



ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT FOR THE PROPOSED REHABILITATION AND AUGMENTATION OF HOMA BAY SEWERAGE TREATMENT SYSTEM, HOMA BAY COUNTY



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In Accordance with

Environmental Management and Coordination Act (EMCA), 1999

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Earthcare Services Limited wishes to gratefully acknowledge the enthusiastic efforts of LVEMP II in its role to ensure that the general principle of EMCA Act (1999) that calls for a clean and healthy environment is achieved by residents of Homa Bay. The report could not have been completed without the support accorded by key stakeholders. Of critical importance was the information availed from the enthusiastic neighbours to the project site, who participated in public participation.

An honourable mention goes to the role played by Homa bay County office, led by Richard Ogindo. NEMA office is equally acknowledged for its supervisory role played to ensure that the project is brought to fruition.

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Last but not least is the role played by Earthcare Services Limited who got involved in data collection, field visitation, public participation forum and report compiling namely Juliet Adhiambo, Hellen Mukuru, John Kuloba and Ignatius Barasa.

EXECUTIVE SUMMARY

An Environmental and Social Impact Assessment (ESIA) is a voluntary assessment conducted to identify, evaluate and develop management measures for environmental and social impacts associated with the construction and operation of a project. This study has been carried out within the framework of the guidelines and procedures spelt out in the Environmental (Impact Assessment and Audit) Regulations 2003 and Environmental Impact Assessment guidelines and Administrative procedures, and as a result of consultations with the project proponent.

This report details on a proposal by Lake Victoria Environmental Management Project phase (LVEMP) II in conjunction with the County government of Homa Bay to rehabilitate and augment the existing waste water collection system for Homa Bay town and its environs. Homa Bay town is the capital of Homa Bay County; it lies on 0°27'S and 0°52'S Latitudes and 34°12' E and 34°40'E Longitudes lines. The town stands on the C19 road that links Kisii to Kisumu through Homa Bay.

The existing sewerage system is managed by Homa Bay County and consists of mains, trunks and outfall sewer lines. Currently, it is faced with many challenges thus functioning below optimal. The proposed project main aim is to avert the lake pollution and safeguard the health of the population in the town; increase sewerage network to cover the areas with permissible densities for connection and augment the capacity in order to meet the future demand

The whole process shall dwell on rehabilitation and augmentation measures for the existing wastewater treatment system. It is proposed that new intake works shall be constructed, an anaerobic pond of dimensions 85m x 30m x 4m depth, rehabilitation of existing settling tanks with augmentation by construction of two 5m radius settling tanks, rehabilitation and equipping of sludge pump house, construction of new sludge thickening tank, construction of new sludge drying beds and rehabilitation of the existing maturation ponds at an estimated project cost is Kshs 195,507,677.50

The aim of this Environmental Impact Assessment (EIA) is to examine both the positive and negative effects that this proposed undertaking is likely to have on both the physical, socio-cultural, and economic environment. The EIA process is an important planning tool for the project proponent as it will inform on significant project effects and clearly define mitigation measures to avoid or curb adverse impacts. Early identification of possible impacts promotes environmental sustainability as anthropogenic factors are balanced with natural environmental needs. The Study sought to identify possible impacts that would arise as a result of the projects' activities. It also sought to recommend workable mitigation measures and formulate an Environmental Management and Monitoring Plan to curb the negative impacts

The study was carried out through extensive desktop study and field investigation. During the field investigations, reconnaissance survey was conducted to gather information on biophysical and socio-economic aspects of the area and its environs. The Environmental Impact Assessment study has been undertaken by the proponent in compliance with Kenya's legislation namely Public Health Act, OSH Act 2007, EMCA 1999 among others.

As a result of the screening and scoping of environmental issues, positive and negative impacts associated with the proposed project were identified. The positive impacts included:

- i) Connection to the sewer line of areas with permissible densities which have not been served by the existing sewer line;
- ii) The proposed activities will avert pollution of Lake Victoria since all waste water will be adequately treated before allowing it to flow to the lake.
- iii) The proposed activities will cater for projected increase in volume of waste water as a result of increased population in the future, up to 2043.

- iv) Provision of employment opportunities during construction and operation phases- Labour is a must therefore residents will have ready opportunities which shall boost their daily income.
- v) The rehabilitation will protect the sewer lines from storm water by enhancing storm drains with concrete. The sewer lines shall be protected from exposure and breakages.
- vi) Flushing, cleaning and De silting of the existing sewer line will address the problem of blockages being experienced and also expand the size of the pipes ferrying waste water.
- vii) The proposed project will centralize wastewater treatment system in Homa Bay which will make pollution monitoring easy.
- viii) There shall be improved aesthetic value of the area of the area due to cleaning up of the mess that is currently experienced in Storm water drains in the towns and the site of blocked drains.
- ix) Sludge from the Stabilization ponds is a rich resource that can be utilized by the community around as fertilizers,
- x) Installation of electrical/mechanical equipments ranging from blowers, scrappers, compressors, sludge pumps etc were either vandalized, broken or out of use will play a huge role in achieving acceptable sewerage design standards.

Anticipated Negative impacts included

Against the background of the positive impacts there will be negative impacts emanating from the rehabilitation, augmentation and subsequent operation activities of the sewage system. They include the following:

- ❖ Impact to soil (soil erosion and degradation) especially when laying the foundation, demolition and other earthworks;
- ❖ Increased noise and vibration generated by construction machinery and plants during construction phase;

- ❖ Visual Intrusion; likely to occur during earthworks for the foundation of the project.
- ❖ Air pollution as a result of dust particles emanating from excavation, demolition, and noxious smells from cleaning and flushing of blocked sewer lines. Also unpleasant smells may emanate from garbage which has been stuffed into the manholes.
- ❖ The health and safety of workers and immediate residents and neighbours may be compromised due to accidents involving tripping into open trenches, holes at construction sites; diseases caused by pathogens from waste water which shall be accidentally flowing out during unblocking and de silting and also from pungent smells from the demolition of manholes and replacement of sewer lines thus exposing effluent.
- ❖ Increased waste generation (both solid and liquid) during construction and operation phases.
- ❖ Safety issues arise from being exposed to physical strain from manual handling of materials and machines during the construction phase.

Mitigation Measures to the anticipated negative impacts.

- ❖ 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

Conclusion

In this scoping and screening process on environmental elements, including social and economic, we conclude that the project meets a threshold requirement of a Finding of Significant Impacts (FOSI) under established environmental examination procedures, and as stipulated under EMCA (1999) EIA procedures (2003). This environmental examination process therefore establishes a negative determination of the impacts on the environment and hence recommends that the proposed rehabilitation and augmentation of Homa Bay Sewerage System be implemented with full adherence of the Environmental Monitoring and Management Plan

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ACRONYMS AND ABBREVIATIONS

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
KPLC	Kenya Power and Lighting Company
LVEMP	Lake Victoria Environmental Management Project
NEAP	National Environmental Action Plan
NEMA	National Environmental Management Authority
OHS	Occupational Health and Safety
TOR	Terms of Reference
WRMA	Water Resources Management Authority

ANALYTICAL CONCEPTS

Finding of Significant Impact The screening and scoping process establishes that the project has negative impacts on environment and therefore should be subjected to further study

Impact A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem, or property by causing nuisance.

Negative determination The project does not cause any negative impact on the environment; the project has only positive impacts

Negative determination with conditions the project causes negative impacts on the environment but they can be effectively mitigated through implementation of the environmental management plan

Positive Impact A change which improves the quality of the environment (for example by increasing species diversity or improving the reproductive capacity of an ecosystem; or removing nuisances; or improving amenities).

Significant Impact An impact which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.

Sewage is wastewater and waterborne wastes conveyed in a pipeline (sewer), generated principally by residential facilities; it may also include wastewater and waterborne wastes from other facilities such as industrial, agricultural, commercial, tourist or recreational facilities

1.0 INTRODUCTION

1.1 Background Information about the project

A major function of an Environmental and Social Impact Assessment (EISA) is to provide information on the potential environmental impacts of a proposal. This report outlines the matters which an EISA for a sewerage system proposal may need to include fulfilling this function. In particular, the details in the EIS should reflect the level of significance of the potential impacts on the environment.

Sewage treatment plants are constructed to transform raw sewage into an easier manageable waste and to retrieve and re use the treated sewage water, if possible. The end products of treatment plant are sludge and treated sewage water. Both products may contain, in addition to organic biodegradable substances and micro organisms, non- biodegradable and toxic substances due to the contamination of sewage with industrial waste waters.

From the environmental standpoint the most important aspect of a sewage treatment plant is the proposed disposal or use of the sludge and the treated sewage water.

The operation of a sewerage system may include the following processes. 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. The system may be vented.

Sewage is treated to meet certain target effluent standards. Bio solids, screenings and other residuals are produced. Treatment processes may range from simple physical treatment such as screening to sophisticated technology such as biological treatment, chemical treatment, advanced physical treatment using membrane technology and bioengineering methods. Overflows may occur when the hydraulic capacity of the treatment system is exceeded.

Treated effluent is conveyed through pipelines or tunnels, with or without pumps, to the sites of its use, temporary storage or final disposal. Before treated effluent is used or applied to land, it may be stored temporarily to cater for the users' demand variation or inability of

the land to accept effluent during wet weather. Overflow may occur when the storage capacity is exceeded.

Treated effluent may be used for irrigation of agriculture, landscaping, mine rehabilitation or Forestry. It may be utilized as non-potable process water in industrial plants or as non-potable water in a dual domestic water system. It may also be used as a potable water supply. Disposal options for any excess treated effluent may include evaporation basins, sand filtration or discharge into water bodies such as rivers or oceans at purpose-built outfalls.

1.2 Project Proponent's background and Philosophy

The Lake Victoria Environmental Management Project Phase II (also known as LVEMP II) is an East African Community project under implementation in the five countries that share the Lake Victoria Basin namely Burundi, Kenya, Rwanda, Tanzania and Uganda. It is a transboundary project designed to achieve two development/global environmental objectives. Firstly, the project is meant to improve collaborative management of transboundary natural resources of Lake Victoria Basin and, secondly, reduce environmental stress in the targeted pollution hotspots and selected degraded sub-catchments as a means of improving the livelihoods of communities who depend on the natural resources of the Basin. The project comprises four main components: (i) Strengthening institutional capacity for managing shared water and fisheries resources; (ii) Point source pollution control and prevention; (iii) Watershed management; and (iv) Project coordination and management.

Component 1: Strengthening institutional capacity for managing shared water and fisheries resources

This component focuses on strengthening the existing institutions to improve the cooperative management of shared transboundary natural resources of the Lake Victoria Basin. The component finances the capacity building programmes of the regional, national, and local institutions for coordination, research, management of resources, and enforcement

of environmental standards. These include the Lake Victoria Basin Commission and the Lake Victoria Fisheries Organisation at the regional level; the national authorities/offices, fisheries, and environmental management institutions; local government authorities, and community-level organizations, such as Beach Management Units.

Component 2: Point Source pollution control and prevention

This component focuses on reducing environmental stresses within the Lake and its littoral zone, through the implementation of mitigation and prevention measures. The component finances investments aimed at reducing point sources of pollution in priority hotspots, through three sub-components: (i) Rehabilitation and improvement of wastewater treatment facilities; (ii) Promotion of cleaner production technologies; and (iii) Pollution risk management and safety of navigation.

The sub-component on rehabilitation and improvement of wastewater treatment facilities aims at reducing point source pollution from municipal waste by supporting public investments like the rehabilitation and improvement of selected wastewater facilities in order to reduce untreated effluents in the Lake; connecting primary treated effluent discharge to constructed or restored wetlands; and providing on-site sanitation facilities. These interventions will lead to reduced amount of untreated wastewater discharged into the Lake by targeted lakeshore cities, towns and communities.

The sub-component on promotion of cleaner production technologies aims at reducing industrial pollution by promoting on-site pre-treatment of factories' waste and efficiency in raw material utilization through sorting, reuse, and recycling activities. These interventions will lead to increased adoption of cleaner production technologies by targeted industries.

