equality biases
- ✓ Sexual Exploitation/Child Abuse

1.6.10. Development of Mitigation and Compensatory Measures

- ✓ Erection of warning / informative signs at the construction sites during the construction phase, and traffic control along the Road.
- ✓ Soil compaction and watering of loose soils on all unpaved access areas at the construction sites to minimize air pollution and erosion by the agents of soil erosion i.e. water and wind.
- ✓ Noise reduction through sensitizing workers on the need to switch off engines when not in use; ensure that the machineries are well maintained and ensure that the work is carried out during the recommended time.
- ✓ Workers should be provided with full protective gear (PPE) to beef up their health and safety standards and they should be sensitized on health, safety and environmental conservation aspects.
- ✓ The sites should be fenced off during construction to keep off animals and the general public.
- ✓ Provision of sound waste management systems and procedures. This will involve provision of solid waste collection bins; segregation of waste at source, appointing a reputable garbage collector etc during operation phase.
- ✓ During the construction phase, the contractor should put in place effective and efficient waste disposal systems. Waste, including excavated soil and debris should be properly disposed of by backfilling or dumping in approved grounds by the Homa Bay County government.
- ✓ An adequately stocked —First Aid Box‖ will be provided and several first aiders will be properly trained on how to administer first aid in case of an accident or injury.
- ✓ Following the completion of the construction phase, measures will be undertaken to restore the affected biodiversity through landscaping; i.e. grasses to cover unpaved areas.
- ✓ Capacity building of the workers and staff; the create awareness towards potential risks and recommended preventive measures through training. This will ensure that health and safety measures are followed.
- ✓ The contractor shall ensure that there is minimal vegetation stripping to sites where civil works are to be conducted, re-vegetation of site after civil works with complete reinstatement of the site to better status
- ✓ A proper resettlement action plan should be carried out to identify affected individuals and compensation done according to Kenyan laws and AfDB resettlement policies. This will prevent conflicts that may arise during project implementation

1.6.11. Design of Monitoring and Evaluation Plans and the ESMP

The Environmental and Social Management and Monitoring Plan (ESMP) is the most important output from the ESIA process. The ESMP is the synthesis of all proposed mitigating and monitoring actions, set to a timeline with specific responsibility assigned and follow-up actions defined. It address issues related both to the construction and operation phases of the project.

1.6.12. Environmental and Social Impact Assessment Reporting

The ESIA report will contain all findings, conclusion, recommendations and a summary, stating the following:

table 1: ESIA report contents

(a).	Executive summary
(b).	Policy, Legal institutional and Administrative Framework
(c).	Methodology
(d).	the nature of the project;
(e).	the location of the project including the physical area that may be affected by the project's activities;
(f).	the objective of the project;
(g).	the activities that shall be undertaken during the project construction, operation and decommissioning phases;
(h).	the design of the project;
(i).	the materials to be used, products and by products including waste to be generated by the project and methods of their disposal;
(j).	the potential environmental impacts of the project and the mitigation measures to be taken during and after implementation of the project
(k).	an action plan for the prevention and management of possible accidents during the project cycle;
(l).	a plan to ensure the health and safety of the workers and neighbouring communities;
(m).	the economic and socio-cultural impacts to the local community and the nation in general;
(n).	Environmental Management Plan
(o).	the project budget; and
(p).	Conclusions and Recommendations
(q).	Appendices (e.g. List of people who prepared the EIA references, minutes of inter-agency meetings, minutes of consultation meetings and so on)
(r).	References

2 POLICY, LEGAL AND REGULATORY FRAMEWORK

2.1 Introduction

This chapter includes a summary of the laws, regulations and institutional setup relevant to environmental and social management in Kenya. A review of the most pertinent regulations and standards governing health and safety has been included. In addition, analysis for MEAs and their applicability to the proposed project were reviewed and presented to guide the proponent. This section also includes a review of environmental quality standards relevant to the proposed project.

Kenya has in place a wide range of policy, institutional and legislative framework to address the major causes of environmental degradation and negative impacts on ecosystems emanating from industrial and economic development programmes

2.2 Constitution of Kenya

The Constitution of Kenya is the country's supreme legislation and has Environmental provisions in Chapter Four, under 'Rights and Fundamental Freedoms', Chapter Five, under 'Environment and Natural Resources', and Chapter Ten, under 'Judicial Authority and Legal System'. The Fourth Schedule also includes environmental provisions under 'Distribution of functions between National and County Governments' and the Fifth Schedule titled 'Legislation to be enacted by Parliament'.

Environmental rights and freedoms are presented in Article 42 of the new constitution, which states: Every person has the right to a clean and healthy environment, which includes the right –

- To have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69; and
- To have obligations relating to the environment fulfilled under Article 70.

The Kenyan constitution also gives prominence to public participation; as a general national value in environmental protection. Article 69(1) states that the State shall encourage public participation in the management, protection, and conservation of the environment.

2.3 Policy Framework governing Environmental Management in Kenya

2.3.1 The Kenya Vision 2030

This is the country's long–term development blueprint, which aims to create a globally competitive and prosperous country providing a high quality of life for all its citizens. It aspires to transform Kenya into a newly industrializing, middle-income country by 2030 with three pillars – Economic, Social and Political.

Vision 2030 envisages a number of enablers including infrastructure and real-estate development across the various sectors.

2.3.2 Sessional Paper No. 10 of 2014 on the National Environment Policy

The policy seeks to provide the framework for an integrated approach to planning and sustainable management of natural resources in the country. It recognizes the various vulnerable ecosystems and proposes various policy measures not only to mainstream sound environmental management practices in all sectors of society throughout the country but also recommends strong institutional and governance measures to support achievement of desired objectives and goals.

In chapter 4 on Management of Ecosystems and Sustainable Use of Natural Resources the policy notes that ecosystems provide a wide range of goods and services which include provisioning, regulating, cultural and supporting services. Despite the services they provide, ecosystems are under pressure from human activities. The most critical ecosystems in Kenya include forests, freshwaters, wetlands, coastal and marine, mountains, arid, semi-arid and spectacularly diverse wildlife populations. Within these ecosystems are key natural and cultural heritage resources which support diverse biodiversity and provide natural capital for economic development and support livelihoods.

2.3.3. National Water Policy, 2012

The National Water Policy, 2012 has been developed in line with the mandate, vision and mission of the Ministry responsible for water affairs in Kenya. This Policy is compliant with the Constitution of Kenya 2010 and the Vision 2030 besides taking into account the targets of Sustainable Development Goals (SDGs).

In essence the Policy is built on the premises of Integrated Water Resources Management (IWRM). The Policy aims at guiding the development of strategies for water management and utilization by water sector stakeholders. This policy recognizes the great expectation of population with regard to access to freshwater supplies and use for domestic, livestock, agriculture and other production purposes

2.3.4. The National Biodiversity Strategy, and Action Plan (NBSAP) 2000

NBSAP was formulated to enable Kenya address national and international commitments defined in Article 6 of the Convention on Biological Diversity (CBD).

The strategy is a national framework of action for ensuring that the present rate of biodiversity loss is reversed and present levels of biological resources are maintained at sustainable levels for posterity.

The general objectives of the strategy are to conserve Kenya's biodiversity; to sustainably use its components; to fairly and equitably share the benefits arising from the utilization of biological resources among the stakeholders; and to enhance technical and scientific cooperation.

2.3.5. Kenya National Policy on Gender and Development (NPGD), 2000

The Policy spells out a policy approach of gender mainstreaming and empowerment of women and clearly states that it is the right of women, men, girls and boys to participate in and benefit equally from the development process. The NPGD provides a framework for mainstreaming gender in all policies, planning and programming in Kenya and puts in place institutional mechanisms to ensure effective implementation

2.3.6. The Draft National Land Use Policy 2016

Requires that to address the low vegetation cover with other competing land uses, the government should: carry out an inventory of all land cover classifications; establish mechanisms to ensure protection and improvement of vegetation cover over time; incorporate multi stake holder participation in a forestation programmes and initiatives; develop a framework for incentives to encourage maintenance of forest cover; promote the use of alternatives and efficient production methods to reduce demand on forest products; and ensure public participation in stakeholder forums in the determination of planning zones.

2.3.7. Physical Planning Policy

The current policy governs the development and approval all building plans as provided for in the Physical Planning Act (Cap 286). The proposed project will be subjected to the provisions of this policy and legislation.

2.3.8. Public Health Policy of 2014

The public health policy calls upon the project proponents to ensure that buildings are adequately provided with utilities so that they are fit for human habitation. The workers camps must be provided with all amenities/utilities that are essential for safeguarding public health for all people using the facilities.

2.3.9. Occupational Health and Safety Policy of 2012

This policy is intended to protect safety and health of workers in work places. The proposed road project will provide employment opportunities to many workers at various categories. The contractor will be expected to comply with the requirements of this policy when engaging workers in various construction activities. The preliminary environmental management provides mitigation measures that can be undertaken to ensure compliance with the requirements of this policy.

2.3.10. HIV/AIDS Policy of 2009

The policy identifies HIV/AIDS as a global crisis that constitutes one of the most formidable challenges to development and social progress. The Pandemic heavily affects the Kenyan economy through loss of skilled and experienced manpower due to deaths, loss of man hours due to prolonged illnesses, absenteeism, reduced performance, increased stress, stigma, discrimination and loss of institutional memories, among others. Due to the large of number of workers who will be involved in the project and the associated social issues with projects of such as scale, HIV/AIDS has been

considered as one of the proposed impacts, but adequate mitigation measures have also been proposed to that effect.

2.4. Institutional Framework governing Environmental Management in Kenya

At present there are over twenty (20) institutions and departments which deal with environmental issues in Kenya. Some of the key institutions include the National, National Environmental Management Authority (NEMA), the Kenya Forestry Services (KFS), Kenya Wildlife Services (KWS), Water Resources Authority (WRA) and others. There are also local and international CSOs involved in environmental issues in the country.

2.4.1. Water Resources Authority (WRA)

Water Resources Authority (WRA) is a state corporation established under Section 11 of the Water Act, 2016. Pursuant to Section 6 of the Act, the Authority is an Agent of the National Government responsible for regulating the management and use of water resources. The Water Act, 2016 makes extensive provisions on the Authority's role in regulating the use and management of water resources. WRA was operationalized on 21st of April, 2017 vide Gazette Notice No. 59. However, the Authority has been in existence for 12 years following its establishment under the Water Act, 2002 as Water Resources Management Authority (WRMA). WRA will provide the necessary borehole and water extraction permits from local streams.

2.4.2. Ministry of Environment and Natural Resources

The Ministry was established and mandated to undertake protection, conservation and development of environment and natural resources to ensure sustainable development. Semi-Autonomous Government Agencies under the Ministry of Environment and Natural Resources include:

- National Environment Management Authority(NEMA)
- Kenya Water Towers Agency(KWTA)
- Kenya Wildlife Service(KWS)
- Kenya Forest Service(KFS)
- Kenya Forest Research Institute(KEFRI)

2.4.3. National Environmental Management Authority (NEMA)

NEMA is a semi-autonomous agency under the Ministry of Environment, established to exercise general supervision and co- ordinate over all matters relating to the environment and to be the principal instrument of the government in the implementation of all policies relating to the environment. The Director General appointed by the president heads NEMA. Any project that falls under the second schedule of EMCA, Cap 387 shall seek an Integrated Environmental Impact Assessment Licence from NEMA.

2.4.4. Directorate of Occupational Safety and Health Services (DOSHS)

The Directorate of Occupational Safety and Health Services (DOSHS) is one of departments within the Ministry of Labour and East African Community Affairs, whose primary objective is to ensure safety, health and welfare of all workers in all workplaces. Unsafe and unhealthy work environment causes accidents, diseases, disasters and environmental pollution that occasion huge economic and social burdens to individuals and enterprises thereby stifling economic and social growth.

2.4.5. EMCA, Cap 387 Administrative Framework

2.4.5.1. National Environmental Tribunal

The National Environment Tribunal (NET) created under Section 125 of EMCA Cap 387 has the following functions:

- To hear and determine appeals from NEMA's decisions and other actions relating to issuance, revocation or denial of (EIA) licences or amount of money to be paid under the Act and imposition of restoration orders;
- To give direction to NEMA on any matter of complex nature referred to it by the Director General; and

If the proponent disagrees with NEMA decisions in exercising the above-mentioned functions then they may lodge a case at the NET to seek to overturn the decision. Should this avenue not lead to a favourable ruling from the NET, an appeal may be lodged in the Environment and Land Court.

2.4.5.2. National Environmental Complaints Committee

The National Environmental Complaints Committee performs the following functions:

- Investigate any allegations or complaints against any person or against the authority in relation to the condition of the environment in Kenya and on its own motion, any suspected case of environmental degradation and to make a report of its findings together with its recommendations thereon to the Cabinet Secretary.
- Prepare and submit to the Cabinet Secretary periodic reports of its activities which shall form part of the annual report on the state of the environment under section 9 (3) and
- To undertake public interest litigation on behalf of the citizens in environmental matters.

This committee will act as a safeguard for members of the public who feel aggrieved by actions taken under the proposed project, and can exercise their constitutional rights to launch a complaint should they have exhausted all other grievance redress mechanisms available to them.

2.4.5.3. National Environment Action Plan Committee

The Authority is responsible for the development of a 6-year National Environment Action plan and shall ensure that it has undertaken public participation before the adoption of the plan. The National Environment Action Plan shall:

- Contain analysis of the Natural Resources of Kenya with an indication as to any pattern of change in their distribution and quantity over time.
- Contain analytical profile of the various uses and value of the natural resources incorporating
- Considerations of intergenerational and intra-generational equity.

2.4.5.4. County Environment Committees

Governors shall by notice in the gazette constitute a County Environment Committee that shall be responsible for the proper management of the environment within the County for which it is appointed. They should also perform such additional functions as prescribed by the Act or as may, from time to time be assigned by the Governor by notice in the gazette. The decisions of these committees are legal and it is an offence not to implement them.

2.4.5.5. National Environment Restoration Fund

The objective of the Restoration Fund shall be to serve as supplementary insurance for the mitigation of environmental degradation where the perpetrator is not identifiable or where exceptional circumstances require the Authority to intervene towards the control or mitigation of environmental degradation. There is a draft EMC (deposit bonds) regulation 2014, but it is yet to be gazetted.

2.4.5.6. National Environment Trust Fund

The trust fund is vested in NEMA and subject to EMCA Cap 387. A board of five trustees appointed by the Cabinet Secretary administers it. These funds may be received from donations, endowments, grants and gifts from whatever source or sums of money or from monies designated by NEMA for this fund. SEQIP may as part of CSR or good industrial practice donate some money to the fund.

2.5. Legal Framework governing Environmental Management in Kenya

There are several legal provisions on environmental protection, which touch on and regulate the developments such as the proposed project. A summary of relevant legislation is given hereunder.

2.5.1. Environmental Management and Coordination Act (EMCA) Cap 397

The Environmental Management and Coordination Act (EMCA), Cap 387 is the legal framework law of environmental management and conservation in Kenya. It was assented on 6th January 2000 and the date of commencement was 14th January 2000. To date, EMCA has 8 Gazetted regulations and 3 draft regulations. The act was amended in 2015 so as to align it to the Kenyan constitution, which was promulgated in 2010 as well as a result of lessons learnt from ECMA Cap 387 and developments in science and environmental matters.

On the basis of the constitutional provisions to a healthy and clean environment, there are a number of legislations aimed at operationalizing these rights, the Environmental Management and Coordination Act (2015) being one the key ones. This is the principal law in Kenya that governs the management, use and regulation of environmental resources including natural capital. The law provides for a number of policy and institutional arrangements aimed at ensuring that the Kenya's environmental resources are utilized in a sustainable and equitable manner. The law provides for a series of measures to be taken in pursuance to achieving this aim, i.e., establishment of various organs from the county level (County Environmental Committee), to the national level, development of County/National Environmental Action Plans and monitoring and compliance plans among others. Other aspects provided for include Strategic Environmental Assessment, Standards and Quality Monitoring, and Environmental Impact assessment. Schedule 2 of the Act provides details on projects that require Environmental Impact Assessment which include projects that may have a bearing on, changes of land-use, waters resources (construction of weirs, river diversion, drilling for the purpose of using underground water resources), and waste disposal (solid waste disposal, waste water disposal/treatment) among others.

Under the second schedule, the proposed project has to undergo an Integrated Environmental and Social Impact Assessment and a project report prepared because it is categorized as a medium risk project

To date, EMCA has 8 Gazetted regulations and 3 draft regulations, these are briefly discussed below:

2.5.1.1. The Environmental Impact (Assessment and Auditing) Regulations, 2003

Environmental Impact Assessment under the Act is guided by the Environmental Impact Assessment (Assessment and Auditing) Regulations of the year 2003, which is given under legal notice no. 101. The regulations stipulate the ways in which environment impact assessment and audits should be conducted. The project falls under the second schedule of EMCA, Cap 387 that requires an Environmental Impact Assessment Study be undertaken to provide baseline information upon which subsequent environmental control audit shall be based.

The EMCA, Cap 387 requires that during the EIA process a proponent shall in consultation with the Authority seek views of persons who may be affected by the project or activity through posters, newspaper, radio and public meetings with the affected parties and communities. This Report complies with the requirements of the Environmental Regulations in the coverage of environmental issues, project details, impacts, legislation, mitigation measures, management plans and procedures. The Proponent shall be required to commit to implementing the environmental management plan laid out in this report and any other conditions laid out by NEMA.

2.5.1.2. Environmental Management and Coordination (Water Quality) Regulations, 2006

Water Quality Regulations apply to water used for domestic, industrial, agricultural, and recreational purposes; water used for fisheries and wildlife purposes, and water used for any other purposes. Different standards apply to different modes of usage. These regulations provide for the protection of lakes, rivers, streams, springs, wells and other water sources. The objective of the regulations is to protect human health and the environment. The effective enforcement of the water quality regulations will lead to a marked reduction of water-borne diseases and hence a reduction in the health budget.

The regulations also provide guidelines and standards for the discharge of poisons, toxins, noxious, radioactive waste or other pollutants into the aquatic environment in line with the Third Schedule of the regulations. The regulations have standards for discharge of effluent into the sewer and aquatic environment. While it is the responsibility of the sewerage service providers to regulate discharges into sewer lines based on the given specifications, NEMA regulates discharge of all effluent into the aquatic environment. The regulations provide for the creation of a buffer zone for irrigation schemes of at least fifty (50) metres in width between the irrigation scheme and the natural water body. Standards for irrigation water are given in schedule nine of the regulations.

Everyone is required to refrain from any actions, which directly or indirectly cause water pollution, whether or not the water resource was polluted before the enactment of the Environmental Management and Coordination Act (EMCA) Gazetted in Cap 387. It is an offence to contravene the provisions of these regulations with a fine not exceeding five hundred thousand shillings.

2.5.1.3. Environmental Management and Coordination (Waste Management) Regulations, 2006

The Minister for Environment and Natural Resources gazetted these regulations in 2006. These Regulations may be cited as the Environmental Management and Co-ordination (Waste Management) Regulations, 2006. Waste Management Regulations are meant to streamline the handling, transportation and disposal of various types of waste. The aim of the Waste Management Regulations is to protect human health and the environment. Currently, different types of waste are dumped haphazardly posing serious environmental and health concerns. The regulations place emphasis on waste minimization, cleaner production and segregation of waste at source.

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

2.5.1.4. Environmental Management and Coordination of Controlled Substances Regulations, 2007 (Legal Notice No.73 of 2007)

The Controlled Substances Regulations defines controlled substances and provides guidance on how to handle them. This regulation mandates NEMA to monitor the activities of persons handling controlled substances, in consultation with relevant line ministries and departments, to ensure compliance with the set requirements. Under these regulations, NEMA will be publishing a list of controlled substances and the quantities of all controlled substances imported or exported within a particular. The list will also indicate all persons holding licenses to import or export controlled substances, with their annual permitted allocations.

The regulations stipulate that controlled substances must be clearly labelled with among other words, “Controlled Substance-Not ozone friendly’’) to indicate that the substance or product is harmful to the ozone layer. Advertisement of such substances must carry the words, “Warning: Contains chemical materials or substances that deplete or have the potential to deplete the ozone layer.”

Producers and/or importers of controlled substances are required to include a material safety data sheet. Persons are prohibited from storing, distributing, transporting or otherwise handling a controlled substance unless a material safety data sheet accompanies the controlled substance. NEMA must license manufacturers, exporters or importers of controlled substances. Further, NEMA must authorize any person wishing to dispose of a controlled substance. The licensee should ensure that the controlled substance is disposed of in an environmentally sound manner. These regulations also apply to any person transporting such controlled substances through Kenya. Such a person is required to obtain a Prior Informed Consent (PIC) permit from NEMA.

2.5.1.5. The Environmental Management and Coordination (Wetlands, Riverbanks, Lakeshores, and Seashores Management Regulations 2009)

This part applies to all wetlands in Kenya whether occurring in private or public Land with the following being the objectives of the regulations:

(a) To provide for the conservation and sustainable use of wetlands and their resources in Kenya;

(b) To promote the integration of sustainable use of resources in wetlands into the local and national management of natural resources for socio-economic development;

(c) To ensure the conservation of water catchments and the control of floods;

(d) To ensure the sustainable use of wetlands for ecological and aesthetic purposes for the common good of all citizens;

(e) To ensure the protection of wetlands as habitats for species of fauna and flora;

(f) To provide a framework for public participation in the management of wetlands;

(g) To enhance education research and related activities; and

(h) To prevent and control pollution and siltation.

In attaining the above objectives, the following principles shall be integral:

(a) Wetland resources shall be utilized in a sustainable manner compatible with the continued presence of wetlands and their hydrological ,ecological, social and economic functions and services;

(b) Environmental impact assessment and environmental audits as required under the Act shall be mandatory for all activities likely to have an adverse impact on the wetland;

(c) Special measures shall be essential to promote respect for, preserve and maintain knowledge innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices;

(d) Sustainable use of wetlands shall be integrated into the national and local land use plans to ensure sustainable use and management of the resources;

(e) The principle of public participation in the management of wetlands

(f) The principle of international co-operation in the management of environmental resources shared by two or more states;

(g) The polluter-pays principle.

(h) The pre-cautionary principle.

(i) Public and private good.

In protection of River Banks, the regulation seeks to promote soil conservation measures along river banks, lake shores, and the seashore, including the following conservation and management measures: terracing; mulching; tree planting or agro forestry; grassing; Soil engineering, compaction and placement of fills; zoning and planning; building of gabions; control of grazing and recommending the promulgation of appropriate by-laws by the relevant local authorities (County Governments).

2.5.1.6. Environmental Management and Coordination (Conservation of Biodiversity regulations 2006)

Kenya has a large diversity of ecological zones and habitats including lowland and mountain forests, wooded and open grasslands, semi-arid scrubland, dry woodlands, and inland aquatic, and coastal and marine ecosystems. In addition, a total of 467 lake and wetland habitats are estimated to cover 2.5% of the territory. In order to preserve the country's wildlife, about 8% of Kenya's land area is currently under protection.

The country has established numerous goals, as well as general and specific objectives that relate to these issues, among others: environmental policies and legislations; involvement of communities; documentation of national biological resources; sustainable management and conservation of biodiversity; fair and equitable sharing of benefits; technical and scientific cooperation; biodiversity assessment; dissemination of information; institutional and community capacity building; and integration of biodiversity concerns into development planning.

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

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

- ✓ Time of the day;
- ✓ Proximity to residential area;
- ✓ Whether the noise is recurrent, intermittent or constant;
- ✓ The level and intensity of the noise;

- ✓ Whether the noise has been enhanced in level or range by any type of electronic or mechanical means; and,
- ✓ Whether the noise is subject to be controlled without unreasonable effort or expense to the person making the noise.

These regulations also relate noise to its vibration effects and seek to ensure that the level of noise causes no harmful vibrations. Any person(s) intending to undertake activities in which noise is suspected to be injurious or endangers the comfort, repose, health or safety of others and the environment, must make an application to NEMA and acquire a license subject to payment of requisite fees and meeting the license conditions. Failure to comply with these regulations attracts a fine of KES 350,000 or 18 months jail term or both.

The Proponent/management shall observe policy and regulatory requirements and implement the measures proposed in this documenting an effort to comply with the provisions of the Regulations.

2.5.1.8. Environmental Management and Coordination (Air Quality) Regulations, 2008

The objective this regulation is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. It provides for the establishment of emission standards for various sources, including as mobile sources (e.g. motor vehicles) as outlined in the Environmental Management and Coordination Act, Cap 387. It also covers any other air pollution source as may be determined by the Minister in consultation with the Authority. Emission limits for various areas and facilities have been set. The regulations provide the procedure for designating controlled areas, and the objectives of air quality management plans for these areas. The following operations (provided they are not used for disposal of refuse), are exempt from these regulations:

- Back-burning to control or suppress wildfires;
- Fire fighting rehearsals or drills conducted by the Fire Service Agencies
- Traditional and cultural burning of savannah grasslands;
- Burning for purposes of public health protection;

The Proponent shall observe policy and regulatory requirements and implement the mitigation measures proposed in this document in an effort to comply with the provisions of these Regulations on abatement of air pollution.

2.5.1.9. The Environment and Land Court Act, 2011

This Act is in place to give effect to Article 162(2) (b) of the Constitution; to establish a superior court to hear and determine disputes relating to the environment and the use and occupation of, and title to, land, and to make provision for its jurisdiction functions and powers, and for connected purposes.

2.5.1.10. The Water Act No. 43 of 2016

The Water Act No. 43 of 2016 was assented to on 20th September 2016. The new Act repealed the water Act 2002. The enactment of this law aimed at aligning national water management and water services provision with the requirements of the Constitution of Kenya 2010 particularly on the clauses devolving water and sanitation services to the county governments. Consequently, the new law retained some and established other new institutional arrangements including, Ministry of Water and Irrigation as the sector coordinator, Water Services Regulatory Board (WASREB) for regulation of water services' providers, Water Resources Regulatory Authority (WRA formerly WRMA) for water resource use regulation, National Water Harvesting and Storage Authority for major water infrastructural development, Water Tribunal for dispute resolution, Water Sector Trust Fund for water services development towards the un-served and poor segments of the society in peri-urban and rural areas, Water Works Development Agencies to replace the Water Service Boards, and Basin Water Resources Committees to replace Catchment Advisory Committees (CAACs)

The Act vests provision of water and sanitation services with the county governments through Water Services Providers (WSPs) whose operations must be in accordance with a Service Agreement entered between each WSP and WASREB.

During the entire project lifecycle, regulations and guidelines as per the Water Act provision should be taken into account.

2.5.2. The Land Act, 2012

This is an ACT of Parliament to give effect to Article 68 of the Constitution, to revise, consolidate and rationalize land laws; to provide for the sustainable administration and management of land and land based resources, and for connected purposes. Part viii of this ACT provides procedures for compulsory acquisition of interests in land. Section 111 (1) States that if land is acquired compulsorily under this Act, just compensation shall be paid promptly in full to all persons whose interests in the land have been determined. The Act also provides for settlement programmes. Any dispute arising out of any matter provided for under this Act may be referred to the Land and Environment Court for determination. The developer will acquire land for the proposed project in accordance with this Act.

2.5.3. The Land Registration Act, 2012

This is an Act of Parliament that revises, consolidates and rationalizes the registration of titles to land, to give effect to the principles and objects of devolved government in land registration, and for connected purposes. The Act requires that there is proper marking and maintenance of boundaries. An interested person who has made an application to the Registrar for his/her boundaries to be ascertained, the Registrar shall give notice to the owners and occupiers of the land adjoining the boundaries in question of the intention to ascertain and fix the boundaries. With regard to the maintenance of boundaries, the Act requires every proprietor of land to maintain in good order the fences, hedges, stones, pillars, beacons, walls and other features that demarcate the boundaries, pursuant to the requirements of any written law.

2.5.4. The National Land Commission Act, 2012 (No. 5 of 2012)

The National Land Commission of Kenya is an independent government commission whose establishment was provided for by the Constitution of Kenya to, amongst other duties, manage public land on behalf of the national and county governments, initiate investigations into present or historical land injustices, recommend appropriate redress, monitor and have oversight responsibilities over land use planning throughout the country. It was officially established under The National Land Commission Act, 2012. The mandate of the National Land Commission is drawn from the National Land Policy of 2009, Constitution of Kenya 2010, National Land Commission Act, 2012, the Land Act 2012 and the Land Registration Act of 2012. Under the National Land Commission Act, the Commission shall among other duties monitor the registration of all rights and interests in land and ensure that public land and land under the management of designated state agencies are sustainably managed for their intended purpose and for future generations. Also, the commission is required to manage and administer all unregistered trust land and unregistered community land on behalf of the county government and develop and encourage alternative dispute resolution mechanisms in land dispute handling and management. The Commission is also required in consultation and cooperation with the national and county governments, to establish county land management boards for the purposes of managing public land.

2.5.5. Penal Code Act (Cap.63)

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

2.5.6. County Governments Act, 2012

This Act vests responsibility upon the County Governments in planning of development projects within their areas of jurisdiction be it projects of importance to the local COUNTY government or those of national importance.

Section 102 of the Act provides the principles of planning and development facilitation which include integration of national values in county planning, protect the right to self-fulfilment within the county communities and with responsibility to future generations, protection of rights of minorities and marginalized groups and communities, promotion equity resource allocation, among others.

Section 103 of the Act sets out the prime objective of county planning which aligned to the bill of rights and the constitution of Kenya.

Section 114 and 115 indicate and give guidelines in planning of projects of national significance and instil the aspect of public participation in every aspect of the planning process through that: clear strategic environmental assessments; clear environmental impact assessment reports; expected development outcomes; and development options and their cost implications.

Each county assembly is tasked with the role to develop laws and regulations giving effect to the requirement for effective citizen participation in development planning and performance management within the county.

Therefore, in the execution of the PBSA Project, the County Government of Uasin Gishu forms a key stakeholder in project planning in ensuring equal allocation of the resource in question and ensuring public participation.

2.5.7. Occupational Safety and Health Act (OSHA 2007)

Before any operations begin at a site after construction, certificate of registration must be obtained from the chief inspector. The occupier/proponent must keep a general register. The Act covers provisions for health, safety and welfare. This Act applies to all workplaces where any person is at work, whether temporarily or permanently. The purpose of this Act is to secure the safety, health and welfare of persons at work, and protect persons other than persons at work against risks to safety and health arising out of, or in connection with, the Activities of persons at work. Some of the areas addressed here are machinery safety, chemical safety and health, safety and welfare special provisions are also provided in the ILO conventions on safety and health in construction recommendation, 1988 R175. Failure to comply with the OSHA, 2007 attracts penalties of up to KES 300,000 or 3 months jail term or both or penalties of KES 1,000,000 or 12 months jail term or both for cases where death occurs and is in consequence of the employer.

The report advices the Proponent and all relevant stakeholders on safety and health aspects, potential impacts, personnel responsible for implementation and monitoring, frequency of monitoring, and estimated cost, as a basic guideline for the management of Health and Safety issues in the proposed project.

2.5.8. Public Health Act (Cap. 242)

This is an Act of Parliament that makes provision for securing and maintaining health of individuals and the public in general. Section 115 of the Act states that no person shall cause nuisance or cause to exist on any land or premises any condition liable to be injurious or dangerous to human health. Section 116 requires that

Local Governments take all lawful, necessary and reasonably practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable to be injurious or dangerous to human health.

Such nuisance or conditions are defined under section 118 as waste pipes, sewers, drainers or refuse pits in such state, situated or constructed as in the opinion of the medical officer of health to be offensive or injurious to health. Any noxious matter or waste water flowing or discharged from any premises into the public street or into the gutter or side channel or watercourse, irrigation channel, or bed not approved for discharge is also deemed as nuisance. Other nuisances are accumulation of materials or refuse which in the opinion of the medical officer of health is likely to harbour rats or other vermin.

Part XII, Section 136, states that all collections of water, sewage, rubbish, refuse and other fluids which permit or facilitate the breeding or multiplication of pests shall be deemed nuisances under this Act. This part seeks to guard against the breeding of mosquito which is key as they cause malaria which is one of the major causes of death in this country.

2.5.9. The Physical Planning Act, 1996

The basic provisions of the Physical Planning Act have been outlined. The Physical Planning Act has the potential to provide a basis for the nature conservation and environmental management in Kenya. Its impact has so far been limited, due largely to limited implementation of the Act. Additionally, it has not been the practice in Kenya to carry out.

2.5.10. The Environment and Land Court Act, 2011

This is an Act of Parliament to give effect to Article 162(2) (b) of the Constitution to establish a superior court to hear and determine disputes relating to the environment and the use and occupation of land. The Environment and Land Court is one of the Courts contemplated by article 162(2). It is a Superior Court and has the same status as the High

Court. The court is established under section 4 of the Environment and Land Court Act No. 19 of 2011. It has jurisdiction to hear any other dispute relating to environment and land. The jurisdiction of the court is provided under section 13 of the Act. The Court has original and appellate jurisdiction to hear and determine all disputes in accordance with Article 162(2) (b) of the Constitution and with the provisions of the Act or any other written law relating to environment and land. The court has powers to deal with disputes relating to land administration and management. The court is also empowered to hear cases relating to public, private and community land and contracts or other instruments granting any enforceable interests in land. The court also exercises appellate jurisdiction over the decisions of subordinate courts or local tribunals in respect of matters falling within the jurisdiction of the Court. The court further exercises supervisory jurisdiction over the subordinate courts, local tribunals, persons or authorities in accordance with Article 165(6) of the Constitution.

2.5.11. The Employment Act, 2007

The Employment Act, 2007 defines the fundamental rights of employees including the basic conditions of employment of workers. It also regulates employment of children. The contractor on site will have to employ casual labourers probably from the communities where the road traverses during construction.

The basic conditions of employees should be observed to avoid unnecessary conflicts during the construction works. The Contractor shall pay the entire amount of the wages earned by or payable to the workers. Payment of such wages should be done at the end of a working day at or near the place of work. The Contractor shall also ensure that all statutory deductions are submitted without delay to appropriate government agencies e.g. Kenya Revenue Authority, NSSF, NHIF, among others.

2.5.12. Work Injury Compensation Benefit Act (WIBA) 2007

The Work Injury Compensation Benefit Act 2007 provides guideline for compensating employees on work-related injuries and diseases contacted during employment. The Act also requires provision of compulsory insurance for all employees. The Act defines an employee as any worker on contract of service with employer. It will be important for the Contractor of the proposed project to ensure that all workers contracted during the project implementation phase are provided with appropriate insurance covers so that they can be compensated in case they get injured while working.

