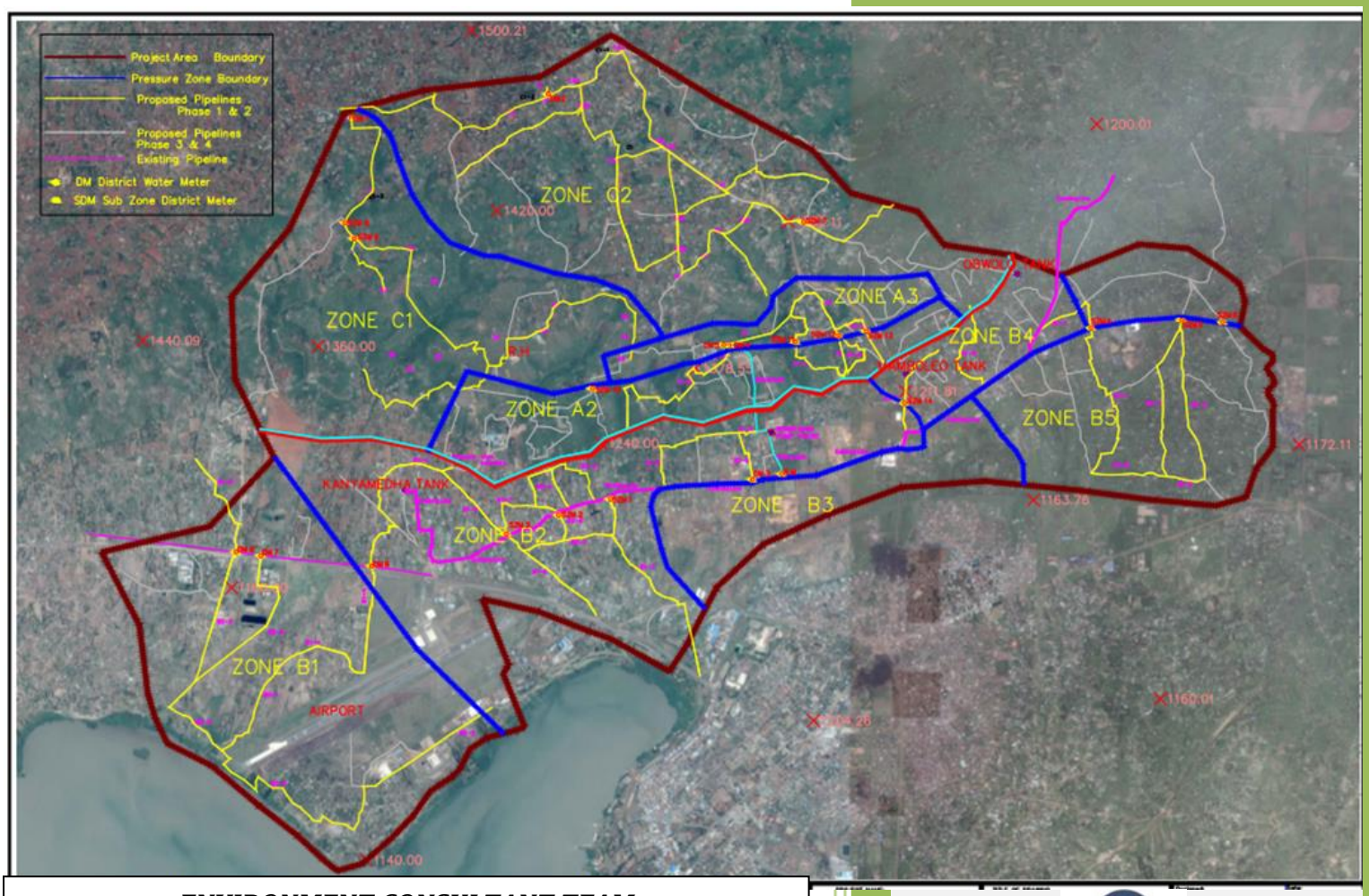
[2017]

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT STUDY REPORT FOR THE PROPOSED OUTPUT BASED AID (OBA) PROJECT FOR KISUMU WATER & SEWERAGE COMPANY, (KIWASCO) WATER EXPANSION –PHASE (1&2) IN SEVEN SUB-LOCATIONS (DAGO,MIKENDWA, KOGONY, KANYAKWAR, KORANDO "A" KONYA, WATHOREGO), KISUMU COUNTY (TENDER NO: KWSC/RFP/30/2015-2016)