The sub-component on pollution risk management and safety of navigation is contributing to the prevention of marine vessel accidents, which could be a major source of pollution and to the improvement of safety of navigation for both cargo and passenger ferries and fishing vessels.

Component 3: Watershed management

This component focuses on the reduction of environmental stresses – like sediment loads, nutrients, and agro-chemicals – from the Lake Basin through the implementation of non-point sources pollution mitigation and prevention measures. It is supporting community-driven investments in rehabilitating three priority degraded sub-catchments of Lake Victoria. These include catchments of rivers Simiyu in Tanzania; Nyando in Kenya; and Katonga in Uganda. This component has got two sub-components: (i) Natural resources conservation and livelihoods improvement; and (ii) Community capacity building and participation.

The sub-component on natural resources conservation and livelihoods improvement is providing grants to communities in order to promote local partnerships in addressing degradation of the watershed. This sub-component is expected to increase sustainable land management and natural resource conservation practices by participating communities in targeted sub-catchments.

The sub-component on community capacity building and participation is mobilizing communities and building their capacity in the preparation and implementation of CDD-type subprojects in watershed management. It is also creating community awareness about the key environmental issues of the Lake Victoria Basin. This sub-component will enhance communities' ability to plan, implement, and monitor watershed management interventions in targeted sub-catchments.

Component 4: Project coordination and management

The component focuses on effective coordination and communication as well as monitoring and evaluation of the project activities.

1.3 Back ground and rationale of ESIA study

In an attempt to comply with national and international legislations and protocols, LVEMP II has contracted the services of Earthcare Services Limited, a NEMA registered firm of

environmental experts to carry out an Environmental and Social Impact Assessment for the proposed rehabilitation and augmentation of the Homa Bay Sewerage System. The assessment is meant to address any possible negative impacts, environment-related and social conflicts that may result from the activities of the proposed project. This will in the long term ensure not only a safe and clean environment, but also ensure that the proposed development activities are in conformity with the existing rules and regulations.

1.3.1 Objective of the project

The objectives of the proposed development include:

- Extensive rehabilitation of the existing facilities at the sewage treatment works and the entire sewer network as shown per the recommendations of the feasibility report.
- The project will reach the areas which have not been served by the existing sewer line;
- Provision of employment opportunities during construction and operation phases;
- It will address the problem of blockages being experienced and also expand the size of the pipes ferrying waste water
- Achievement of the acceptable quality of final effluent water released to the lake as per EMCA (Waste Regulations,2006)
- The proposed project will centralize wastewater treatment system in the town which will make pollution monitoring easy.
- Improved aesthetic value of the area of the area due to cleaning up of the mess that is currently experienced in Storm water drains in the towns and the site of blocked drains.

1.3.2 Specific Objectives of the project

The specific objectives are outlined in the proposed works (In the feasibility report) as shown in this table;

<i>Component</i>	<i>Brief Description of Works</i>
Sewerage System	
Sewers	<p>Desilting and flushing the entire sewer network with water under pressure</p> <p>Provision of rodding sticks and equipment</p> <p>Provision of sewage exhauster truck with pump, hose and accessories</p> <p>Replacement of all sewers of below Dia. 225 with 225mm dia. Pipes</p>
Manholes	Flushing manholes replacement of manhole covers, ladders and step irons repairs/replacement
Property connections	New connections comprising of 150mm dia. Sewer pipes, backdrops, Y-junctions, masonry inspection chambers with concrete covers
Waste stabilisation ponds -Internal Works	
Site clearance	<p>Bushes, debris and other deleterious material</p> <p>Reconstruction of internal service road, including storm water drainage</p>
Inlet works	Rehabilitation of the inlet works
Aeration lagoons	<p>Modifying the existing two Number aerated lagoons to become one anaerobic pond of dimensions 85m x 30m</p> <p>Construction of one 85mX30 m anaerobic pond</p>
Settling tanks	<p>Dislodging</p> <p>Rehabilitation of the existing two number settling tanks</p>
Pump house	<p>New submersible electric pumps</p> <p>Rehabilitation of components and equipments</p>
Stand by generator	One diesel generator for emergency power supply source during main electric power supply failure

Sludge drying beds	shifting of the existing sludge drying beds to near the pumping station
Sludge thickening tank	shifting of the existing sludge thickening tank between the sludge drying beds and the pump house
Embankment clearance	Clearing of bushes and debris Placing top soil and grassing of the embankment slopes
Maturation ponds	General clearance and uprooting of all vegetation and compaction of reservoir floor Desludging
Top water level concrete slabs	Replacement of 600x600x50mm PCC paving slabs including 10mm compacted gravel bedding
Waste stabilisation ponds -External Works	
Perimeter fence	New chain link fencing with concrete posts, barbed wire for top crank section
Access road	Rehabilitation and improvement to gravel standards (all weather) of the main access roads
Main gate	Steel gate with double leaves, a wicket door
Administration building	
Administration building	Demolition and rebuilding elsewhere on the same site of existing facility to allow construction of anaerobic pond

Table 1: The specific objectives of the project

1.3.3 Objectives of the ESIA the study

The main objective of the ESIA study is to carry out a systematic examination of the present environmental situation within the project area to determine whether the proposed project

will have any adverse environmental and social impacts to the surrounding area. Specifically, the study set out to achieve the following objectives:

- i. To identify and evaluate the significant social & environmental impacts of the proposed project with special emphasis on:-
 - a. Health and Safety issues of the public and the workers
 - b. Management of mobility and accessibility to shops and homesteads by the residents during the rehabilitation works
 - c. Traffic flow along and on adjacent roads along the proposed sewer network
 - d. Solid waste management-Debris and others materials
- ii. To incorporate the environmental management plan and monitoring mechanisms during implementation and operation phases of the project.
- iii. To propose adequate mitigation measures for the identified negative impacts.

1.3.4 Scope of the study

The study has been conducted to evaluate the potential and foreseeable impacts of the proposed rehabilitation and augmentation of the Homa Bay Sewerage system. The physical scope is limited to the proposed sites where the system passes. Any potential impacts, (localized or delocalized) are also evaluated as guided by EMCA 1999 and the Environmental (Impact Assessment and Audit) Regulations 2003. This report includes an assessment of impacts of the proposed site and its environs with reference to the following:

- ❖ A review of the policy, legal and administrative framework
- ❖ Description of the proposed project
- ❖ Baseline information (Biophysical and Socio-Economic environment)
- ❖ Assessment of the potential environmental impacts of the proposed project on the biophysical, socio-economic and cultural aspects.
- ❖ Development of the mitigation measures and future monitoring plans.
- ❖ Occupational Health and Safety (OHS)

The study also assesses the impacts of the proposed development on the environment in accordance with Environmental Management and Coordination Act, of 1999 and the subsequent Environmental (Impact Assessment and Audit) Regulations, 2003.

1.3.5 Terms of Reference (TOR)

The project assessment investigations and analysis of the anticipated environmental impacts of the proposed development in line with terms of reference stipulated in the Environmental (Impact and Audit) regulations 2003 and in particular part II S 7[1] and which are listed below.

- Nature of project.
- The location of the project including the physical environment that may be affected by the project’s activities.
- The activities that shall be undertaken during the design of the project, construction and operation.

1.3.6 Project budget

This is an abstract of the feasibility study on estimated costs.

<i>Item</i>	<i>Description</i>	<i>Amount Kshs.</i>
1	Existing Sewerage System	
1.1	Sewers and manholes	18,144,625.00
1.2	Pump Station	5,950,000.00
1.3	Sewerage works-Ponds and settling tanks	27,950,000.00
1.4	Property Connections	13,280,000.00
<i>Sub-Total 1</i>		65,324,625.00
2	New Sewerage System	
2.1	Secondary Sewers and manholes	42,702,052.50
2.2	Inlet works	1,000,000.00
2.2	Anaerobic Ponds	19,130,000.00

2.3	Settling tanks	50,000,000.00
2.4	Perimeter fence and Access road	12,251,000.00
Sub-Total 2		125,083,052.50
3	Administration office and Laboratory	
3.1	Administration office and Laboratory	5,100,000.00
Sub-Total 3		5,100,000.00
Grand total= Subtotals (1+2+3)		Kshs 195,507,677.50
Exchange rate: Kshs 86=1US\$		\$ 2,273,345.09

Table 2: The Project Budget

2.0 PROJECT DESCRIPTION

2.1 Nature of the project

The whole process shall dwell on rehabilitation and augmentation measures for the existing wastewater treatment system comprises of rehabilitation and augmentation of preliminary treatment unit for screening and grit removal, construction of anaerobic ponds, rehabilitation and augmentation of the existing settling tanks and maturation ponds.

2.2 Existing Sewerage system.

Most of the generated waste water from the town is collected and conveyed through the main sewer lines to the waste water treatment plant. The treatment plant is composed of inlet works, two aerated lagoons, two settling tanks, two stabilization lagoons and sludge drying beds.



Figure 1 : Lagoon and water inlet at the sewage treatment, near the lake.

2.3 Justification of the proposed project

The existing sewerage coverage is about 25%. The rest of the populace use on-site facilities such as septic tanks, VIP latrines and pit latrines. Most of the residents of Shauri yako, Sofia and Got Rabuor indicated that they are not connected to the main sewer network of the town.

Therefore an improved sanitation and solid waste management plan is urgently required in Homa Bay Town as a prerequisite that can avert the lake pollution and safeguard the health of the population in the town.

There is need of the areas served with water to be likewise connected with sewer lines for waste water collection and a review of capacity and immediate measures to augment the system for the future demands. A new and fully conventional system which is not energy dependent is the only eventual solution to the current problems being encountered

2.4 Project Activities Description

2.4.1 Existing sewerage system-rehabilitation and improvement of works

The existing facilities at the sewage treatment works and the entire sewer network require extensive rehabilitation.

It is proposed that new intake works shall be constructed, an anaerobic pond of dimensions 85m x 30m x 4m depth, rehabilitation of existing settling tanks with augmentation by construction of two 5m radius settling tanks, rehabilitation and equipping of sludge pump house, construction of new sludge thickening tank, construction of new sludge drying beds and rehabilitation of the existing maturation ponds.

The following table details the major components of improvement works.

Component	Brief Description of Works
Sewerage System	
Sewers	Desilting and flushing the entire sewer network with water under pressure
	Provision of rodding sticks and equipment
	Provision of sewage exhauster truck with pump, hose and accessories
	Replacement of all sewers of below Dia. 225 with 225mm dia. Pipes

Manholes	Flushing manholes replacement of manhole covers, ladders and step irons repairs/replacement
Property connections	New connections comprising of 150mm dia. Sewer pipes, backdrops, Y-junctions, masonry inspection chambers with concrete covers
Waste stabilisation ponds -Internal Works	
Site clearance	Bushes, debris and other deleterious material
	Reconstruction of internal service road, including storm water drainage
Inlet works	Rehabilitation of the inlet works
Aeration lagoons	Modifying the existing two Number aerated lagoons to become one anaerobic pond of dimensions 85m x 30m
	Construction of one 85mX30 m anaerobic pond
Settling tanks	Desludging
	Rehabilitation of the existing two number settling tanks
Pump house	New submersible electric pumps
	Rehabilitation of components and equipments
Stand by generator	One diesel generator for emergency power supply source during main electric power supply failure
Sludge drying beds	shifting of the existing sludge drying beds to near the pumping station
Sludge thickening tank	shifting of the existing sludge thickening tank between the sludge drying beds and the pump house
Embankment clearance	Clearing of bushes and debris
	Placing top soil and grassing of the embankment slopes

Maturation ponds	General clearance and uprooting of all vegetation and compaction of reservoir floor
	Desludging
Top water level concrete slabs	Replacement of 600x600xx50mm PCC paving slabs including 10mm compacted gravel bedding
Waste stabilisation ponds -External Works	
Perimeter fence	New chain link fencing with concrete posts, barbed wire for top crank section
Access road	Rehabilitation and improvement to gravel standards (all weather) of the main access roads
Main gate	Steel gate with double leaves, a wicket door
Administration building	
Administration building	Demolition and rebuilding elsewhere on the same site of existing facility to allow construction of anaerobic pond

Table 3: Summary of rehabilitation works

2.4.2 Proposed New works

The new works for the proposed rehabilitation and augmentation will comprise of the following components:

1. Sewers, manholes and property connections
 - Sophia to CBD to treatment works- Total length: 3,128 m and 65 manholes
 - Shauri Yako area to CBD to treatment works: 1,950m and 40 manholes
 - Makongeni to treatment works: 1,420m and 30 manholes
2. Construction of the anaerobic pond
3. Construction of the Settling tanks
4. Construction of the administration building

2.5 Design criteria

The following factors were taken into account during analyzing or determining the type of wastewater collection, conveyance, treatment and disposal techniques that would be more appropriate for the Homa Bay Municipality:

1. Wastewater quality;
2. Prevailing ground and soil conditions at the various sites;
3. Cost-effectiveness of the alternatives;
4. Availability of operational and maintenance skills;
5. Availability of adequate land.