2.5.13. The Traffic Act Cap 403

The Traffic Act reserves the use of the road corridor for road facilities only. Any vegetation grown to protect the road edges should not cause problems during maintenance. Encroachment along the road corridor will have to be checked especially during the operational phase of the project. The Act also spells out conditions for use of roads by motorists, among others. The contractor's vehicles shall comply to all traffic rules in Kenya.

2.5.14. Building Code 2009

This by-law recognizes the county governments as the leading planning agencies. It compels potential developers to submit development applications for the approval. The county governments are hence empowered to approve or disapprove any plans if they do or don't comply with the law, respectively. Any developer who intends to erect a building must give the respective local authority a notice of inspection before the erection of the structure. On completion of the structure, a notice of completion shall be issued by the local authority to facilitate final inspection and approval. No person therefore shall occupy a building whose certificate of completion has not been issued by the county government.

Section 214 of the by law requires that any public building where the floor is more than 20 feet above the ground level should be provided with firefighting equipment that may include one or more of the following; hydrants, hose reels and fire appliances, external conations portable fire appliances, water storage tanks, dry risers, sprinkler, drencher and water spray spring protector system.

Section 194 requires that where sewer exists, the occupants of the nearby premises shall apply to the local authority for a permit to connect to the sewer and all the waste water must be discharged to the sewers. Finally, section 196 provides that the county government may refuse to admit to sewer any trade waste or any other effluent unless it has been treated in an approved manner. In this regard, the county government may cause the occupier of the premise to

construct an approved manhole connected to the pipe conveying such effluent. In the development of the project, the proponent will have to comply with the provisions of this Act by complying to the Building code provisions.

2.5.15. Urban Areas and Cities Act No 13 of 2011

This is an Act of Parliament to give effect to Article 184 of the Constitution, to provide for the classification, governance and management of urban areas and cities and to provide for the criteria of establishing urban areas. The Act also provide for the principle of governance and participation of residents of towns and cities. Under the Act a town is an urban area with a population of at least ten thousand residents. Also, under the Act the management of a city and municipality is vested in the county governments. The County Governments may impose such fees, levies and charges for delivery of services by the municipality or the city.

2.5.16. The Sexual Offences Act, 2006 and its amendment 2012

Observing a standard work ethic is recommended to ensure persons from both genders are not subjected to sexual offences. Ample working environment should prevail in all work places in the project, to be enhanced through implementation of a Sexual Misconduct Policy.

2.5.17. Persons with Disability Act, Chapter 133

This act protects the rights of people with disabilities ensuring they are not marginalized and that they enjoy all the necessities of life without discrimination. The act guarantees that (1) No person shall deny a person with a disability access to opportunities for suitable employment. (2) A qualified employee with a disability shall be subject to the same terms and conditions of employment and the same compensation, privileges, benefits, fringe benefits, incentives or allowances as qualified able-bodied employees. (3) An employee with a disability shall be entitled to exemption from tax on all income accruing from his employment.

A person with disability is entitled to exemptions which apply with respect to exemptions and deductions as described in Schedule 42 subsection (2) of the act, among other provisions within this act that should be complied with all parties involved.

2.6. African Development Bank Safeguards

2.6.1. Integrated Safeguard System (ISS)

African Development Bank has established an Integrated Safeguard System (ISS) for a comprehensive projects review and ensuring a cross the board perspective of environmental and social linkages. The ISS comprises of four components, all that existed separately but with identifiable operational weakness.

The components include;

1) Integrated safeguard policy statement (ISPS)
2) Operational safeguards(OS)
3) Environmental and social assessment procedures (ESAPs)
4) Environmental and social impact Assessments (ESIAs

Integrated Safeguard System (ISS)encompasses into five number (5NO) operational safeguards addressing the following fields;

- ✓ Environment
- ✓ Involuntary
- ✓ Gender
- ✓ Climate risk management and adaptation
- ✓ Civil society engagement framework
- ✓ Health (vii)Integrated water Resources management
- ✓ Agriculture and rural development
- ✓ Poverty reduction

2.6.2. Operational safeguards

The specific safeguards are briefly described below;

Operational Safeguard 1 (OS1)

This is the main safeguard that guides environment and social assessment as well as climate issues. The safeguard governs the process of determining a projects environment and social assessment requirement. OS is designed to identify, access and manage potential environment and social risks and impacts including climate change issues. More specifically, OS1 achieves the following;

- ✓ Identify and assess risks and impacts,
- ✓ Avoid and/or minimize, risks and impact,
- ✓ Provide for stakeholders participation.
- ✓ Ensure effective management of risks and impacts
- ✓ Contribute to capacity building elements.

In the categorization requirements under OS1–5 are also considered as support safeguards.Under the safeguards environmental and social impacts assessment (ESIA) studies are undertaken on clearly defined projects while environmental and social management framework (ESMF) is prepared for programmes or plans with a multiplicity of uncertain projects.

Operational Safeguard 2(OS2)

The safeguard focuses on involuntary resettlements, land acquisition, population displacements and requirements and compensation. It consolidates the policy commitment and requirements on involuntary resettlements and incorporates improvements operational effectiveness.

Operational Safeguards 3 (OS3)

This safeguard is designed to govern biodiversity and ecosystem services for the conservation and promotion of sustainable use of natural resources. Among the focus is on the integrated water resources management where commitments translated into operational requirements.

Operational Safeguard 4(OS4)

OS4 governs pollution prevention and control, hazardous materials and resource efficiently. It covers a wide range of impacts arising from pollution, wastes and hazardous materials and particularly those under international conventions and regional standards. This also includes greenhouse accounting. The OS4 principles also support OS1 described above.

Operational safeguard 5 (OS5)

Labour conditions, health and safety are a major concern in projects. The Bank therefore, has established OS5 to address requirements concerning works conditions, rights and protection from abuse and/or exploitation

2.7. International Conventions and Treaties

Kenya has signed a number of international conventions and agreements that obligate the country to promote sustainable environmental and natural resources management and social equity. The country actively participated in the formulation of the Sustainable Development Goals (SDGs). The 2030 Agenda for Sustainable Development, including the 17 Sustainable Development Goals (SDGs), are new global objectives that succeeded the Millennium Development Goals on 1 January 2016. The SDGs will shape national development plans over the next 15 years. From ending poverty and hunger to responding to climate change and sustaining our natural resources, food and agriculture lies at the heart of the 2030 Agenda.

Conventions are legally binding bilateral, regional or international agreements that binding to the states that are parties thereto. Kenya has ratified some of the most important conventions on the environment and is bound by the same.

2.7.1. The Ramsar Convention on Wetlands of International Importance

Kenya ratified the Convention in June 1990. The Ramsar Convention on Wetlands is primarily concerned with the conservation and management of wetlands. Parties to the Convention are also required to promote wise use of

wetlands in their territories and to take measures for the conservation by establishing nature reserves in wetlands, whether they are included in the Ramsar list or not. Wetlands are defined by the Ramsar Convention as "areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary with water that is static or flowing, fresh, brackish or salty, including areas of marine water the depth of which at low tide does not exceed six meters".

The National Wetland Standing Committee of Kenya's Inter-Ministerial Committee on Environment (IMCE) defines wetlands as "areas of land that are permanently, seasonally or occasionally water logged with fresh, saline, brackish or marine water, including both natural and man-made areas that support characteristic biota" while EMCA defines wetland as "an area permanently or seasonally flooded by water plants and animals have become adapted.

2.7.2. United Nations Framework Convention on Climate Change

UNFCCC has near universal membership and is the parent treaty of the 1997 Kyoto Protocol. The Kyoto Protocol has been ratified by 192 of the UNFCCC Parties.

The ultimate objective of both treaties is to stabilize greenhouse gas concentrations in the atmosphere at a level that will prevent dangerous human interference with the climate system.

2.7.3. United Nations Convention to Combat Desertification

Established in 1994, UNCCD is the sole legally binding international agreement linking environment and development to sustainable land management.

The Convention addresses specifically the arid, semi-arid and dry sub-humid areas, known as the dry lands, where some of the most vulnerable ecosystems and peoples can be found.

2.7.4. Vienna Convention for the Protection of the Ozone Layer

The Vienna Convention for the Protection of the Ozone Layer was adopted in 1985 and entered into force on 22 Sep 1988. In 2009, the Vienna Convention became the first Convention of any kind to achieve universal ratification.

The objectives of the Convention were for Parties to promote cooperation by means of systematic observations, research and information exchange on the effects of human activities on the ozone layer and to adopt legislative or administrative measures against activities likely to have adverse effects on the ozone layer.

2.7.5. Convention on Biological Diversity (CBD)

The CBD is one of the outcomes of the United Nations Conference on Environment and Development held in Rio de Janeiro in 1992. The CBD establishes a global legally binding framework for the conservation of biodiversity, the sustainable use of it components and the fair and equitable sharing of benefits arising out of utilization of genetic resources. The provisions of this convention should be taken into account in the conservation of various species of plants, animals and the variety of ecosystems in the project area.

2.7.6. The Rio Declaration and Agenda 21

The Rio Declaration and Agenda 2, the action plan for the 21st century are two non-legally binding instruments adopted by the 1992 United Nations Conference on the Environment and Development (UNCED). While the Rio Declaration contains general principles and objectives, Agenda 21 contains detailed guidance on their practical implementation. Principle 4 of the Rio Declaration provides that in order to achieve sustainable development environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it. Principle 25 accentuates this by stating that peace, development and environmental protection are interdependent and indivisible.

In an effort to control levels of air pollutants from industries sources, the Geneva Convention on long-range trans-boundary air pollution was signed. Other conventions include the convention on the law of the sea (1994). Conventions on nuclear accidents (Notification Assistance) 1986; the Montréal Protocol on substances that deplete the ozone layer, the Biological and toxin weapons etc.

2.7.7. The World Commission on Environment and Development (The Brundtland Commission of 1987)

The Commission in its 1987 report dubbed "Our Common Future" focused on the environmental aspects of development, in particular the emphasis on sustainable development that produces no lasting damage to the biosphere and to particular ecosystems. In addition to environmental sustainability is economic and social sustainability. Economic sustainable development is development for which progress towards environmental and social sustainability occurs within available financial resources. While social sustainable development is development that maintains the cohesion of a society and its ability to help its members work together to achieve common goals, while at the same time meeting individual needs for health and well-being, adequate nutrition, and shelter, cultural expression and political involvement. The key aspect of sustainability is the interdependence of generations.

The concept of EIA is embodied in many multilateral environmental agreements. Principle 17 of the Rio Declaration provides that environmental impact assessment as a national instrument shall be undertaken for proposed activities that are likely to have a significant impact on the environment and are subject to a decision of a competent national authority.

2.7.8. International Labour Organization

The International Labour Organization (ILO) is built on the constitutional principle that universal and lasting peace can be established only if it is based upon social justice. The ILO has generated such hallmarks of industrial society as the eight-hour working day, maternity protection, child-labour laws, and a range of policies which promote workplace safety and peaceful industrial relations.

The ILO has four principal strategic objectives:

To promote and realize standards, and fundamental principles and rights at work.

To create greater opportunities for women and men to secure decent employment.

To enhance the coverage and effectiveness of social protection for all.

To strengthen tri-parties and social dialogue.

The key ILO Conventions applicable to the proposed road project include:

Equal Remuneration Convention (1951) (No. 100) - Calls for equal pay and benefits for men and women for work of equal value.

Discrimination (Employment and Occupation) Convention (1958) (No. 111) - Calls for a national policy to eliminate discrimination in access to employment, training, and working conditions, on grounds of race, colour, sex, religion, political opinion, national extraction or social origin, and to promote equality of opportunity and treatment.

Minimum Age Convention (1973) (No. 138) - Aims at the abolition of child labour, stipulating that the minimum age for admission to employment shall not be less than the age of completion of compulsory schooling.

Worst Forms of Child Labour Convention (1999) (No. 182) - Calls for immediate and effective measures to secure the prohibition and elimination of the worst forms of child labour which include slavery and similar practices, forced recruitment for use in armed conflict, use in prostitution and pornography, any illicit activity, as well as work which is likely to harm the health, safety, and morals of children.

2.7.9. Sustainable Development Goals (SDGs)

The Sustainable Development Goals (SDGs) are a new, universal set of goals, targets and indicators that UN member states will be expected to use to frame their agendas and political policies over the next 15 years. The SDGs include 17 Sustainable Development Goals and 169 targets. The 17 sustainable development goals (SDGs) include

GOAL 1: No Poverty

GOAL 2: Zero Hunger

GOAL 3: Good Health and Well-being

GOAL 4: Quality Education

GOAL 5: Gender Equality

GOAL 6: Clean Water and Sanitation

GOAL 7: Affordable and Clean Energy

GOAL 8: Decent Work and Economic Growth

GOAL 9: Industry, Innovation and Infrastructure

GOAL 10: Reduced Inequality

GOAL 11: Sustainable Cities and Communities

GOAL 12: Responsible Consumption and Production

GOAL 13: Climate Action

GOAL 14: Life Below Water

GOAL 15: Life on Land

GOAL 16: Peace and Justice Strong Institutions

GOAL 17: Partnerships to achieve the Goal

The GOALs seek to build on the Millennium Development Goals that expired in 2015. Most notably SDGs are integrated, indivisible and balance the three dimensions of sustainable development: the economic, social and environmental. This project is expected to cut-across the three dimensions of sustainable development hence making SDGs a key reference point. The SDGs are also linked to several Kenyan legal frameworks such as Water Act, Forestry Act, and EMCA Cap 387.

3 ENVIRONMENTAL BASELINE INFORMATION

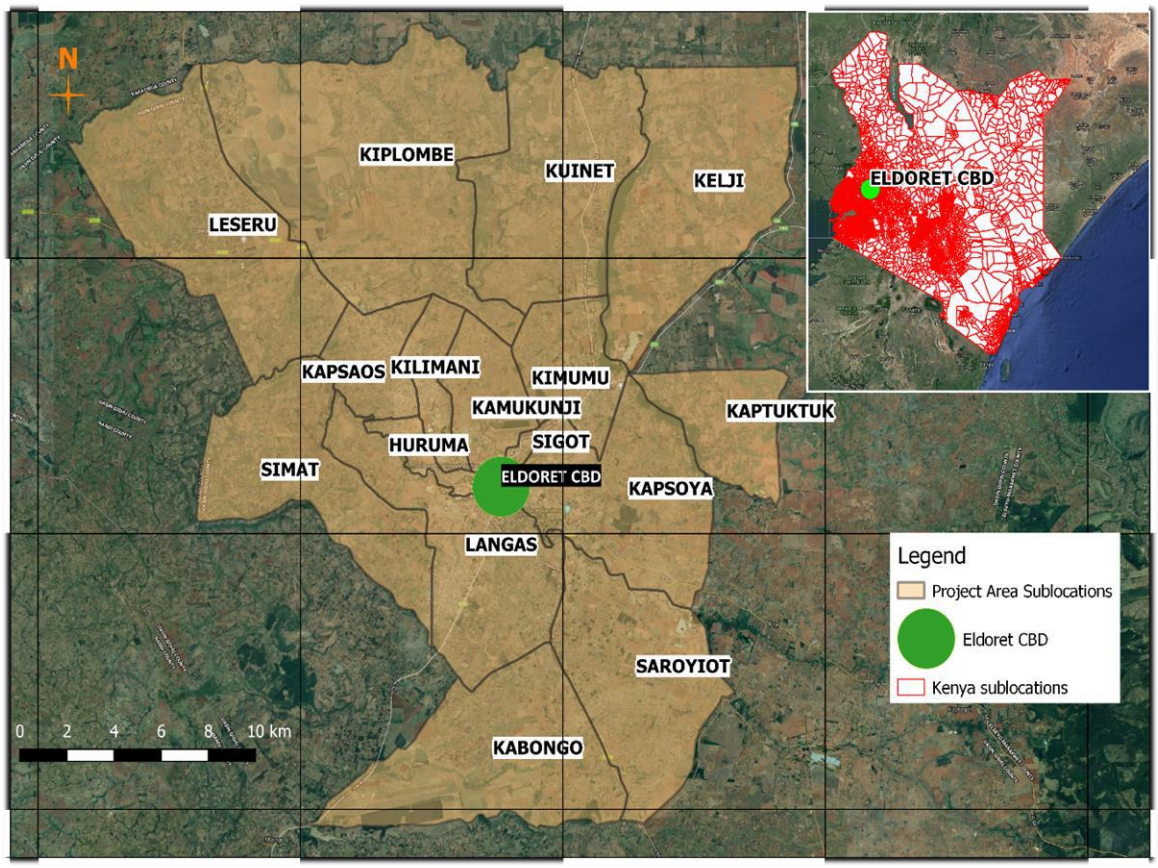
3.1. Background information of the project area

Eldoret is a principal city in western Kenya and the 5th largest in the country. Lying south of the Cherangani Hills, Eldoret is located in Uasin Gishu County in Western Kenya, at approximately 300 km form Nairobi, 135 km from Kisumu and 400 km form Kampala (Uganda). It is the second most important city in Western Kenya after Kisumu and also serves as the capital of Uasin Gishu County. Uasin Gishu County is surrounded by Elegeyo County in the East, Nandi County in the South, Kakamega County in the West and Trans Nzoia County in the North. The name "Eldoret" is based on the Maasai word "eldore" meaning "stony river"; a reference to the bed of the Sosiani River (a tributary of the Nile), that runs through the city.

The town is served by two sewage treatment plants with a combined design capacity to treat 18,000 m3/day (Boundary with capacity of 10,000 m3/day and Quarry with capacity of 8,000 m3/day). The two plants currently operate at an average of 60% of the design capacity due to low coverage of the sewerage network. The sewer network covers less than 30% of the town leaving the rest dependent on onsite sanitation methods which is both expensive and unsustainable to the environment. There is therefore need to expand the sewer network to improve on the sanitary conditions of the town and to utilize the existing capacities of the sewage treatment plants

The proposed sewerage extension and reahabilitation works will be implemented in the following areas within eldoret municipality; Annex, Sukunanga, Kipkorgot, Kenmosa, Hillside, Racecource And Elgon View. Proposed Sewerage Rehabilitation Works Will Be Done In Langas, Huruma and Plateau Areas.

map 1: Eldoret municipality



3.2. Climate

The climate in Uasin Gishu County is warm and temperate. RIts Koppen-Geiger classification is Cfb.

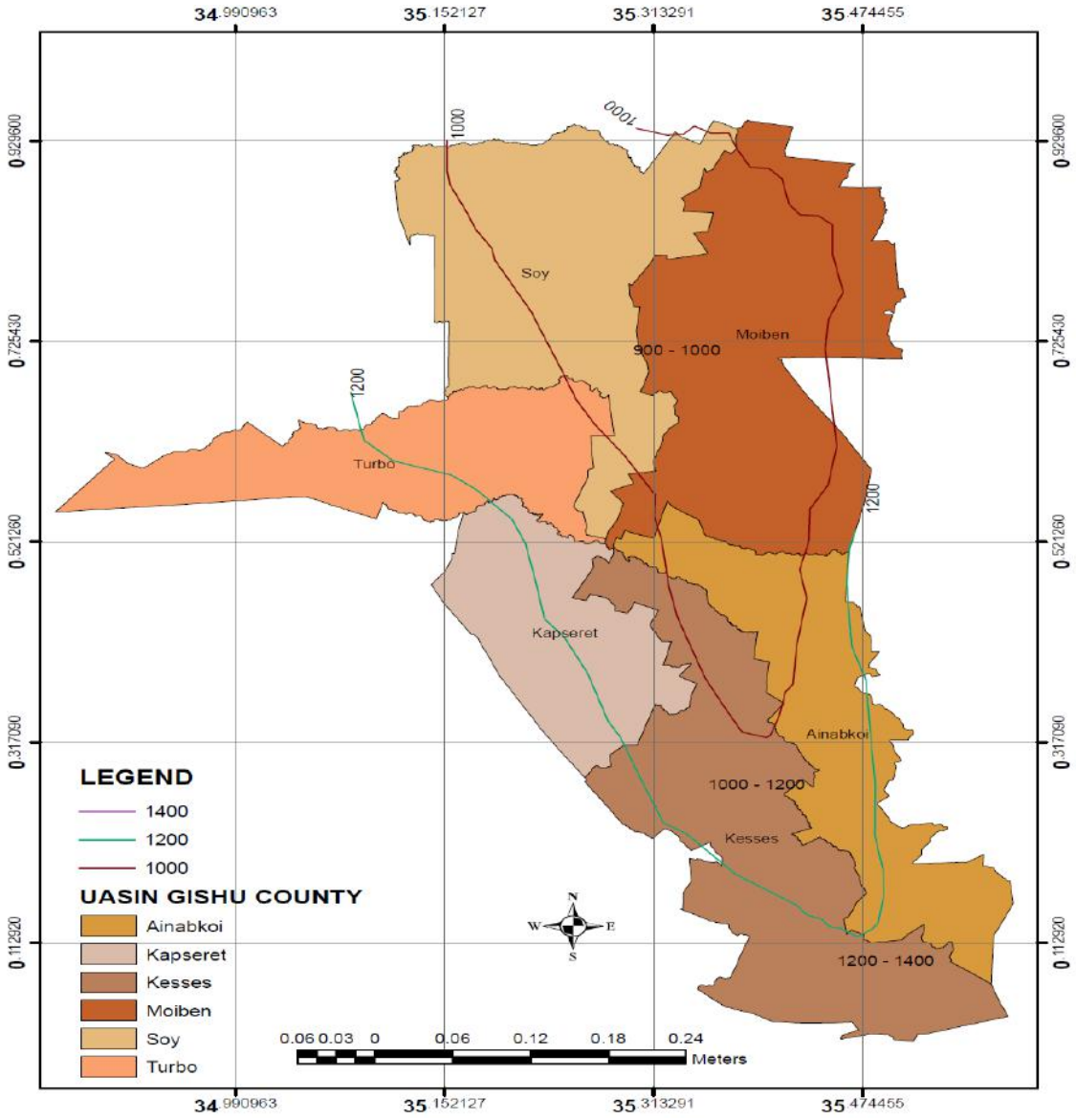
3.2.1. Rainfall

Uasin Gishu has high, reliable rainfall averaging between 900mm and 1400 mm (Refer Map 3-1). The rainfall is experienced in March to September, with two peaks in May and August. The wettest areas are Ainabkoi, Kesses and Kapsaret divisions. Turbo receives average rainfall while Moiben and Soy relatively low rainfall. November to March is dry months.

Rainfall reliability is good, with a probability of obtaining less than 750 mm of rainfall in a year being 0% to 10%. A study of the reliability of rainfall in agro-humid period of the first rains (March and June), gave a 60% reliability with the amounts surpassing the average in six out of the ten years (Error! Reference source not found.).

Generally the rainfall increase towards the higher southern and eastern highlands, thus Moiben trading centre in the north experiences an annual average of only 970 mm while Timboroa in the southern highland plateau records an annual average of 1171 mm.

map 2: Average annual rainfall of Uasin Gishu County



(Source: A thesis submitted at University of Nairobi titled Effects of Damming on the Sosiani River Ecosystem: An Environmental Impact Assessment by Winston Omukoba dated 1998 figure 27 page 34)

Eldoret town is located just one degree north of the equator and at an altitude of about 2100 m above sea level (masl).

The total annual rainfall varies between 545 mm and 1,615 mm with a mean value of 1,094 mm. Precipitation occurs mainly during April and May with a short dry period in June, followed by increasing rainfall in July and August and declining in September and October. A dry period of four to five months with scattered showers follows.

figure 1 Average Monthly Rainfall of Eldoret Town from 1979 to 2009

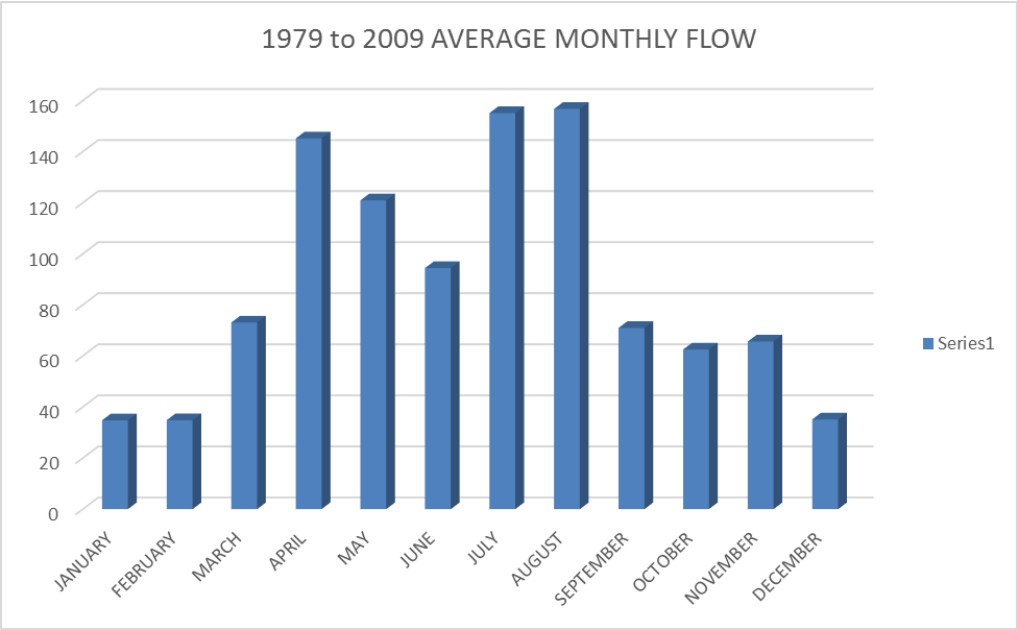
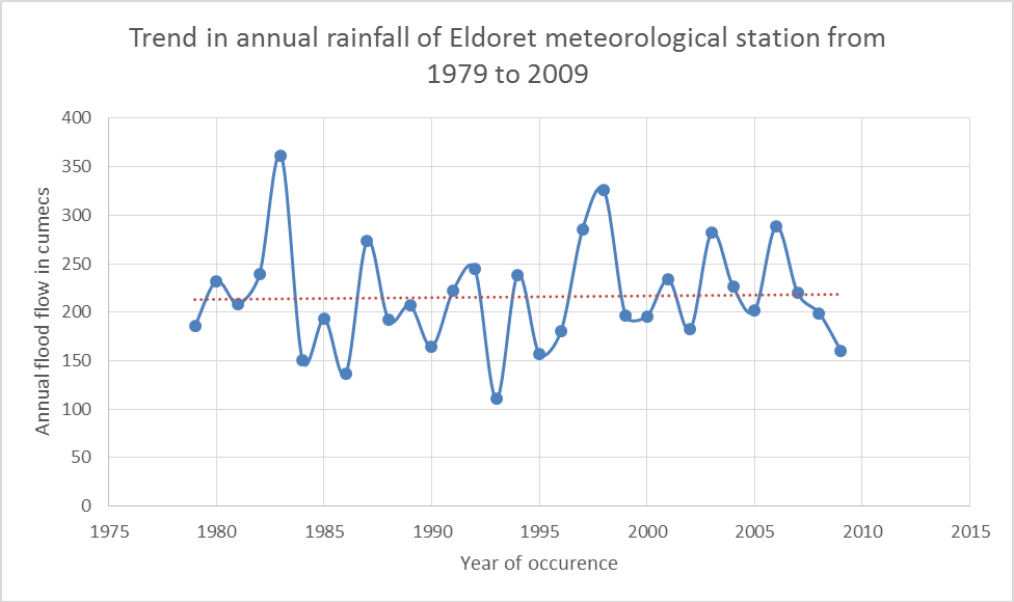


figure 2: Trend in annual rainfall of Eldoret meteorological station from 1979 to 2009



Source: Deduced from data provided in Progress Report No. 1 on the National Water Master Plan 2030 in the Republic of Kenya by Nippon Koei Co. Ltd dated February, 2011 table 4.1.2 page T-15 (203)

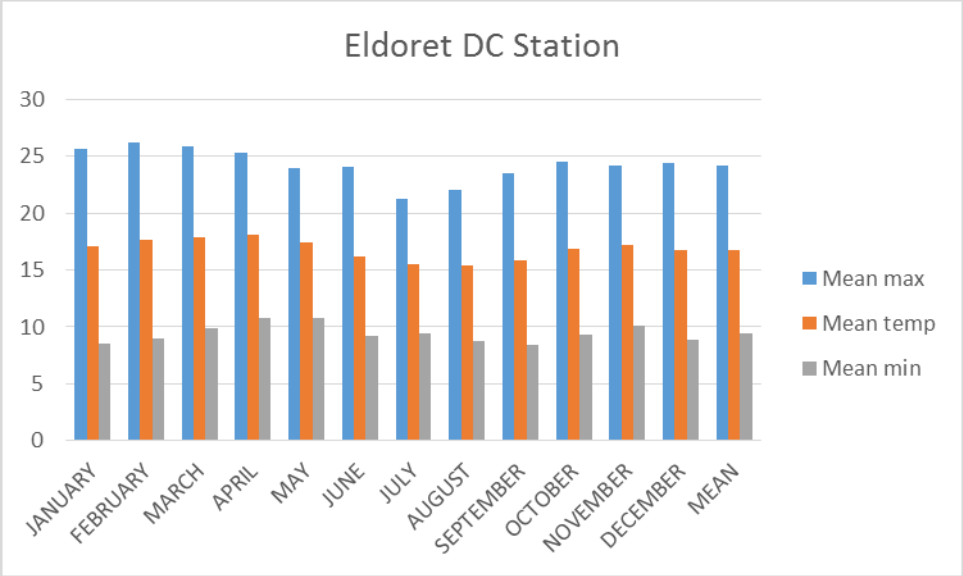
3.2.2. Temperature

Temperature in the county varies with altitude. Thus the lower western and northern plateau experience slightly higher temperatures than the higher eastern and southern highland plateaus. The average maximum temperature is 23.4°C, the average night temperature is 9.8°C. The maximum and minimum temperature extremes registered in the period 1959-1967 and 1973-1980 varies from 29.7°C to 1.6°C respectively.

The Temperature pattern of the Study Area naturally follows the wet and dry periods, with highest Temperatures recorded in the month of March and lowest in the month of July (9.4°C). The mean Temperature varies by 1.8°C in the year.

Eldoret at an altitude of 2084 m above sea level has a mean maximum and minimum of 23.7° C and 9.5° C respectively. The highest temperatures are recorded in the dry and usually cloudless month of January to March while June to September are relatively cool months with temperatures of between 12° C and 17°C).

figure 3: Eldoret DC Station Mean max, average and min temperature



3.2.3. Evaporation

The evaporation varies from a maximum mean monthly value of 227 mm (March) to a minimum of 1119 mm in July. The total annual evaporation varies between 1,607 and 2,214 mm with a mean value of 2,002 mm.

3.2.4. Wind

The average wind speed is 5 to 6 knots, from a prevailing easterly direction.

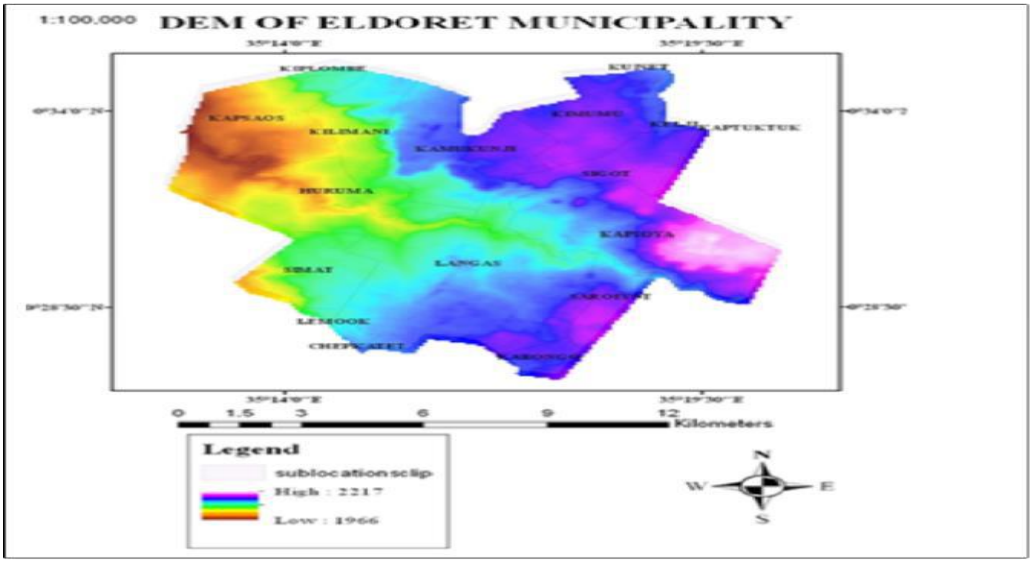
3.2.5. Agro-ecological zones:

- **LH3** – Low highland which occupies the largest part of the county and covers Moiben, Kesses, Soy and Kapsaret. Maize and wheat are the major crops.
- **UH4** – Upper midland covering Turbo (Tapsangoi and Sugoi areas) and is a maize zone.
- **UH2** – Upper midland covering Timboroa. Wheat and pyrethrum are the main crops. Much forest is found here.
- **LH4** – Lower highland covering Moiben, Soy, Kesses, and Kapsaret. Cattle, sheep are reared, and crops grown include wheat and barley.