OBA-KIWASCO-COMMUNITY WATER EXPANSON COVERAGE IN KISUMU



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KIWASCO
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PROJECT PROPONENT

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CERTIFICATION

This Environnemental and Social Impact Assessment (ESIA) Study report was carried out by a team of consultants from Finix Consulting Ltd (see table 1 below) to undertake screening, scoping and evelopment of Environmental Management Framework of the proposed water project in seven subocations in Kisumu County. This EIA study report provides an accurate and truthful représentation of findings established during the study and has been prepared in accordance with the World Bank Guidelines and Environmental (Impact Assessment and Audit) Régulations 2003 and International Environnemental Safety Guidelines fulfils the réquipements of section 147 (part 2) of the Environnemental Management and Coordination Act (EMCA) 1999, revised 2015.

Table 1: **List of Planning & Participating ESIA Team**

NAME	EXPERTS QUALIFICATIONS	YEARS OF EXPERIANCE	AFFILIATION
Mr. Fredrick Juma (Environmentalist, Lead Expert, NEMA Reg. No. 7512) Tel.0720349175	MSc. GIS & Remote Sensing, BSc Environmental Science	9 Years	FINIX Consulting Ltd, (Environment Department) & Part-Time Lecturer at Masinde Muliro University & Technology (MMUST), Busia, Kakamega Campuses
Prof. William A. Shivoga (Environmental Ecologist)	PhD, Limnology Msc. Environmental Education Bsc. Education Studies	26 Years	Senior Lecturer and Executive Dean Faculty of Science, Masinde Muliro University of Science & Technology (MMUST), Kakamega Main Campus
Dr. Anthony Sifuna (Biological Scientist)	PhD, Biological Sciences Msc. Biological Sciences Bsc. Botany	15 Years	Senior Lecturer in Biological Science Department, Faculty of Science, Masinde Muliro University of Science & Technology (MMUST), Kakamega Main Campus
Mr.Michael Barasa	(BSc, MSc. Ecol & Nat res Mngt)	12 Years	Private Consultant on EIA
Mr. Ochieng Odindo		20 years	FINIX Consulting Social Expert

SUBMISSION OF DOCUMENTATION

I MR. **FREDRICK JUMA OUMA,** hereby submit this Environmental Impact & Social Impact Assessment Study Report for the proposed expansion of the water supply project (Phase 1&2) in seven sub-locations (Dago, Mikendwa, Kogony, Kanyakwar, Korando "A", Konya, Wathorego) within Lake basin, Kisumu County, Kenya. To my knowledge all information contained in this report is accurate and a truthful representation of all findings as relating to the proposed project.

Signed at Nairobi on .....Day of October, **2016.**

Signature: .....

Designation: **NEMA EIA/Audit Lead Expert REG. No.7512**

Msc. Applied GIS/Remote Sensing for Environment (JKUAT)

Bsc. Environmental Science (Egerton University)

SUBMISSION OF DOCUMENTATION

I MR/S. _____ on behalf of Kisumu Water & Sewerage Company (KIWASCO) hereby submit this Environmental Impact & Social Impact Assessment Study Report for the proposed expansion of the water supply project (Phase 1&2) in seven sub-locations (Dago, Mikendwa, Kogony, Kanyakwar, Korando "A", Konya, Wathorego) within Lake basin, Kisumu County, Kenya. Kenya. To my knowledge all information contained in this report is accurate and a truthful representation of all findings as relating to the proposed project.

Signed at Nairobi on this…….. Day of October, **2016**.

Signature: ……..……..

PROJECT PROPONENT:

ACKNOWLEDGEMENT

We hereby express our appreciation to all the individuals and organizations that were consulted and thereby contributed to the drafting of these report for their support towards the successful completion of this project study report. The task of gathering data and field work visits for the project study report was much eased by NEMA registered experts, Kisumu County Government, County Commissioners office, KIWASCO, Lake Victoria Basin Development Authority(LBDA), WRMA Kisumu Regional office, Water Resource Users Associations,Kisumu Water & Social Department, Lake Victoria Water Services Board, Assistant County Commissioners-Winam Division, Chiefs and Assistant Chiefs from seven sub-locations, a Finix Consulting team who assisted the EIA experts and proponent in the technical aspect of the exercise.