In general the aim of the sewage treatment process to be rehabilitated and augmented shall ensure that the sewerage system efficiently treats waste water to acceptable National Environmental Management Authority (NEMA) and Water Resources Management Authority (WRMA) standards.

2.6 Construction activities and inputs

All the construction inputs shall be obtained from licensed dealers. The following will be required for successful implementation of construction activities:

- Construction tools and equipment including machinery mainly transportation vehicles will be used for the transportation of materials and in the execution of the proposed works.
- A construction labour force of both skilled and non skilled workers
- Water for construction purposes

2.6.1 Input during construction

Typical inputs which will be used in construction phase are, Land, Water to be obtained from the existing piped water by South Nyanza Water Services Board Limited. The materials that shall be used include building sand, aggregates, natural stones, hand cut construction

stones, timber for making structural formwork of the administration building. Others include concrete block for constructing selected internal and external pavements, precast units for drains, PVC pipes for sewer and water reticulation, paints, electrical wiring and fitting, barbed wires, wire mesh and other hand held tools will also be needed.

2.8 Operation and maintenance

2.8.1 Sewage collection and transmission works

In order to achieve the purpose of O&M of sewer pipes, an appropriate management plan, including preventive maintenance, is mandatory. Systematic maintenance is required to make the sewer system function in the most efficient way. The proposed sewage O/M work include the activities listed Table.

Purpose of Work	Scope of work necessary
Inspection of present condition	Visual inspection and logging of condition of inside & outside of sewers and diversion manholes Inspection of internal condition of sewers Investigation of flooding problems including lifting of manhole covers due to surcharging Investigation of odour problems and establishing of counter measures
Maintenance of Sewer functions	Sewer cleaning works Supervision of construction work in proximity to sewers Repair of damaged facilities and pipes
Improvement of sewers	Improvement and rehabilitation work to renovate pipes and other facilities Improvement measures to prevent flooding

Table 4: The proposed sewage O/M work

2.8.2 Sewage treatment works

Wastewater stabilization ponds are unique among sewage treatment systems in their ability to continue in operation and providing a high quality effluent, despite poor or even non-

existence maintenance. However, such neglect may cause mosquitoes, flies and odour nuisance and will eventually lead to the clogging of screens and gradual filling up of the ponds, limiting their capacity to handle sewage. Pond systems require minimal simple maintenance and this should be undertaken regularly to ensure that they remain in good condition.

The operation and maintenance duties for a typical waste stabilization pond system should include the following items:

- For the manually operated bar screens, regular cleaning and daily burial or burning of screenings should be carried out.
- Embankments vegetation should be kept short and not allowed to extend into the ponds. Grass may be permitted to grow down to the edge protection slabs only. Otherwise the water's edge should be sprayed with weed killer.
- Scum on maturation ponds should be removed and broken up. Scum and algae mats should be dried and disposed off by burying them nearby. Scum on anaerobic ponds aids the treatment process and should be left to form a hard crust, but sprayed to prevent any flies from breeding.
- Inlets and outlets weirs of the various facilities should be kept free from accumulating solids.
- Any vegetation emerging through the hard edge protection or from the pond liquid should be removed.
- Regular records should be kept of flow rates into and out of the pond system and the influent and effluent quality should be regularly monitored.
- A careful watch should be kept for evidence of embankment damage caused by burrowing rodents, snakes, ants etc. Fencing should keep out larger animals such as water buffalo or hippopotamus and other unwanted people.

- Pond cleaning should be undertaken when the pond is approximately half full of sludge. This will generally occur every two years with an anaerobic pond, or every twenty years or more for a maturation pond.
- Sludge removal can be carried out by raft mounted sludge pumps or by manual removal and carting away, which appears to be a more common method.

2.9 Construction activities and timetable

The construction activities shall begin from the time NEMA gives approval and license. Materials from the demolished structures, excavations of the ground and foundation work will be reused for earth works and landscaping.

3.0 STUDY AREA

3.1 Physical environment

3.1.1 The location of the project

Homa Bay is located in the western part of Kenya on the shores of Lake Victoria, about 100km from Kisumu City. It is the major social, economic and political centre of the South Nyanza region. The town covers an area of 23km² out of which only 3km² falls within the Central Business District (CBD). The town covers the Sub locations of Arujo, Homa Bay town and Asego.

Homa Bay Municipality is located on the 0°27'S AND 0°52'S Latitudes and 34°12' E and 34°40'E Longitudes lines. The town stands on the C19 road that links Kisii to Kisumu through Homa Bay.

The town is accessible by railway, national trunk road, water and air (via the Homa Bay Airstrip). Its location nationally plays a significant role as a lake trade route with the neighbouring countries of Uganda and Tanzania. It is also the County headquarters of Homa Bay County.

The Municipality is administratively divided into several wards and the wards covered by the project are Asego, Homa Bay Town and Arujo.

The study area generally is the area bounded by Arujo River to the East, Lake Victoria to the West, the entire Homa Bay town CBD and Shauri Yako area to the South.

3.2.2 Topography

The Homa Bay area has a gently rolling terrain that flattens towards Lake Victoria. It is characterized by various hills standing separately. Most parts of the Homa Bay area drain westwards to the lake except the areas of Got Rabuor, Arujo and parts of Sofia, which drain into the Arujo stream which eventually drains into Lake Victoria.

The Municipality of Homa Bay is located on the lakeshore lowland, which ranges between 1143 to 1220 meters above sea level and comprises of a narrow stretch bordering Lake

Victoria. At the end of lakeshore lowland lays Homa Bay. The bay is skirted by a shoreline stretching for approximately 16.5 km covering parts of Asego and Rangwe Divisions.

3.2.2 Precipitation

Homa Bay area experiences two rainy seasons; the long and the short rains, which fall between February and March and between the months of August and November respectively. The area can be characterized as tropical equatorial climate with convectional type of rainfall and temperatures affected by the land and sea breeze due to the proximity with Lake Victoria.

The rainfall pattern ranges between 250 and 700mm per annum. In Asego Division the rainfall is relatively low compared to other divisions. The rainfall probabilities and nature of soil determine the activities of small scale farmers around the Homa Bay area. Crops grown here are, therefore those requiring low rainfall like cassava, millet and sunflowers.

3.2.3 Wind

Generalized wind speeds average about 4 m/sec and have certain regularity due to the convection effect of the large water body of the lake that borders the often hot dry land.

3.2.4 Temperatures

Temperature varies with altitude and proximity to the lake and tends to increase towards the low land with an average of 17.10 to 34.80 centigrade. Temperatures are highest between December and March with the hottest weather being experienced in February and the lowest in April and November.

3.2.5 Soils

The soil type is black cotton soil, which is difficult to work upon with simple hand implements. It is also difficult to work on during heavy rains, making farming difficult. The lake shore lowland is dominated by alluvial soils, mainly the sandy loam type which is well drained and suitable for cotton, sunflower, maize, beans, cow peas and vegetable production.

3.2.6 Geology

Homa Bay area lies in the Kavirondian and Nyanzian system of rock of the Precambrian era. The municipality is underlain by various rock types, namely, agglomerates, conglomerates, tuff sandstone, granite and other deposits which are useful in the construction industry.

3.2.7 Existing Water Facilities

The main source of water for the area is the Homa Bay intake works situated some 200 m south of the Homa Bay Pier and drawing raw water from Lake Victoria through two intakes. The water supply infrastructure belongs to and is operated by the South Nyanza Water Services Board Limited while the sewerage system is owned and operated by the Municipality of Homa Bay.

3.2.8 Flora

The Proposed project area is dominated by grass, scattered mature trees and shrubs. Some of the identified trees include; *Eucalyptus globulus*, Cyprus, Pine, Acacia, Cactus.

3.3 Social environment

3.3.1 Population

At the time of the 2009 population and housing census, the total estimated residential population of Homa Bay Municipality consisting of Arujo, Asego and Homa Bay Town had a population of 35,816. The female population stood at 18,561 while male population stood at 17,255. The total number of households were estimated at 8,854 with a population density of 1,684 People per Km². The annual inter-censal growth rate was 2.7%, an increase that takes place mainly through natural increase and in-migrations. The natural growth of Homa Bay is high owing to a number of factors; high fertility rates at 7.1% and low acceptance of family planning, natural increase takes place at high rates because of high fertility rates, low acceptance of family planning, which stands at 35% and decreased mortality rates.

3.3.2 Hospitals, Dispensaries and Health Centres

The MoHB has the highest concentration of health facilities in the County. These facilities are run by the GoK, private sector and Non-Governmental Organizations (NGOs). The health facilities operating include hospitals, maternity and nursing homes, health centres, dispensaries and clinics. Apart from the district hospital, there are also nine private health centres run by Catholic Church, seven private clinics, one health centre belonging to the Anglican Church and several private and public VCT centres.

3.3.3 Education Facilities

Education services in Homa Bay Municipality include pre-primary, primary, secondary and tertiary education. Education service providers include the government and the private sector.

Early Childhood Development (Nursery)

There are 58 Early Childhood Development (ECD) Nursery schools of which 25 are public and 33 private. These facilities are within the range of 500 square meters, thus making access easy for pupils. At the moment, the facilities are more than enough since the majority are managed by the private sector and always placed where there is demand.

3.4 Built Environment

3.4.1 Roads

Homa Bay County has a total of 645 Km of both classified and unclassified roads and all these roads affect the transportation network of the municipality. The roads consist of the newly constructed, Homa Bay – Rongo tarmac road, Homa Bay - Kendu Bay tarmac road and the newly upgraded Homa Bay - Mbita Road. The roads in the CBD are bitumen surfaced and have been recently rehabilitated.

Roads connecting the municipality with the residential estates are earth/ gravel surface. Some of the roads are often impassable during the heavy rains.

3.4.2 Water transport

There is a concrete pier at the harbour which used to be run by the Kenya Railways but has been shut down due to the water hyacinth menace that made navigation impossible. The shipping route to Homa Bay has since been recalled because of the receding waterline and the water hyacinth. However, the small boats and canoes that ply various lake routes still link Homa Bay and other lakeshore destinations. These routes include:

- Homa Bay to Kisumu
- Homa Bay to Kendu Bay,
- Homa Bay to Mfangano Island,
- Homa Bay to Kampala, Uganda, among other high potential routes

3.4.3 Air transport

The airstrip that serves MoHB is located 8 Km southeast of the municipality at Kabunde. The major function of the facility is to facilitate air transport for tourists travelling from Nairobi, Maasai Mara, and other tourist attraction centres to Ruma Game reserve, Simbi Nyaima, Rusinga Island and Mfangano Island. It is mainly used by light aircraft.

3.4.4 Energy Sources

The main energy sources are electricity, petroleum fuel and fuel wood. The main energy sources for cooking are kerosene, charcoal and firewood. Use of electricity and petroleum gas for cooking is limited. For lighting, the main sources are kerosene and electricity. The majority of these consumers (about 65%) are domestic. Industrial consumers are negligible. The report reveals that the electricity supply is inadequate to meet the demand since there were a high number of applicants on the waiting list.