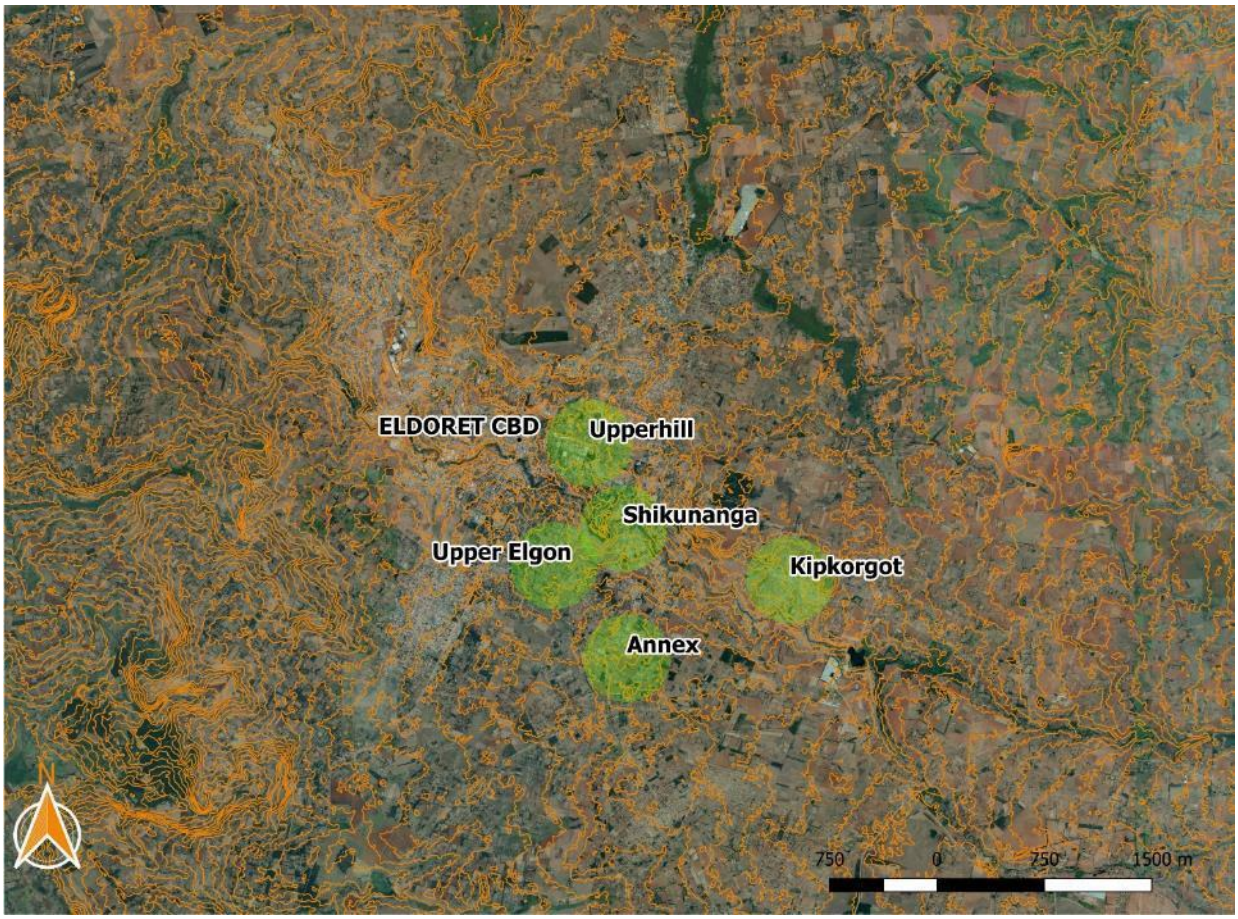
3.3. Topography

The local elevation in Eldoret varies from about 2100 metres above sea level at the airport to more than 2700 metres in nearby areas. Terrain in Eldoret town is very hilly including various steep slopes and valleys. This will obviously highly impact the drainage pattern and consequently the wastewater collection system.

map 3: Topographic Map of Eldoret Municipality



map 4 : ***Eldoret Topography – 10m elevation lines***



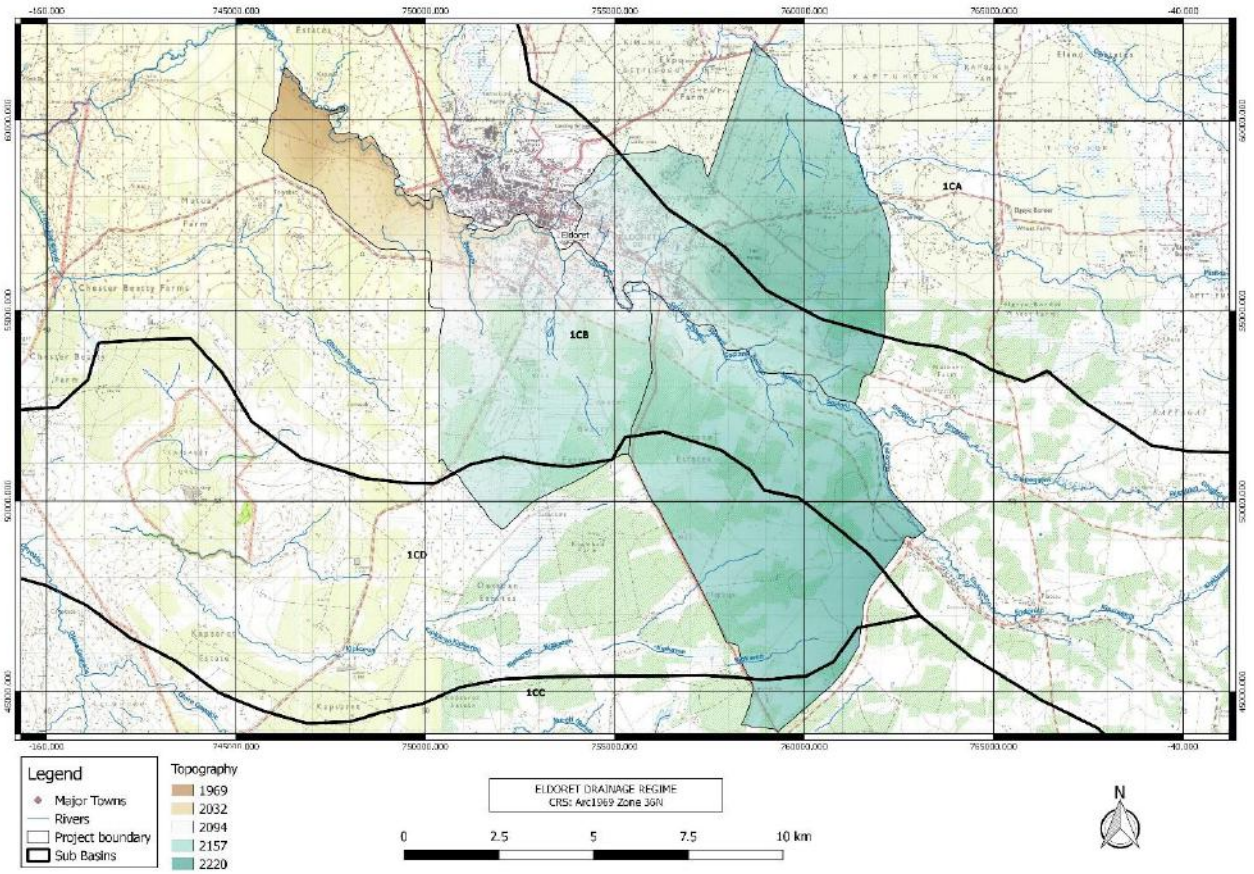
3.4. Drainage Regime

Eldoret Municipality is located within what is known by the Water Resource Management (WRA) as the Lake Victoria North (LVN) Catchment basin. The catchment, which has an area of 12,835 km^2, lies between latitudes 10 30'N and 00 05'S and longitudes 340 and 350 45'E with Nzoia River as its predominant drainage. **Error! Reference source not ound.** shows the extent of the Lake Victoria North Catchment basin.

The project area is located within the 1CB, 1CD, and 1CA sub drainage basins. River Sosiani, which forms the main drainage in the 1CB sub drainage, cuts across the Municipality from the south-east to the north-west direction, with

several tributaries joining the river, while River Misikuri drains at the north of the Municipality. The Kipkaren river sub drainage forms the 1CD sub drainage, which is located south of the project area, while the Misikuri sub drainage (1CA) is located North of the project area. The general slope of the topography is from south-east to north-west. All the sub drainage basin are part of the larger Nzoia Basin, whose main river is River Nzoia, draining into Lake Victoria.

map 5: Eldoret drainage regime



3.5. Geology

The basement in the Eldoret area consists of metamorphic pre-Cambrian rocks. During the Miocene period (Tertiary), two successive flows of lava covered the area and formed the Uasin Gishu Plateau. The thickness of the basalt-like rock (phonolite) is estimated at about 100 m in the area of Eldoret. No deposits younger than phonolite exist in this area, except of insignificant local alluvial accumulation in stream and river beds.

The actual land surface, with the exception of the escarpments and of the local protrusions with phonolite outcroppings, consists of phonolite weathering products formed in situ. The limits between the different layers are rather distinct, with the transition zones generally not exceeding 10 cm in thickness.

The top soil consists of silt with a locally variable clay, containing some fine sand. The colour is predominantly red. The thickness ranges between 0.30 and 0.60 m

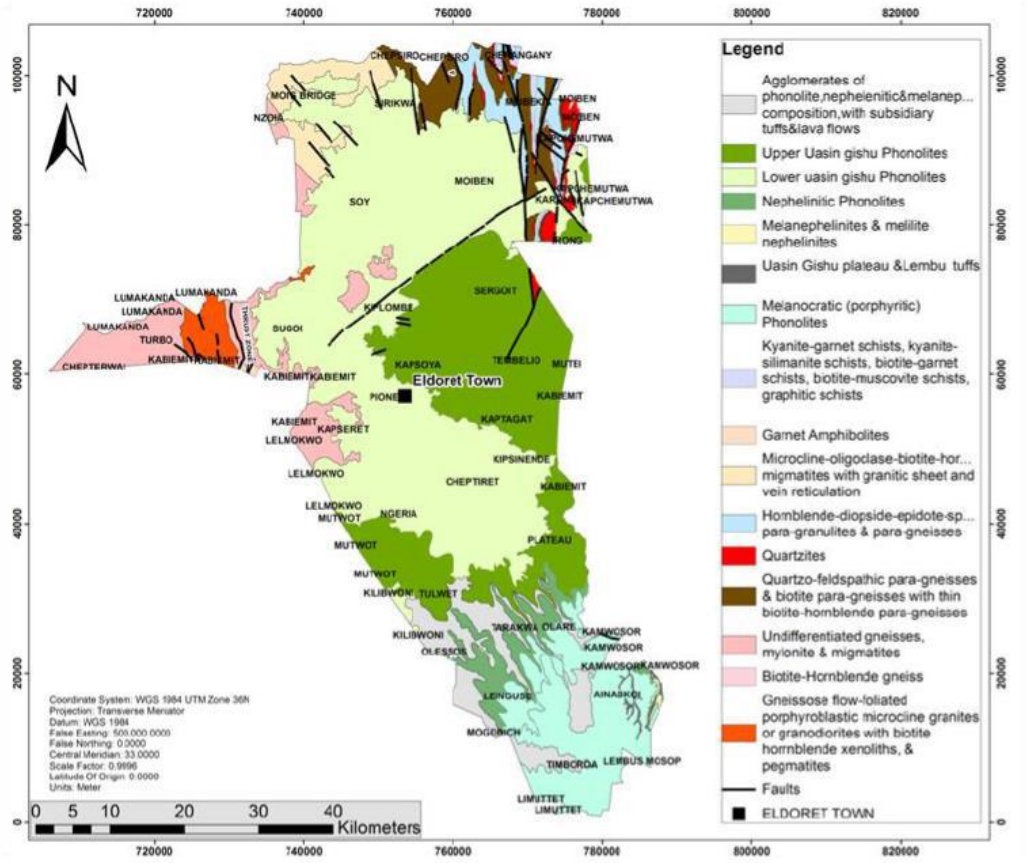
Below the top soil lies normally 1 to 3 m of an advanced weathering product of the phonolite, called murram. This material can be described a mass of compact lateric gravel in a matrix of clay-silt which fills the interstices between the coarse grains. Murram can be excavated by hand or with machinery. This material has been and is being quarried for road and other construction purposes and most of the wells and pit latrines penetrate the murram layer. In parts of the sloping areas the murram layer thickness is reduced by erosion disappearing completely in more exposed places, as is locally the case in the settlements of Kamukunji and Huruma.

Above the phonolite rocks exists a layer of weathered phonolite which assumes a mudstone like character. This material becomes soft and can be excavated by hand or machinery.

The weathered phonolite layer thickness in the plateaux can be over 15 m. In sloping areas, especially where soil and murram have been eroded, the thickness of weathered phonolite is frequently reduced to a few metres or less. Irregularities can be observed over short distances and must be expected when executing excavation work in sloping areas.

The phonolites are fine-graded grey hard rocks with scattered coarser crystals of feldspar. The irregular joint pattern is due to the shrinking of the lava in the course of cooling. Water infiltration and groundwater movements take place along joints exclusively, because the rock itself is practically impervious. The phonolites are hard, excavating requires blasting and heavy machinery. This material is quarried for road construction and for concrete aggregate.

map 6: Uasin Gishu Geological map



(Source: Water Resources Report by Mangat I.B. Patel (MIBP) Limited dated June, 2017 Figure E.30 page E.30)

3.6. Soils

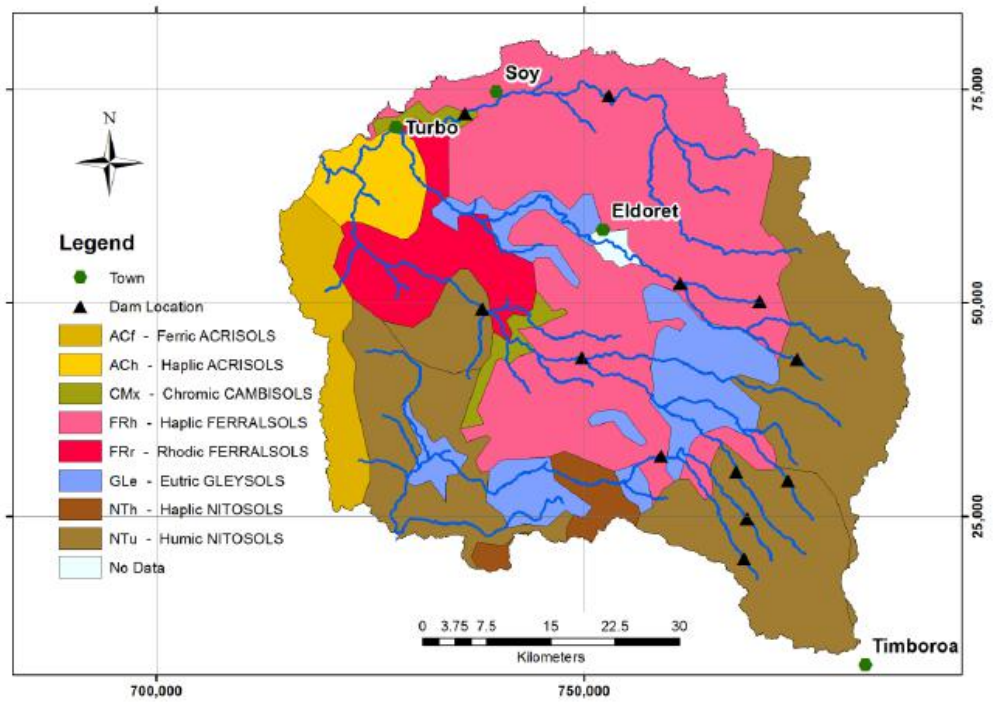
There are four main soil types in Uasin Gihu county.

1. **Red loam soils** – Occur mainly in the northern part of the district in Turbo, Moi's Bridge and Lower Moiben areas. The soils are derived from the basement complex rocks e.g. granites and laterites, and mainly support maize sunflower and cattle. Vegetation comprises of scattered tree grassland (low tree – high grass).
2. **Red clay soils** occur around Soy Upper Moiben and Nandi border areas. These are derived from phonolites. In some cases murram is of good depth. They support wheat and maize growing. Vegetation is similar to (1) above.
3. **Brown clay soils –** These are centered mainly around Plateau station and cover most of the Upper Lessos/plateau Location. These are mainly shallow with murram close to the surface and poorly drained. The soils are good for rearing beef livestock.
4. **Brown Loam Soils –** Occur in high altitude areas of the district, mainly in Ainabkoi and Kaptagat locations. They are derived from both volcanic and basement complex rocks. They are deep soils. Vegetation is natural highland forest and derived grassland (mainly kikuyu grass) and bush land. The soils are good for forestry, dairying and wheat, pyrethrum, potatoes, oats and barley farming.

The soils comprise of red loam soils, red clay soils, brown clay soils and brown loam soils that mainly support maize, sunflower, wheat, pyrethrum, potatoes and barley farming. They also support livestock rearing and forestry.

The agro-ecological zone LH3 which covers the central parts of the district (including Eldoret town and surroundings) is covered with soils of low fertility developed mainly on the intermediate igneous rocks. The most widely spread soil group here are the heavily textured *Glevsols* which are poorly drained, moderately deep, dark grey to grey, mottled, firm clay and humic topsoil. However most parts are covered with soils developed on intermediate igneous rocks which are well drained, moderately deep to deep, dark red, friable clay of a light texture (*Ferralsols*).

map 7: Soils covering Uasin Gishu County



(Source: Water Resources Report by Mangat I.B. Patel (MIBP) Limited dated June, 2017 Figure 6.4 page 6-4)

The upper reaches of most Catchments are covered by Humic Nitosols which are classified as well drained soils with good porosity. The Nitosols are characterized by a blocky structure. The middle reaches of the catchments are covered in Haplic Ferralsolss which have a varying texture, from sandy loam to clay. Many Ferralsols have excellent porosity and good permeability.

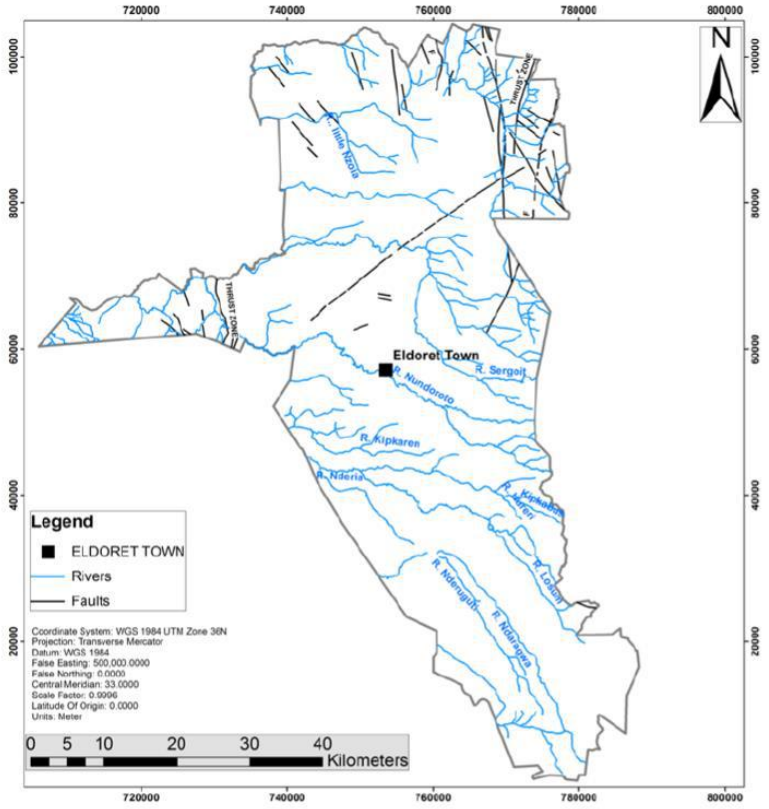
3.7. Hydrology

Uasin Gishu County lies within the Lake Victoria catchment basin and all its rivers drain into the lake Victoria. The County is drained by 4 major rivers namely Moiben River (with 3 tributaries), Sosiani River (with 3 tributaries), Sergoit River (with 2 tributaries) and Kipkarren River (with 9 tributaries). Nzoia River also traverses the boundary between Trans Nzoia and Uasin Gishu County to the North and Kakamega County to the North West.

These rivers are dotted with many dams and wetlands which help regulate river flows. The higher forested areas in the south act as part of the catchment for the rivers. The forests are Timboroa, Cengalo, Nabkoi, Lorenge, Kipkurere and Kapsaret.

The Sosiani River and its tributaries act as the receiver for all effluents discharged within the project area. The Sosiani River arises from the conjunction of the Endoroto and Ellegirini River, about 12 km upstream from Eldoret. The Two River Dam is located at this confluence, which is one of the sources of Eldoret's water supply. The Sosiani River flows after a course of 63 km into the Kipkarren River. The altitude of Sosiani River at Two River Dam is about 2,160 masl and at the confluence with Kipkarren River is 1,710 masl. The average slope of the Sosiani River is about 7%.

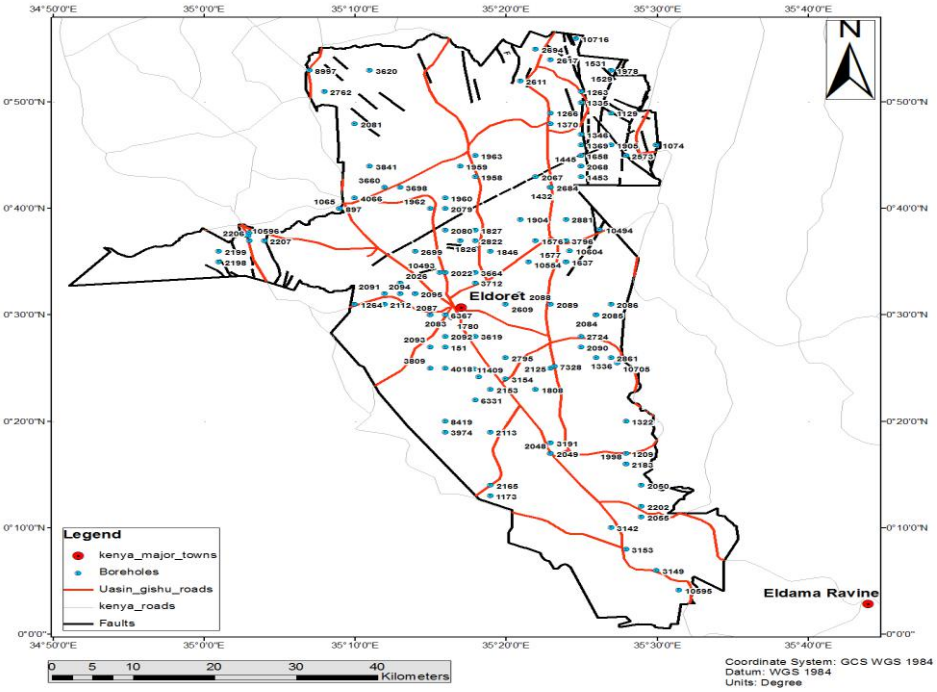
map 8: **River systems in Uasin Gishu County**



(Source: Water Resources Report by Mangat I.B. Patel (MIBP) Limited dated June, 2017 Figure 7.1 page 7-2)

3.7.1. Groundwater sources

map 9: Registered boreholes in Uasin Gishu County



A ground water assessment was conducted by MIBP Consulting Engineers and reported in the October 2016 Feasibility Study and Preparation of Water Supply Master Plan for Eldoret. From the examination, it was observed that the

Sergoit catchment appeared to contain higher yielding wells, followed by the upper part of the Sosiani and Kipkarren catchments. The overall conclusion of the groundwater study was that groundwater resource within the study area was low.

According to IBMP (2016), the main water sources in Uasin Gishu County include dams, rivers, boreholes, shallow wells and springs. There are also about 250 boreholes in the County out of which 170 are registered.

Groundwater infiltration in the phonolites is reduced by a clogging of joints by clay-like weathering products at the top of these rocks. Practically, all shaft wells in the area draw their water from weathered phonolite layer. The "depth to water" level depends upon the local morphology and the thickness of the weathered phonolite layer. On the plateaux water levels are encountered at depth of around 10 m. In sloping areas stand the water level are mostly higher. The permeability of the weathered phonolite depends upon the locally variable degree of jointing and on the degree of joint sealing by mineral precipitation, but is always low and many wells fall dry at the end of the dry season.

The shallow depth and poor filtration in the comparatively thin soil and in the jointed aquifer constitute pollution hazards. The predominance of pit latrines, open and partially unlined sewer ditches and the disposal of mineral oil, especially in the area of the town centre, contaminate the shallow groundwater in the densely populated areas.

3.7.2. Surface water sources

There are over 120 small dams which were constructed by the colonial government for recreational purposes but are now water sources for some communities.

The overall capacity of existing bulk water sources within Uasin Gishu County is around 56,000m3/day.

Table 2: Existing Surface Water Sources in Uasin Gishu County

Source	Yield	Comment
Two Rivers Dam	14950	Main source for Eldoret Municipality
Ellegirini Dam	9000	Currently serves as a reserve for Two Rivers Dam which supplies water to the Sosiani Treatment Plant. Proposed source for Naiberi and Kipkorgot as well as expansion of Kapsoya Treatment Works serving Eldoret
Kipkarren Dam		No existing supply scheme
Moiben (Chebara) Dam	26000	Source for Eldoret Municipality including communities enroute the Chebara Pipeline
Ellegirini River Intake	3450	Soure for Eldoret Municipality and its environs

4 SOCIO-ECONOMIC BASELINE CONDITIONS

4.1 Socio-economic characteristics of project area

4.1.1 Administration

Administratively, Eldoret city is divided into thirteen wards. Six of them (Huruma, Kamukunji, Kapyemit, Kidiwa/Kapsuswa, and Stadium/Industrial, Market) are in Eldoret North Constituency, Three (Hospital, Kapsoya and Kimumu/Sergoit) are in Eldoret East Constituency, and the remaining four (Kipkenyo, Langas, Pioneer/Elgon View and Race Course) are part of Eldoret South Constituency. Eldoret is governed by a County Government of Uasin Gishu. The county government manages all the city affairs.

Table 3: Eldoret town Municipality Wards

Eldoret North Constituency	Eldoret East Constituency	Eldoret South Constituency
Huruma	Hospital	Kipkenyo
kamukunji	Kapsoya	Langas
Kapyemit	Kimumu/sergoit	Pioneer/elgon view
Kidiwa/kapsuswa		Racecource
Stadium/industrial		
Market		

4.1.2 Infrastructure Development

4.1.2.1 Roads

Eldoret town has an extensive road network comprising of tarmac roads, marrum and earth roads. The Nairobi-Malaba Highway passes through the heart of the Central Business District of Eldoret Municipality. Some of the roads crossing the proposed project areas include the main Eldoret-Nakuru highway traversing along annex and sukunanga, the old Nairobi road connecting Annex, Nandi road connecting hillside, kenmosa and kipkorgot, stendi kisa-yala road connecting racecourse and upper elgon, others within the town include the new bishop muge road, eldama ravine road and eldoret Kisumu road.

4.1.2.2 Airport/ Airstrips

Eldoret airstrip is located on the Eldoret-Iten Road, about 20 kilometres from the Eldoret International Airport on Kisumu Road.

4.1.2.3 Information, Communication and Technology

Eldoret town enjoys a great mobile phone coverage which is provided by all the major service providers in Kenya. It also connected to the fibre optic cable thus, giving it access to fast internet connectivity**.** Recently, Rivatex opened a Digital Assembly Plant with the capacity to produce laptops, tablets, electric meters, smart phones and other digital devices. Additionally, In early 2019, Safaricom, Kenyas largest mobile network operator, set up its second largest call center, and its first outside Nairobi in Eldoret town. The town is also home to the MGW site, located at Kapsoya, the first of safaricom's data centres in the north rift, set up in 2015.

4.1.3 Land and Land Use

Eldoret municipality has an average land holding of 0.25 of hectares. The main land use activities within the proposed project area mainly features commercial and residential developments, industrial, and agricultural. There are four forms of land ownership in Eldoret namely; municipal land, government land, Kenya Railways Corporation land and private land in the form of freehold or leasehold...It is an important storage, processing and distribution centre for agricultural produce from its hinterland and neighbouring agricultural areas. The town plays a significant role in the wholesale and retail trade in agricultural commodities, and sales and servicing of farm tools and machinery and other agricultural inputs. It offers administrative services, banking services and entertainment. Today Eldoret is a major dynamic regional administrative, commercial, educational and industrial centre. The town has a vibrant informal sector that offers employment to many of its residents.

4.1.4 Demographic Characteristics

According to the 2009 Population and Housing Census, the total population of Uasin Gishu County stood at 894,179 while Eldoret town had a population of 289,380. Eldoret Town is densely populated which had population density of

1996 persons per Km² in 2012. The high population density in Eldoret Town is attributed to urbanization and being the seat of the county government. The areas with high population concentration are Langas, Munyaka, Huruma, Maili Nne, Kamukunji which have informal settlements. The following are population projections for Eldoret town

Table 4: Population Projections – Eldoret town

Census 2009		2018 projections		2020 projections		2022 projections	
Male	146596	**Male**	210,120	**Male**	234084	**Male**	251560
Female	142,784	**Female**	204656	**Female**	227,997	**Female**	251,560
Total	289,380	**Total**	414,777	**Total**	462,081	**Total**	503,119

Source: (Uasin Gishu CIDP)

Eldoret is often referred to as a cosmopolitan city: A place where several Kenyan ethnic groups live and mingle. The most represented ethnic groups in Eldoret are the Kalenjin, the Kikuyu, the Luhya, the Luo and the Kisii.

4.1.5 Education

Eldoret town is well served with education institutions-schools, colleges, universities. The town is home to Moi University. Though the university's main campus is located about 30 kilometers away in Kesess, four of its campuses are within the city limits of Eldoret. These campuses are; Annex Campus (School of Law), Town Campus(School of medicine and school of dental sciences), Rivatex Campus(School of aeronautical engineering) and Eldoret West campus (for privately sponsored students) a student population of 14,855 as of 2006.

The University of Eldoret is the second largest university in the city. Its main campus is located within the city limits to the north of the town. Other universities with campuses in the town include Catholic University of East Africa, Jomo Kenyatta University, University of Nairobi, University of East Africa - Baraton, Kabarak University and Kisii University. The city also is home to many technical and vocational institutes including Rift Valley Technical Training Institute, Eldoret National Polytechnic, African Institute for Research and Applied Studies.

4.1.6 Health

Most of the facilities are concentrated within Eldoret Municipality but whose catchment extends up to Uganda, Rwanda and South Sudan. At the apex of the health system is the Moi Teaching and Referral hospital. Whereas the number of existing facilities is quite appreciable they are not sufficient to service the wide catchment area including the health needs of the County itself.

There are a number of medical facilities in the city, notably Moi Teaching & Referral Hospital; The only referral national hospital in western Kenya. The county has the Uasin Gishu District Hospital, and there are several private institutions: St. Luke Orthopaedic and Trauma Hospital, Eldoret Hospital, Mediheal Hospital, Eldoret Oncology Associates Cancer Hospital, Reale Hospital, Alexandria Cancer Centre and Palliative Care Hospital and Elgon View Hospital among others.

4.1.7 Transport

Eldoret town has an extensive road network comprising of tarmac roads, marrum and earth roads, railway line, an airport and airstrips, making it the region’s service hub. Eldoret International Airport is a large airport that serves the city of Eldoret and the surrounding communities with daily flights to Nairobi and Lodwar. The Nairobi-Malaba Highway passes through the heart of the Central Business District of Eldoret Municipality. The city is also served by the Kenya-Uganda railway. Due to the reduced use of the railway line to Uganda, there has been an unprecedented upsurge in the volume of road traffic, particularly heavy haulage trucks passing through the town.

4.1.8 Commerce and industry

Industrial development in Eldoret town is diverse. These include: agro processing, construction, plastic manufacturing and textile. The major industries in the town include: Rivatex, Kenknit, Raymond, Unga Group Millers among other developing industries. Eldoret is surrounded by prime agricultural lands and acts as a trading centre for Uasin Gishu's economy which is driven by large-scale grain farming, dairy and horticultural farming. The town is also a local manufacturing hub with a number of nationally recognised manufacturing concerns, including Raiply woods, Rupa Textiles, Kenya Pipeline Company, Kenya Co-operative Creameries as well as corn, wheat and pyrethrum factories all within the town. The runners from Eldoret have also contributed significantly to the economy of Eldoret town, primarily investing in small businesses and real estate, from their winnings in races all over the world, which has become known as the ‘city of champions’ due to the success of these athletes in the world’s most prestigious marathons.

4.1.9 Agriculture

Located in the fertile highlands of the Rift Valley, Eldoret is often described as an agricultural centre. Surrounded by large farms producing mainly wheat and maize, the city plays a key role in the supply chain of agricultural products. It is home to flour-milling and food-processing facilities, and is renowned for dairy products, including milk, yoghurt and cheese. Eldoret is also a farmers' hub: Where agricultural goods are brought to market and sold; where farming inputs and machinery are bought; and where money earned after the harvest is spent. It is an important storage, processing and distribution centre for agricultural produce from its hinterland and neighbouring agricultural areas. The town plays a significant role in the wholesale and retail trade in agricultural commodities, and sales and servicing of farm tools and machinery and other agricultural inputs.

Observations around the town and its environs reinforce the significance of agriculture due to the presence of cattle dips, agricultural experimental farm and soil and water services being taken to maintain the ecological equilibrium of the region. Horticultural crops are most common due to availability of nearby markets. Livestock production in the area embraces dairy and beef cattle, sheep, goats, pigs, rabbits and poultry.

4.1.10 Water supply

Eldoret Town is served mainly by the following water supply systems:

- Chebara Water Supply whose source is Chebara Dam with a Treatment Capacity of 26,000m3/day.
- Sosiani Treatment Works whose source is Two Rivers dam with a current capacity of 14,000m3/day (2735 m3/day for Eldoret)
- Kapsoya Treatment Works whose source is Ellegerini Dam with a capacity of 9000m3/day (4000 m3/day for Eldoret)
- Upgrade and rehabilitation of the Two Rivers Dam is however ongoing. After project completion, capacity of the extended dam and treatment works will be around 70,000m3/day
- There is a proposed project, Kipkarren Dam, which will supply an additional 25,000m3/day whose construction will be funded by the African Development Bank (AfDB)

Total production of water from this two sources is around 32,000 m^3/day against an estimated water demand (2020) of about 68,120 m^3/day (see **Error! Reference source not found.**). The existing Distribution Water Mains within the unicipality of Eldoret is approximately 300km and area of coverage is approximately 150km^2. The sizes / (ignoring anything 50mm dia. or below) varies from 80mm dia. to 500mm dia.

All systems in Eldoret are managed by ELDOWAS and any development of new infrastructure of rehabilitation of any dilapidated works will be undertaken by LVNWWDA.

4.1.11 Sanitation

As indicated in the figure below, the majority of people in Eldoret Town at 69.46% use pit latrines.