The ESIA study team was positively assisted by resourceful advices from KIWASCO-FINIX Engineering team and project area local administrations lead by county commissioner. The Social team was led by Mr.Ochieng Odindo who took to task to executive a household and departmental water needs assessment. In addition, the special thanks goes to all chiefs, village heads in the project area (in seven sub-locations (Dago, Mikendwa, Kogony, Kanyakwar, Korando "A", Konya, Wathorego) and management of Obunga Social hall for hosting public barazas.

The final report is the result of a collaborative process which drew on the effort, knowledge, and patience of the EIA Lead expert (spending days and nights documenting/compiling the report), consulting team (ESIA Baseline researchers from MMUST-Prof. William A. Shivoga and Dr. Anthony Sifuna, Michael Barasa, Finix Engineers & Field data Collectors), and the consulted county departments-Land, water, education, environment, natural resources, Water Resources Management Authority (WRMA). Others that have not been named here, their efforts are earnestly recognized.

LIST OF ABBREVIATIONS

EA -	Environmental Audit
EIA -	Environmental Impact Assessment
ASwT-	Aboveground Storage Water Tanks
EMCA -	Environmental Management and Coordination Act
EMP -	Environmental Impact Assessment
KIWASCO-	Kisumu Water & Sewerage Company
ESIA-	Environmental Social Impact Assessment
FGD-	Focused Group Discussion
Ha -	Hectares
IEC -	Important Environmental Components
MoA-	Ministry of Agriculture
MoE-	Ministry of Environment
m -	Metre
NEMA-	National Environmental Management Authority
ToR-	Terms of Reference
NGO-	Non-Governmental Organization
CIDP-	County Integrated Development Plan
GOK –	Government of Kenya
SOK-	Survey of Kenya
NDMA-	National Drought Management Authority
ASL-	Above Sea Level
KNBS-	Kenya National Bureau of Statistics
MOWD-	Ministry of Water Development
MOWI-	Ministry of Water and Irrigation
F.A.O-	Food and Agriculture Organization
KDHS-	Kenya Demographic and Health Survey
BOQ-	Bill of Quantities
O & M-	Operation & Maintenance
LTAP-	Long Term Action Plan
LVSWSB-	Lake Victoria South Water Services Board
OBA-	Output Based Aid

CONTENTS

EXECUTIVE SUMMARY

This Environmental Impact Assessment report serves to describe the proposed plan for the Water Supply Pipeline Construction project covering three divisions which are: - Kisumu Central (Korando A), Kisumu East (Kogony, Dago, Kanyakwar and Mikendwa) and Kajulu West (Koya and Wathorego). These project areas lie on the immediate northern side of Kisumu. The plan serves to further assess the current environment, the proposed works and its impact on the environment. The report has assessed the potential impacts and has addressed both the positive impacts of the project as well as the negative. The negative impacts have been few and mitigation measures, which if followed, will serve to reduce or avoid those identified.

In this report KIWASCO is regarded here as (the Client) has appointed Environmental Experts from Finix Consulting Ltd, (the Consultant) for undertaking an Environmental and Social Impact Assessment Study for the proposed water expansion.

The requirement for an EIA license is obligated by section 58 of the Environmental Management and Coordination Act, 1999 (EMCA) which stipulates that a proponent must seek an EIA license "notwithstanding any approval, permit or license granted under this Act or any other law in force in Kenya…". The requirement for an EIA license applies to all projects listed in the Second Schedule to the Act. Among the listed activities is an activity out of character with its surrounding, any structure of a scale not in keeping with its surrounding or major changes in land use.

The project proponent appointed the EIA experts to conduct an environmental impact assessment for the proposed project and prepare a project report for submission to National Environment Management Authority (NEMA). This is in line with section 58 of the Environmental Management and Coordination Act 1999 and its subsidiary legislation, Environmental (Impact Assessment and Audit) regulations, 2003 contained in the Kenya gazette supplement No. 56, legislative supplement No. 31 Legal notice No. 101 of 13th June, 2003.