3.5 Economic dimensions

3.5.1 Commerce and Industry

Formal and informal sectors thrive in Homa Bay Town where heavy industrial processing factories, medium factories, commercial institutions, horticultural and subsistence farming,

livestock keeping-beef and dairy, wholesale, retail business, motor-vehicle garages, an abattoir that provides Homa Bay with meat is in the town. These activities continue to play a key role in enhancing employment opportunities.

These formal industries are industries that operate under law and are regulated by the government licensing and fiscal regimes. The industries in MoHB operate within a framework of fish-processing, by product of fish processing, boatbuilding and fishing gear repairs. Others are agro-based industry like the defunct cotton ginnery.

The most remarkable industry in MoHB is Capital Fish which produces Nile Perch fillets for exports.

Informal sector commonly referred to as Jua Kali form the basis of industrial development in the MoHB. The Jua Kali sector has a direct linkage with the agricultural, building/construction and industrial sectors for demand and supply of both Jua Kali inputs and finished products.

3.5.2 Land Use and Tenure

In Homa Bay town, the land tenure system is such that within CBD there is trust land and leasehold (99 years). Areas of Kalanya and Katuma have a freehold land tenure system, while areas of Kothidha and Kanyadier are community land under a land adjudication programme.

3.5.3 Land Ownership

Most of the landowners in Homa Bay have land whose size ranges from an eighth to 20 acres. However, most households living in Homa Bay own land ranging between an eighth to 3 acres with the majority, about 23.7% owning a quarter acre.

The land has been sub-divided to sizes uneconomical for agricultural activities.

Economic Activities and Livelihoods

3.6 Current Waste water management in Municipality of Homa Bay

The wastewater disposal system used in the MoHB includes sewerage, septic tanks, soak pits and pit latrines.

The storm water drainage network is indeed poor and inadequate. The municipality does not have a comprehensive storm water drainage system, but they have two types, primary and secondary networks.

Primary Drainage

The primary drainage system consists of natural streams and valleys that drain the municipality. This natural system adequately drains the municipality.

The only limitation is that the natural flow of streams has been interrupted by development and building activities. The natural causeways have, therefore, in due course been blocked.

Secondary Drainage

The secondary drainage system consists of the manmade drainage system. The secondary drainage system in many parts of the municipality is totally inadequate and/or totally lacking in the CBD. The storm water drains are often broken down and many are blocked by solid waste. Along the main streets in the CBD, manhole covers and the slabs are broken and deep drains are left open.

In many areas, the drains are not lined. This leads to serious erosion because of the steep land slope, deep loose soil and heavy rainfall storms experienced in the area. The drainage system has also been blocked by encroachment of business and building activities.

3.7 Solid Waste Management

The management of solid waste is the responsibility of the Homa Bay Municipality. The MoHB is limited in terms of solid waste collection. Solid waste is dumped in an abandoned quarry in at the foot of Asego Hill, adjacent to the cemetery and Homa Bay High School. The amount of waste collected is not known as the municipality does not keep the records. Solid waste is dumped in an abandoned quarry in at the foot of Asego Hill, adjacent to the

cemetery and Homa Bay High School. The tipping is not controlled and scavenging of waste is common.

3.8 Physical Planning

Homa Bay Municipal Council is a body created within the framework of the Local Government Act (Cap 265) which stipulates the roles and responsibilities of all local authorities. The council comprises of two arms, namely the legislative arm and the executive arm.

Homa Bay Municipal Council relies on the services of the Homa Bay County Physical planner to ensure the successful implementation and enforcement of the Local Physical Development Plan.

4.0 PROJECT ALTERNATIVES

4.1 Introduction

This section examines alternatives to construction of the proposed development in terms of the site, products, materials, technology and waste management. Also, impacts of each alternative are identified, discussed and compared with those of this development proposal. With such information, reviewers have basis for decision making.

4.2 Site Selection

The proposed rehabilitation and augmentation works are projected to require 2.13 Ha of land for ponds. The best location should also be close to the lake since final waste water shall be disposed at Lake Victoria.

The existing site is the most appropriate since total land requirement for ponds is 2.13Ha, whereas the available land area is 3.1 Ha.

The total land available onsite is about 8 acres which is adequate for the proposed rehabilitation and augmentation of the project upto 2033.

4.3 Site Alternative

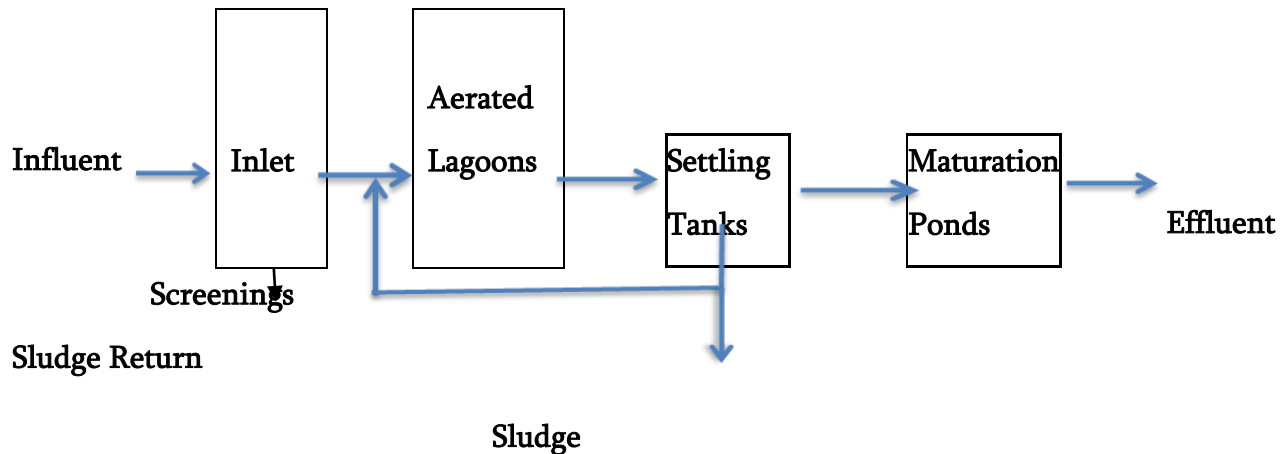
Currently, there is no other alternative site available to the proponent for the proposed development.

4.4 Technology Options

Option 1-Rehabilitation of the existing Homa Bay sewerage system

The first option after preliminary treatment entails the rehabilitation of the existing facilities.

The existing facilities are designed to operate as follows:



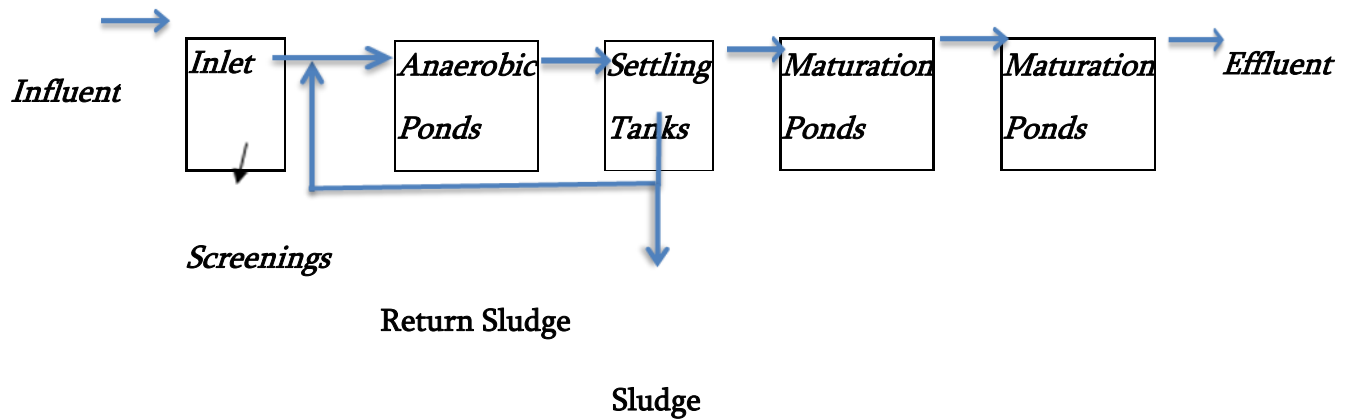
Flow Chart 1: Option 1-Rehabilitation of the existing Homa Bay sewerage system

- i) 2 Number aerated lagoons: with a total area of 3,300 m² and a Total Volume of 5,600 m³
- ii) 2 Number settling tanks: Each with a radius of 4.5 m and a depth of 3, with a detention period of 2.3 hours.
- iii) 2 Number maturation ponds: with a Total Volume of 13,400 m³

The main works will be the rehabilitation of the facilities to their original capacities by reinstatement of vandalized equipments and structures, desludging of lagoons, settling tanks and maturation ponds, installation of pumps and replacement of the mechanical works and quality testing and monitoring facilities.

Option 2 – Anaerobic alternative

Subsequent to the preliminary treatment of the waste water, the second alternative entails the use of the available land with a modification to the facilities by substituting aerated lagoons with anaerobic ponds. The flow of the waste water is as shown below:



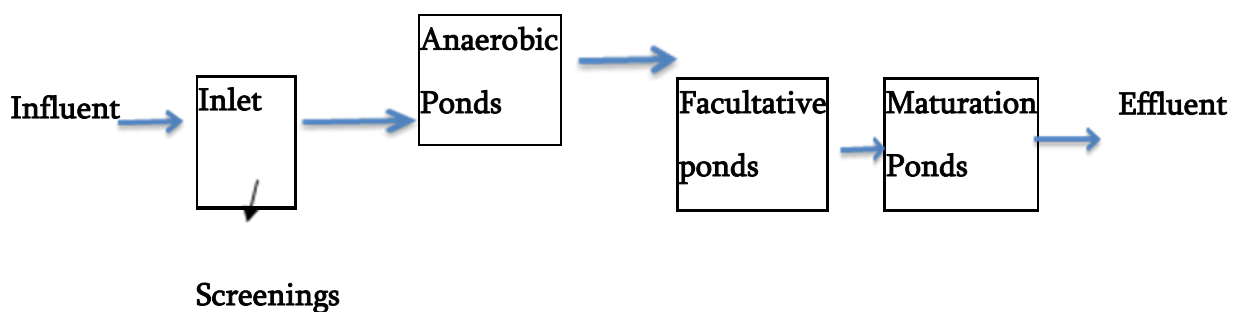
Flow Chart 2: Option 2 – Anaerobic alternative

It is proposed that two number anaerobic ponds will be provided.

Option 3 – Waste Stabilization Ponds

The third option entails the use of the following facilities and techniques for the waste treatment process;

Flow Chart 3: Option 3 – Waste Stabilization Ponds



- i. The effluent after the screening process will be passed into pond system. This will consist of anaerobic ponds, facultative ponds and maturation ponds.

- ii. Due to the stringent environmental management standards that are becoming tighter day after day, additional polishing ponds are proposed as final waste treatment technique. These are proposed due to their cost effectiveness as compared to the other options.

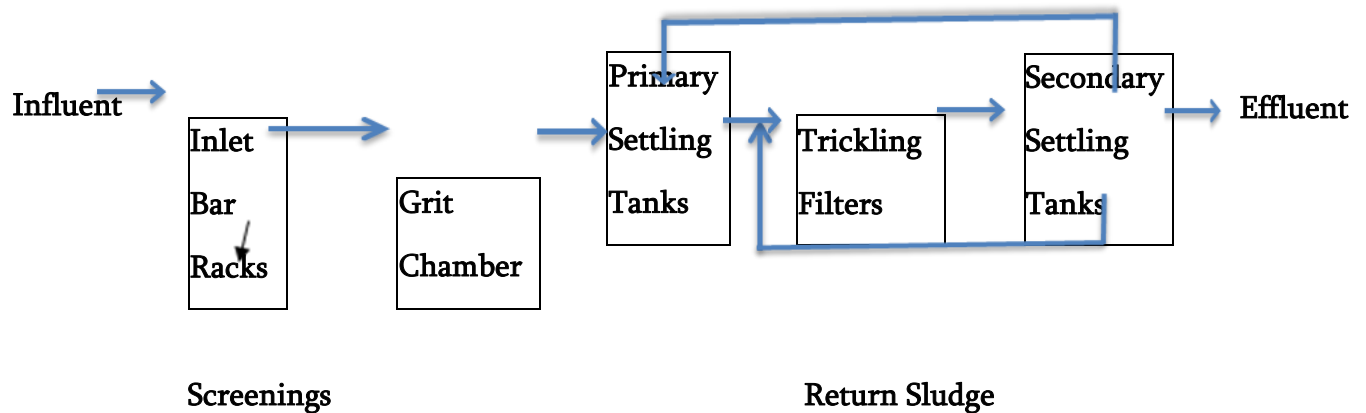
This option is highly cost effective in term of construction, operation and maintenance costs. If well designed, at the prevailing environmental conditions in the project area, this can be a very effective system in pathogen removal.