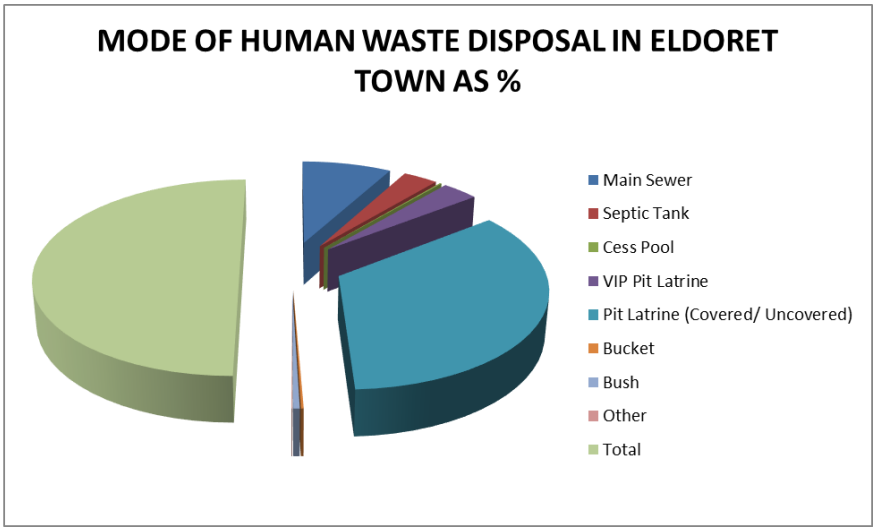


figure 4: Mode of Human waste disposal in Eldoret Town (Census 2009)

Eldoret town is served by two sewage treatment plants (Quarry WWTW & Boundary WWTW) with a combined design capacity to treat 18,000m3/day. Both WWTW have a more or less equal capacity and are interconnected to allow for

diversion of the entire flow to one of them during yearly de-sludging. Sludge is sold to surrounding communities as fertilizer. Quarry Treatment plant is a conventional treatment plant existing of the following"

- Mechanical screening
- 4 no Primary ponds
- 2 no Secondary ponds
- 2 no Tertiary ponds
- 2 no Maturation ponds
- 1 trickling filter

Boundary Treatment plant has a similar set-up:

- Mechanical screening
- 2 no Primary ponds
- 1 no Secondary ponds
- 1 no Maturation ponds
- 1 trickling filter

The two treatment plants currently operate at almost the design capacity due to low coverage of the sewerage network. The sewer network covers less than 30%of the town leaving the rest dependent on onsite sanitation methods which is both expensive and unsustainable to the environment, since no structural de-sludging logistics and treatment facilities are in place for onsite sanitation solutions.

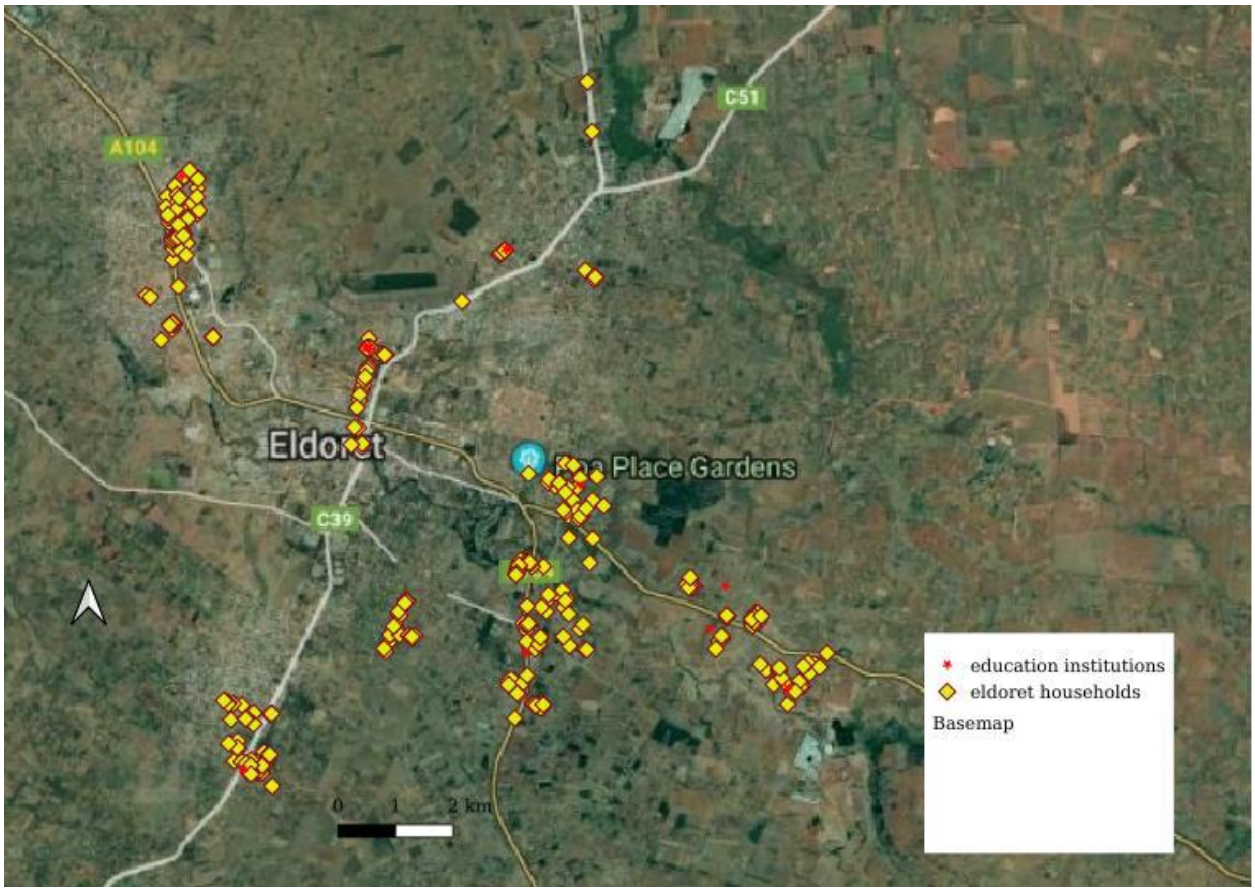
The Contractor will make available any land for quarries, borrow pits, stockpiles and spoil areas, except for those areas in road reserves specifically approved by the resident engineer. The contractor will be entirely responsible for locating suitable sources of materials complying with the Standard and Special Specifications and for the procurement, mining, haulage to site of these materials and all costs involved therein.

Similarly, the contractor will be responsible for the provision and costs involved in providing suitable areas for stockpiling materials and spoil dumps. Should there be suitable sites for spoil dumps or stockpiles within the reserve forming the site of the works the Contractor may utilize these subject to the approval of the Engineer.

4.2 Socio-economic assessment findings

4.2.1 The study area

The socio-economic survey was carried out in selected areas identified by RVWWDA for sewerage extension project in Eldoret town. These included Upper Hill, Annex, Sukunanga, Kenmosa, Hillside, Kipkorgot, Racecource, Upper Elgon, and Langas. The survey areas are shown on the map below.



map 10: Eldoret survey locations

4.2.2 Population and household characteristics

A total of 440 participants responded to the household survey that was administered during the household data collection exercise. Among the interviewed respondents, 54.9% were female while 45.1 % were male.

4.2.2.1 Education level of household head

Among those sampled, 39.3% had completed secondary education, about 29.1% of them having attained a degree and 23.8% had college level education while only 4.4% had not completed vocational training. Furthermore, 1.7% had not completed secondary education while 1.1%` had attained primary level of education and 0.3% had not completed primary education as well as those with no education at all.

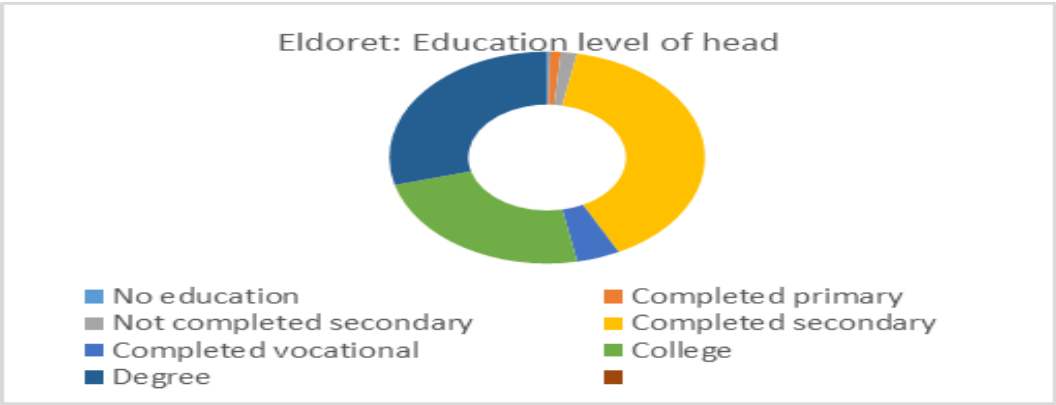


Figure 5: Education level of household head

4.2.2.2 Education level of household members

Slightly more than a quarter (25.3%) of the respondents had completed secondary level of education followed by 20.3% who had not completed primary school education. 18.6% had a degree while 18.2% had attained a college level

of education. 7.8% had not completed secondary education while 5.2% had no education. 2.9% had completed vocational training and the least of the respondents 1.7% had completed primary level of education.

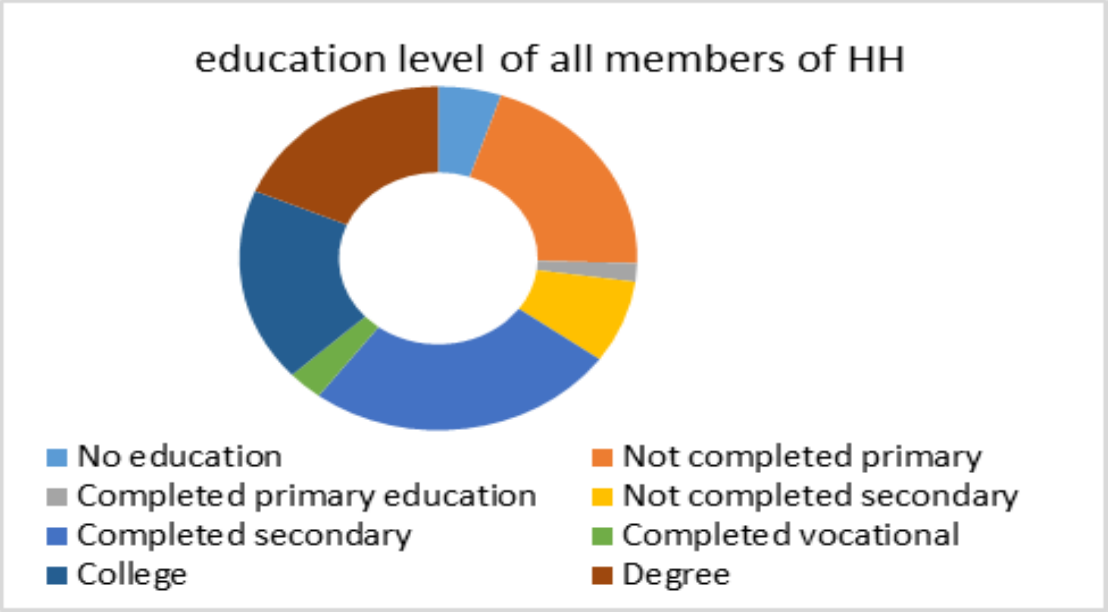


Figure 1: Education level of household members

4.2.3 Livelihood, income and expenditure

4.2.3.1 Employment

The survey established that about half of the respondents within the project areas (49.1 %) are in formal employment.

4.2.3.2 Sources of livelihood

The primary sources of livelihood for households surveyed are employment, businesses and farming.

4.2.3.3 Household income

Among those sampled, slightly less than half (49.1 %) of the survey respondents were employed and 35.3% were self-employed as business men / women operating within Eldoret town. Much less than a quarter (8.8%) reported practicing farming (mainly food crops and horticulture) while 2.4% were in livestock and dairy farming. Furthermore, 3.1% had remittances from relatives and friends as their main source of income and 0.7% reported being dependant on sports as their main source of income. Very few (0.2%) of the respondents use rent as their main source of income. Water vending was cited by 0.2%. of the respondents. Another 0.0% did not disclose their main source of income, citing personal reasons. None of the respondents depended on gifts/gratuities, casual, hustling, money for elderly, bodaboda, charity or pension.

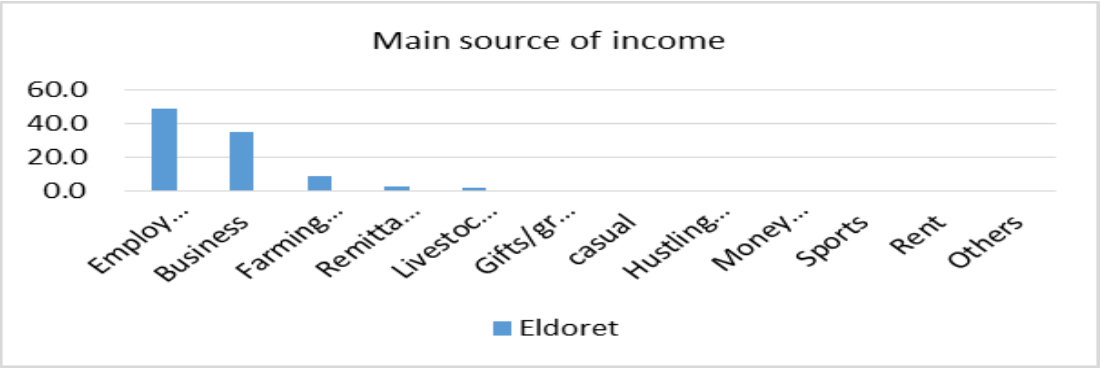


Figure 2: main source of income

4.2.3.4 Household expenditure

Expenditure on clothing in the last 12 months

From the survey, 52.6% of the respondents had spent over K.Sh.5000 on clothing in the last one year. 11.0% had spent between K.Sh3001 and K.Sh4000. 10.3% spend between 1001 and 2000 while 10.1% spend between 4000 and 5000 on clothing. 8.1% spend between 0 and 1000 shillings and 7.9% spend between 2000 and 3000 shillings on clothing in the last one year.

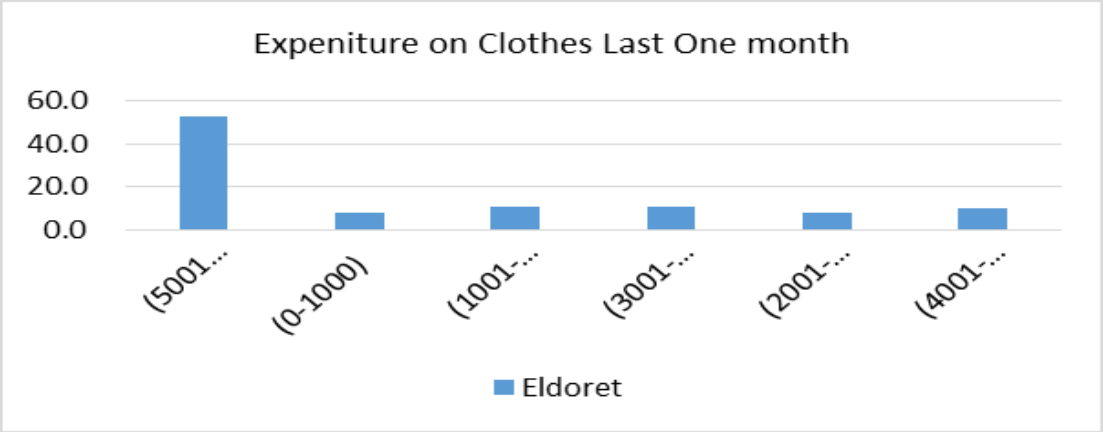


Figure 3: Expenditure on clothing in one month.

Expenditure on water in the last one month

About 23.5% of the respondents spend between K.Shs201-400 on water and 21.7% spend between K.Shs801-1000 per month. 17.8% of the respondents spend between 401-600 shillings while 17.3% spend between 0-100 shillings. 11.6% spend K.Shs101-200 and the least of the respondents 8.1% spend K.Shs601-800 on water per month.

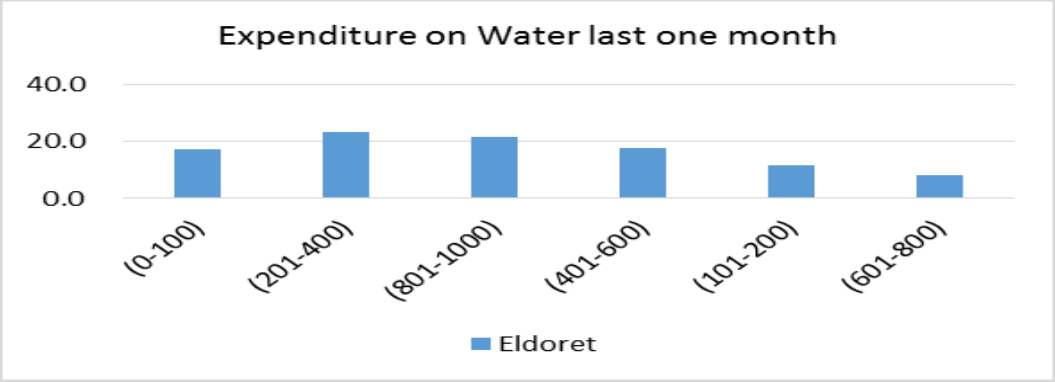


Figure 4: Expenditure on water in the last one month

Expenditure on transport in the last one month

Among those interviewed, slightly below a third (31.8%) had their expenditure on transport in the last one month above K.Shs5000., while less than a quartet 17.5% spend between K.Shs3001 and Kshs4000 and 17.1% spent between K.Shs2001 and Kshs3000. 11.6% spent between K.Shs1001 and Kshs2000 while only 10.3% spent between K.Shs-1000 or less on transport in the last one month.

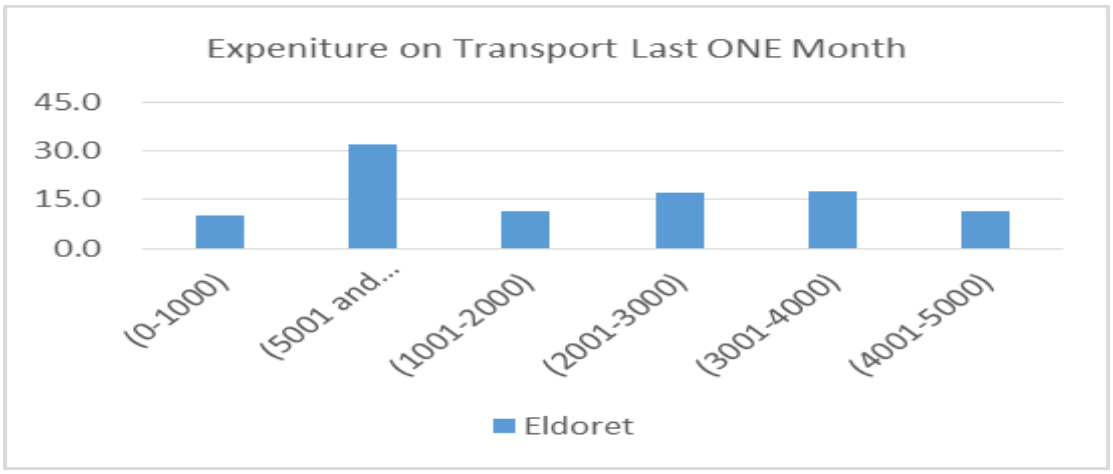


Figure 5: Expenditure on transport

Expenditure on electricity in the last one month

More than half (58.1%) of the respondents spent between up to Shs1000 on electricity in the last one month prior to the survey while 23.9% spent between K.Shs1001and Ksha2000. Much less than a quarter (10.8%) of the respondents spent between K.Shs2001 and Kshs3000 and 4.0% spend between K.Shs3001-4000. 2.6% of the respondents spent between K.Shs4000-5000 and only 0.7% spend above K.Shs5000 on electricity in the last one month.

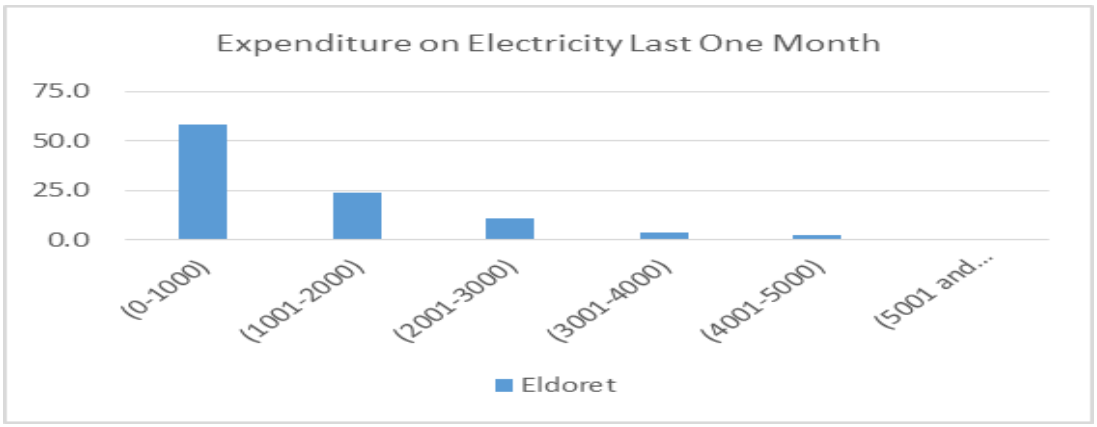


Figure 6: Expenditure on electricity in last one month

Expenditure on garbage in the last one month

Among those sampled, more than a third (34.4%) of the respondentsspent between K.Shs100 or less on garbage in the last one month, while more than a quarter (29.2%)spent between K.Shs101 and Ksha 200. A further 26.3% spent between K.Shs201 and Kshs400 on garbage disposal, while 6.1% spend between K.Shs601 and Ksha800 amd 3.5% spent between K.Shs401-600 and very few (0.4%) spend between K.Shs801 and Kshs1000 on garbage disposal.

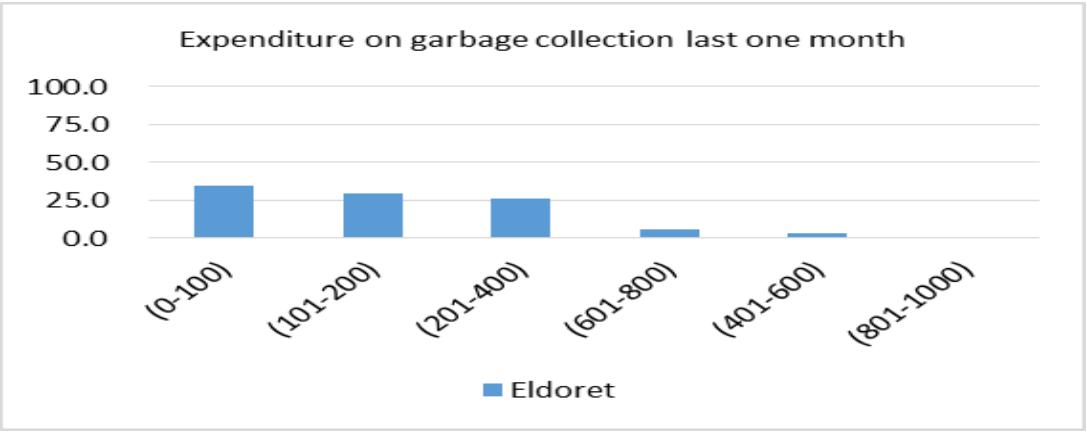


Figure 7: Expenditure on garbage in last one month

Expenditure on food in the last one month

Among the survey respondents 46.5% spent between K.Shs5001-10000 on food followed by 28.5% of the respondents who spent between K.Shs5000 or less in the last one month. Slightly less than a quarter (19.1%) spent between K.Shs10001 and 20000 on food while 4.8% spent between K.Shs20001and 40000 on food in one month and 0.7% of the respondents spend between K.Shs40001 and 50000 on food, then only 0.4% spends above K.Shs50000 on food in the last one month.

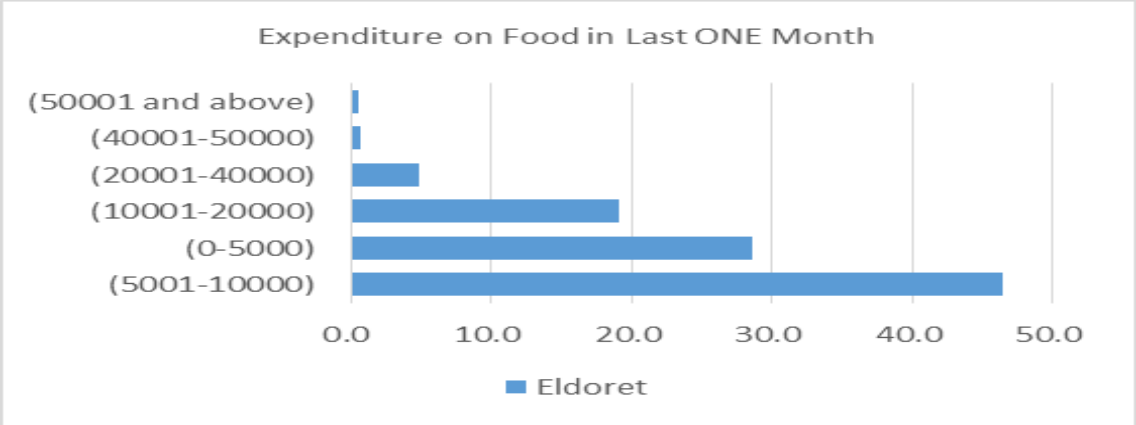


Figure 8: Expenditure on food in last one month

Expenditure on education in the last 12months

Regarding expenditure on education 32.2% of the survey respondents spent over K.Shs50000 on education in the last one year and while 27.2% had spent between K.Shs5000 or less on the same. Less than a quarter (11.6%) of the respondents spend between K.Shs20001and 40000 while almost the same proportion (11.4%) spent between K.Shs10001 and 20000 on education in the last 12 months. An even smaller proportion (10.8%) of the respondents spent between K.Shs4000150000 while even less(6.8%) spent between K.Shs5001 and 10000 on education in the last 12 months. Education expenditure covered all levels of education from primary, secondary, college and university.

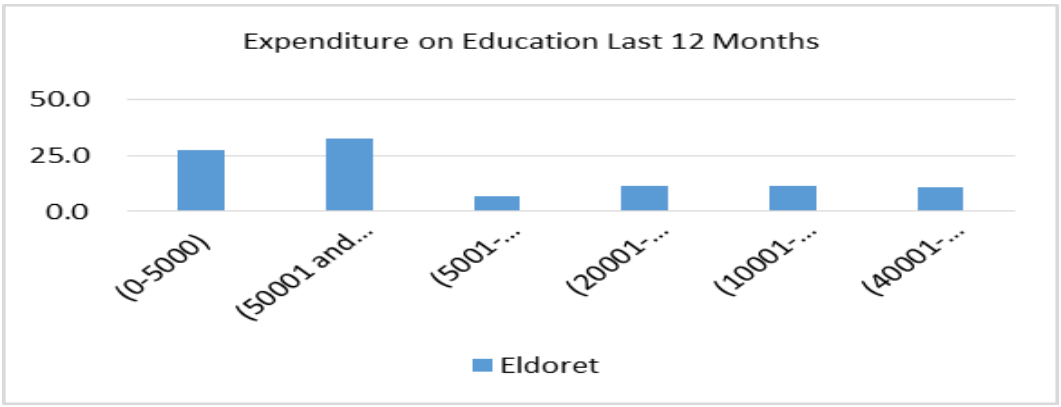


Figure 9: expenditure on education in last one year

Expenditure on health in the last 12 months

Among those surveyed, slightly more than a third (35.3%) of the respondents had spent K.Shs-5000 or less on health in the last 12 months. Almost the same proportion (31.6%) of the respondents had spent between Ksh 5001 and 10000 while 22.4% reported spending between Ksh 10001and 20000 and 6.1% spent between K.Shs20001 and 0000. A very small proportion (2.6%) spent between K.Shs40001and 50000 on health in the last one year, while an even smaller proportion (2.0%) reported spending over K.Shs50000 on health in the last one year. Health expenditure also included those using different health insurance covers and was determined by how much they contributed towards that in the last one year

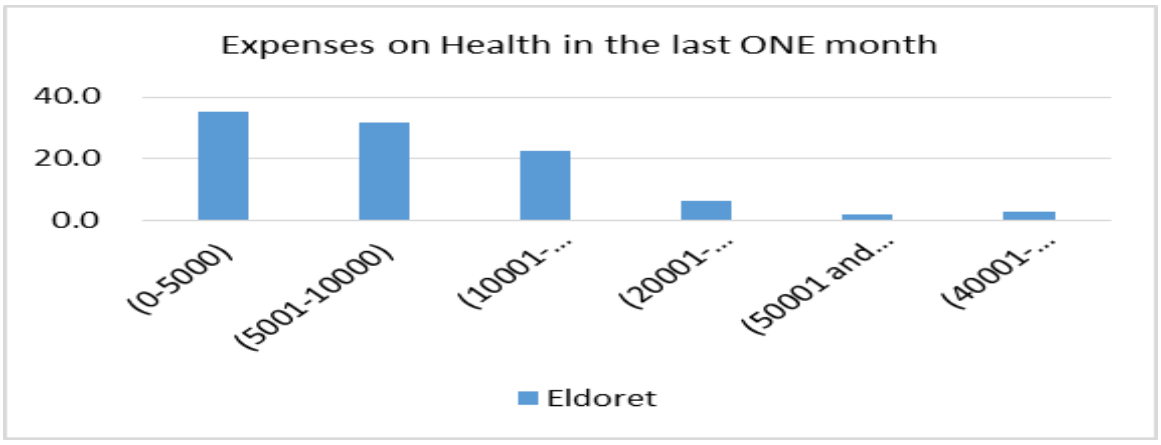


Figure 10: Expenditure on health the last 12 months.

Other significant expenses in the last one month

On other expenses apart from the listed above, majority of the respondents 25.2% spend between K.Shs0-1000 and 19.1% spend over K.Shs5000 in the last one month. About 17.3% of the respondents spent between K.Shs1001-2000 and 13.4% spent between K.Shs4001 and 5000. 13.2% of the respondents spend between K.Shs2001 and 3000 while 11.8% spent between K.Shs3001 and 4000 on other expenses in the last one month.

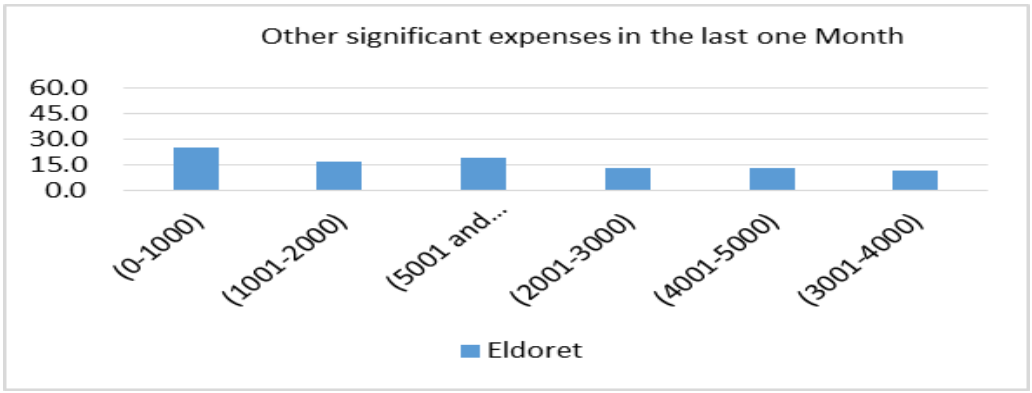


Figure 11: Other significant expenses in last one month

3.7.3. Housing condition

3.7.3.1. Type of main house

Among those sampled, more than three quarters (84.7%) were living in permanent houses and about less than 14.3% were living in semi-permanent houses. Only 1% of the respondents were living in temporary houses. None of the live in mud plastered and grass thatched houses.

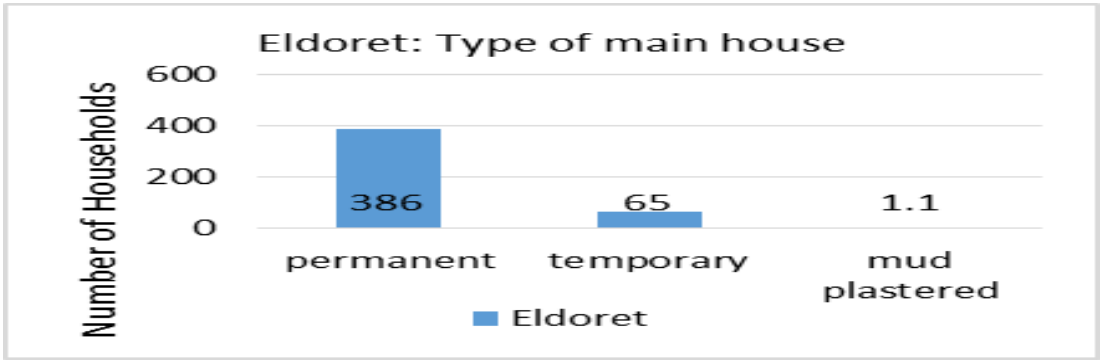


Figure 12: Type of main house

4.2.4 Wall material of the main house

Among those surveyed, slightly more than half (54.4%) of the respondents had their main houses'walls made of bricks and 30.5% had their houses' walls made of stones while 5.7% had plastered the walls of their and 3.5 had house walls made of mud as well as iron sheets. Only 2.4% of the respondents had house walls made of timber.