Its use is limited by the huge land requirements which tend to be more compared with other options. In the case of Homa Bay, the land required is approximately 17 Hectares.

Option 4 – Conventional Wastewater Treatment

The fourth option entails the use of the following facilities and techniques for the waste treatment process;

Return Sludge-Optional



Flow Chart 4: Conventional Wastewater Treatment

- i. The effluent from the preliminary treatment units is then subjected to primary sedimentation so as to effect reduction of the organic load to the following facility

by removal of sludge (sludge is the one responsible for the high levels of organic loading in the sewage) by a similar process as for the grit removal.

- ii. Once removed, the sludge will be processed by using anaerobic sludge digesters and open-air sludge drying beds. Here, pumping will be necessitated.
- iii. The effluent from the primary sedimentation will be passed through a trickling filter unit.
- iv. The effluent from the trickling filters will be directed to a humus (secondary sedimentation) tank
- v. Due to the stringent environmental management standards that are becoming tighter day after day, a constructed wetland is proposed as a final waste treatment technique.

This option can achieve the highest removal of pollutants in the waste stream compared with the other options and requiring the lowest land requirements. However, for Homa Bay site, this option would entail disregarding all the existing facilities and coming up with new physical treatment system.

4.5 Comparison of the options

The above detailed options have their advantages and disadvantages. In analysing the above options, the following are the deductions on their viability:

- Waste stabilisation ponds require extensive land area for their construction. This is not readily available in the project site.
- Rehabilitation of the existing facilities to their functional state has the challenge on their maintenance and operation. The existing system is costly to operate and maintain.
- The conventional system though requiring a smaller land area has higher capital investment and operational maintenance costs compared with option 2.

Option two is a compromise of option one and four. It has the advantage of utilising the existing area and facilities: aeration lagoons being modified to anaerobic ponds, reducing the operation cost of the system.

4.6 No Project Alternative

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 burst pipes as a result of increased effluent from unplanned connections.

4.7 Proposed Project alternative (option 2)

An improved sanitation is urgently required in Homa Bay Town as a prerequisite that can avert the lake pollution and safeguard the health of the population in the town. It has the advantage of utilising the existing area and facilities: aeration lagoons being modified to anaerobic ponds, reducing the operation cost of the system. With an addition of two settling tanks, the present site can be adequate to treat sewage upto to year 2043 assuming an 80% of the project is sewer connection

4.8 Effluent and Sludge Disposal

Effluent Disposal

Depending on the effluent quality attainable and the location of the point of discharge, in addition to the direct disposal to the lake/river, the following modes of effluent disposal will be investigated

- Irrigation
- Ground Water Recharge
- Fish Farming
- Industrial Re-use

Among the existing options for the final waste disposal after treatment, the most economical, environmentally and financially sound option is the disposal of the final effluent from the

treatment works to Lake Victoria. This is the most cost effective method of disposing off the waste as opposed to irrigation or fish farming.

Sludge Disposal

Upon drying, a recommendation on the final sludge remnant will be made depending on the quality of the sludge. Two very feasible methods are;

- Incineration
- Composting

The treated and dried sludge may be disposed off by using it as humus on nearby gardens. Composting of the sludge will be an appropriate way of adding nutrients value to the sludge prior to use in the agricultural activity. Green solid waste, i.e. organic waste from plants like food left-over and throw-away, can be very good materials for blending the fertilizer.

Sludge incineration might be a more technically effective for small quantities of, but uneconomical for waste water treatment plants like the one for Homa Bay.

4.9 Construction Materials and Technology

There is a wide range of construction and furnishing materials which can be sourced locally and internationally. In this construction, certified raw materials/equipments and modern technology will be used. Also, electrical appliances that save energy will be given first priority. The concrete walls will be made using locally sourced stones, cement, sand (washed and clean), metal bars and fittings that meet the Kenya Bureau of Standards requirements.

5.0 STAKEHOLDER ENGAGEMENT & PUBLIC CONSULTATION

5.1 Introduction

Public participation basically involves encouragement of the public to express their views. The exercise tries to ensure that due consideration will be given to public values, concerns and preferences when decisions are made.

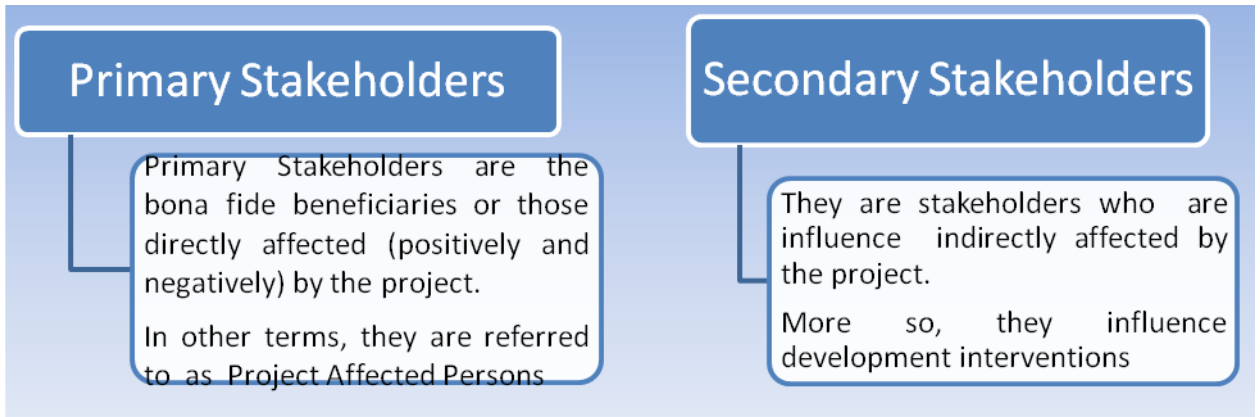
Information and notification, strictly speaking, are the preconditions of meaningful public involvement. On its own, information disclosure is not a sufficient provision in public involvement for an audit of a major project. Consultation denotes an exchange of information designed to canvass the views of stakeholders on a project and its impacts. Participation is a more interactive process of engaging the public in addressing the issues, establishing areas of agreement and disagreement and trying to reach common positions.

Public participation is mandatory in the audit process as outlined in Section 17(1) of the Environmental (Impact Assessment and Audit) Regulations of 2003, which requires that views of persons who may be affected by the proposed project are sought and documented in the audit report.

5.2 Stakeholder Identification

Stakeholder analysis is the process of identifying the individuals or groups that are likely to affect or be affected by a proposed action, and sorting them according to their impact on the action and the impact the action will have on them.

Stakeholders were identified based on their interests, needs, relative power and potential impact on project outcome. Two major categories of stakeholders were identified. These included:



5.3 Objectives of Stakeholder Engagement & Consultation

The objectives of the public consultation process were to:

- Facilitate consideration of alternatives, mitigation measures and tradeoffs;
- Ensure that important impacts are not overlooked and benefits are maximized;
- Reduce conflict through the early identification of contentious issues;
- Provide an opportunity for the public to influence project design in a positive manner (thereby creating a sense of ownership of the proposal);
- Improve transparency and accountability of decision-making; and increase public confidence in the Audit process.
- To solicit the views of the public and incorporate them in the main Audit Project Report.

5.4 Actual Consultations

A public consultation forum was held on 22nd of January 2014. The minutes for the forum are appended on the study report

6.0 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

6.1 Introduction

The prime purpose of this section is to provide the proponent with quick reference to the critical legal and policy provisions to enable proper planning and impact assessment during project planning and implementation. Environmental Management and Coordination Act (EMCA, 1999) is the principle law of environmental management. This framework law guarantees every Kenyan the right to a clean and healthy environment.

There are a number of policy and legal provisions that have direct bearing on the optimum operation of the proposed development.

6.2 Relevant national policies

The following national policies are of relevance to the proposed project

6.2.1 The National Environmental Action Plan (NEAP)

The NEAP was a deliberate policy effort to integrate environmental considerations into the country's economic and social development. The integration process was to be achieved through a multi-sectoral approach to develop a comprehensive framework to ensure that environmental management and conservation of natural resources are an integral part of societal decision making.

Relevance to the proposed project

The NEAP has indicated how resources within particular sections of the country should be managed in order to ensure their sustainable utilization. The project should be implemented and operated based on these guidelines

6.2.2 Environment and development policy (Sessional Paper No.6 of 1999)

The aim of this policy is to harmonize environmental and development goals so as to ensure sustainability. The paper provides comprehensive guidelines and strategies for government action regarding environment and development.

Relevance to the proposed project

The interaction of the proposed project with physical elements may lead to some negative impacts. Mitigation measures are therefore necessary to ensure balanced coexistence of the project and the surrounding environment and facilities

6.3 Legal framework

6.3.1 Environment Management and Coordination Act, 1999

Section 58.(1) Of the Act states “Notwithstanding any approval, permit or license granted under this Act or any other law in force in Kenya, any person, being a proponent of a project, shall, before financing, commencing, proceeding with, carrying out, executing or conducting or causing to be financed, commenced, proceeded with, carried out, executed or conducted by another person any undertaking specified in the Second Schedule to this Act, submit a project report to the Authority, in the prescribed form, giving the prescribed information and which shall be accompanied by the prescribed fee”.

According to the Environmental Management and Co-ordination Act (EMCA, 1999, Second Schedule Part XII) and subsequent Environmental (Impact and Audit) Regulations, 2003, it is mandatory to get environmental clearance for certain development projects. Among these projects are;

Waste disposal projects including:

- a) Sites for solid wastes disposal;
- b) Sites for hazardous waste disposal;
- c) Sewage works disposal
- d) Works involving major atmospheric emissions
- e) Works emitting offensive odours

The proposed project therefore falls in the category of those that require clearance from NEMA before development.

Relevance to the proposed project

Environmental Management and Coordination Act 1999 provide a legal and institutional framework for the management of the environmental related matters. This report has been written pursuant to section 58 (1) of this Act.

The proponent shall obtain environmental clearance from NEMA before commencing the proposed activities.

6.3.2 Environmental Impact Assessment and audit regulations 2003.

These regulations stipulate how an EIA project report should be prepared and specifies all the requirements that must be complied with. It highlights the stages to be followed, information to be made available, role of every stakeholder and rules to be observed during the whole EIA project Report making process

Relevance to the proposed project

The proposed project will be planned, designed, constructed and operated based on these regulations. It shall also be maintained and guided by the same regulations and an environmental audit study will be done periodically to monitor compliance with the set environmental standards.

6.3.3 Water Quality Regulations (2006)

The Water Quality Regulations (2006) are contained in the Kenya Gazette Supplement No. 68, Legal Notice No. 120. Water Quality Regulations apply to water used for domestic, industrial, agricultural, and recreational purposes; water used for fisheries and wildlife purposes, and water used for any other purposes. Different standards apply to different modes of usage. These regulations provide for the protection of lakes, rivers, streams, springs, wells and other water sources. It is an offence to contravene the provisions of these regulations with a fine not exceeding five hundred thousand shillings.

In addition, of immediate relevance to the proposed project for the purpose of this Project Report is Part II Sections 4-5 as well as Part V Section 24.

Part II Section IV states that “Every person shall refrain from any act which directly or indirectly causes, or may cause immediate or subsequent water pollution”.

Part IV Section 24 states that “No person shall discharge or apply any poison, toxic, noxious or obstructing matter, radioactive wastes, or other pollutants or permit any person to dump any such matter into water meant for fisheries, wildlife, recreational purposes or any other uses”.

According to these regulations, “Every person shall refrain from any action which directly or indirectly causes, or may cause immediate or subsequent water pollution, and it shall be immaterial whether or not the water resource was polluted before the enactment of the Act”.

Relevance

The proponent shall refrain from polluting water on the process of rehabilitation and augmentation works. The proponent shall also refrain from letting raw sewerage into the lake as the rehabilitation will be on progress of the existing lagoons.

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

PART II-MANAGEMENT OF WETLANDS AND WETLAND RESOURCES

Application of Part

This part applies to all wetlands in Kenya whether occurring in private or public land.

General Principles

5. (1) the following principles shall be observed in the management of all wetlands in Kenya;
 - (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;
 - (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;

Relevance

The final effluent is expected to be discharged into the lake therefore the quality of effluent should be as per the described standards by NEMA.

6.2.5 EMCA (Waste management) Regulation, 2006

The Waste Management Regulations (2006) are contained in the Kenya Gazette No. 69, Legal Notice No. 121. The Waste Management Regulations are meant to streamline the handling, transportation and disposal of various types of waste. The aim of the Waste Management Regulations is to protect human health and the environment. The regulations place emphasis on waste minimization, cleaner production and segregation of waste at source. The regulation requires licensing of transporters of wastes and operators of disposal site (sections 7 and 10 respectively). Of immediate relevance to proposed development for the purposes of this project report is Part II Sections 4(1-2), 5 and 6.

Section 4 (1) states that “No person shall dispose of any waste on a public highway, street, road, recreational area or any other public place except in a designated waste receptacle”.

Section 5 provides method of cleaner production (so as to minimise waste generation) which includes the improvement of production processes through conserving raw materials and energy.

Section 11 provides that any operator of a disposal site or plant shall apply the relevant provisions on waste treatment under the local government act and regulations to ensure that such waste does not present any imminent and substantial danger to the public health, the environment and natural resources.

Section 12 provides that every licensed owner or operator shall carry out an annual environmental audit pursuant to the provision of the act

Relevance

The Proponent must ensure that waste water is handled as per the regulation

The contractor during construction phase shall take precaution not to dump wastes in areas not registered and designated as so.

6.2.6 EMCA (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.

These regulations also relate noise to its vibration effects and seek to ensure no harmful vibrations are caused by controlling the level of noise.

Part II Section 4 state that: except as otherwise provided in these Regulations, no person shall

- a) make or cause to be made excessive vibrations annoys, disturbs, injures or endangers the comfort, response, health or safety of others and the environment; or
- b) Cause to be made excessive vibrations which exceed 0.5 centimetres per second beyond any source property boundary or 30 metres from any moving source.

Section 14 relates to noise, excessive vibrations from construction, demolition, mining or quarrying site, and state that: where defined work of construction, demolition, mining or quarrying is to be carried out in an area, the Authority may impose on how the work is to be carried out including but not limited to requirements regarding a) machinery that may be used, and b) the permitted levels of noise as stipulated in the Second and Third Schedules to these Regulations.

Relevance

The contractor shall be required to implement these measures, ensure that all machineries are in good working condition to reduce noise. Also construction activities shall be restricted between 0800Hrs-1700Hrs to ensure that the neighbours are not disturbed.

6.2.7 Draft Environmental Management and Coordination (Air Quality) Regulations, 2008

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

provisions of the Seventh Schedule (Emission limits for controlled and non-controlled facilities) and Second Schedule (Ambient air quality tolerance limits).

Relevance

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

6.2.8 Act No.8-Water Act, 2002

This Act of Parliament provides for the management, conservation, use and control of water resources and for the acquisition and regulation of rights to use water; to provide for the regulation and management of water supply and sewerage services; to repeal the Water Act (Cap. 372) and certain provisions of the Local Government Act.

Section 25 (1) states that a permit shall be required for any of the following purposes:—

- (a) Any use of water from a water resource, except as provided by section 26;
- (b) The drainage of any swamp or other land;
- (c) The discharge of a pollutant into any water resource;
- (d) Any purpose, to be carried out in or in relation to a water resource, which is prescribed by rules made under this Act to be a purpose for which a permit is required.

Relevance

The proponent shall apply for a permit to discharge treated effluent into the lake.

6.2.9 Occupational Health and Safety Act 2007 CAP 514

This is an act of Parliament to provide for the safety, health and welfare of workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes. The Act was published in the Kenya Gazette Supplement No. 111 (Acts No.15). It received presidential assent on 22nd October, 2007 and became operational on 26th October, 2007.

The key areas addressed by the Act include:

- i. General duties including duties of occupiers, self employed persons and employees

- ii. ii) Enforcement of the act including powers of an occupational safety and health officer
- iii. iii) Registration of workplaces.
- iv. iv) Health General Provisions including cleanliness, ventilation, lighting and sanitary conveniences
- v. Machinery safety including safe handling of transmission machinery, hand held and portable power tools, self acting machines, hoists and lifts, chains, ropes & lifting tackle, cranes and other lifting machines, steam boilers, air receivers, refrigeration plants and compressed air receiver
- vi. Safety General Provisions including safe storage of dangerous liquids, fire safety, evacuation procedures, precautions with respect to explosives or inflammable dust or gas
- vii. Chemical safety including the use of material safety data sheets, control of air pollution, noise and vibration, the handling, transportation and disposal of chemicals and other hazardous substances materials
- viii. Welfare general provisions including supply of drinking water, washing facilities, and first aid
- ix. Offences, penalties and legal proceedings

Under section 6 of this act, every occupier is obliged to ensure safety, health and welfare of all persons working in his workplace. The occupier shall achieve this objective by preparing and as often as may be appropriate, revising a written statement of his general policy with respect to the safety and health at work of his employees and the organization and arrangements for the time being in force for carrying out that policy (Section 7).

He is also required to establish a safety and health committee at the workplace in a situation where the number of employees exceeds twenty (section 9) and to cause a thorough safety and health audit of his workplace to be carried out at least once in every period of twelve months by a registered safety and health Advisor (Section 11).

In addition, any accident, dangerous occurrence, or occupational poisoning which has occurred at the workplace needs to be reported to the occupational safety and health officer of the respective area by an employer or self-employed person (section 21).

According to section 44, potential occupiers are required to obtain a registration certificate from the Director for all premises intended for use as workplaces. Such places shall be maintained in a clean state during the operation phase (section 47).

Relevance to the proposed project

Workers safety will be given priority during both construction and operation phases of the project.

There proponent shall be required to Have an EHS plan guided by the provisions of OSH Act, 2007.

The proponent shall be guided by the provisions of this act.

6.2.10 the Physical Planning Act of 1996 CAP 286

Part V clause 36 of the act requires that, “If in connection with a development application a local authority is of the opinion that proposals for industrial location, dumping sites, sewerage treatment, quarries or any other development, will have injurious impact on the environment the applicant should be required to submit together with the application an environmental impact assessment report.”

Relevance to the proposed project

This Act provides for order in terms of development execution. This development should therefore comply with all the provisions of this law.

6.2.11 The Penal Code CAP 63

Chapter XVII on “Nuisances and offences against health and convenience” contained in the penal code strictly prohibits the release of foul air into the environment which affects the health of the persons. It states “Any person who voluntarily vitiates the atmosphere in any

place so as to make it noxious to the health of persons in general dwelling or carrying on business in the neighbourhood or passing along a public way is guilty of a misdemeanor”

Relevance to the proposed project

Waste disposal and other project related activities shall be carried out in such a manner as to conform to the provisions of the code.

7.0 ENVIRONMENTAL AND SOCIAL IMPACTS

7.1 Background

Sewerage is the removal of excreta, flushing water from toilets and household sullage through a pipe or sewer network to a treatment works or disposal point. When this is operated correctly and the waste is treated, sewerage is an effective method of excreta disposal. In many parts of the world, however, sewage is allowed to flow directly into rivers untreated, presenting a major public health risk. Sewerage is high cost technology and requires water for flushing. Sewage should always be treated prior to discharge into any surface water body or disposal onto land. The advantages of sewerage are that it can remove large amounts of wastewater and it provides great user convenience. The main disadvantages are the high capital and operating costs, and the fact that the effluent still contains large numbers of germs. Sewage can be treated in lagoons, and this is generally an appropriate method.

7.2 Description of the existing and anticipated impacts

The proposed development will change the salient biophysical and socio-economic environmental features of Homa Bay town. During implementation, potential positive and negative environmental effects are expected to arise out of the construction and operational activities of the station. The environmental effects of the proposed project are expected to emanate from the construction activities and operation activities.

7.2.1 Existing impacts

- ❖ Due to vandalism of manhole covers, the residents dump garbage into the manholes causing unpleasant sight.
- ❖ Blocked drains -The size of sewer pipes that are conveying the sewage from various points of generation could not handle the quantity of waste water.

- i. *A case example is the line serving the Homa Bay Prisons which is served by a 160mm Diameter UPVC pipe. As a consequence, the sewer line serving prisons is perennially blocked and spilling into adjacent land.*
- ii. *Similarly, the line serving upper Makongeni area from MH R3 to MH Q3 is a 160mm pipe against relatively high population served.*
- Siltation and blockage-It was observed that most of the waste water is disposed through open channels, some of which have been silted and others blocked at culvert road crossings, thereby presenting a public nuisance in the whole disposal system

-Unnecessary vegetation at the ponds and at the intake.

7.2.2 Anticipated impacts

The anticipated impacts of the proposed project on the environmental elements are both positive and negative. The magnitude of each impact is described in terms of being significant, minor or permanent, short-term or long term, specific (localized) or widespread, reversible or irreversible. The assessment criteria for the significant impacts are as shown in the table below:

Table 5: Assessment criteria for significant impacts

Key	Type of impact	Key	Type of impact.
++	Major positive impact.	+	Minor positive impact.
--	Major negative impact	-	Minor negative impact.
0	Negligible/zero impact	NC	No change
Sp	Specific/localized	W	Widespread.
R	Reversible	Ir	Irreversible.
Sh	Short term.	L	Long term.
T	Temporary	P	Permanent

On the basis of information gathered during both the desktop and field study, the potential environmental impacts of the proposed project are as tabulated below.

Table 6: Potential environmental and Socio impacts

Impacts on Or due to	Construction	Occupation
Noise Pollution	-	0
Visual intrusion	--Sh	0
Air/Dust Pollution	--Sh	0
Soil erosion	- -Sh	0
Pressure on water resources	- Sh	0
Vegetation and flora	--Sh	0
Employment	++	++
Water quality	--Ir	0
Occupational Health & Safety	Sp--	-
Public health ,social disruption	--Sh	0
Improved sewerage system and covera	++L	++

7.3 Positive impacts

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

1. The proposed Rehabilitation and augmentation 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 following will be the new works:

- Sewers, manholes and property connections
 - i) Sophia to CBD to treatment works- Total length: 3,128 m and 65 manholes
 - ii) Shauri yako area to CBD to treatment works: 1,950m and 40 manholes
 - iii) Makongeni to treatment works: 1,420 and 30 manholes

2. The proposed project activities will provide adequate storm water drainage for the town.
3. There will be reduced soil erosion due to improved drains which are built putting into consideration erosion prevention measures.
4. 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.
5. The proposed activities shall also cause removal of trapped waste in manholes and drains thus reducing the mosquito breeding sites.
6. 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.
7. Provision of employment opportunities during both construction and operation phases of the project.
8. 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 Homa Bay up to 2043.
9. Improved health of the people- Reduced cases of respiratory and water borne diseases associated by poor sanitation due poor waste water management.
10. If efficient the system shall save Lake Victoria from receiving raw effluent which has adverse effects on the aquatic life.
11. Sludge from the WWTW is a rich resource that can be utilized by the community around as fertilizers to enhance agricultural produce.

7.4 Negative environmental Impacts

7.4.1 Negative Impacts -Construction phase

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.

❖ 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

❖ 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.

❖ **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;

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.

❖ **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.

❖ **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

❖ **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.

7.4.2 Mitigation measures – Construction phase

Prevention of dust and gaseous Emissions:

- 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.

Mitigation of Noise Nuisance

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.