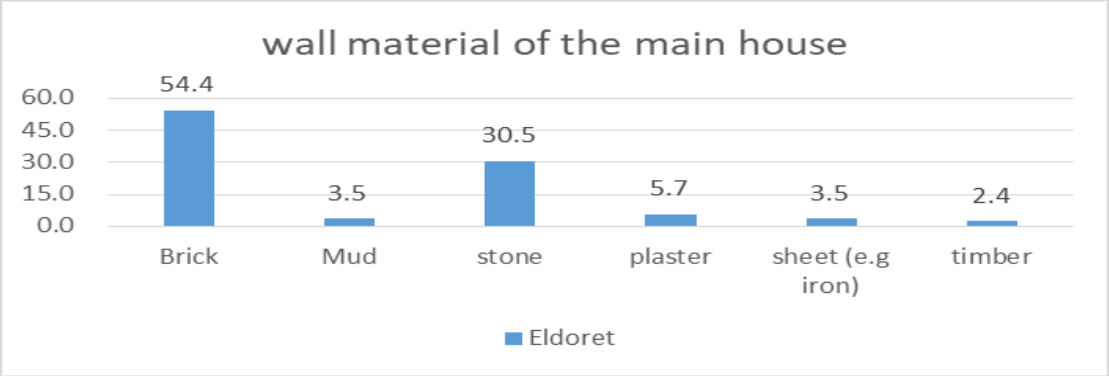


Figure 13: Wall material for the main house

4.2.5 Ownership status of main house

Majority of the respondents within the project area 60.8% owned the houses they lived. About 33.6% rented the houses they lived and only 5.7% lived in houses provided by their employers.

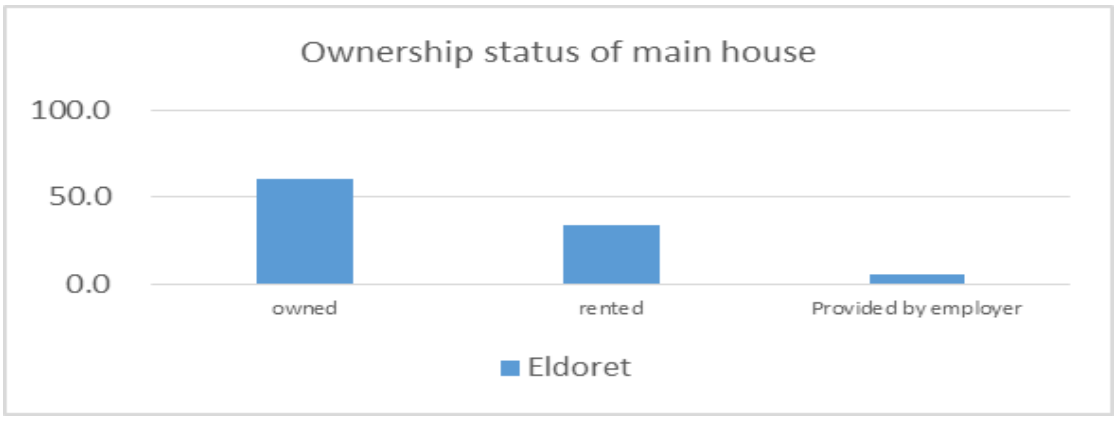


Figure 14: ownership status of main house

3.7.3.2. Land owned and proportion cultivated by household

Those living in g permanent houses own land of about 0.7acres on average and 0.3 acres was under cultivation. Those living in semi-permanent houses owned land of about 0.8acres on average and 0.6acres of it is under cultivation. Those in temporary houses owned land of approximately 0.5 acres and 0.4acres under cultivation. Overall, the survey respondents in the project area owned land of about 0.7acres and about 0.4acres were under cultivation.

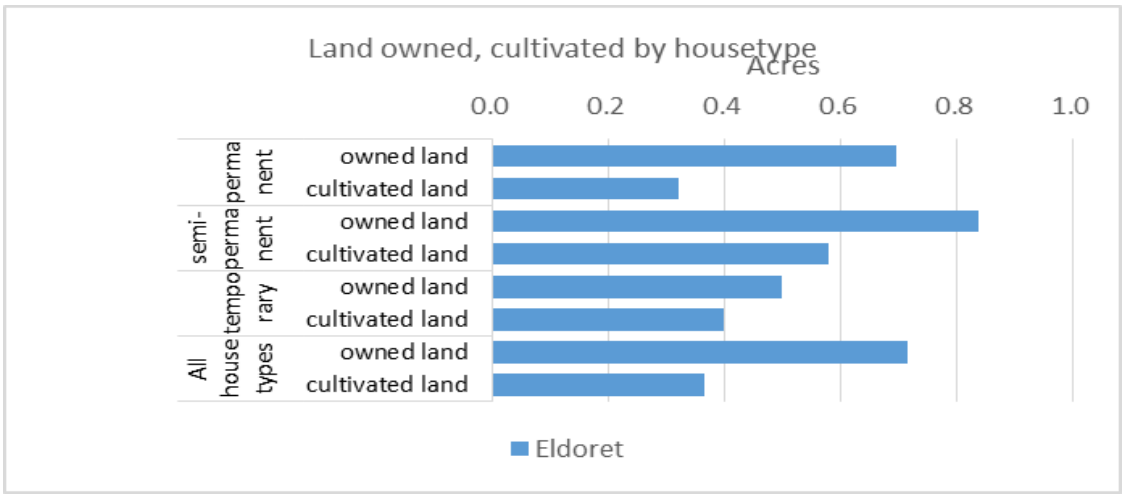


Figure 15: Land owned, cultivated by household.

3.7.4. Access to electric power and supply

3.7.4.1. Main type of lighting

Majority (97.4%) of the respondents use electricity as the main source of energy for lighting followed by 1.5% who use solar. 0.4% of the respondents use kerosene lamp as well as light solar light. Only 0.2% use gas lamp as the main source of lighting. It was further expressed by the respondents that they use various sources of energy for lighting when the one they depend on fails to work.

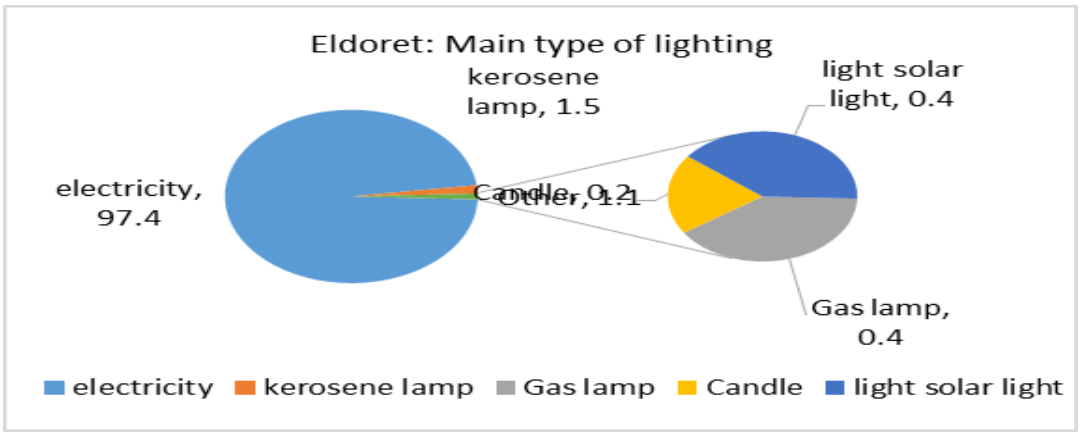


Figure 16: Main type of lighting

3.7.4.2. Main cooking fuel

Among those surveyed, 65.8% use gas as the main fuel sources for cooking in their households. 21.7% of the respondents use charcoal as their main source of cooking in their houses 10.3% of the respondents do use firewood for cooking and 2.0% of the respondents do use electricity for the same purpose of cooking. About 0.2% of the respondents are using kerosene for cooking.

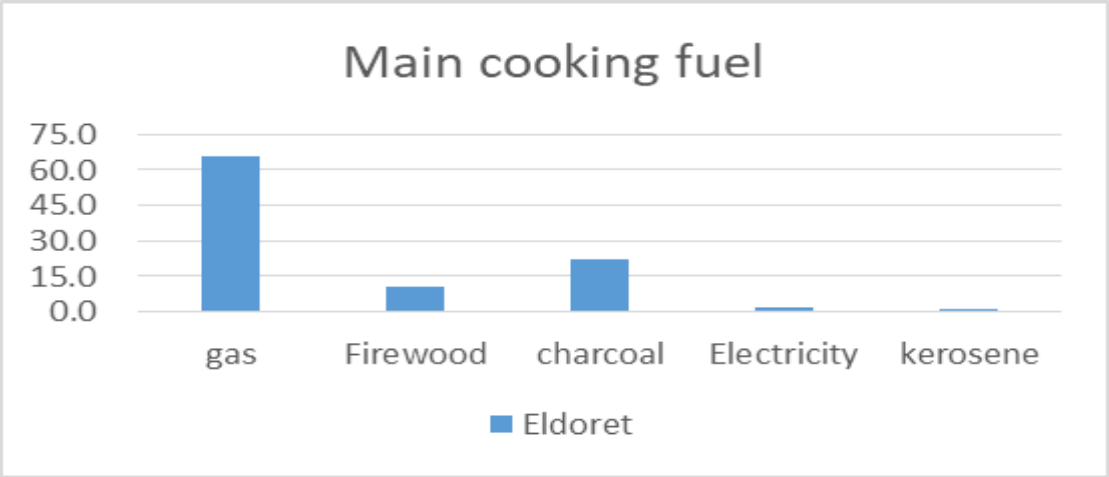


Figure 17: Main cooking fuel

3.7.5. Access to sanitation facilities

4.2.6 Presence and types of toilets facilities

In regard to whether or not the households had toilet facilities 99.6% of the households in the project areas had toilet facilities and only 0.4% had no toilet facilities. Among those who had toilets, we sought to find out the type of toilets and 71.2% of the survey respondents had flush/pour flush toilets as means of disposing of human wastes in their homes, and 19.6% had pit latrines with slab. 31.9% of the respondents had ventilated improved pit latrines and 1.1% had pit latrines without slab.

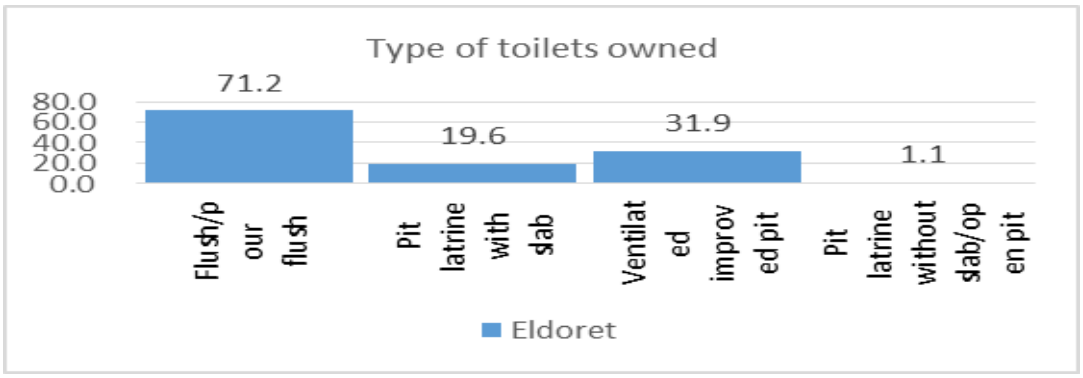


Figure 18: Types of toilets

3.7.5.1. Households sharing toilet facilities

On sharing of toilets with other households, slightly more than three quarters (76.7%) of the households indicated that they do not share toilet facilities with other households while 23.4% of the households do share toilet facilities with other households.

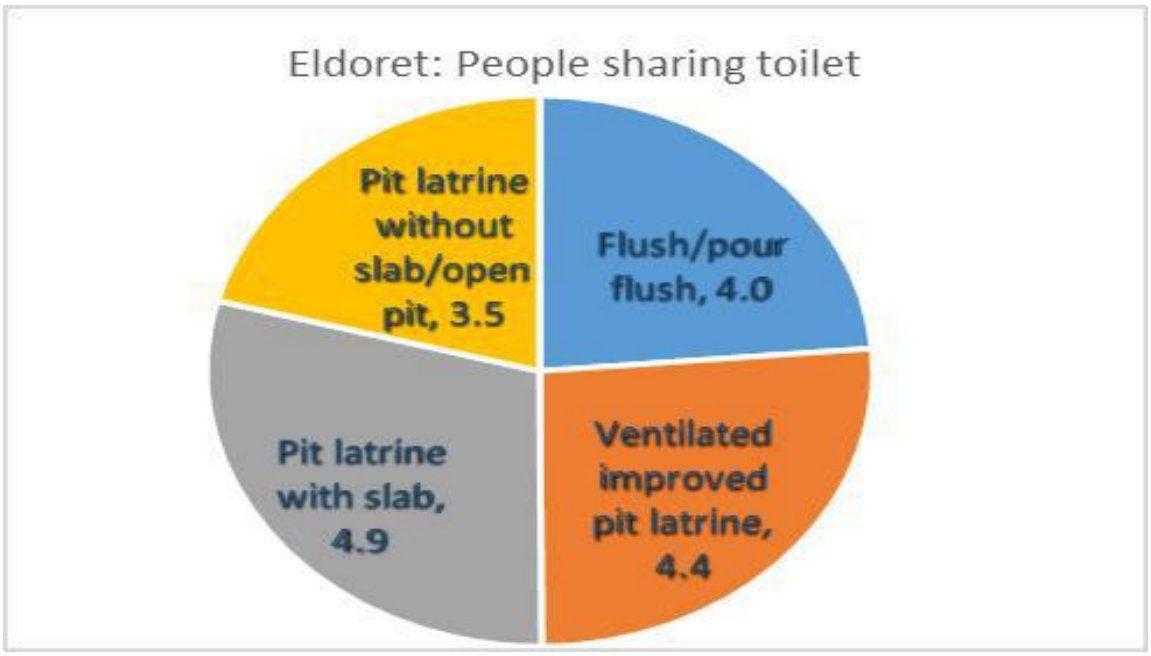


Figure 19: Households sharing toilets

4.2.7 Sewerage connectivity

On connectivity to sewerage mains, most (93.4%) of the respondents within the proposed project area indicated that they are not connected to sewer line, and only 6.6% are connected to sewer-line.

4.2.8 Water supply-sources, service level and determinants

4.2.8.1 Sources of water supply

On sources of water for domestic use, 48.7% of the survey respondents indicated that they are sourcing their domestic use water from piped water in the dwelling while 36.8% source their domestic use water from boreholes and 8.3% have piped water in the plot as their source for domestic use water. A further 5.9% of the respondents get their domestic water from a protected dug well, while 0.2% sources their water from unprotected dug well.

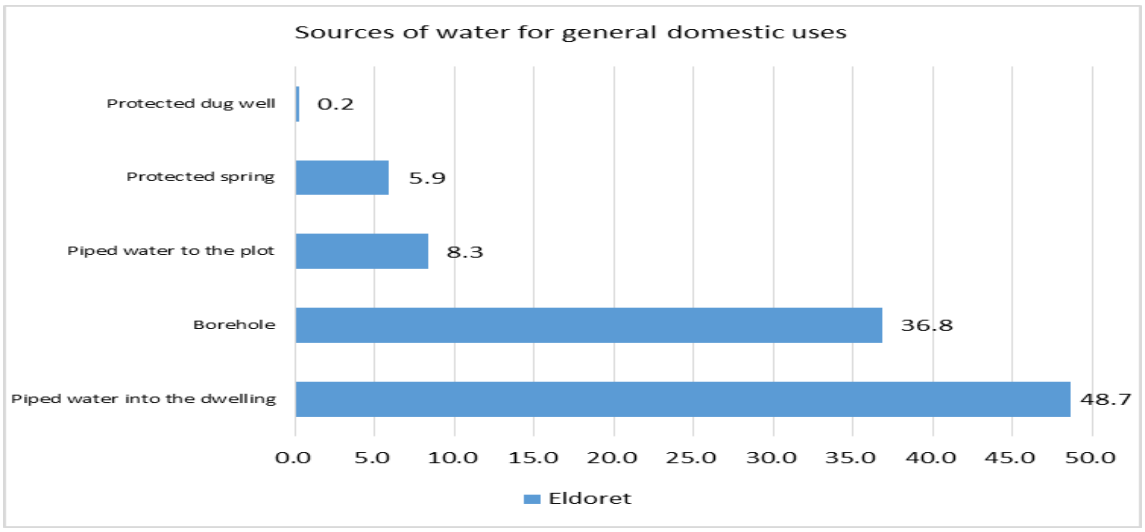


Figure 20: Sources of water for domestic uses

4.2.8.2 Water consumption

The respondents used an average of 153.3 liters of water per day for domestic use from their main sources.

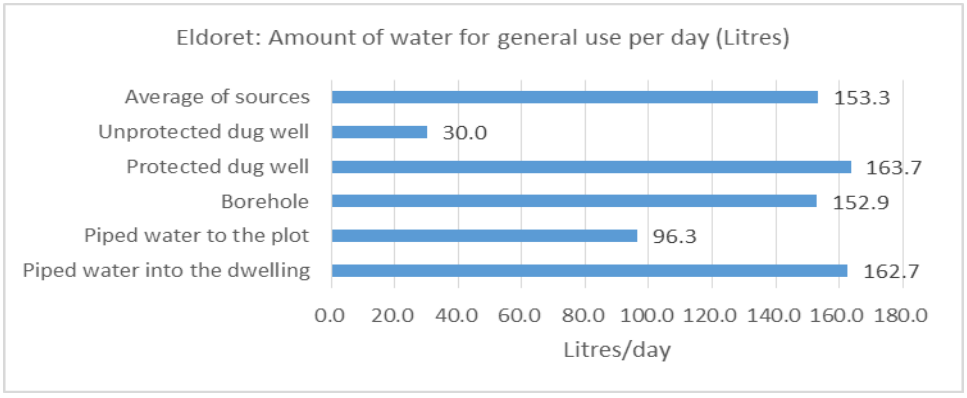


Figure 21: Amount of water per day

In regard to the daily usage of water for drinking. On average, the survey respondents used 18.6 litres of water for drinking purposes per day.

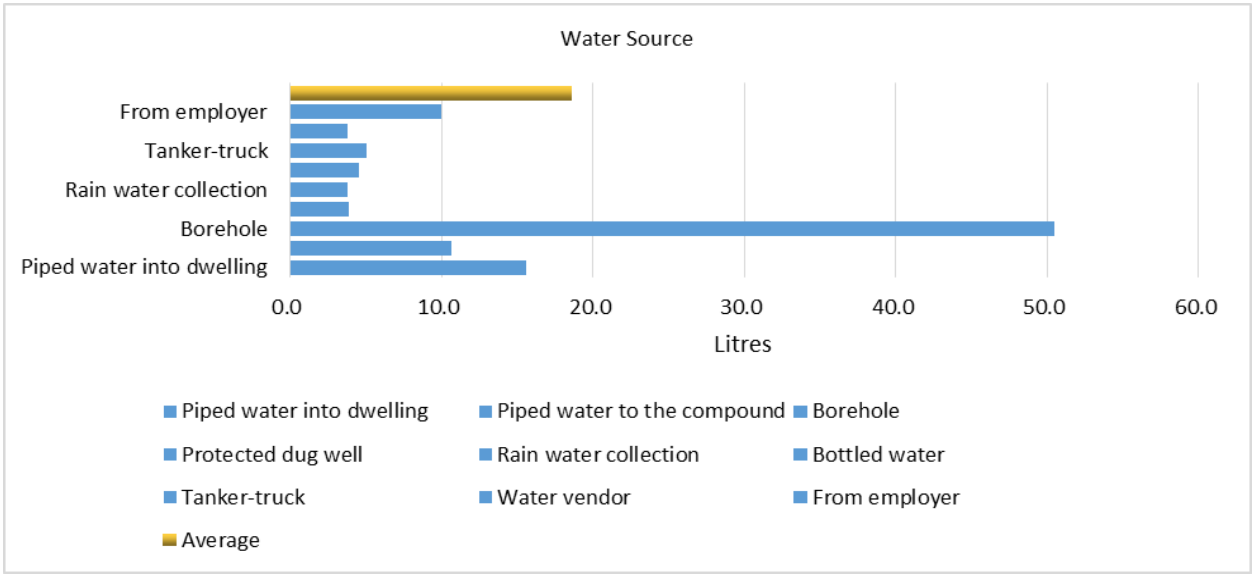


Figure 22: water consumption per source

4.2.8.3 Service level

In regard to connection to water mains, most (95.0%) of the respondents indicated that they are connected to water supply while only 5.1% of the respondents are not connected to water supply. Among those who are not connected to the mains, the reasons were varied. The most cited (45.5%) was that because it is expensive to connect, and 36.4% said they had other water sources in the area. 13.6% of the respondents said they had no idea about the connection process, and 4.6% said they are not connected because county water services are unreliable.

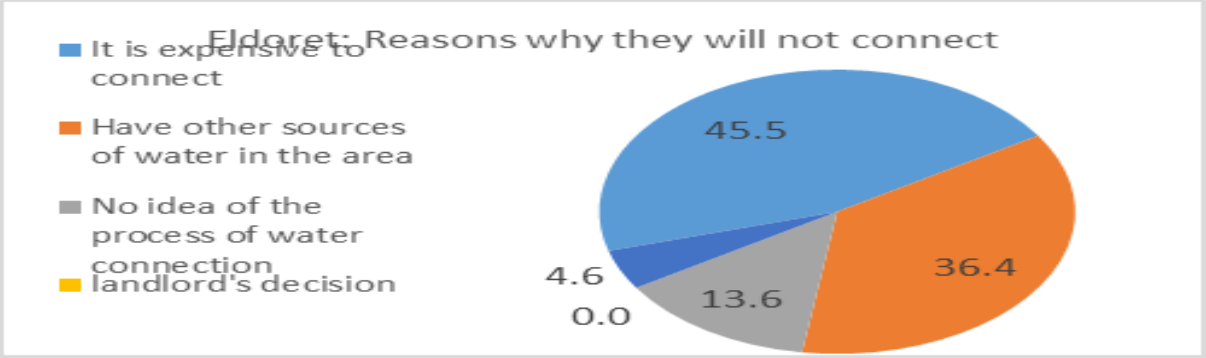


Figure 23: Reasons for not connecting

It was important to find out if the water used by the household was enough and 96.9% of the respondents using piped water into dwelling indicated that yes water is enough for general use, while 3.2% said that water was not enough. Among those using the borehole as their sources of water, 95.2% of the respondents indicated yes the water was enough while 4.8% said no the water was inadequate. Then there are those using protected well, among whom 96.3% i indicated the water was enough while 3.7% said the water was not enough. All (100%) of those using unprotected dug well said the water was enough for general use.

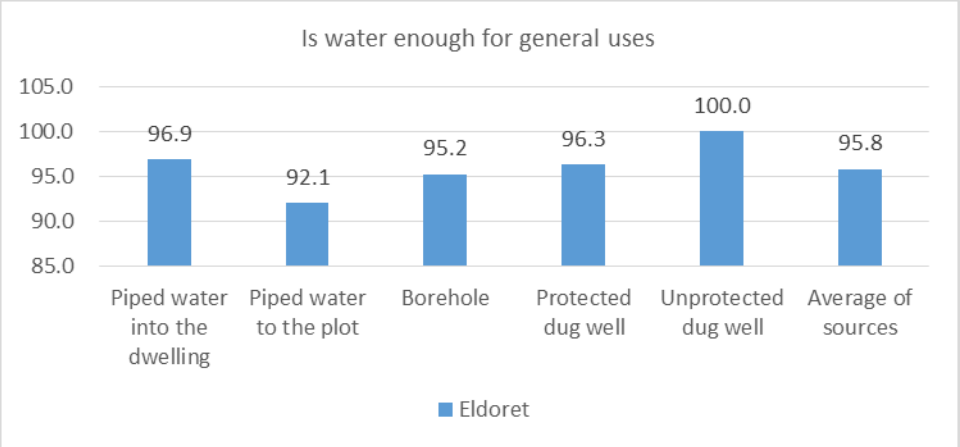


Figure 24: Sufficient water enough for general use

Availability of water for general use is very important. In this regard, slightrly less than half (46.7%) of the respondents indicated water was available daily for 24 hours in the last six months, while 26.5% indicated availability s daily at certain hours and 19.3% said that water was available three to five days a week, and 7.5% indicated that water was available one or two days a week.

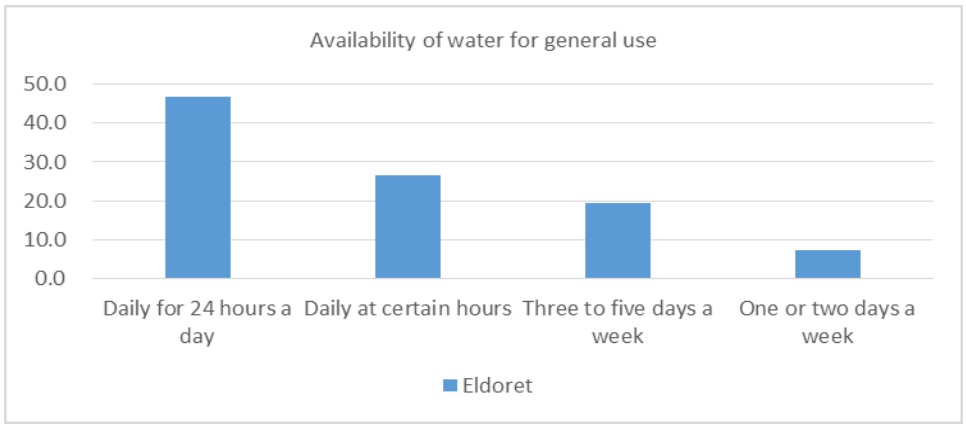


Figure 25: Availability of water for general use

The reasons for unavailability of water were varied. More than a third (37.2%) of the respondents indicated that water was not available at all, while 41.6% said it was due to water service interruption. Slightly less than a quarter (14.6%) of the respondents said that water dried up, while 2.7% said the water pipe or pump broke, and 2.2% said water was too expensive and only 0.9% of the respondents said that water dried up due to drought and also 2.2% of the respondents indicate that the source of water was not accessible

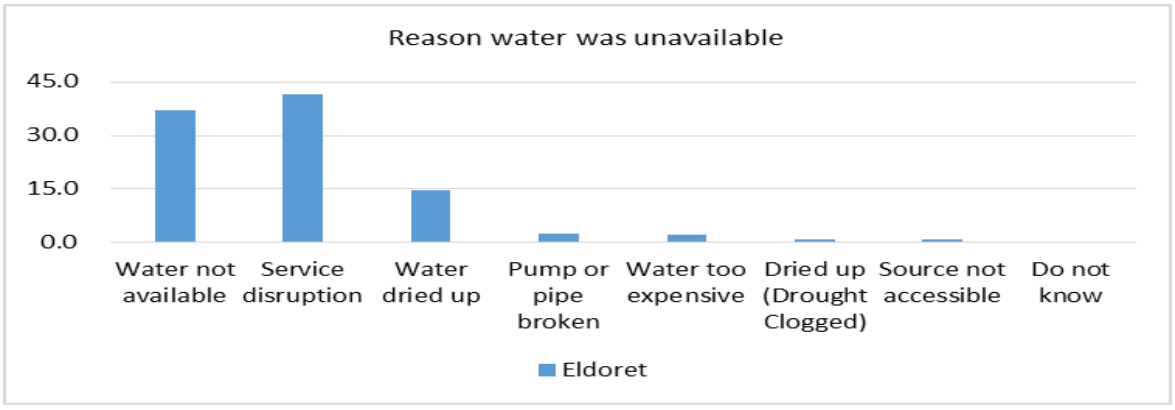


Figure 26: Reasons water not available

4.2.8.4 Water supply service hours and distance from home

Regarding whether the household collects water for domestic use, majority of the survey respondents 94.5% indicated that they do not collect water for domestic use. This means that majority have the water within the plot or in their dwelling units. The corresponding 5.5% do fetch water for domestic use outside their dwelling place.

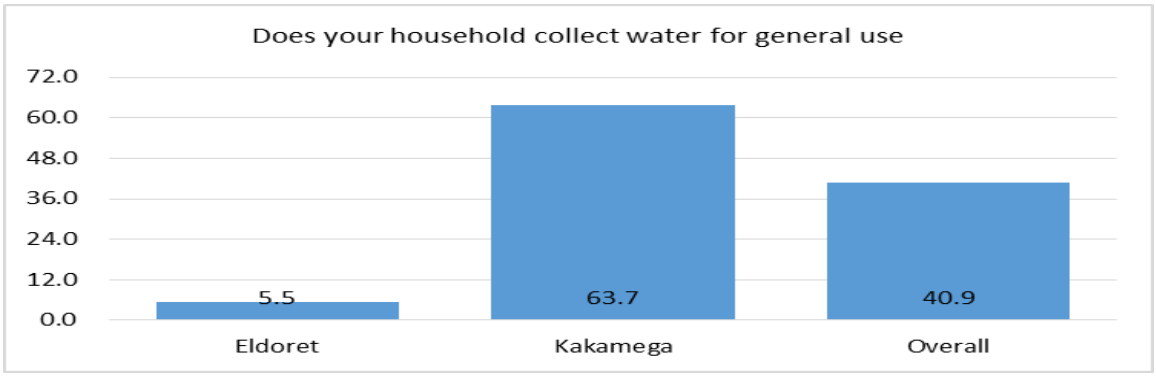


Figure 27:Does your household collect water

On the distance covered in search of water, all (100%) of the respondents indicated they cover a distance of1 kilometers or less to obtain water for general use.

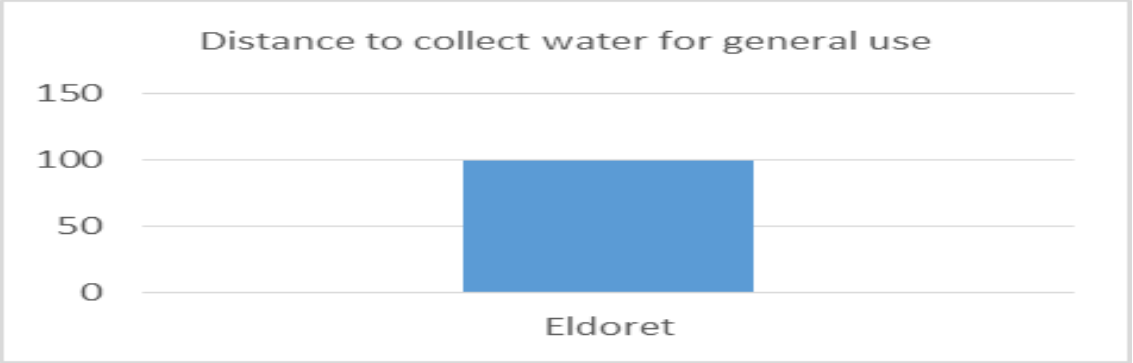


Figure 28: Distance to collect water

In regard to time spent fetching water, all (100%) of the survey respondents spend between 0-30 minutes to fetch water for general use.

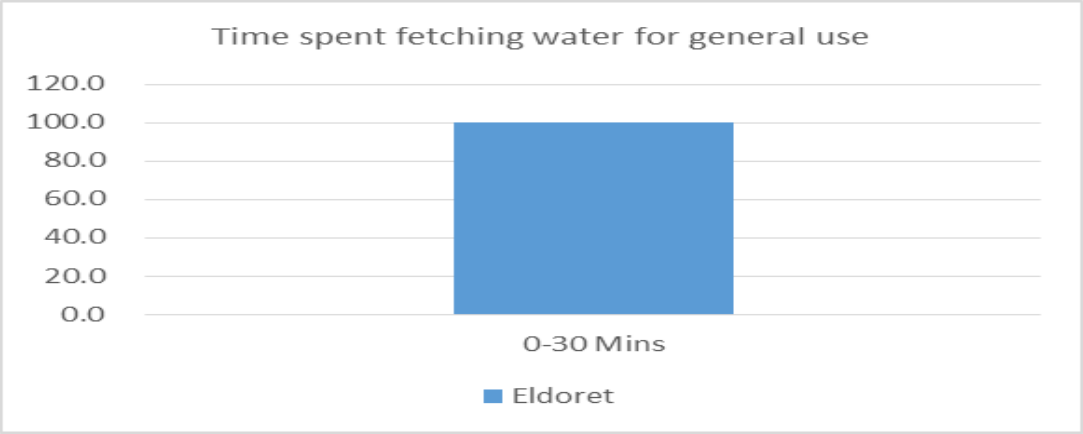


Figure 29: Time spend fetching water

4.2.9.1. Preferred drinking water supply

Main source for drinking water for slightly more than half (59.4%) of the respondents was piped water in the compound while 16.0% of the respondents sourced drinking water from piped water in the plot and 14.3% used borehole water for drinking purposes. 4.0% of the respondents used bottled water, 2.2% had protected dug well as well as rain water collection. 0.9% of the respondents used tanker-truck or water vendor for drinking purposes. 0.2% of the respondents said that they got drinking water supplied by employer.

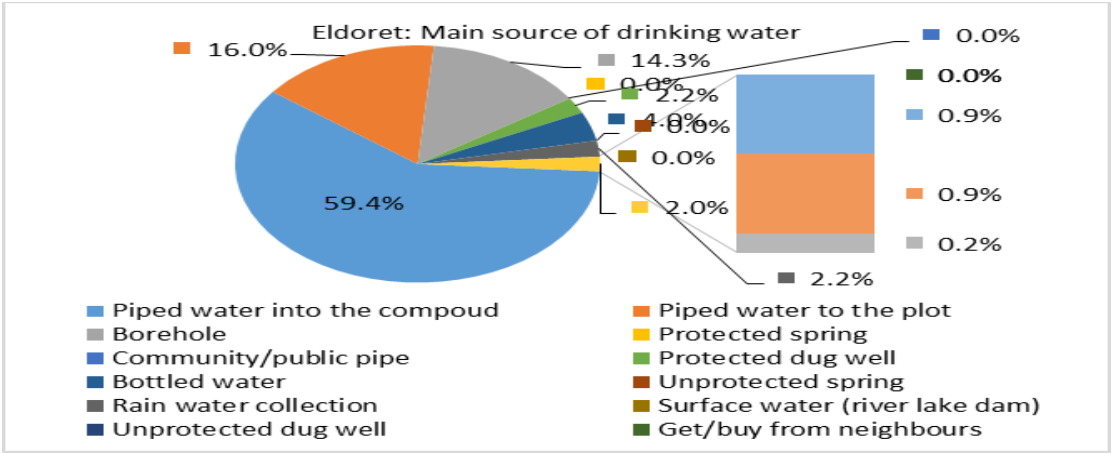


Figure 30: Main source of drinking water

4.2.8.5 Perception about water supply service from ELDOWAS

Perception about water supply from ELDOWAS was well captured during Focus Group Discussions held in specific project areas and it varied from one area to another.