Mitigation Measures for destabilization of Soil structure

- 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.

Mitigation Measures for Visual Intrusion

- 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.

Mitigation measures for water quality compromise

- 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 Lake.
- 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.

Mitigation Measures for disruption to business, traffic and residents

- The contractor shall 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.

Mitigation Measures to curb health and safety

- 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.

7.5 Long-term Potential Environmental Impacts

❖ 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.

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

❖ 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.

❖ **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 be 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.

❖ **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.

❖ **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.

❖ **Pipe corrosion**

H₂S 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 H₂S in pipes is pipe corrosion. Anaerobic bacteria in the sewage feed on the amino acids and release H₂S. This then dissolves in the water on ceiling of the pipe, where other, aerobic, bacteria use it as a source of energy.

❖ **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.

❖ **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.

❖ **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.

❖ **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.

❖ **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.

❖ **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

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

7.6 Mitigation Measures for potential environmental impacts

- The system should be regularly be inspected to ensure performance is maintained at high levels;
- Regular inspection of the system to ensure performance is maintained at high levels;
- Blockages should be detected and promptly replaced;
- Regular monitoring and sampling of the waste water at influent and effluent points as well as in the receiving water bodies;

- Communities living within the Lake 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;
- Training secession should be organized by NEMA and the Homa bay County through the supervising firm assigned to the project;
- 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 LVEMP and MoHB to prevent flooding or water logging caused by clogged drains;
- Monitoring activities carried will also be carried out to ensure that untreated effluent from industries is not discharged into the proposed sewer system;
- LVEMP and MoHB 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;
- A chain-link fence and a gate to be installed around the ponds to restrain intruders (animals and the public) from accessing the ponds.
- 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.

8.0 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN (EMMP)

8.1 Introduction

Environmental management is a crucial segment of Management, in view of the global concept of sustainable development. Apart from the social obligation, the Companies are liable to suffer a series of drastic actions by statutory authorities, if the former ignore the above said aspect. At its worst, the running factories may be brought to a grinding halt by the pollution control authorities that possess the requisite powers. Therefore, the preparation of Environmental Management Plan (EMP) is a must to fulfill the bifocal aspect of the statutory compliance as well as that of social concern.

8.2 Significance of EMMP

The aim of the environmental monitoring and management plan (EMMP) is to provide a road map to the proponent on how to address identified significant impacts (environmental and social), requirements for labour specialization (responsibility), frequency of monitoring activities, and estimated cost implications.

8.3 Environmental monitoring and audits

Environmental monitoring and audits are essential in Projects life span as they are conducted to establish if project implementation has complied with set environmental management standards for Kenya as spelt out in EMCA 1999 and the Environmental (Impact Assessment and Audit) Regulations 2003. In this Project, environmental monitoring and auditing will be conducted to ensure that identified potential negative impacts are mitigated during the project's life span.

Table 8.1 below provides this summary based on phase 1 of the project

Table 7: Environmental Monitoring and Management Plan (EMMP)

Environmental and Social Impact	Mitigation measure to be taken	Project phase	Responsible agency	Cost Estimates (Lump sum)
Soil and water contamination	<ul style="list-style-type: none"> -Plan emergency response measures in case of accidental oil spills. -Regular servicing and maintenance of construction equipments to avoid oil spills 	Construction	Contractor	4,000,000.00
	<ul style="list-style-type: none"> -At the end of construction works, level off the soils and facilitate vegetation regeneration. 	Construction		
	<ul style="list-style-type: none"> -Ensure protection of the local ecosystem by ensuring liquid and hazardous wastes do not find their way into storm drains. 	Operation		
	<ul style="list-style-type: none"> -Ensure proper maintenance of drainage system like regular cleaning to ensure smooth flow of the storm water and to avoid blockages and overflows especially during rainy seasons. 	Operation		

<p>Odour, dust and noise pollution</p>	<p>Ensure proper operation and maintenance practices of the waste stabilization ponds.</p> <p>Provide protective clothing like helmets, dust masks and hardy gumboots to the construction crew.</p> <p>Maintain vehicles and construction machinery in good working condition in order to minimize gas emissions and noise.</p> <p>The contractor to regulate night time construction when noise is loudest</p> <p>Construction sites and transportation routes to be water-sprayed on dry and windy days up to three times a day, especially if these sites are near sensitive receptors, such as residential areas.</p>	<p>Operation</p> <p>Construction</p> <p>Construction</p> <p>Construction</p>	<p>Contractor, LVEMP ii and MoHB</p>	
<p>Solid waste and Liquid waste generation</p>	<p>Unusable construction waste, such as damaged pipes, formwork and other construction material, must be disposed of at an approved dumpsite or sold to willing</p>	<p>Construction</p>	<p>Contractor</p>	

	buyers for salvage value.			
	Arrangements should be made for the regular collection of litter and for its disposal.	Construction	Contractor	
	Proper solid waste receptacles and storage should be placed at strategic points especially to dispose packaging material from food stuff consumed by employees at lunch time.	Construction	Contractor	
Public Health and safety	Sensitize workers and the surrounding community on awareness, prevention and management of HIV / AIDS through staff training, awareness campaigns, multimedia, and workshops or during community “Barazas”.	Construction		
	The ponds to be properly maintained to ensure that the ponds do not become mosquitoes breeding site.	operation		

	Provide workers with appropriate protective clothing such as dust masks, helmet, sturdy gumboots, gloves and overalls	Operation construction		
	Maintain operations at the ponds clear of unwanted vegetation	Operation		
	<p>-Ensure that all construction machines and equipment are in good working conditions to prevent occupational hazards.</p> <p>-Ensure that fire extinguishers canisters are placed in prioritized areas as per accessibility and proximity of specific fire hazard.</p> <p>-Provide appropriate human and solid waste disposal facilities</p> <p>-Establish a Health and Safety Plan for all works</p> <p>Appoint a trained health and safety team for the duration of the construction work.</p> <p>-Provide workers with training on safety procedures and emergency response such as</p>	Construction		

	<p>fire, oil and chemical spills</p> <p>-At the end of the project, the contractor to submit to the client the health and safety file. The file is a record of useful health and safety information and will help better manage health and safety risks during any future maintenance, repair, construction work or demolition.</p>			
Risk of accidental falls and drowning	<p>-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.</p> <p>- A chain-link fence and a gate to be installed around the ponds to restrain intruders (animals and the public) from accessing the ponds.</p> <p>-cordon around open trenches with red tapes to protect the public from falling into the</p>	Construction and operation	LVEMP ii MoHB Contractor	

	trenches.			
Road safety and Traffic management	<ul style="list-style-type: none"> -Prepare a traffic management plan during the construction activities. -Monitor adherence to the traffic management plan - Review and monitor road safety records to ensure all project related road accidents are being properly investigated and reported 	Construction and Operation	Contractor	
Interruption of service delivery/access routes	<p>Provide appropriate signage to warn motorists and other road users of the construction activities, diversion routes to ward off traffic accidents.</p> <ul style="list-style-type: none"> -Communicate any intended disruption of the services in good time to enable the people to prepare e.g. by having emergency water storage facilities. 	Construction	Contractor	
Bio-diversity/Vegetation	-Spare the vegetation that must not necessarily be removed such as trees.	Construction	Contractor	

	<ul style="list-style-type: none"> -The contractor will take reasonable precautions to minimize disturbance to the native flora during the construction. -Ensure protection of the local ecosystem by proper handling of cement during civil works and other solid and liquid wastes. 			
Employment	<ul style="list-style-type: none"> -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 	Construction	Contractor	
Access to public and private Properties	<p>Monitoring impact of project on dwelling and business in the project area</p> <p>Monitor construction activities to ensure public and private property is not damaged</p>	Construction	Contractor	

Anxiety by Onlookers	<ul style="list-style-type: none"> -Ensure there is restricted access to machinery being used for construction activities -Fence off an area under construction to keep away onlookers. - Discourage Idlers who camp near construction sites. 			
Discharge of industrial effluent	<p>Monitor discharge of industrial effluent into the sewer including</p> <p>Review of consent to operate forms submitted to the MoHB and analysis of wastewater sample from industries discharging into the sewer system.</p>	Operation	County of Homabay	
Impact on flora as a result of leak in the system	<p>Ensure that any leak detection system are fully operational and regularly serviced</p> <p>In the event of leakage, the contaminated area must be cleared as soon as possible and the and the affected area rehabilitated as soon as possible (in accordance with accepted</p>	Operation	Proponent	

	practice relevant to the specific substance			
Spread of alien and invasive species	Put in place weed eradication program should be implemented during and after construction.			
Soil erosion	Re vegetation of disturbed surfaces should be done as soon as possible	Construction		
Ground and surface pollution	<p>Monitoring of different pipelines and routes. This can be done through monitoring of different boreholes (if any) located around the different options as well as the boreholes closest to the pipeline routes.</p> <p>Pipeline routes should be monitored regularly to ensure that they are leak free.</p> <p>Regular maintenance inspection of pipelines will counter possible breaks</p> <p>Operational maintenance should be tested and calibrated on a regular basis</p>	Operation stage		

	Detailed operational procedures must be implemented in an effort to negate most probable discharges from the treatment plants			
Decommissioning waste generation and sludge handling	Personnel must be well versed in handling the existing waste management procedures and activities on site Recovered sludge from the plant will be useful s manure	Operation stage		
Mosquito breeding and disease transmission	Put in place various control measures to ensure that environmentally sound measures are taken to ensure that permit the plant to produce no adverse effect on transmission rates of mosquito- transmitted diseases such as malaria	Operation	Project proponent	

9.0 ENVIRONMENT, HEALTH AND SAFETY (EHS)

9.1 EHS management and administration

The EHS is a broader and holistic aspect of protecting the worker, the workplace, the tools / equipments and the biotic environment. It is an essential tool in determining the ESIA study. The objective of the EHS on the proposed project is to develop rules that will regulate environmentally instigated diseases and occupational safety measures during construction and the operation phases of the proposed project by:

- Avoidance of injuries
- Provision of safe and healthy working environment for workers comfort so as to enhance maximum output.
- Control of losses and damages to plants, machines, equipment and other products.
- Enhance environmental sustainability through developing sound conservation measures.

9.2 Policy, Administrative and Legislative Framework

It is the primary responsibility of the contractor to promote a safe and healthy environment at the workplace and within the neighborhood in which the proposed project will be constructed by implementing effective systems to prevent occupational diseases and ill-health, and to prevent damage to property. The EHS Management Plan when completed will be used as a tool and a checklist by the contracted engineers in planning and modification of the construction of this expansion project.

9.3 Organization and implementation of the EHS Management Plan

The contractor shall use the EHS plan at the proposed project site both during construction and operation. The engineer will use it during construction phase with the assistance of an EHS consultant who shall enforce its provision throughout the life of the project.

9.4 The Guiding Principles to be adopted by the contractor

The contractor will be guided by the following principle: -

- It will be a conscious organization committed to the promotion and maintenance of high standards of health and safety for its employees, the neighboring population and the public at large.
- Ensuring that EHS activities are implemented to protect the environment and prevent pollution.
- Management shall demonstrate commitment and exercise constant vigilance in order to provide employees, neighbors of the project and the environment, with the greatest safeguards relating to EHS.
- Employees will be expected to take personal responsibility for their safety, safety of colleagues and of the general public as it relates to the EHS management plan.

9.5 EHS management strategy to be adopted by the contractor

The following strategies will be adopted to achieve the above objectives:

- Create an Environment Health and Safety Management committee and incorporate EHS as an effective structure at various levels and units to manage and oversee EHS programs in all construction and operation phases of the project
- Maintain an effective reporting procedure for all accidents.
- Provide appropriate tools and protective devices for the success of the project.
- Encourage, motivate, reward and support employees to take personal initiatives and commitment on EHS.

9.6 Safety Agenda for both the proponent and contractor.

- There will be a permanent EHS agenda during construction.