At Annex/Sukunanga area, the residents are not fully satisfied with their services, that the services are 50% satisfying. The water supply is not reliable due to water rationing. Water shortage is severe especially during months of January to April. The standing charges are not justifiable and reconnection fee is exorbitant. There is also a recent problem of meter separation whereby ELDOWAS insist that every household must have a separate meter for every household which is very costly. We recommend that the standing charges be scrapped off if possible, ELDOWAS to reconsider the reconnection fee because it's too much. Recommend ELDOWAS to be prompt in their response to burst pipes.

At Kipkorgot area, the major suppliers of water in this area are the water vendors and only a few people are connected to ELDOWAS water supply. Those connected to piped water from ELDOWAS acknowledged the services are good only that the connection fee is high. We would recommend that connection fee for piped water be lowered to enable majority connect so that we can have access to safe drinking water.

In Elgon view and Racecourse areas, about 75% of the households are connected to piped water, only a few sections are not connected to piped water and expect to be connected within the next one year. The residents reported that their services are not satisfying because their water is not reliable, there is water rationing especially during dry seasons. Some residents claimed that ELDOWAS are very slow in response when there is interruption of water pipes which leads to water contamination. They recommend that ELDOWAS improve their services by increasing the water supply, be prompt in response to leaking pipes.

4.2.9 Willingness to be connected to sewer

On whether or not those not connected were willing to be connected to the sewer line, most (81.9%) of them indicated that they are willing to be connected to sewer-line while 18.1% are not willing to connect to sewerage.

4.2.10 Willingness to pay

The survey also sought to know the amount of money the respondents were willing to pay for sewerage services. On average, the respondents indicated they are able to pay at least Ksh.2, 614.6 for sewerage services.

4.2.10.1 Factors affecting willingness and ability to pay

Among those not willing to be connected, reasons for their responses varied with the majority ((64.9%) indicating that it is too expensive to connect, while 13.0% already had septic tanks and 11.7% did not see the need to be connected 5.2% said water was their priority not sewerage and 2.6% said it's their landlords responsibility since they are only tenants. 2.6% of the respondents said connection to sewer would increase their water bill.

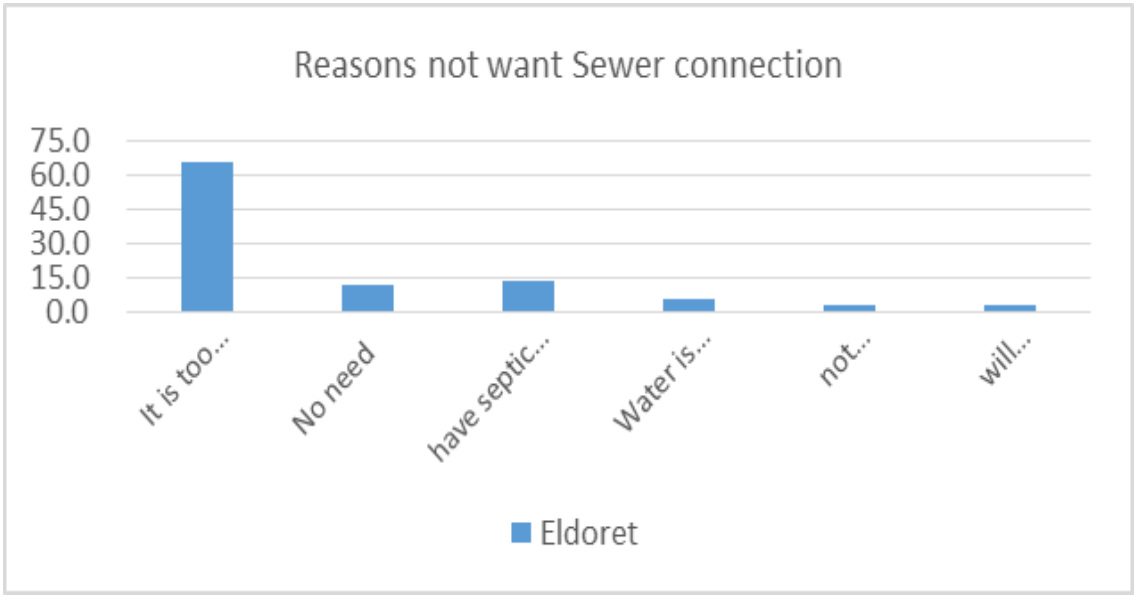


Figure 31: Reasons for not connecting to sewer

4.2.11 Conclusion and recommendations

The socio-economic survey was carried out in sampled project areas as selected by RVWWDA and included Upper Hill, Kenmosa, Hillside, Kipkorgot, Annex, Sukunanga, Racecourse, Upper Elgon and Langas. It employed both qualitative and quantitative data collection methods and tools, including a household survey, health and education institutions survey, industries and waste handlers key informant interviews, community focus group discussions and public consultative meetings. A sample of 545 households, 14 education institutions and 2 health institutions were interviewed, 3 focus group discussions and 7 public consultative meetings were held within the project areas.

The socio-economic data analysis shows that economically, most households in the project areas depend on employment as their main source of livelihood, followed by business and farming. This could be attributed to Eldoret town being the headquarters of Uasin Gishu County whereby most residents are employed as county workers, as well as the town being a trading centre for agricultural products.

In regard to water supply and access, it was established that most households are connected to ELDOWAS piped water supply. Other sources of water in the project areas include boreholes, wells, springs and river Sosiani. Looking at specific project areas, it was noted that the main source of water for Kipkorgot was boreholes and that only a few households had been connected to piped water supply. The other project areas had most households connected to piped water except that water rationing was reported in these areas. There was also a general concern by the residents that water connection fee was high.

Regarding sanitation facilities, most households have toilet facilities and the common type of toilet facility is flush toilets, followed by improved ventilated pit latrines. Septic tanks were common in these areas as there is no sewer line and the residents are faced with sanitation challenges especially during rainy seasons whereby the pit latrines and septic tanks overflow and they are compelled to empty them regularly through exhauster services which very costly. A big number of respondents expressed their willingness to be connected to sewer services and indicate that they are able to pay an average of Ksh. 2,414.6 for sewerage services. The survey was able to assess the socio-economic status of the project areas and established that the residents within these areas are currently facing water and sanitation challenges due to lack of sewer line in the areas yet they are so much willing to connect to sewer line once the line is provided. Generally, the targeted households within the project areas welcomes the sewerage project therefore the general recommendation as far as the socio-economic assessment is concerned, the proposed sewerage connectivity project should be implemented.

5 PROJECT DESCRIPTION

5.1 Introduction

Rift Valley Water Works Development Agency on behalf of Lake Victoria North WWDA, proposes to expand and rehabilitate existing sewerage system for eldoret town, Uasin Gishu county. Eldoret town existing sewer network covers less than 30% of the town leaving the rest dependent on onsite sanitation methods which is both expensive and unsustainable to the environment, since no structural de-sludging logistics and treatment facilities are in place for onsite sanitation solutions. The project is aimed at improving, access, availability and sustainability of wastewater management services in eldoret town with a view to catalysing commercial activities, driving economic growth, improving quality of life of people and building resilience against climate variability and change. The project area covers mostly residential areas within Eldoret town and the surrounding neighbourhoods.

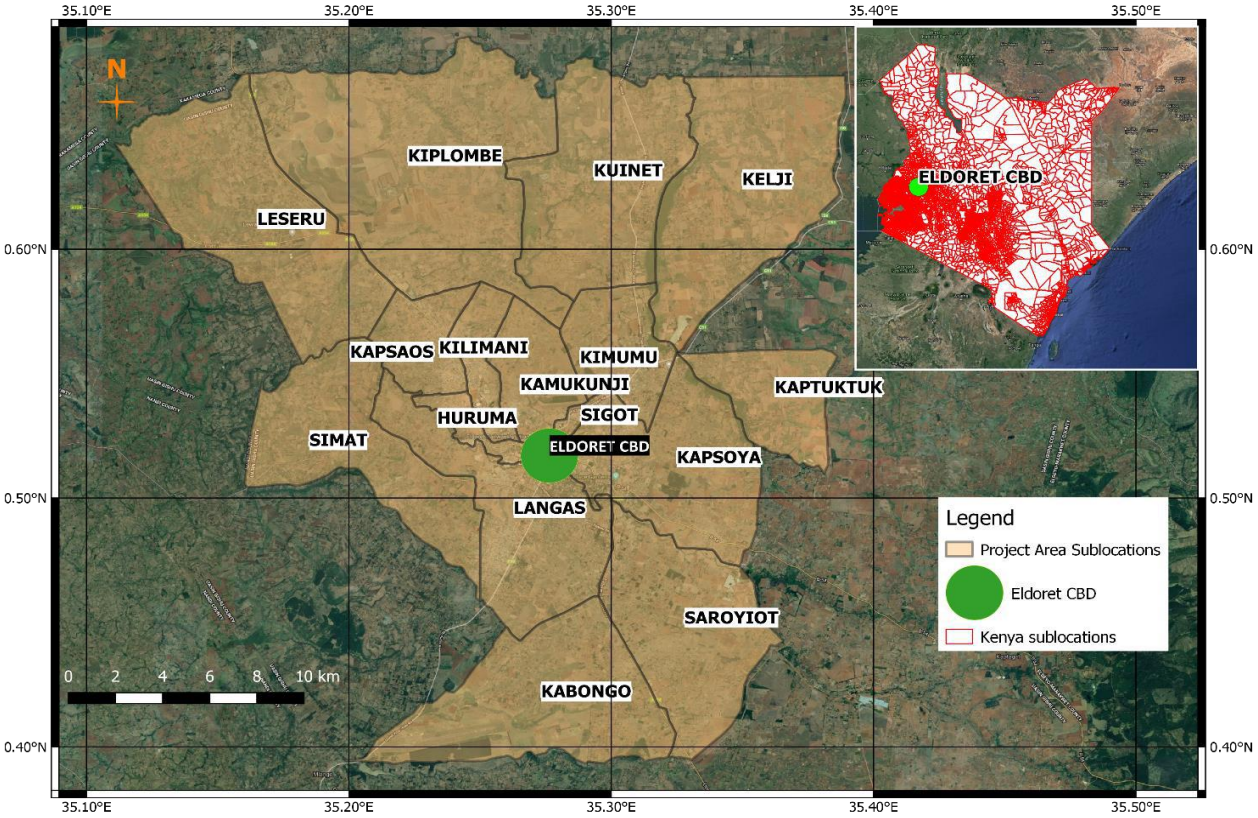
5.2 Project location

Lying south of the Cherangani Hills, Eldoret is located in Uasin Gishu County in Western Kenya, at approximately 300 km form Nairobi, 135 km from Kisumu and 400 km form Kampala (Uganda). The Sosiani River crosses Eldoret Town with a flow direction of South-East to North-West.

Eldoret town lies within the former Langas, Sigot and Huruma Sub locations as shown in the map below. Uasin Gishu County is surrounded by Elegeyo County in the East, Nandi County in the South, Kakamega County in the West and Trans Nzoia County in the North.

Within Uasin Gushu County and even for neighbouring counties, Eldoret acts as a regional administrative centre, being the commercial and communication centre within the areas. Eldoret municipality is divided into 13 wards.

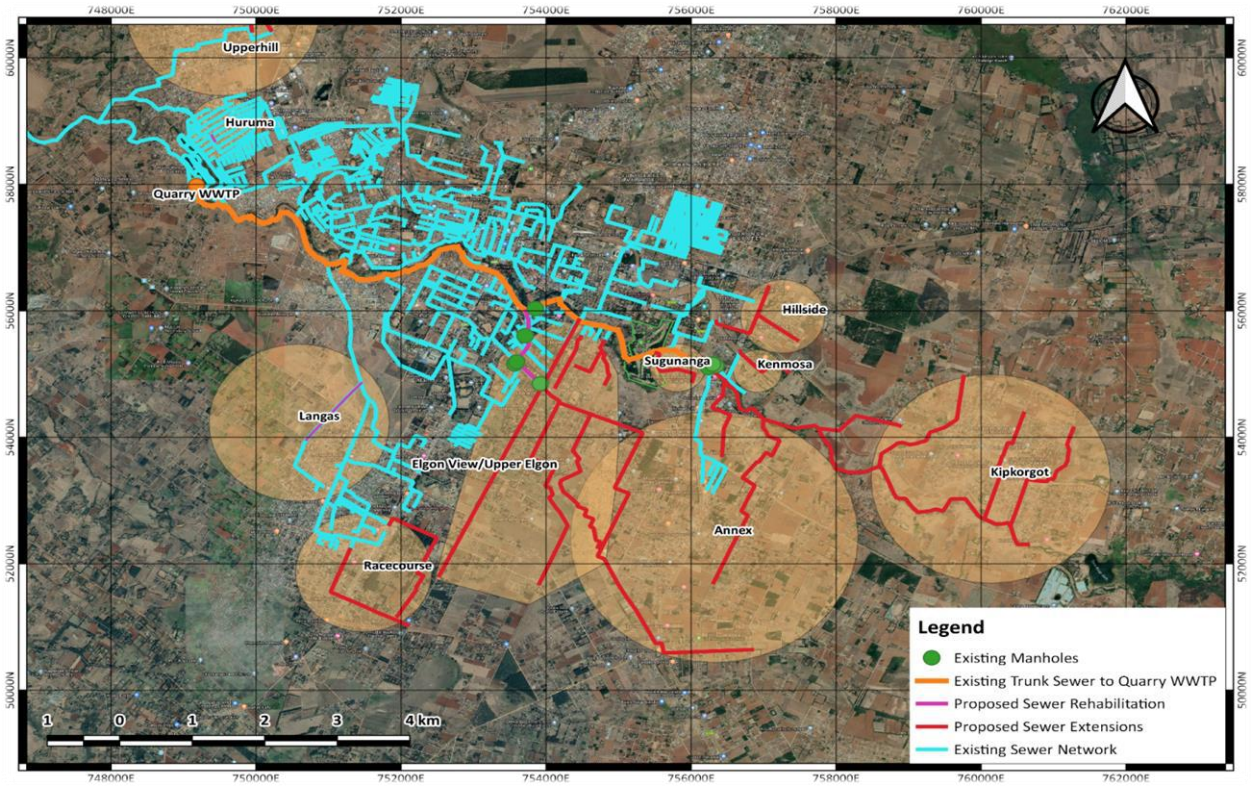
map 11: project location



5.3 Proposed project scope

The proposed sewer extension and rehabiliotation areas are as shown below. They include upper hill, huruma, kenmosa, hillside, kipkorgot, annex, sukunanga, racecource, elgon view and langas.

map 12: proposed project areas



5.4 Proposed Sewer System Extensions works

5.4.1 sewer network infrastructure

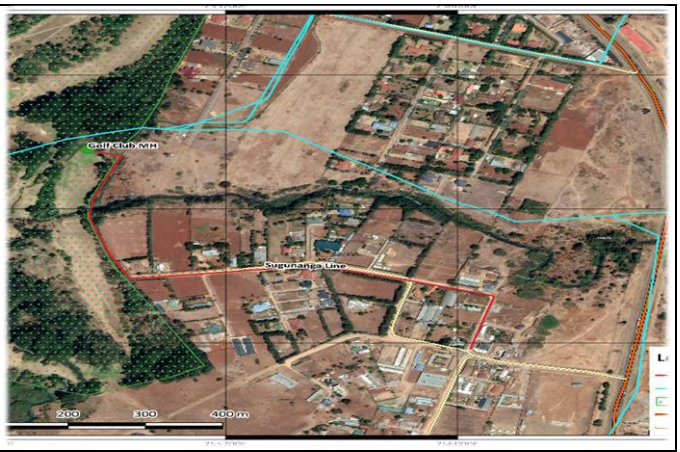
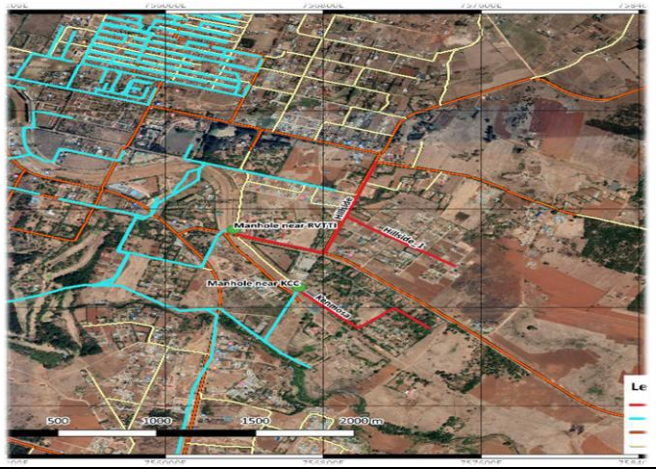
For Eldoret Town, the following sewers will need rehabilitation:

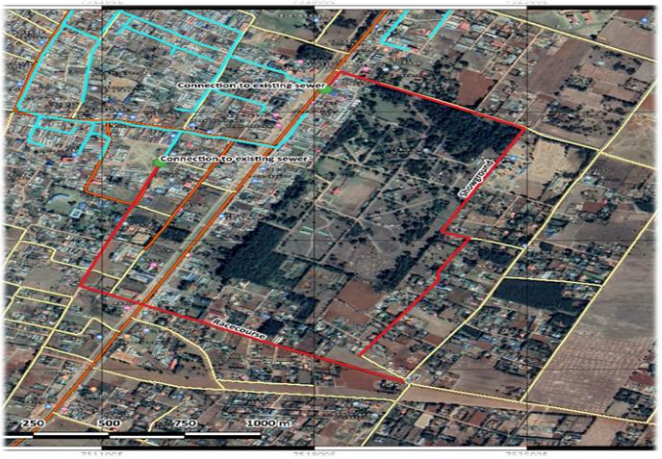
Langas ✓ The section to rehabilitate is about 1,171 m long with a Concrete pipe of DN 375mm.	

Huruma ✓ 100 m long section of sewer that was susceptible to blockage and flooding and would need rehabilitation.	
Elgon view ✓ Elgon View – Reinforcement of main Elgon View trunk. On the upstream part, blockages have been experienced due to inadequate gradient of the pipeline leading to flooding; On the downstream part, the pipe is undersized.	

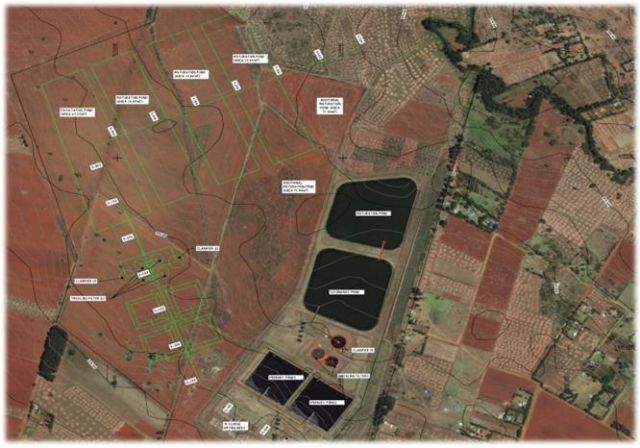
Apart from the rehabilitation proposed, the following sewer line extensions were designed for Eldoret Town, with a total length of 45.8 km.

Kipkorgot ✓ Kipkorgot_1, Kipkorgot_2, Kipkorgot_3, Kipkorgot_4: serve the upper and lower catchment area of Kipkorgot area. They all cross the Eldoret – Kaptagat Road (B54) at different locations and drain into the Kipkorgot Annex Trunk sewer. These sewers mainly follow the estate gravel roads but some sections traverse private property and the railway: ✓ The Kipkorgot – Annex Trunk sewer: located along the Sosiani River riparian land, starting at Kolol Riverside Resort near Two Rivers Dam and connecting to the existing sewer network at an existing manhole near Tanning factory.	

Sukunanga ✓ Sugunanga sewer – SG1: will serve the estate and institutions in the vicinity, and drain to the existing sewer network through an existing manhole at Eldoret Golf Club. The sewer will cross the River Sosiani aided by an aerial crossing, which will also serve to achieve recommended design slope due to the difference in elevation on either side of the river. ✓ Last part passes through private land and Eldoret Golf Club land	
Upper hill ✓ Upperhill/KPC_1: will serve the population directly opposite Khetias Supermarket and drain into the manhole adjacent the Eldoret – Kitale highway. ✓ Upperhill/KPC_2: will serve the area north of the Moi University West Campus. It will drain into KPC_3. ✓ Upperhill/KPC_3: will serve the catchment north of KPC_2 and north east of Moi University West Campus beyond the railway line.	
Hillside and kenmosa ✓ Hillside 1 and Hillside 1.1: will serve the Hillside Estate, part of Kapsoya Estate and environs. It is envisaged that in future, the area north east of Hillside Estate will develop tremendously and thereby be connected to the Hillside sewer. This sewer will connect to the exiting manhole near Rift Valley Technical Training Institute (RVTTI). ✓ The Kenmosa sewer, KEN1: will serve the Kenmosa Gardens and Resort, and connect to the existing manhole near KCC Eldoret. ✓ Passes through Kenmosa Company Wedding garden and KCC land	

Eldoret ASK Showground & Racecourse: ✓ Showground sewer – SH1: is expected to serve the institution and the surrounding settlements. Will collect wastewater from the southern part of the grounds all the way to the existing sewer network at Relax Inn, adjacent Kisumu Road. ✓ 2/3 passes through ASK land ✓ Racecourse sewer – RC1 – is expected to serve the adjacent catchment comprising Racecourse Hospital and housing estates. Will cross Kisumu Road and pass through Green Park Academy and Racecourse Inn, then drain to the manhole near AIC Malel Primary School	

5.4.2 Wastewater Treatment Infrastructure

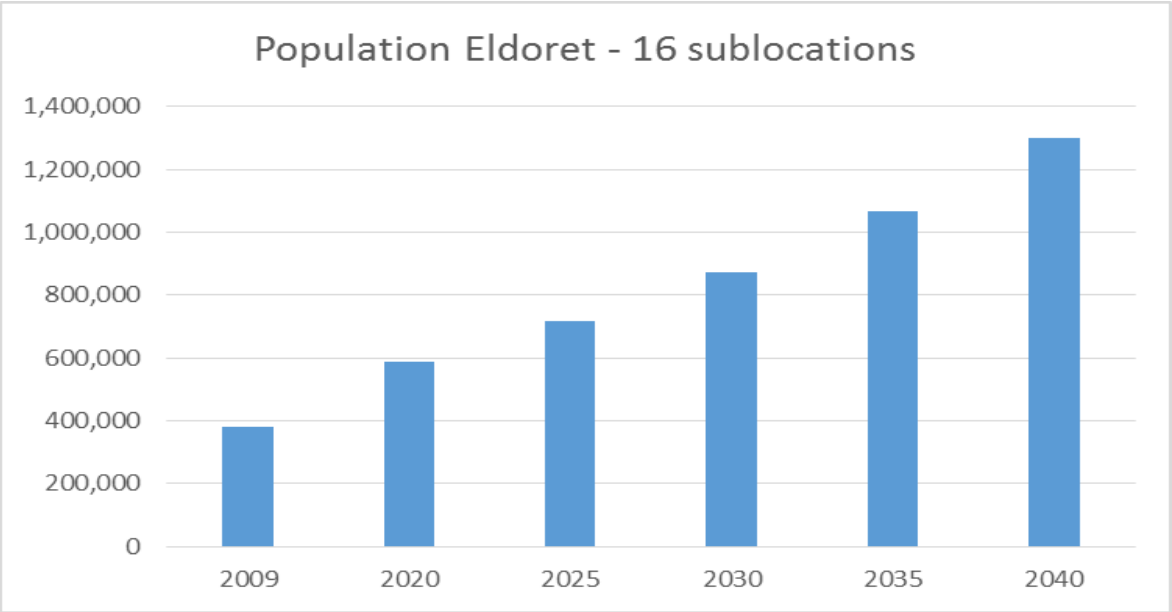
The following are proposed rehabilitation measures for Quarry WWTW: ✓ Change control of the recirculation pumps of the facu ✓ Disconnect direct wastewater discharge into maturat ✓ Increase size of the two maturation ponds from 14,28 surface area)	
The following are proposed rehabilitation measures for Boundary WWTW: ✓ Rehabilitate the flow measurement sensor ✓ Realign the trickling filter ✓ Fix sludge return pump ✓ Automate clarifier effluent return ✓ Add two maturation ponds (2X 17,070 m2 each) ✓ Duplicate the design for Boundary (with optimizatio WWTW	

5.5 Population, Water Demand and waste water flow projections

5.5.1 Population projections for the study area

The projected population for the project areas up to 2040 was as below:

Figure 32:population projections



5.5.2 Water demand

Water Demand estimation for each consumer category in the Study Area were estimated for the present year (2020) and the long-term requirements up to the year 2045 as shown below

Table 5: water demand projections

	INITIAL YEARV	INTERMEDIATE YEAR	FUTURE YEAR	INTERMEDIATE YEAR	ULTIMATE YEAR
YEAR	**2020**	**2025**	**2030**	**2035**	**2040**
Population	589,153	717,304	873,793	1,064,974	1,298,638
Domestic demand (m3/d	39,674	48,376	61,619	78,218	103,229
Livestock demand (m3/d)	0	0	0	0	0
Institutional demand (Health facilities and schools) (m3/d)	9,033	10,994	13,391	16,318	19,897
Industrial/ Commercial demand (m3/d)	15,000	15,000	15,000	15,000	15,000
Firefighting (m3/d)	1152	1152	1152	1152	1152
Total Water Demand (m3/day)	68,102	79,299	95,720	116,223	151,321
Comparison with water demand figures of previous studies					
MIBP	**55,042**	**67,070**	**80,887**	**96,551**	**114,069**
SEURECA/ VEOLIA	**53,184**	**64,836**	**78,258**	**93,489**	**110,519**

5.5.3 Wastewater Flow Projections

A summary of Waste Water flows per sub location for Design Horizons 2020, 2025, 2035 and 2040 is given below

Table 6: waste water flow projections

WASTE WATER FLOWS PER SUB LOCATION FOR ELDORET PROJECT AREA (M3/DAY)					
YEAR	**2020**	**2025**	**2030**	**2035**	**2040**
Kapsoya	6351	7392	9283	11011	14,069
Kaptuktuk	581	667	768	886	1,024
Kelji	579	664	765	882	1,020
Kimumu	1952	2221	2536	2905	3,336
Sigot	4258	5107	6649	8057	10,550
Huruma	6637	7868	10061	12094	15,631
Kamukunji	6830	7424	8484	9465	11,174
Kapsaos	5164	6076	7703	9211	11,835
Kilimani	6651	7711	9602	11353	14,401
Kiplombe	2208	2573	3000	3499	4,084
Kuinet	1341	1558	1812	2108	2,456
Leseru	2357	2747	3203	3738	4,363
Kabongo	985	1140	1323	1536	1,786
Langas	15362	18190	21049	28129	39,951
Saroiyot	1082	1253	1455	1691	1,968
Simat	1338	1554	1807	2103	3,838
Total	63,676	74,145	89,498	108,668	141,486

5.5.4 Summary of Total Population, Water Demand and Waste Water Flow Projections

A summary of Total Population, Water Demand and Waste Water Flow Projections for Design Horizons 2020, 2025, 2035 and 2040 is given below

Table 7: summary of population,water demand and waste water flow projections

	INITIAL YEAR	**INTERMEDIATE YEAR 1**	**FUTURE YEAR**	**INTERMEDIATE YEAR 2**	**ULTIMATE YEAR**
YEAR	**2020**	**2025**	**2030**	**2035**	**2040**
Pupulation	589,153	717,304	873,793	1,064,974	1,298,638

Total Water Demand (m3/day)	68,102	79,299	95,720	116,223	151,321
Total Waste Water Flows (m3/day)	63,676	74,145	89,498	108,668	141,486

5.6 Sewer design criteria

The adopted criteria apply to both the existing and proposed system, its needs and the project scope.

Table 8:Sewer design criteria

DESIGN CRITERIA/ PARAMETER	CONSIDERATION/LIMITS
Sewerage Collection System	It is essential that a sanitary sewer has adequate capacity for the peak flow and that it functions at minimum flows without causing operational problems. A peak flow factor will be considered in the design. The daily peak flow in a sewer is a function of the area contributing to the sewer, which, in turn, determines the contributing population and, hence, the size of the pipe. The type of sewerage system must be determined by taking into account the topography, meteorology and the present condition of wastewater/storm drainage facilities if any. The sewer collection systems to be considered include: Separate systems (only waste water); Combined systems (sewer pipes carry both wastewater and storm water); and Partially separate systems (designed to carry all of the wastewater together with some rainwater. The bulk of the rainwater is collected in an independent system of pipes and open drains.) It is recommended that separate sewerage systems be adopted for the design of sewers in Kenya.
Design Approach	Gravity flow system
Hydraulic Design Formula/Equation	Manning's equation recommended for sewer design in Kenya. The Manning formula is (1/n)R2/3S1/2 Where; n= Manning Constant R=Hydraulic Radius in m S=Hydraulic Gradient in m/m
Minimum Velocity	0.6m/s for large diameter sewers >DN 300mm and 0.75 m/s for sewer diameters < 300mm; The minimum velocity criteria shall be checked for preliminary flow estimates to check risk of settling at mild slope sections. Recommendations will be made for frequent flushing until connections increase to attain the cleansing velocity
Maximum Velocity	4.0 m/s; Maximum velocities of flow have, in the past, been specified, in order to reduce the possibility of pipe erosion. Such effects were said to occur at flow velocities in excess of 4.0m/s
Hydraulic capacity of sewer	75 % of the depth when conveying the estimated design peak flow
Infiltration	10 - 20 % of the average waste water flo
Peak Flow	Qp = Qavg x pf + I/I Where: Qp = Peak domestic flow rate (L/s); Pf = Peak Factor; Qavg =Average domestic WW flow; I/I = Infiltration & Inflow (L/s);
Peak Factor	For sewers 12 inches (300 millimetres) in diameter or less; PF = 2½ For sewers exceeding 12 inches (300 millimetres) but less than 24 (600 millimetres) in diameter; PF = 2 For sewers 24 inches (600 millimetres) in diameter or more; PF =1½

DESIGN CRITERIA/ PARAMETER	CONSIDERATION/LIMITS
Crossing Structures	No siphon will be provided
Minimum Pipe Slope	Sewer Diameter (mm) 200, 250, 300, 400,500, 600 Minimum Design Slope (m/100 m) 0.3, 0.3, 0.3, 0.3, 0.3, 0.3
Steep Slope Protection	Less than 11 m c/c on grades 20% - 35%; Less than 7.3 m c/c on grades 35% – 50% Less than 4.9 m c/c on grades 50% and over
Minimum pipe diameter	350 mm for Trunk sewers; 250 mm for secondary sewers 200 mm for laterals
Minimum cover	Pipe laid along highways should have a minimum cover of 1.2 m Pipes laid outside high ways =0.9m If the above criteria cannot be met, concrete protection is required
Material of Sewer Pipes	uPVC pipe up to 350 mm PCC pipe from 375 mm and above DCI for pipes laid above ground/ If encasement is possible, uPVC will be used. For larger pipe size other materials like Concert, GRP, Steel and DI can be used.
Alignment	No curved alignment is allowed. If there is change of direction manholes will be provided
Route Selection	The route or streets to be traversed by a proposed sewer should be based upon sewer deficiency studies and demand for sewage service. The proposed routes for sewers must be such that there is minimum disruption to existing features and services e.g. roads, railways, rivers etc.
Route Investigation	Environmental considerations should be considered. The need for the sewer project and the economic feasibility should not be different than originally intended.
Right-of-Way	Sewers shall be placed in public right-of-way whenever possible.
Sewer layout	The natural drainage system will be used as a basis of design of the trunk sewer system. The trunk sewers will be located at the lower drainage boundaries as much as permissible so as to maximize sewage collection from feeder lines. The trunk sewers drain into treatment works whilst the interceptors drain to the trunk sewers.
Manhole spacing	50 m for sewer diameters less than 600 mm, 100 m for 600 to 900 mm sewers, 150m for 900 to 1200 mm sewers, At changes in slopes in sewers At changes in direction; At changes in pipe diameter; At junctions; and same as previous design approach
Manhole sizes	Less than 400mm pipe size and up to 3m depth of manholes: - 1.2 m For manholes, deeper than 3m: 1.2 m 400 – 600mm pipe sizes: 1.2 m 700 – 900 mm pipe sizes: 1.5 m
Relation to water lines and other utilities	As much as possible sewer lines shall be laid in parallel with a minimum horizontal separation of 2m and vertical separation of 0.5m between the bottom of the water line and the crown of the sewer When gravity Sewers pass over or under water lines, sewer material shall be encased in continuous steel, ductile iron, pressure rated PVC, GRP, or HDPE Note: Typical drawings will be prepared to be used at the time of constructio
Sewers	The main criteria adopted in selecting alternative sewer routes and sewage treatment works sites must consider the amount of sewage generated, available land and recent development in sewage treatment. The identified alternatives must be subjected to technical, financial, economic, social and environmental evaluation.

5.7 Project activities

5.7.1 Preconstruction activities

Preconstruction activities are centredtowards compliance with the law and regulation set forth. These activities include:♣Designing the project♣Getting statutory approvals from relevant government agencies i.e. county government, NEMA, NCA♣Land acquisition and compensation where necessary

5.7.2 Construction phase activities

The major Works to be executed under the Contract comprise mainly of but are not limited to the following: -

- Site clearance.
- Earthworks.
- Installation of main truck sewerage lines.
- Landscaping including top soiling and grassing.
- Any other activity not listed above in either category but deemed to be necessary by the Engineer, shall be subject to the Engineer's formal instructions and within the mode of payment stipulated either by day works or on a measured basis.

5.7.3 Operation phase activities

The Contractor will be required to remedy any defects during the Defects Liability Period. The major items of work during Defects Liability period included in the contract are as follows:

- Repair of any defects on the sewerage furniture;
- Construction of designed sewerage ;
- Removal of construction camps, removal of un-used material stockpiled on the wayleave, tidying and general cleanness of the construction sites.

5.7.4 Decommissioning phase

Decommissioning refers to the final disposal of the project and associated materials at the expiry of the project life span. In respect to the sewerage, decommissioning is not anticipated. However, it will be sustained in accordance to sewerage demands of the project area expected at the end of construction works.

Nevertheless, after the construction period, construction equipment and dismantled camp materials will be salvaged and removed from the site by the contractor. The following is a description of some of the decommissioning activities.

5.7.4.1 Demolition works

The proposed project will have a lifespan of several decades save for period maintenance. This will produce a lot of solid waste, which will be reused for other construction works or if not reusable, disposed of appropriately by a licensed waste disposal company.

5.7.4.2 Dismantling of equipment and fixtures

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

5.7.4.3 Site restoration

Once all the waste resulting from demolition and dismantling works is removed from the site, the site will be restored through replenishment of the topsoil and re-vegetation using indigenous plant species or developed according to the development trend of the time.

5.7.4.4 Construction materials and energy used

The main sources of energy that will be required for decommissioning of the project will include electricity and fossil fuels (especially diesel). Electricity will be used for welding, metal cutting/grinding and provision of light. Diesel will run material transport vehicles and construction equipment/machinery such as bulldozers and concrete mixers. The

proponent should intend to promote efficient use of materials and energy through proper planning to reduce economic and environmental costs of excavating new materials.

5.7.4.5 Solid waste generated

Large amounts of solid waste will be generated during decommissioning of construction phase facilities. These will include metal cuttings, rejected materials, surplus materials, surplus spoil, excavated materials, paper bags, empty cartons, empty paint and solvent containers, broken glass among others. The contractor is advised to take steps to minimize the generation of such waste and to ensure proper disposal procedures or recycling/ generated wastes.

5.7.4.6 Liquid effluents generated by the project

During decommissioning disconnection of pipes and other activities like washing are likely to generate effluents.

5.7.4.7 Environmental protection

The Contractor is supposed to ensure so far as is reasonably practicable and to the satisfaction of the proponent; that the impact of the construction on the environment shall be kept to a minimum and that appropriate measures as brought out in the ESMP are taken to mitigate any adverse effects during the construction.

Table 9: below shows the various type of products, by products and waste that will be generated during the project's cycle.

Table 9; The products, by products and waste generated during project cycle

Project activities	Material /equipment to be used	Waste/by products generated	Disposal method
1. Planning and design Phase – No anticipated physical activities or processes			
2. Construction Phase			
Clearing the site	✓ Power Saws ✓ Caterpillar/ Shovel	✓ Cut vegetation ✓ Rock debris ✓ Noise (by power saw)	✓ Soil to be used for backfilling ✓ Wood would be used as fuel and in the construction. ✓ Good maintenance of machines being used.
Excavation/Earthworks including removal topsoil	-Excavation equipment's including caterpillars, haulers etc.	✓ Soil ✓ -Roots ✓ -Noise	✓ Soil to be used for backfilling and landscaping.
Transportation materials maintenance equipment's	Trucks Fuel, spare parts and lubricants oil	✓ Fumes ✓ Used oil, and other lubricants.	✓ -Used oil/grease to be reused for lubricating movable parts of Equipment.
Construction/Building Materials	✓ Machine cut stones ✓ Steel ✓ Cement ✓ Soils ✓ Timber ✓ Nails, galvanized iron sheets ✓ Gravel, sand	✓ Stone /Rock Debris ✓ Timber Splits ✓ Broken Glass ✓ Nails and Iron Sheets ✓ Cuts ✓ Piping Remains ✓ Plastic Waste	✓ Soil and rock debris would be used for landscaping & back filling the reserves ✓ Timber splits would be used for firewood ✓ Plastic waste should be resold to waste collectors or dumped in appropriate designated

Project activities	Material /equipment to be used	Waste/by products generated	Disposal method
	✓ Glass	✓ Oil and Greases Spills ✓ Waste Water ✓ Used Containers	sites.
	✓ Water ✓ Packaging ✓ Materials ✓ Pipes and Pvc ✓ Oil and Grease ✓ Storage ✓ Containers e.g. Drums		✓ Metallic containers can be reused in storage of other materials or be sold to dealers. ✓ Metallic wastes can be recycled or be sold to dealers. ✓ Waste water can be recycled by watering diversions to control dust. ✓ Oils and grease should be reused, be sold to dealer or be disposed off in areas
Human Consumables	✓ Stationeries ✓ Computers ✓ Photocopiers ✓ Clothing Materials ✓ Vehicles ✓ Medicines ✓ Reagents ✓ Food and Water	✓ Used paper ✓ Obsolete/ spoilt clothing, computers, photocopiers and ✓ Vehicle parts ✓ Human waste ✓ Expired drugs and reagents	✓ Sell waste paper to dealers. ✓ All obsolete materials should be carefully sorted, stored and sold to dealers. ✓ Septic tanks should be provided in all the workmen's camps and disposed of appropriately in designated sites.

6 PROJECT ALTERNATIVES

6.1 Analysis of alternative for the trunk sewers

The natural drainage system has been used as a basis of design of the trunk sewer system. The trunk sewers have been located at the lower drainage boundaries as much as permissible so as to maximize sewage collection from feeder lines. Some trunk sewers drain into treatment works whilst some drain to other larger trunk sewers.

The sewer routes as were identified during the detailed survey by the consultant together with a representative of the ELDOWAS have been adopted in the design. Proposed sewers have been routed on rivers riparian, road reserves and utility way-leaves as much as possible. Main sewers have been provided for areas currently served with piped water and those with the potential of being served with piped water soon, as identified.

The secondary sewers have been proposed as collectors for the laterals and are planned such that they discharge the flows at appropriate points to the proposed trunk sewers. Tertiary sewers have been located on the residential/estates road network so as to facilitate ease of property connection.

6.2 The "No Project Alternative" option

This "alternative" implies maintenance of the status quo. That is, the proposed project is put on hold and mechanisms currently being used for disposal of sewage be maintained. This option implies that the existing situation prevail i.e. Poor waste water management in the town will prevail, there will be increased waterborne diseases, the town will be foul due to blockages experienced and leaks due bust pipes as a result of increased effluent from unplanned connections. This would have far reaching negative implications on the environment in its totality including among others:

- ✓ Loss of economic benefits from the construction and operation of the proposed project.
- ✓ Continued pollution of ground due to reliance on pit latrines.
- ✓ Pollution of surface waters by raw sewage being washed into these bodies.
- ✓ Population will continue to be affected by water borne and other diseases associated with exposure to raw sewage.
- ✓ Access to proper sanitation is a human right. If this option is adopted, the population will be denied this right.

This being the case then, "No Project Alternative" is discarded in favour of the Preferred Alternative which will lead to realisation of the project objectives which are for the good of the greatest majority.

6.3 Analysis of alternative construction materials and technology

The proposed project will be constructed using the following materials mainly;

- ✓ High density Polyethylene (HDPE) PN10 pipes
- ✓ Survey equipment
- ✓ Excavation equipment
- ✓ Vehicles including dumber tipers
- ✓ Micro turnelling equipment
- ✓ Epoxy coated steel pipes and sleeves

This EIA proposes that rainwater should be harvested and used in construction activities whenever there is water usage need. Heavy use of timber and wood during construction should be discouraged to minimize destruction of trees. The exotic tree species should be preferred to indigenous species in the construction of the project components where need will arise as they can be replanted with ease.

The equipment and vehicles should have highest levels of combustion efficiency, capability to use cleaner fuels like biofuels and should have enhanced safety features.

6.4 Proposed Project alternative (option 1)

An improved sanitation is urgently required in Eldoret Town as a prerequisite that can avert the river sosiani pollution and safeguard the health of the population in the town. It has the advantage of utilising the existing area and facilities: The selected treatment process train for Quarry and Boundary seems well adjusted to the local situation in Eldoret: technologies used are robust and require low operational cost. The ELDOWAS team is also highly familiar with

operation and maintenance of technologies. With the rehabilitation of the two facilities, the present site can be adequate to treat sewage upto to year 2040.

The Consultant recommends Alternative No. 1 as the most cost effective to construct, maintain and operate, as well as the most technically viable sewerage system for the project area for implementation. This recommended option consists of works to be implemented, and comprise of the following;

Rehabilitation works for existing sewers;Langas, Huruma, and Plateau Rd – Ramogi Drive (Elgon View.

New sewer extension lines: Kipkorgot - Annex Trunk, Kipkorgot_1, Kipkorgot_2, Kipkorgot_3, Kipkorgot_4, Racecourse, ASK Showground, Sugunanga, Upperhill/KPC_1 , Upperhill/KPC_2 , Upperhill/KPC_3, Royalton - Elgon Trunk, Elgon_1, Elgon_2, Elgon Drive Trunk, Annex_1, Annex_2, Testimony_1, Testimony_2 , Testimony_3, Hillside, Hillside 1, Kenmosa, Plateau Ramogi Drive.

Rehabilitation measures for the Quarry and Boundary WWTW

7 PUBLIC PARTICIPATION

7.1 Introduction

Public consultation plays an important role in gathering social and environmental data, understanding likely impacts, determining community and individual preferences, selecting project alternatives and designing viable and sustainable mitigation and compensation plans. It allows an open participatory approach in the planning of projects and consultation with Interested and Affected Parties (IAPs).

Public consultation in the ESIA process is undertaken during the project design, implementation and initial operation. The aim is solicit views from the project affected persons and key stakeholders and consulting on sensitive issues regarding the project. Further, public participation assists in making informed decision thus enhancing accountability thought the project

Public consultation process for the Eldoret town Sewerage Project took place at the ESIA stage. The main objective of the consultation process was to involve the community at the very early stage so as to identify likely negative impacts and finding ways to minimize these negative impacts. The consultation also identified positive impacts and ways to enhance these impacts for the good of the community

7.2 Objectives of the public consultation

An important element in the ESIA process is seeking and gathering information that will enable successful completion of the assessment.

The overall goal for the consultation process was to disseminate project information and incorporate the views of the Project Affected Persons (PAPs) in the design of the mitigation measures and management plan as well as in the preparation of the resettlement Action Plan for Eldoret Sewerage Project.

The specific aims of the consultation process during the ESIA stage were;

- ✓ To inform the local people, leaders and other stakeholders about the proposed Eldoret Town sewerage Project and its objectives
- ✓ Obtain the main concerns and perception of the community and their representatives regarding the project
- ✓ Obtain opinions and suggestions from the directly affected persons on the project impacts and best suited measures
- ✓ To improve on the project designs and therefore minimizing conflicts and delays in implementation
- ✓ To facilitate the development of appropriate and acceptable entitlements options
- ✓ To increase long term project sustainability and ownership
- ✓ To reduce problems of institutional coordination, especially at the different governments levels.

7.3 Stakeholder consultations during field reconnaissance

The study team held introductory meeting with various key stakeholders at the field reconnaissance study between 9/06/2019 to 14/06/2019 . the key stakeholders meeting held on 10th june 2019 served as introduction to the Eldoret town Sewerage project and set the ground for the ESIA and RAP studies.

The meeting was attended by the CEC - Water, Environment, Natural Resources, Tourism and Wildlife Management, officials from RVWWDA, LVNWWDA and ELDOWAS, NEMA, and WRA.

The main issues of concern at this stage were identification of crucial issues for further consultation during the ESIA study.

7.4 Consultation methodology

The study made use of the following consultation strategies:

- ✓ Public Meetings
- ✓ Household socio-economic survey;
- ✓ Key stakeholder interviews;
- ✓ Focus group discussions

Public consultation was extensively carried out in the entire project area to elicit concerns and compliments from the PAPs. The proposed project spans a fairly large administrative area with a mix of socio-economic characteristics.

The socio-economic survey employed both qualitative and quantitative tools namely household/health and education institutions socio-economic questionnaire, Focus group discussion guide and key informant interview guide. The quantitative tools were digitized and coded using an open data kit(ODK). This enabled the enumerators to access the server and download the forms and upload/submit the completed interviews in real time.

Key intervews were held with a number of waste handlers, and industries within the proposed project areas.

The local Chiefs, Sub-chiefs, Members of County Assemblies and ward administrators were used to mobilize the public to attend the meetings. The announcements for the meetings were made by phone calls, announcement at centres and settlements, in places of worship and chiefs barazas Consultation meetings were convened in public areas to enable maximum attendance..

7.5 Public consultations outcomes

7.5.1 Actual consultations

The public consultations were held from 15th to 27th july 2019.

A total of 525 Household Socio-economic survey questionnaires were administered within the proposed project areas to assess the socio-economic status of the project area.

Three (3) focus group discussions were held within the proposed project areas. Participants were the opinion leaders including the chiefs, village elders, men and women,youth representative and PWD representative

A total of seven public consultation meetings were held in the help of local administration. The breakdown of the meeting held is as shown below;. The output and participants are in respective Appendices.

Table 10: breakdown of the meetings held

No	Date	Time	Project area	Venue	Attendance
1	25/07/2019	11.00am -1:30pm	Upperhill	Jesus Christ Ministry Church-Shirika village	104
2	26/07/2019	10:00am-10:40am	Kenmosa	Kenmosa gardens Estate	7
3	26/07/2019	12:00noon-1:30pm	Hillside	Hillside Gated Community Estate	13
4	26/07/2019	3:00pm -5:00pm	Kipkorgot	Kipkorgot market centre	20
5	25/07/2019	3:20pm-5:30pm	Annex/Sugunanga	Neema childrens home	51
6	27/07/2019	10:30am -1:30pm	Racecourse/Elgon-view	AIC Saramek Kimalel church hall	53
7	27/07/2019	3:20pm -5:30pm	Langas	Chuma 90, Langas	33

7.5.2 Issues and concerns raised

A summary of the comments on the eldoret town Town Sewerage Project raised from the public meeting is presented in the following sections. Minutes for the public meetings are presented in Appendix of this report.

Table 11: Summery of comments/questions/concerns raised and response

Project areas	Concern/Comment/Question	Response/Recommendation
Upperhill	Ms Rahab Wanjiku sought to know what will happen to those not covered by the proposed sewer due to gravity of their area.	The proposed project will consider all possible passage areas depending on the gradient of the area
	Mr. Joel Suter needed clarification on where the sewer trunk line will pass	Mr. Maina ELDOWAS described the proposed trunk line passage areas
	Mr Caleb requested that the youths be prioritized for construction job opportunities.	The youths will be considered for casual workers
	One of the participants wanted to know when the project is expected to commence- project timeline	Mr. Musili explained the project timeline
	One of the participants wanted to know if experts during construction will be sourced from the county engineers or from the national government	The proposed project is a national government project therefore it will provide the required experts.
	Francis Gitau noted that there was a local committee formed to initiate on sewerage connectivity in the area and they've been following up on it, he wondered if it is the same project they've been following up or it's a different one	We shall incorporate what they have to the project design
	Ms. Josephine(village elder) raised a concern on how will the contractor ensure that the social life of the residents is not interrupted and how the residents will cope with such issues like the construction workers impregnating our girls She also raised a concern about an open manhole at huruma estate	Awareness/sensitization will be done on regular basis Report any cases of vandalism and sewer blockage to ELDOWAS
	Osoro raini requested that those whose properties will be affected by the project be notified in good time to allow easy relocation	RAP will be done to identify those affected for the purpose of compensation and they will be notified.
	James okomo requested that he be considered for a contractor job during construction	To do an application during tendering process
	There was a bigger concern on severe water shortage in the area and complains of failed follow up	Mr. Maina of ELDOWAS addressed the water issues

Project areas	Concern/Comment/Question	Response/Recommendation
	Mr David Rotich (retired chief) supports and welcomes the project and urged the residents to do the same and not bring politics into it. Emphasized that the residents need the sewerage and expects that that the project will be implemented without any problems of fraud experienced in other projects like kimwarer and arror dams.	
Annex/ Sugunanga	Hon. Amos Kiptanui(Area MCA) was concerned that the notice for the meeting was too short and requested that next time the residents should get the meeting programme in good time. He thanked the participants for availing themselves and Neema childrens home for the venue provision.also urged the community members to cooperate and support the project.	The consultant agreed the meeting notice was short because there were protocols to follow before engaging the local community
	There was a general concern about an ongoing similar project within Sukunanga area that has resulted to road blockage and an open trench that's risky to the residents. Locals requested that the same should not happen with the proposed project.	The ongoing project is done by a different consultant not SMEC and the MCA promised to intervene and solve.
	One of the community member requested if during construction he can tap on the extra marrum left after construction.	To talk to the contractor
	Bett Mary requested the area MCA to help with feeder sewer connectivity once the main trunk line is installed.	The MCA agreed to consider feeder connection.
	Joshua Mbithi (reverent Neema Children Home) appreciates and welcomes the proposed project. Says it will help the children home a great deal because emptying the septic tanks is too costly. Requested for the proposed project CSR to consider the children home by constructing them a borehole, underground water tank, dairy cows/pigs rearing project and school fees/food aids.	The consultant to incorporate the CSR request in the report.
Kenmosa	Mr. Paul Mutai, Kenmosa estate manager was the only representative available for the meeting and noted that the notice for the meeting was short therefore not able to mobilize the residents within the short period, however he promised to pass the message to the residents. He further noted that the idea of sewerage connectivity will be acceptable to everyone in the estate because the estate had already begun plans of	

Project areas	Concern/Comment/Question	Response/Recommendation
	applying for sewerage connectivity to ELDOWAS. Says that they fully support the proposed project because it's something they've been waiting for and urgently needed.	
Hillside	It was noted that the estate needs four main sewer trunk lines connecting to kaptagat road main pipe and not one as earlier captured during the reconnaissance. The general comment was that the notice for the meeting was too short and the available participants are not a good representation of the estate. They requested the next meeting to be communicated in good time. The residents however welcomed the project and requested to be sent a copy of the minutes of the meeting	
Kipkorgot	The community was concerned about water scarcity problem in the area and how they will connect to sewer when they do not have adequate water.	You will not be connected to sewer if you have not connected to piped water.
	The locals sought to know if those connected to water and will not connect to sewer will be charged for sewer as well, since water and sewer are paid at once.	You will not be charged for sewage if you are not connected to sewer line.
	One participant wanted to know what will happen to those already using septic tanks	You will decide if you want to be connected to sewer line or you want to continue using the septic tank.
	One participant sought to know if the sewage pipes will pass through the culverts	Sewerage pipes will be installed underground. Culverts are for storm water and will not be used for sewerage
	A participant needed clarification on the proposed sewer coverage, and sought to know what will be done to those who will not be served by the trunk line due to gravity of their area.	We shall consider all the possibilities on where the sewage line passes but gradient will be the determinant
Racecourse/ elgon view	One participant sought to know which areas will not be covered by the proposed sewer line	Mr. Maina of ELDOWAS described the areas identified for the sewer line and stated that the feasibility study will inform better after the surveyors come to the ground.
	John tuwei wanted to know what will happen to those having septic tanks and will not be covered by the proposed sewer line	There are licensed exhausters to empty the septic tank at a fee and dispose at the treatment plant.

Project areas	Concern/Comment/Question	Response/Recommendation
	The MCA Hon. Amos Kiptanui requested that the contractor consider starting the sewerage construction works at racecourse because there is a plan of tarmacking the roads soon and thinks it will be easier for the sewer to be installed first before the road tarmacking begins.	
	The church representative Rev. Geoffrey Sangok requested for CSR; A social hall and a modern flush toilet.	
	One of the participants, a teacher at racecourse school requested that the contractor consider constructing them one classroom as CSR during the sewer connectivity	

8 IMPACT ANALYSIS

8.1 Introduction

The environmental baseline information and the project characteristics discussed earlier, form the basis for impact identification and evaluation. The impacts that are expected to arise from the project could either be termed as positive, negative, direct, indirect, short-term, long-term, temporary, and permanent depending on their area of cover and their stay in the environment. This assessment is done for all the project phases namely; construction, operational and decommissioning phases.

8.2 Quantification of the magnitude of impacts

The magnitude and significance of impacts was assessed based on the following factors:

- ✓ Location or extent: The area/volume covered
- ✓ Timing: Whether immediate or delayed
- ✓ Duration: Short term, long term, intermittent or continuous
- ✓ Reversibility or irreversibility
- ✓ Likelihood: Probability of the impact taking place
- ✓ Significance: Whether it is local, regional or global

In order to make the following observation, expert knowledge based on the magnitude of the predicted impacts was relied upon. The impacts are rated based on the applicable mitigation measures. The scale that was applied in the analysis of impacts is shown in the table below and all the impacts discussed within this chapter have been quantified in line with this scale.

Table 12: Levels of scale used in the analysis of impacts

Value	Description	Scale Description
0	No impact	This means that to the best knowledge of the expert, the particular activity/action will not have any known impact on the environment. Such an impact will not in any way affect the normal functioning of either the human or the natural systems and does not therefore warrant any mitigation.
1	Minimal impact	Any activity with little impact on the environment calls for preventive measures, which are usually inexpensive and manageable. Such activities have minimum impacts on either natural or human environment or both.
2	Moderate impact	A moderate impact will have localized effect on the environment. If the effect is negative and cumulative, action in form of mitigation measures needs to be put in place to ensure that it doesn't become permanent and /or irreversible.
3	High impact	An impact is high if it affects a relatively high area (spatial), several biological resources (severity) and/or the effect is felt for a relatively long period (temporal) e.g. more than one year. In case the effect is negative, such an impact needs to be given timely consideration and proper mitigation measures put in place to prevent further direct, indirect or cumulative adverse effects.
4	Very high impacts	Such an activity rates highly in all aspects used in the scale i.e., temporal, spatial and severity. If negative, it is expected to affect a huge population of plants and animals, biodiversity in general and a large area of the geophysical environment, usually having trans-boundary consequences. Urgent and specialized mitigation measures are needed. It is the experts' opinion that any project with very high negative impacts **MUST** be suspended until sufficient effective mitigation measures are put in place. If positive then the project needs to be highly encouraged.
5	Not known	There are activities for which impacts are not yet known e.g. some chemicals are suspected to produce carcinogenic effects but this has not yet been confirmed.

9 POTENTIAL IMPACTS AND THEIR MITIGATION MEASURES

9.1 Construction Phase

9.1.1 Positive Impacts

There are a number of positive benefits associated with the proposed development. The following are some of the positive benefits anticipated.

- ✓ Creation of employment opportunities
- ✓ Gains in the local and national economy
- ✓ Transfer of skills
- ✓ Provision of market and supply for building materials
- ✓ Injection of money into the local economy;
- ✓ Creation of wealth to residents through direct and indirect business
- ✓ Interaction of people from different communities

9.1.2 Negative Impacts

During the construction phase there would be some impact on air, noise and water quality, and management of solid waste. Also there would be some impact on quality of life due to inconvenience caused to public as a result of construction activities

9.1.3 Dust and Gaseous Emissions

The construction activities on the sites will result to increased dust and gas emissions. Some construction machinery and trucks (including small vehicles) generate hazardous exhaust fumes Dust (particles) as caused by vibrations of machines and vehicle movement suspends in the air mostly during dry spells. Such dust and gases have direct negative impact to the quality of air. Construction activities including land clearing, trenching, lying of pipes, construction of foundations and superstructures, handling and transportation of construction and demolition materials, cause dust particles to rise into the atmosphere and settle on places Wind may also blow soil particles from open sites and stock pile areas

Mitigation measure

- ✓ Provide PPE such as nose masks, goggles to workers who are will be stationed at areas
- ✓ where dust is expected to emanate etc.
- ✓ Carry out regular maintenance to the construction machinery and equipment. This
- ✓ will minimize generation of hazardous gases and other suspended particulate matter.
- ✓ Control over areas generating dust particles. Use water sprays and mists as dust
- ✓ suppression measures
- ✓ On exposed construction surfaces during dry/windy periods fugitive dust generation
- ✓ will be suppressed by spraying of water or other suitable means.
- ✓ Workers working in dust prone areas will be provided with masks and goggles.
- ✓ Waste such as broken pipes, replaced sewers and manhole concrete casts, covers and
- ✓ ladders transported by trucks will be covered to contain dust.

9.1.4 Noise and vibrations Nuisance

Noise is unwanted/undesirable sound that can affect job performance, safety, and health. Psychological effects of noise include annoyance and disruption of concentration. Physical effects include loss of hearing, pain, nausea, and interference with communications when the exposure is severe. Relatively high noise levels are expected in the area during the construction phase. Excavation works, machinery on sites, and demolition of existing sewer systems-manholes, sewer pipes. Noise control measures should be implemented in the construction area if the noise levels exceed 90dB (A) for a continuous 8 hours exposure. In addition, protection against the effect of the noise exposure among the workers should be effected.

Mitigation measure

Workers should be provided with relevant personal protective equipment (PPE)/ materials such as earmuffs and earplugs; when operating noisy machinery and when in noisy environment. These provide a physical barrier that reduces inner ear noise levels and prevent hearing loss from occurring

- ✓ Suppressors or silencers on equipment or noise shields for instance corrugated iron sheet structures;
- ✓ Machineries should be maintained regularly to reduce noise resulting from friction.
- ✓ Provision of bill boards at the construction site gates notifying of the construction
- ✓ activity and timings.
- ✓ Construction and the use of construction machinery should be limited between 0600hr and 1800hr on weekdays

9.1.5 Soil erosion and destabilization of soil structure

Soil movement is common in construction activities. This mostly happens during the laying of foundations (earthworks) for the projects and site clearing and demolition of underground infrastructures. Most top loose material is excavated and transported elsewhere. Comprehensive soil erosion measures are thus important during the construction phase;

Mitigation measure

- ✓ Provision of soil conservation structures on erosion prone areas to control occurrence
- ✓ of soil movement.
- ✓ Avoid unnecessary movement of soil materials from the site.
- ✓ Good management of the runoff/storm water to reduce its impact on loose soil
- ✓ Control construction activities especially during rainy / wet conditions
- ✓ Landscaping: Re-surface open areas after completion of the project and introduce
- ✓ appropriate vegetation.
- ✓ Trenches will have adequate backfill. Upon completion of backfill the surface shall be restored fully to the level that existed prior to the construction of the sewer

9.1.6 Visual Intrusion

Visual impacts are likely to occur during earthworks for the proposed project activities and also if blocked drains will be surfaced, presence of excavation scars, poorly managed construction waste, untidy storage of construction materials, visible portable latrines. The visual impact will however be contained within the sites. Water quality compromise This may occur from runoff and waste and sewage generated from construction activities, it may also happen if during unblocking drains sewage comes to surface then flows to nearby water bodies.

Mitigation measure

- ✓ On completing the earthworks, the excavated or disturbed areas should be restored immediately; especially through backfilling and leveling.
- ✓ All debris from construction activities should be cleared on completion.
- ✓ Compensation for the loss of landscape resources e.g. vegetation by replacing with an
- ✓ equivalent resource e.g. planting ornamental trees and grass
- ✓ During flushing the contractor should minimize surfacing sewage but instead use sewage exhauster truck with pump, hose and accessories to unblock drains

9.1.7 Water quality compromise

This may occur from runoff and waste and sewage generated from construction activities, it may also happen if during unblocking drains sewage comes to surface then flows to nearby water bodies.

Mitigation measure

- ✓ The contractor shall ensure that any wastewater generated during construction of the sewer system is properly collected through drains and stabilized in the ponds
- ✓ Waste water in the existing lagoons shall be managed carefully during rehabilitation to prevent direct release of untreated water into the rivers.
- ✓ Machineries should be operated and maintained according to manufacturer's guidelines, this is to avoid oil, lubricants and fuel leaks that might pollute water resources in the area

9.1.8 Disruption to businesses, traffic and residents

During the proposed activities there will be influx of laborers and construction activities will be taking place mainly along the roads and outside many shopping centers and social places. Excavation works may cause some areas to be cordoned off to allow construction work to be done thus inconveniencing some people and vehicle movement over a period of time.

Mitigation measures

Road safety and traffic management during construction

The contractor/Proponent will coordinate preparation of a traffic management plan for the project area.

The plan will include:

- ✓ Measures to be taken to prevent traffic snarl up
- ✓ Provision of temporary safe access to buildings, which will be blocked due to construction.
- ✓ Measures to be taken for safe passage of traffic including temporary diversions, and/or separation of motor vehicle traffic from non-motorized and pedestrian traffic where necessary. Measures to be taken to ensure safety of traffic passing through the construction area including signs, marking flags, lights and flagmen as may be required.
- ✓ Prevention of Accidents and Damage to Property
- ✓ All necessary precautions will be taken to prevent accidents and/or damage to property. Measures taken by the contractor will include but not limited to:
- ✓ Safe execution of construction work
- ✓ Providing adequate health and safety protection to workers.
- ✓ Sufficient insurance coverage covering all risks including property damage, third party
- ✓ Liability and workmen compensation
- ✓ The contractor shall strive to strive to reduce disruption to our customers and to residents and businesses in the affected area
- ✓ The contractor will ensure the safety of workers, residents and the environment, temporary disruptions will be necessary and warnings and notices shall be issued and placed for the inconvenience. These may include (but are not limited to) traffic disruptions, temporary sewer service disruptions and disturbance of landscapes (which will be restored after construction).
- ✓ Further it is required broader public participation be carried out to reach out to all (Stakeholders) residents and business premises that will be temporarily be affected by the proposed new connections and rehabilitation activities
- ✓ The contractor shall strive to strive to reduce disruption to our customers and to residents and businesses in the affected area
- ✓ The contractor will ensure the safety of workers, residents and the environment, temporary disruptions will be necessary and warnings and notices shall be issued and placed for the inconvenience. These may include (but are not limited to) traffic disruptions, temporary sewer service disruptions and disturbance of landscapes (which will be restored after construction).
- ✓ Further it is required broader public participation be carried out to reach out to all (Stakeholders) residents and business premises that will be temporarily be affected by the proposed new connections and rehabilitation activities

9.1.9 Health and Safety Concerns

During construction, there will be increased dust, air and noise pollution. These are considered as negative impacts as they significantly lower the quality of environment. The residents and workforce involved would be more subjected to these environmental hazards. Food is provided by mobile individuals most of which operates without licenses. This can compromise health of the workers especially if such foodstuffs are prepared un hygienically. Again excavation scars during extraction of smaller drains for replacement and manholes will be hazardous if people trip and fall inside. Garbage from manholes is also a source of health hazard since it may contain pathogens.

Mitigation measures

- ✓ Depending on the occupational safety and health hazards encountered while performing assigned job tasks, workers may require using properly fitting personal protective equipment (PPE) to avoid injuries and illness. They (workers) must be provided with full protective gear. This include working boots, overalls, helmets, goggles, earmuffs, masks, gloves etc

- ✓ A first aid kit should be provided within the site. This should be fully equipped at all times and should be managed by qualified persons.
- ✓ Safety awareness may be gained through regular safety meetings, safety training or personal interest in safety and health. This awareness will increase ability to respond if, some day in future, one is a bystander in an emergency.
- ✓ The contractor should have workmen's compensation cover. It should comply with workmen's compensation Act, as well as other ordinances, Regulations and union Agreements.
- ✓ Sanitary facilities should be provided with respect to gender. Standard cleanliness of the facilities should be maintained.
- ✓ Local individuals preparing food for the workers at the site must be controlled to ensure that food is hygienically prepared.
- ✓ The contractor will be expected to handle garbage/stuff from manholes and blocked drains in accordance with the EMCA, Waste regulations,2006
- ✓ Sewage from flushing and lagoons shall be managed hygienically without surfacing sewage on roads and on farms. The contractor shall also ensure all untreated sewage does not end up in the Lake; this can be achieved by the use of standby exhauster

9.2 Operation phase

9.2.1 Positive impacts

- ✓ The proposed Rehabilitation and extension will see areas previously not connected to the sewerage network get connected; this will in turn reduce underground water pollution through disposal of waste water via septic tanks and pit latrines.
- ✓ The proposed project activities will provide adequate storm water drainage for the town.
- ✓ There will be reduced soil erosion due to improved drains which are built putting into consideration erosion prevention measures.
- ✓ There will be improved aesthetic in the project area due to rehabilitation of the sewer pipes and manholes allowing waste water to flow without blockage hence cleaning up of the mess that is currently experienced in Storm water drains in the town.
- ✓ The proposed activities shall also cause removal of trapped waste in manholes and drains thus reducing the mosquito breeding sites.
- ✓ The proposed activities will increase coverage of the sewerage network. This will eliminate discharge of untreated waste in undesignated areas. It will also allow the upcoming developments to discharge their waste into the sewer line.
- ✓ Provision of employment opportunities during operation phases of the project.
- ✓ The proposed project will centralize the town's wastewater treatment and will make pollution monitoring easy and more effective. The projected improvement shall cater for Eldoret town up to 2040.
- ✓ Improved health of the people- Reduced cases of respiratory and water borne diseases associated by poor sanitation due poor waste water management.
- ✓ If efficient the system shall save river Sosiani from receiving raw effluent which has adverse effects on the aquatic life.
- ✓ Sludge from the WWTW is a rich resource that can be utilized by the community around as fertilizers to enhance agricultural produce.
- ✓ Growth of secondary businesses in the project area.
- ✓ Achieve economic benefit by saving some healthcare expenses, improving people's productivity and improving water resources management.
- ✓ Increased revenues for the service providers.
- ✓ Improvement in groundwater quality through preventing infiltration of sewerage from porous cesspits and pit latrines.
- ✓ Improve living conditions for targeted residents through achieving the above environmental benefits, upgrade their real estate values and contribute in alleviating poverty conditions through work opportunities in construction and operation of the project.
- ✓ Strengthen community participation in environmental protection through involving community based organizations in project operation and mobilization activities.

- ✓ Land Value will go up
- ✓ Corporate social responsibility (CSR)

9.2.2 Negative impacts

9.2.2.1 Sewage collection and transfer

Sewage from generating sources is conveyed to a treatment plant through networks of pipelines, tunnels, pumping stations or storages. Overflow may occur if the sewage flow exceeds the hydraulic capacity of the system.

9.2.2.2 Effects of Water Pollution

Possibility of continual lake contamination by unsatisfactory treated effluents from the WWTW. When toxic substances enter a body of water (accidentally), they will be dissolved, become suspended in water or get deposited on the bed of the water body. The resulting water pollution causes the quality of the water to deteriorate and affects aquatic ecosystems. Pollutants can also seep down and effect groundwater deposits.

Possibility of river contamination by overflowing manholes blocked sewer trunks during operation phase, history of sewer puncturing to irrigate.

9.2.2.3 Domestic Sewage

Domestic sewage contains a wide variety of dissolved and suspended impurities. It amounts to a very small fraction of the sewage by weight, but it is large by volume and contains impurities such as organic materials and plant nutrients that tend to rot with time. The main organic materials are food and vegetable wastes. Plant nutrients come from chemical soaps, washing powders, etc. Domestic sewage is also very likely to contain disease-causing microbes. The various substances that are used for keeping our houses clean add to water pollution because they contain harmful chemicals. Most detergents and washing powders contain phosphates which are used to soften the water, among other things. These and other chemicals contained in washing powders affect the health of all forms of life in the water. When sewage enters a lake or stream, microorganisms begin to decompose the organic materials. Oxygen is consumed as micro-organisms use it in their metabolism.