(a) Contractors

The EHS management plan code of practice shall be applicable to the contractors working in the premises, and shall be read and signed. It shall be incorporated into the contract to perform work. This should also remind the contractor of his/her;

- Legal requirements
- Statutory obligations
- Obligation to lay-down a system for reporting accidents
- Responsibility to ensure that his employees are supplied with personal protective equipment and where applicable as per the EHS management plan for the whole project.
- Responsibilities as it relates to contracting an EHS consultant in liaison with the proponent
- Obligation to ensure that he obtains detail of jobs and areas where permit-to-work must be issued.

9.7 Safety requirement at the project site during construction and operation Period

(a) The contractor

The contractor will ensure that:

- Ensure adequate briefing of job at hand on the safe system of work before commencement of work
- The EHS coordinator must be in attendance at all times throughout the duration of the project.
- The EHS consultant must maintain constant assessment of the risk involved as the work progresses

(b) The Traffic / Drivers

Within the construction premises, the following traffic rules will be observed: -

- Observe speed limits and all other signs and obey traffic rules.

- Use the vehicle for the purpose to which it is intended only.

9.8 Emergency procedure during construction and operation.

An emergency situation means:

- Unforeseen happening resulting in serious or fatal injury to employed persons or the neighboring communities
- Fire or explosion.
- Natural catastrophe.

In the event of such an emergency during construction, the workers shall:

- Alert other persons exposed to danger.
- Inform the EHS coordinator.
- Do a quick assessment on the nature of emergency.
- Call for ambulance on standby.
- When emergency is over the EHS coordinator shall notify the workers by putting a message: “ALL CLEAR”

In the event of such an emergency during operation the workers shall: -

- Alert other persons exposed to danger
- Ring the nearest police station
- Call for ambulance on standby.

10.0 DECOMMISSIONING

10.1 Introduction

Decommissioning is an important phase in the project cycle and comes last to wind up the operational activities of a particular project. It refers to the final disposal of the project and associated materials at the expiry of the project lifespan. If such a stage is reached, the proponent needs to remove all materials resulting from the demolition/ decommissioning from the site.

10.2 Purpose and objectives of decommissioning

The generally accepted purpose of decommissioning is to allow for release of valuable assets such as buildings and sites for alternative use, recycling and reuse of materials and the restoration of environmental amenity. In all cases, the basic objective is to achieve an end-point that is sensible in technical, social and financial terms, that properly protects workers, the public and the environment and, in summary, complies with the basic principles of sustainable development.

10.3 Social aspects

The long-term safety, environmental and social implications of the decommissioning activity need to be carefully considered. In Kenya, there are well-developed mechanisms for involving stakeholders in the planning of activities that affect such social and environmental issues. Developers are bound by the terms of directives of EMCA 1999 and Environmental (Impact Assessment and Audit) Regulations 2003 that require an Environmental Impact Assessment in circumstances like this. This requires detailed assessment of a wide range of factors including impact on amenities, landscape, noise, transport provisions, general nuisance, effects of accidents or untoward events and contribution to promotion of sustainable development as well as the more specific issues of waste management and impact on the environment as such.

Most importantly, they make specific provision for informing and involving the public and neighbouring communities. Table 8 below shows a detailed decommissioning plan for this project.

Table 8: EMP for Decommissioning

Expected Negative Impacts	Recommended Measures	Responsible Party	Time Frame
Scraps material and other debris	<ul style="list-style-type: none"> ▪ 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 be 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. 	Project Manager & Contractor	During decommissioning
	<ul style="list-style-type: none"> ▪ 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. 	Project Manager & Contractor	During decommissioning
	<ul style="list-style-type: none"> ▪ 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	During decommissioning
Vegetation	<ul style="list-style-type: none"> ▪ Implement an appropriate re-vegetation programme to restore the site to its original status. 	Project Manager &	During

<p>disturbance</p> <p>Land deformation: soil erosion, drainage problems</p>	<ul style="list-style-type: none"> ▪ 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; 	<p>Contractor</p>	<p>decommissioning</p>
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11.0 CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusion

The project upon completion would realize several positive impacts, most significant of which being reduction of public health hazard as result of improved drainage and sewerage conditions in the service area. 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.

This environmental examination process therefore establishes a negative determination of the impacts on the environment and hence recommends that the proposed rehabilitation and augmentation of Homa Bay Sewerage System be implemented with full adherence of the Environmental Monitoring and Management Plan

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;
- ❖ The positive environmental impacts the project will realize far out-scales the negative ones, which can be contained by following the prescribed EMMP;
- ❖ The project proponent should commence the project immediately once this report is approved;
- ❖ 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;
- ❖ 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;
- ❖ Involvement of all relevant stakeholders is proposed throughout the process to ensure project acceptability;
- ❖ All construction waste will be properly disposed off in a timely manner, the excavated material wherever possible will be used as raw material for a range of activities, such as road repair or construction, and for use as building material e.g. stones, and;
- ❖ Annual environmental audits should be carried out on the project in order to ensure compliance of the project with the mitigation measures outlined in the Environmental Management Plan (EMMP).

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2. Wanjohi Consulting Engineers 2013: The Feasibility Study and Detailed Design for the Rehabilitation and Augmentation of Homa Bay Sewerage System. LVEMP II
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8. Homa Bay County Development profile, 2013
9. Homa bay District Development Plan (2008 -2012)

APPENDICES

1. Minutes for the public consultation forum
2. List of attendance
3. Public participation pictures
4. Project designs
 - Layout plans for the existing sewerage system, water supply and Revised existing sewerage system
 - Manholes and inspection chamber
 - Perimeter wall, Gate house, foundations, layout and plan details
 - Inlet works layout and details
 - Settling tanks layout
 - Sludge pump house details
5. Copy of Terms of Reference

APPENDIX 1: MINUTES FOR PUBLIC PARTICIPATION

MINUTES OF THE STAKEHOLDER ENGAGEMENT ON THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESMENT FOR THE PROPOSED REHABILITATION AND AUGMENTATION OF HOMA BAY SEWERAGE TREATMENT SYSTEM, HOMA BAY COUNTY HELD ON 17th JANUARY 2014

VENUE: Homa Bay AIC

TIME: 09:30 PM

IN ATTENDANCE

See attached.

MIN 1: Preliminaries

The meeting kicked off with a word of prayer from Hellen Abund. There after Juliet Adhiambo (EIA Expert) welcomed EIA team, KIRDI officials, NEMA officials, Homa bay Bunge, Homa bay County Youth Initiative and other members of the public to the meeting. She further elaborated the importance of the Environmental impact assessment to those in attendance.

The EIA team told participants that public involvement is a feature of all EIA reports, and that the public involvement of stakeholders in EIA is widely recognized as a fundamental element of the process. It was further said that the main objectives of the meeting was to help the community understand the process, enable the community

participate in decision making and most importantly know if the community supports the project or not.

MIN 2: Project Description

Participants were briefed about the project via a power point presentation. Key issues that were addressed included importance of the proposed treatment plant, positive impacts, negative impacts of the project and the corresponding mitigation measures, the existing facilities, proposed works and expected benefits.

Sospeter Mumbo (LVEMP II representative) explained to members about the genesis of the project, its objectives, benefits and future plans. He also elaborated the fact that the project was not a new project but a mere rehabilitation of the existing sewerage system being facilitated by World Bank through the Government of Kenya. He urged members to raise environmental concerns and also notified that the stakeholder conference is going to be held soon, where all stakeholders will be invited.

MIN 3: Comments from the Secondary Stakeholders

Homa bay County Sewerage Department

Mr. Walter Odumbe gave background information about the existing sewerage plant. Members were informed that the system was built in the 1960's when the Homa bay population was low. The diameters of the system were small, and currently the waste was going directly into the lake. He equally mentioned the current problems facing the sewerage system, namely overloading and mechanical.

NEMA Office – Homa Bay County

Members were briefed about the importance and role of public participation. The office further encouraged the participants to get involved in environmental issues and seek more information about the EIA/ Audit process. Members were told that under the current environmental laws and regulations, it was mandatory for major projects to undergo Environmental Impact Assessments and acquire a license from NEMA before they are allowed to proceed.

Area Chief

He briefed the meeting on the importance of the meeting and urged the participants to raise important issues concerning the project.

MIN 4: Comments and issues from the Participants

Issue

Members wanted to know whether the proposed plans had an element of recycling waste to generate electric energy.

Response

The audience was informed that the initial design had no such plans, since the money allocated was only enough to cater for rehabilitation works and few modifications on the sewerage system

Issue

One participant asked whether the project was going to cover other areas or only areas that had already being covered.

Response

LVEMP II was only improving on the existing sewerage system and not does more on the expansion. Upon completion, other areas will be considered, which shall also require other plans and designs

Issue

Another participant wanted to know as to why the feasibility study had population outdated population figures dating back to 2009.

Response

Members were told that population figures and dynamics require referencing, with the help of Information from reliable and accurate data. The population figures were quoted from the Homa bay District Development Plan (2008-2012) and the Homa bay County Development Profile, (2013). The population growth rate and projections were therefore used to estimate the population that will be served by the sewerage system

Issue

A participant suggested whether it was possible to relocate the manholes situated along the road to other areas since they were posing danger to the public.

Response

The issue was elaborated, and members were told that it was not possible to change the man holes, as this will result in changing the whole design, hence requiring different plans and budget

Issue / Question

Supposing if new developments such as industries were developed, will the proposed sewerage system cater for all them?

Response

The session was briefed that before any major development is undertaken, an EIA report, which looks into pertinent issues related to the project (including waste management, designs, and location and site conditions), must be considered before Licensing. In case of such developments, a feasibility study must be carried out to determine the magnitude of such waste to aid guide the proper waste treatment plant. Similarly, consideration of other waste management systems was offered as an alternative to future projects.

Issue / Question

Is it safe to consume Sukuma Wiki that was planted at the sewerage plant near the lake?

Response

Participants were informed that there was no sukuma wiki planted at the lagoons. The only plants that had covered the lagoons were the notorious water hyacinth. However, it was further elaborated that research was been undertaken elsewhere to determine the suitability of planting vegetable at the sewerage plants

Issue/ Question

Is it possible to hand over the project, once complete to the private developer?

Response

Since the project will be handed over to the County of Homa bay, which was recently put in place, it was paramount to give the county a chance to maintain and do all it can to ensure that the project is sustainable. Member was urged to entrust the county since it had enough personnel to do the same.

Issue/ Question

Why was the sewerage plant located near the lake, which has lead to pollution of the Lake?

Response

Initial project designs had been done to allow for full water treatment, which was manageable and is still efficient. However negligence results in lake pollution. However, with the current efforts where the whole system will be expanded, proper measures will be taken into consideration water treatment issues and pollution menace.

Issue/ Question

What measures has the proponent taken into account to minimize erosion?

The audience was briefed about the plans that were underway to erect warning / informative signs at the construction sites during construction phase, and traffic control along the Road. More so Soil compaction and watering of loose soils on all unpaved access areas at the construction sites were to be done to minimize air and soil pollution.

Issue/ Question

What measures have they taken into consideration to curb the problem of vandalism?

Members were urged to take personal responsibility to be on the lookout to abate the menace.

Issue/ Question

What measures will be taken to ensure that storm water doesn't cause the blockage of the sewerage system?

Response

The Homabay County pledged to improve the whole infrastructure, including the storm water drainage systems, a measure aimed at minimizing damage, rather than doing repairs once the project commences.

MIN 4: Response to the questions from the EIA team

1. Do you support the proposed rehabilitation and augmentation of the sewerage plant?

Response

All the participants were in agreement of the project, as evidenced by the pictures

2. What are the benefits of the proposed project?

Responses

The proposed rehabilitation will lead to proper waste management

The lake will be devoid of pollution

Reduced risks of water borne diseases

Creation of jobs

3. What are the negative impacts of the project?

Responses

Soil erosion

Pollution of air and water

Waste will be generated

4. Closing Remark

The EIA Associate expert Miss. Julie Adhiambo in her closing remarks explained the importance of the meeting and emphasized the need for commitment from public members. Those who managed to attend the meeting were thanked.

MIN 6: Adjournment

There being no other business, the meeting was adjourned at 2:00PM



Plate : Stakeholders during the Public participation Session.



Plate : Participants air their views during the forum



Plate : EIA Experts guide the session