9.2.2.4 Ecological Damage

Sewage-contaminated water causes eutrophication, which is the increase in concentration of chemical elements required for life. The nitrates, phosphates, and organic matter found in human waste serve as a food for algae and bacteria. This may cause these organisms to overpopulate to the point where they use up most of the dissolved oxygen that is naturally found in water, making it difficult for other organisms in this aquatic environment to live.

The bacteria basically strangle the other organisms. Some of the organisms that do overpopulate from this can also are disease-causing microorganisms. Phosphates are also found in soaps and detergents, but there are other household products that we use every day that can be toxic to many animals and humans if they are dumped directly into a water body.

Health Risks Bathers are at increased risk of contracting illness due to bacteria and viruses present in sewage effluent. Gastrointestinal disorders have been linked to sewage pollution, with viruses implicated as the cause. Shellfish strain water through their gills to trap microscopic plants and animals for food. If the water was contaminated with disease-causing bacteria, these could be consumed as food by shellfish. When eaten raw or partially cooked, these shellfish can make people sick. Certain fish in contaminated waters can accumulate high levels of toxic substances. When these foods are consumed frequently over a lifetime, they may increase the consumers' risk of adverse health effects. Detergents can cause liver and kidney damage, while sewage water carries diseases such as Giardiasis, Amoebic dysentery and Cholera.

9.2.2.5 Odour

In the absence of adequate oxygen bacteria in the wastewater break down essentially odour free compounds to odorous compounds: fats and carbohydrates go to alcohols, esters, aldehydes and carboxylic acids while proteins go to ammonia, amides, mercaptans and hydrogen sulphide. All of these compounds can give off strong smells, but those formed from protein degradation can emit very intense smells at concentrations in the parts per billion range.

9.2.2.6 Inhabitation of Birds

Possibilities of inhabitation of the area by Marabou stork, cattle egret and Hadada ibis. The birds could be a nuisance both to the community and charter planes flying in the area.

9.2.2.7 Pipe corrosion

H_2S causes significant problems in sewer pipes. It is a potent poison and must be monitored in all pipes. However a further and less well known consequence of the presence of H_2S in pipes is pipe corrosion. Anaerobic bacteria in the sewage feed on the amino acids and release H_2S. This then dissolves in the water on ceiling of the pipe, where other, aerobic, bacteria use it as a source of energy.

9.2.2.8 Sewerage Problems

Problems can occur when storm water runs into the sewerage system. The integrity of sewers is often compromised by illegal storm water connections, faulty joints, tree roots cracking pipes, redevelopment of property and age. Storm water infiltration into the sewer during and following rainfall events can cause the sewerage system to have too much water and to discharge through designed overflow points in creeks and storm water drains. Storm water can enter the sewerage system in the following ways:

a**) Low Sewage Gullies.** Gullies are the openings from sewerage drains, usually found under outdoor taps, or outside kitchens and bathrooms. If the opening to the gully is not elevated above ground level, storm water will enter the sewerage system, especially during periods of heavy rain.

b) Illegal Connections to Sewer. Premises where storm water pipes have been connected to the sewers are a serious problem. This is illegal.

9.2.2.9 Sewage and storm water leaks

Cracked and Leaking Pipes Storm water can infiltrate into sewers through cracks in pipes or faulty joints. Cracks can form in sewers over time due to small earth movements. Old, cracked and leaky sewer pipes have long-term environmental impacts, contaminating groundwater, rivers and harbours.

9.2.2.10 Sewer Overflows

Sewer overflows are designed points within the sewerage system, where sewage can overflow into creeks and waterways in the event of a blockage or overfilling of the sewerage system. These surcharge points ensure that the sewerage system does not back up and overflow into private residences.

9.2.2.11 Eutrophication

Eutrophication is as a result of inputs of nitrogen and phosphorus that are excessive in relation to natural status. There are two primary causes of eutrophication of lakes and watercourses: leaching of phosphorus from arable land and discharges from wastewater treatment and industrial facilities. Storm water and rural on-site wastewater disposal also account for substantial shares of phosphorus emissions. Both phosphorus and nitrogen can affect the marine environment, depending on which substance is in relatively short supply for algal production.

9.2.2.12 Bathing water pollution

Discharges can affect bathing-water quality. For the treatment plants, it may be a matter of overflows, when untreated water is released in conjunction with heavy inflows.

9.2.2.13 Lack of oxygen in existing activated sludge plants, as a result of:

- ✓ Increased waste water inflow
- ✓ Increased concentration of pollutants
- ✓ Greatly fluctuating pollutant load
- ✓ More thorough purification dictated by stricter legal requirements

5.1.1.1. Lack of proper operation and maintenance of the system could cause over flow of sewage and water logging during rainy season, which would be a nuisance and health hazard to public.

5.1.1.2. Risk of drowning and accidental falls of animals or people falling into the stabilization ponds

5.1.1.3. Due to lack of control there may be discharge of hazardous industrial effluents into sewer, which can damage the sewer system, or interfere with the downstream treatment process or pass through the treatment plant and cause damage to the environment.

5.1.1.4. There is a potential health hazard to workers engaged in sewer maintenance workers. These workers are likely to be exposed to toxic gases and hazardous materials present in the sewage and are likely to contract communicable diseases from exposure to pathogens present in the sewage.

5.1.1.5. Risk of encroachment and construction of structures on the sewer wayleaves
5.1.1.6. Risk of farming using raw sewerage, this has potential of vegetation and soil contamination.
5.1.1.7. Risk of Vandalism of Infrastructure
5.1.1.8. Health Risks associated with burst Sewers
5.1.1.9. Inversion of Birds and Reptiles to the Waste Water Treatment Works

9.2.3 Mitigation Measures for potential environmental impacts

- ✓ The system should be regularly be inspected 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;
- ✓ Mapping and installation of beacons to which illustrate the width of the pipeline reserve
- ✓ Regular patrol of the pipeline corridor for encroachment.
- ✓ Prosecution of encroachers as required by County By Laws on way leaves and road reserves maintenance.
- ✓ Conduct public sensitization programs on importance not interfere with the sewer pipeline and dangers associated with farming using raw sewerage.
- ✓ Constant inspection by Sewerage officials to identify and repair the punctures pipelines
- ✓ With the help of police, arrest and prosecute persons farming using raw sewerage using county government by laws.
- ✓ Conduct public sensitization programs on importance not interfere with the sewer pipeline and the need to seek official water connection.
- ✓ Prosecute persons illegally connecting to the sewer lines as provided by County Government By laws.
- ✓ 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 including 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.
- ✓ Use alternative material for manhole covers and step iron
- ✓ Continuous patrol by agency
- ✓ Sewerage owners to attend to burst sewer pipes promptly to prevent excessive soil contamination.
- ✓ Provide high risk areas with appropriate drainage for effective channelling of sewage spills.
- ✓ Encourage land owners along sewer lines to maintain vegetated belts along the pipeline to control any overflows flows and trap soil. They should be encouraged to take responsibilities at the lowest levels in regard to protecting the sewer line.
- ✓ Mark clearly the pipeline for ease of identification and protection by the adjacent landowners.
- ✓ Provide workers with education and awareness on safe management, handling and application of the sludge cake,
- ✓ There should be an initiative to investigate the target areas of sludge use in respect of environmental features (water sources and soil types) as well as social interactions.
- ✓ The quality and safety of the sludge cake should be ensured on a collaborative basis with (public health, agriculture, water and soil) before it is released to the users.
- ✓ Part of ensuring this would be ensuring efficiency of the sludge digestion and effective sludge drying,
- ✓ The opinion of the large communities in the areas of sludge use should also be known
- ✓ Ensure appropriate covering/ventilation of the pre-treatment unit;
- ✓ Ensure scum is appropriately disposed off or properly stabilized;
- ✓ Ensure that the pond series have adequate water flow and aeration to reduce the potential of odour formation;
- ✓ Ensure appropriate handling and removal of grit/grease;
- ✓ Ensure proper sizing and alignment of the lagoons;

- ✓ 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.
- ✓ In the event of larger wildlife e.g. hippos and crocodiles, proponent will ensure appropriate consultations with the Kenya Wildlife Services (KWS) on appropriate management actions,
- ✓ 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.
- ✓ 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
- ✓ Proper security measures should be put in place to guard the equipment 24 hours to reduce cases of vandalism.
- ✓ Design manholes and manhole step iron from material which do not have any value in the scrap metal industry.
- ✓ The design has proposed a security chain link fence including a gate and guard house be erected at sewer treatment plant to protect the site from theft and vandalism
- ✓ Communities living near where the trunk sewers will be constructed should be enlightened on dangers of using raw sewerage to irrigate farmlands;
- ✓ Maintain high standards of hygiene within the WWTW, experience from DESTW (Current Dandora Estate Sewerage Treatment Works) indicate that birds are concentrated at the inlet works due to the solid wastes screened from the raw sewerage flowing to the treatment works;
- ✓ The solid wastes should be promptly removed from site and disposed appropriately in a designated landfill;
- ✓ Tapping 100% of gases generated from the facility, this will be tapped in the sludge digesters, the gases of which are responsible for the foul smell associated by with wastewater treatment plants. The best proposal would be to clean up the gases and use to generate electricity;
- ✓ Periodic preventive maintenance will be carried out by ELDOWAS to prevent flooding or water logging caused by clogged drains;
- ✓ Monitoring activities will also be carried out to ensure that untreated effluent from industries is not discharged into the proposed sewer system;
- ✓ ELDOWAS will ensure that the proper health and safety precautions are adhered to during sewer cleaning operation;
- ✓ Warning notices, in the appropriate local language(s), will be attached to the fence advising that the ponds are a wastewater treatment facility, and therefore potentially hazardous to health;
- ✓ Cordon around open trenches with red tapes to protect the public from falling into the trenches.
- ✓ Sewage treatment plants neutralize and deactivate the chemicals found in the sewage water. They work by relying on the bacteria that is found in our colons, which eat away the nitrates, phosphates and organic matter that is found in sewage. These plants can be expensive to build and operate for many governments, but there are cheaper alternative which rely on nature to do most of the work. This is done by rebuilding or restoring lagoons, because the plants and bacteria found in the wetlands will do the same thing that bacteria in standard sewage treatment plants do. This helps the environment in two ways: restoring wetlands and treating human waste water before it pollutes the natural waterways

10 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN (EMMP)

10.1 Introduction

The purpose of the following Environmental and Social Management Plan (ESMP) for the proposed project is to initiate a mechanism for implementing mitigation measures for the potential negative environmental impacts and monitor the efficiency of these mitigation measures based on relevant environmental indicators. The EMP identifies certain roles and responsibilities for different stakeholders for implementation, supervision and monitoring.

Objectives of ESMMP

10.2 The objectives of the ESMP are:

- ✓ To provide evidence of practical and achievable plans for the management of the proposed project.
- ✓ To provide the Proponent and the relevant Lead Agencies with a framework to confirm compliance with relevant laws and regulations.
- ✓ To provide community with evidence of the management of the project in an environmentally acceptable manner.

Conversely, Environmental monitoring provides feedback about the actual environmental impacts of a project. Monitoring results help judge the success of mitigation measures in protecting the environment. They are also used to ensure compliance with environmental standards, and to facilitate any needed project design or operational changes. A monitoring program, backed up by powers to ensure corrective action when the monitoring results show it necessary, is a proven way to ensure effective implementation of mitigation measures. By tracking a project's actual impacts, monitoring reduces the environmental risks associated with that project, and allows for project modifications to be made where required.

This ESMMP is prepared for the three project stages where potential significant negative impacts manifest. These are:

i. Construction Phase ESMP
ii. Operation Phase ESMP and
iii. Decommissioning Phase ESMP

The table below summarizes the environmental management plan for the proposed project. They describe parameters that can be monitored, and suggest how monitoring should be done, how frequently, and who should be responsible for implementation and monitoring. The estimated costs for the various mitigation measures have been provided where possible. It will be noted that most of these measures will be part of the project's operational costs.

Table 13: Environmental and social Monitoring and Management Plan (ESMMP)

Potential impact	Mitigation measures	Responsibility	Time frame	Cost estimate
Pre-construction phase				
Impact on the existing urban land use pattern	✓ Relate the project land use plan with the existing urban future plan and over to exclude some affected area	Project consultant, contractor	During designing time and construction	Nil if the proposed action is applied
Climate change incident	✓ Search research findings on devising ways and means to reduce GHG emissions ✓ Plan sewer systems to address ways and means of reducing GHG emissions without jeopardizing the beneficial effects of the project.	Contractor, RVWWDA, local community and relevant stakeholders	Throughout project cycle	Nil cost its sharing of legal responsibility
Construction phase				
Air pollution	✓ Drivers should be instructed on the benefits of driving practices that reduce both the risk of accidents and fuel consumption, including measured acceleration and driving within safe speed limits; ✓ Contractors should consider additional ways to reduce potential impacts including implementing a regular vehicle maintenance and repair program. ✓ Ensure that all vehicles involved in the transport of construction material and staff, and machinery involved in the construction is properly maintained and serviced. ✓ Machines must not be left idling for unnecessary periods of time; this will save fuel and reduce emissions. ✓ Use of dust control methods, such as covers water suppression ✓ Ensure that all trucks carrying aggregate and sand are covered during delivery to the site. ✓ Ensure that all material (sand and aggregate) stockpiled on the site to be used in construction activities are regularly sprayed to reduce the effects of wind whipping ✓ Care must be taken in the unloading construction materials (aggregate, sand and cement) to prevent spillage. If a spill occurs, this should be cleaned up as soon as possible thereafter. ✓ Extra care must be taken to reduce dust in periods when wind speed is greatest and the rainfall amounts are lowest. This will involve extra wetting of the construction area to suppress dust particles.	Contractor Project Manager	Throughout the construction period	3,000,000

Potential impact	Mitigation measures	Responsibility	Time frame	Cost estimate
	✓ Retain a buffer area of trees and other vegetation generally around the perimeter of the development site which will serve as a natural windbreaks which may reduce the level of dispersion of dust particles generated during this phases of the development. ✓ All raw materials must be sourced as close as possible to the construction site thus reducing the emissions from vehicular traffic. ✓ All waste must be transported off-site for processing, not burnt or stored for any longer than is absolutely necessary.			
Water pollution	✓ If diesel and motor oil are to be stored on site, ensure that they are properly contained in a bunded area (With capacity to contain 1½ times the amount of substances stored). This area must have signs indicating the storage of these substances erected. ✓ Provide workers at the development site with chemical toilets during this phase of the development. A reasonable ratio would be fifteen (15) workers per toilet. ✓ Store all raw materials away from the vicinity of water bodies located on the property to avoid contamination in these areas. ✓ General refuse generated during these phases of the development must be stockpiled in one central area of the development site, away from existing water bodies and collected, transported and disposed of appropriately at the designated disposal site. ✓ Clearance of vegetation must be avoided in periods of heavy rainfall	Civil Engineer and Contractor	Throughout the construction period	1,500,000
Solid wastes	✓ Use an integrated wastes management system observing the following hierarchy of options: f. Reduction at source g. Recycling h. Reuse i. Combustion j. Land filling. ✓ Incorporation of waste management commitments contained in the Waste Management Guidelines ✓ Agreement with suppliers to accept the return of unused materials. ✓ Agreement with and license details of companies to be used for the off-site transport of wastes ✓ Workforce training programs in waste minimization practices ✓ Where practical any excess materials will be returned to the supplier ✓ Waste oil will be collected for transport and off-site disposal Littering, specifically of the natural areas, should be prevented. Adequate containers for litter removal should be supplied on site. These containers should be emptied on a regular basis and the	Contractor	Throughout the construction period	1,000,000

Potential impact	Mitigation measures	Responsibility	Time frame	Cost estimate
	contents removed to an appropriate and licensed waste disposal site. ✓ The Contractor shall set up a solid waste control and removal system. ✓ Bins shall be emptied on a daily basis. ✓ Waste and litter shall be disposed of into scavenger – and weather proof bins. The contractor shall then remove the refuse collected from the working areas, from site at least once a week.			
Noise and vibration	✓ Best available work practices will be employed on-site to minimize occupational noise levels. All construction equipment will be regularly inspected and maintained in good working condition. ✓ Combine noisy operations so that they occur at the same time. The total noise level will not be significantly louder than the level produced if the operations were to be undertaken separately. ✓ Noisy operations will be carried out strictly during the day time. ✓ Switch off engines when not in use. ✓ Access roads should be cut that are exclusively used for the transportation of workers, goods and materials. These roads should be sited in such a way that the noise from this movement affects as few of the existing residents as possible. ✓ Where possible silenced machinery and instruments should be employed to reduce the impact of noise on the existing residents and workers. ✓ Machinery, vehicles and instruments that emit high levels of noise should be used on a phased basis to reduce the overall impact. These pieces of equipment such as drills, graders and cement mixers should also be used when the least number of residents can be expected to be affected, for example during periods where most residents are at work or school. ✓ Temporary barriers such as earth berms, zinc fencing and sound dampening fencing such as acoustic screens should be employed to reduce the impact of noise to the existing residents; ✓ Ensure that construction activities for the development of the project are staggered to decrease the levels of noise and vibration in the area; ✓ Construction hours should be limited to the hours of 8:00 a.m. and 6:00 p.m. daily. The delivery of raw materials must be limited to 8:00 a.m. and 6:00 p.m daily.	Contractor	Throughout the contrsuction period	200,000
Biodiversity loss	✓ Only clear vegetation that is absolutely necessary for the construction activities; ✓ Avoid the use of Invasive Alien Species in the landscaping activities ✓ Determine Access roads which are to be used by machinery used in the construction and site clearance phase development to avoid the unnecessary trampling	Contractor	Throughout construction phase	1,500, 000

Potential impact	Mitigation measures	Responsibility	Time frame	Cost estimate
	of vegetation that will be maintained within the development area. ✓ Ensure that green belts' which have been proposed for the STW are large as possible as small patches may not be able to support viable populations of some species and these small patches tend to more susceptible to edge effect. It possible position these green belts in adjacent to existing vegetated areas. In addition species richness tends to increase with area, which would be the desired outcome of the incorporation of green belts.			
Disturbance of traffic and difficulty of access	✓ Provide diversion routes where possible. ✓ Give a construction itinerary in advance Erect warning signs of ongoing works. ✓ Expedite construction works so as to reduce the times where roads are blocked. ✓ Traffic department should approve crossing plan prior to construction, and should approve obstruction times during construction Access of residents should be facilitated by installing appropriate temporary bridges over the pipeline trenches. ✓ Suitable warning signs should be placed at near locations and should be visible at night. ✓ A guard ✓ should be available 24 hours to help people access across pipeline trenches. ✓ Alternatives access ways should be communicated to the community.	Contractor	Throughout the construction phas	3,500,000
Damage of underground infrastructure	✓ Get maps of the underground infrastructure from the relevant institutions. ✓ Sensitise workers carrying out Excavations so that they exercise caution to minimize chances of underground infrastructure damage. ✓ Work closely with the responsible institutions o that incase of damage, the services are restored within the shortest time. Reroute sensitive infrastructure where possible. ✓ Notify affected parties if service needs to be temporarily relocated or was affected by the project works	Contractor	Throughout the construction phase	2,000,000
Soil erosion	✓ Re vegetation of disturbed surfaces should be done as soon as possible	Contractor	Construction	
Occupational accidents	✓ Ensuring that the drivers and machine operators hired to work on the site are qualified. ✓ Workers on site must be provided with appropriate PPE. ✓ Appropriate signs must be erected on the site to warn workers and visitors. ✓ There should be safety policy clearly displayed on the site. ✓ Machines should be properly maintained. ✓ A first aid kit should be provided and a trained first aider should always be on site. ✓ Fire extinguishers should be provided. ✓ Proper scheduling of activities to avoid workers being overworked.	Contractor	Throughout construction phase	500,000

Potential impact	Mitigation measures	Responsibility	Time frame	Cost estimate
	✓ Machines/equipment for the intended purpose. ✓ No worker should be allowed on site while under the influence of alcohol or other inebriating substances. ✓ Only the Blaster licensed by the Mines and Geology should carry out blasting on the site. ✓ Blasting should only be carried out as per the provisions of the blasting license away from house and power lines. ✓ All charged holes must be covered with appropriat medium to arrest fly rocks. ✓ Inspection of workers to ensure they are using the PPE at all times when necessary. ✓ Provide a fully stocked First Aid box on the site ✓ Display at prominent places occupational health and safety rules. ✓ Test and approve equipment such as ladders before use. ✓ Training workers on how to use various PPE and proper use of machinery. ✓ Have a trained First Aider on the site. ✓ Registration of the premises as required by Law. ✓ Appropriate insurance should be acquired as required by law ✓ Medical examination of all workers before engagement and after the project is over. ✓ Display an emergency evacuation procedure. ✓ Moving parts of machines should be guarded to protect workers from injuries. Should an accident occur: ✓ The injured worker should be given first aid and immediately taken to the hospital. ✓ An investigation should be initiated immediately to ascertain the cause of the accident and preliminary findings released within 12 hours			
Social conflicts	✓ Immediate action undertaken as soon as possible and within 24 hours of receipt of a complaint ✓ Investigations completed within seven days of receipt of complaint. ✓ All corrective actions implemented by due date ✓ All incidents or complaints about either environmental or social issues will be managed in accordance to the existing procedure in line with the legal framework. ✓ All incidents and complaints will be recorded in the contractors incident reporting system Additional environmental awareness training of the workforce with respect to procedures to be followed for environmental incidents or complaints ✓ Sensitize workforce on cultural sensitivities	Contractor	Throughout construction phase	450,000
Spread of HIV/ aids	✓ Sensitize the migrant workers on dangers of risky sexual behaviour. ✓ Have VCT services on site and encourage workers to undergo the same. ✓ Uptake of VCT by project workers and the host community.	Contractor	Throughout construction	1,500,000

Potential impact	Mitigation measures	Responsibility	Time frame	Cost estimate
	✓ Provision of condoms to the workers. ✓ Preference for hiring workers from local community to minimize influx of migrant workers.		phase	
Employment	✓ As a priority offer employment opportunities to the local residents ✓ Employed persons with credible skills ✓ Ensure workers have an Insurance Cover. ✓ Working hours should be as per the Kenyan Labour laws	Contractor	Construction phase	
Access to public and private Properties	✓ Monitoring impact of project on dwelling and business in the project area ✓ Monitor construction activities to ensure public and private property is not damage	Contractor	Contrstuction period	
Displacement of people	✓ Avoid displacement as much as possible Prompt and fair compensation of all the PAPs in full prior to beginning of construction works at the site.. ✓ Pre and post resettlement counseling's support. ✓ Financial education for the recipients of compensation funds. ✓ Identification and full resettlement assistance for vulnerable PAPs.	Contractor and Project Manager	Throughout the contruction period	
Operational phase				
Water and soil pollution from leaks and sewage overflow and leaks	✓ Consider the installation of Separate sewer systems for domestic wastewater and storm water runoff in the overall planning and design of new sewerage systems; ✓ When on-site sanitation systems where excreta are mixed with water predominate, consider use of small-diameter sewerage system to collect water effluent from septic systems or interceptor tanks; ✓ Limit the sewer depth where possible (e.g., by avoiding routes under streets with heavy traffic). For shallower sewers, small inspection chambers can be used in lieu of manholes; ✓ Use appropriate locally available materials for sewer construction. Spun concrete pipes can be appropriate in some circumstances but can suffer corrosion from hydrogen sulphide if there are blockages and/or insufficient slope; ✓ Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent buildup of solids and hydrogen sulphide generation; ✓ Design manhole covers to withstand anticipated loads and ensure that the covers can	ELDOWAS	Throughout the operation phase	O & M Budget

Potential impact	Mitigation measures	Responsibility	Time frame	Cost estimate
	be readily replaced if broken to minimize entry of garbage and silt into the system; ✓ Equip pumping stations with a backup power supply, such as a diesel generator, to ensure uninterrupted operation during power outages, and conduct regular maintenance to minimize service interruptions Consider redundant pump capacity in critical areas; ✓ Development of an inventory of system components, with information including age, construction materials, drainage areas served, elevations, etc ✓ Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas. ✓ Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. ✓ Monitoring of sewer flow to identify potential inflows and outflows ✓ Immediate clearing of blockage or repairs warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow			
Accidents and inhiries	✓ Install railing around all process tanks and pits. Require use of a life line and personal flotation device (PFD) when workers are inside the railing, and ensure rescue buoys and throw bags are readily available; ✓ Use PFDs when working near waterways; ✓ Implement a confined spaces entry program that is consistent with applicable national requirements and internationally accepted standards. ✓ Valves to process tanks should be locked to prevent accidental flooding during maintenance; Use fall protection equipment when working at heights; ✓ Maintain work areas to minimize slipping and tripping hazards; Use proper techniques for trenching and shoring; Implement fire and explosion prevention measures in accordance with internationally accepted standards; ✓ When installing or repairing mains adjacent to roadways, implement procedures and traffic controls, such as: ✓ Establishment of work zones so as to separate workers from traffic and from equipment as much as possible ✓ Reduction of allowed vehicle speeds in work zones; ✓ Use of high-visibility safety apparel for workers in the vicinity of traffic ✓ For night work, provision of proper illumination for the work space while controlling glare so as not to blind workers and passing motorists ✓ Locate all underground utilities before digging	Contractor and ELDOWAS	Throughout the operation phase	2,500,000

Potential impact	Mitigation measures	Responsibility	Time frame	Cost estimate
Offensive odours	✓ Provide adequate buffer area, such as trees, or fences, between processing areas and potential receptors; ✓ Avoid siting facilities near densely populated neighbourhoods and installations with potentially sensitive receptors, such as hospitals and schools. Site facilities down-wind from potential receptors, if possible. ✓ Cover emission points (e.g., aeration basins, clarifiers, sludge thickeners, tanks, and channels), and vent emissions to control systems (e.g., compost beds, biofilters, chemical scrubbers, etc.) as needed to reduce odours and otherwise meet applicable national requirements and internationally accepted guidelines	ELDOWAS	Throughout operations	1,500,000
Public health issues related to irrigation with treated sewage	✓ Consider use of drip irrigation of treated wastewater, which minimizes worker exposure and the amount of water needed. ✓ Avoid use of spray irrigation of treated wastewater, if possible; ✓ Provide field workers with personal protective equipment, such as rubber gloves and waterproof shoes; ✓ Provide access to safe drinking water and sanitation (including hand washing) facilities; ✓ Provide worker health monitoring, including regular physical examinations; ✓ Control vectors and intermediate hosts of diseasecausing micro- organisms. ✓ Treat wastewater and sludge used for land application in a manner consistent with WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater and applicable national requirements; ✓ Stop irrigation with treated wastewater two weeks prior to harvesting; ✓ Limit irrigation with treated wastewater to crops that are cooked before eating; ✓ Restrict public access to hydraulic structures carrying wastewater and to fields irrigated with treated wastewater.	Farming community	Throughout operations	3,500,000
Scavengers birds and other animals	✓ Proper fencing of the Plant to keep off wildlife is recommended ✓ Maintaining high standards of hygiene at the site throughout the operation phase of the facility ✓ Constant consultations with KWS in event that wildlife is spotted in the area. ✓ The inlet works should be enclosed in a building to avoid exposure to birds ✓ Daily burying of the wastes in appropriate solid Waste disposal section covering with soil, this reduces the tonnage of wastes on site and exposing the wastes to scavenging birds	ELDOWAS	Throughout the operation phase	3,000,000

Potential impact	Mitigation measures	Responsibility	Time frame	Cost estimate
Climae change incident	✓ Encourage forestry Actions: encourage tree planting on the hills, community and private land and develop better management of forestry operations as trees absorb and store atmospheric CO2 and avoid forest fires not to release CO2 ✓ Minimize the off-take of woody biomass for construction and fuel and use other alternatives such as stoves, electricity, stones and cement concrete breaks instead of wood for house	RVWWDA, local community and relevant stakeholders	Post construction	Nil cost its sharing of legal responsibility
Decommissioning phase				
Scraps material and other debris	✓ Use of an integrated solid waste management system i.e. through a hierarchy of options. ✓ Wastes generated as a result of facility decommissioning activities will characterized in compliance with standard waste management procedures. ✓ The contractor will select disposal locations and the local council based on the properties of the particular waste generated ✓ All buildings, machinery, equipment, structures and partitions that will not be used for other purposes should be removed and reused or rather sold/given to scrap material dealers ✓ Where recycling/reuse of the machinery, equipment, structures and other waste materials is not possible the materials should be taken to approved dumpsites by a duly registered waste transporter.	Project Manager & Contractor	Decommissioning phase	To be determined
Vegetation disturbance Land deformation: soil erosion, drainage problems	✓ Implement an appropriate re-vegetation programme to restore the site to its original status. During the re-vegetation period, appropriate surface water runoff controls will be taken to prevent surface erosion; ✓ Monitoring and inspection of the area for indications of erosion will be conducted and appropriate measures taken to correct any occurrences; ✓ Fencing and signs restricting access will be posted to minimize disturbance to newly-vegetated areas;	Project Manager & contractor	During decommiosioning	To bedetermined

11 CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusion

During the preparation of this report, it is observed and established that most of the negative impacts on the environment are rated low and short term with no significant effect other than those mentioned with mitigation measures that accompanies any development. The project upon completion would realize several positive impacts which are highly rated and will benefit all the stakeholders. These include elimination of discharges of untreated sewage to sosiani river, lead to environmental conservation and management as pollution from septic tank/pit latrines (onsite sanitation) leakages will be eliminated, greater sewerage coverage in the town, provision of employment, and most significant of which being reduction of public health hazard as result of improved sanitation conditions in the service area. The positive environmental impacts the project will realize far out-scales the negative ones, which can be contained by the prescribed EMMP. The project has been planned in full cognizance of the requirements of the neighbourhood where it is to be implemented and all standard planning considerations have been taken into account and given the attention they deserve

It is therefore concluded that the proposed project will not compromise the wellbeing of the neighbours, area ecological and environmental conditions and will improve economic wellbeing of resident of Eldoret Town. It is therefore recommended that the proposed project be approved subject to the following recommendations:-

- ✓ RVWWDA/ELDOWAS should make all the necessary efforts to comply with conditions set in the various approvals and licenses issued by various authorities including Ministry of Lands, Physical Planning, Health Department, Uasin Gishu County Government and National Construction Authority
- ✓ Ensure implementation of the proposed mitigation measures and compliance with the ESMP during the project cycle.

11.2 Recommendations

Having considered the information collected, collated and analyzed through research in the field and literature search, the following conclusions were arrived at: The project does not pose any serious environmental concern, other than those mentioned with mitigation measures that accompanies any development; and, the project proponent should commence the project immediately once this report is approved;

RVWWDA/ELDOWAS will need to ensure the following:

- ✓ Effluent Monitoring by construction of a well-equipped simple water laboratory facility within the site for effective and efficient effluent analysis
- ✓ The staffs are equipped with the necessary facilities and skills for effective management of their safety, health and protection of the environment.
- ✓ Occupational, Health and Safety gadgets such as firefighting equipment, PPE, disaster management training, first aid training among others;
- ✓ that the entire project implementation will not cause any unnecessary disruption to public utilities, storm water/surface runoff drainage systems, ecological systems and human settlement. Whenever any of these problems or any other impact highlighted in this report are anticipated, then the management will take appropriate mitigation actions.
- ✓ Involvement of all relevant stakeholders is proposed throughout the process to ensure project acceptability;
- ✓ The design should ensure comprehensive waste water treatment to allowable limits by NEMA and WHO standards and the World Bank Environmental Health and Safety Guidelines, before releasing into the river;
- ✓ Ensure that worker's occupational health and safety standards are maintained through capacity building, proper training, providing protective clothing and managing their residential camps up to the required health standards;
- ✓ The local community should be sensitized to abate stealing of pipes and metals of the sewerage system, and;
- ✓ Once the project is complete, there is a need to develop plans to recycle waste for power production;
- ✓ Plant fast growing trees species known for good land rehabilitation capacity and no alellopathic effect round the perimeter of site to reduce or contain the odour. The best tree species include; casuarina equsitifolia and graveria robusta.
- ✓ Constant monitoring of the sosiani river water quality should be done to note any pollution detection and appropriate measures taken to correct the same.

- ✓ A proper resettlement action plan should be carried out to identify affected individuals and compensation done according to Kenyan laws and AfDB resettlement policies. This will prevent conflicts that may arise during project implementation
- ✓ RVWSB shall ensure that all natural resources including water, flora and fauna are protected and conserved during design, construction and operation

Further the following recommendations are made with respect to the contractor's responsibility;

- ✓ The Contractor shall ensure that construction of all facilities in the proposed Project is carried out in accordance with the designs;
- ✓ The Contractors and the Proponent shall ensure that the stakeholders' views are fully exhausted and that any unforeseen impacts shall be immediately addressed and mitigated;
- ✓ The Contractor shall ensure that the proposed mitigation are put in place to ensure that noise, vibrations and dust are managed to acceptable levels;
- ✓ The Contractor shall put in place measures to manage waste emanating from project construction activities;
- ✓ Land contamination and erosion shall be mitigated accordingly and measures shall be put in place by the Contractor to prevent the occurrence of such incidences;
- ✓ The Contractor will implement measures as proposed in this report and others in the field to ensure that fire incidents are prevented, minimized or managed;

Monitoring should include the following aspects

- ✓ Maintain appropriate monitoring points within the sewer plant
- ✓ Identify the most critical parameters to monitor including among others the BOD, COD, TSS, waste treatment efficiency of the facility, energy consumption trend and changes in social perception.
- ✓ Carry out annual environmental audit to ensure continued compliance with environmental regulations under the national laws.

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APPENDICES

Appendix A: project location

Appendix B: project designs

Appendix C: public consultation meetings minutes

Appendix D: public consultation forms and list of attendance

Appendix E: pictorial presentations

Appendix F: copy of TOR

Appendix G: practising licence

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local people
global experience

SMEC is recognised for providing technical excellence and consultancy expertise in urban, infrastructure and management advisory. From concept to completion, our core service offering covers the life-cycle of a project and maximises value to our clients and communities. We align global expertise with local knowledge and state-of-the-art processes and systems to deliver innovative solutions to a range of industry sectors.

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