Scope of EIA: Screening, Scoping, Project designs & Processes, Baseline Survey (Soil/Water/Geology/GIS & Topographical Survey), Water Quality and Quantity Assessment, Flora/Fauna assessment, Analysis of project alternatives, Public & Stakeholder Analysis (Baraza, key informant interviews, FGDs, Questionnaires, Public Media), Impact identification, Impact Analysis(Positive/Negative), Environment Management Framework, and Environmental Monitoring Plan, Report compilation, Submission to NEMA, Approval conditions and NEMA Licensing.

Environmental Baseline

Only the descriptions of the most sensitive environmental receptors are summarized below. The main report contains a more comprehensive review of general environmental parameters. Data pertaining the existing environment in this report were for Climatology, Meteorology,

Physiography, Geology and Structure, drainage, seismicity, land use, air and noise quality, soil, Natural Hazards, and Socioeconomics.

Ecological Zone: Kisumu County is an area falling in the ecological zone II & III.

Temperature, rainfall & Micro-climate: Kisumu is situated on the equator, leading to a hot and humid year-round climate and annual rainfall of approximately 1,200 mm. The City has two rainy seasons-from March through June, and November through December. Temperatures are relatively cool, high average monthly maximum temperature of 30^0C and average minimum monthly temperature of 160C at night.

General Geology: Deposits of Pleistocene to recent age include hill wash gravels (colluvium), semi consolidated river alluvium, quartz rubble and lateritic ironstone capping. Brown sandy soils with occasional and locally distributed deposits (laterites) occur in the project areas. The subsurface geology of the project area comprises of intrusive rock. Outcrops of these granites are noted within the vicinity confirming them as the host rock. In hand specimen they are dense, coarse grained felsic rocks. Occasionally, minute feldspar crystals are recognizable to unaided eye.

Topography, drainages and soil: In the upper reaches from the foot of the Riat Hills to the upper plains of Kisian the elevation within the project area varies boundaries varies generally from 1340m asl to 1550 m asl. Within the lowlands at the foot of the hills to the lake shores and railway reserve ranges from 1160 m asl to 1240 m asl. The upper reaches are within rocky areas particularly on the steep slopes of the hills. The soil profile changes to loamy soils with rocky patches in the gentler slopes after the steeps. The lower reaches have soils which are a combination of laterites (Murrum), loamy and clay soils. The progressive change in the soil types occurs with movement from the hills towards the lake shores. The general project area is generally well drained with run off and discharges eventually draining into Lake Victoria. The predominant soils are black cotton soils.

Biodiversity of the Project Area: Biodiversity in the main consists of fish species, birds and higher vertebrates such as amphibians, reptiles and mammals as well as several plant species. A total of 31 amphibians, 28 reptilian and 44 mammalian species have been recorded on various sites in the Lake Victoria basin.

The dominant terrestrial vegetation comprises of dry, peripheral, semi- evergreen rainforest and scrub forest in the eastern parts of the basin. Several species are currently threatened, particularly those in fragile areas such as wetlands. Zooplanktons consist of abundant copepods and cladorerans.

Sewerage: The area is not served by local Kisumu Water & Sewerage Company sewerage system. Most facilities around the site are either connected to septic tanks or use pit latrines.

Electricity: The area is well covered in terms of electricity supply, with an established KPLC company grid system along the road reserve.

Solid Waste Management: The nearest and the only waste dumping facility in Kisumu, is the Open-dumping Kachok waste management facility. Private waste collection companies collect waste from commercial and residential areas near the project area. The system adopted for managing this waste must be efficient and environmentally dependable. In terms of waste management, volumes are more useful quantity to consider than weight. Waste in the project area is minimal and is collected onsite and disposed at designated dump sites. Waste collection will be undertaken privately by contracted garbage collectors.

Security: Security services are undertaken privately, in addition to the public police patrols.

Ambient Air Quality: The project is not expected to generate major air pollution. The major existing source of emissions in proximity to the site is the moderately busy main road (Kisumu-Busia and Kisumu – Kakamega roads with associated service lanes). Other major air pollutants are associated with minimal exhaust emissions and fugitive dust.

Ambient Noise Levels: As in the case of ambient air quality, this project is not expected to result in a significant change to ambient levels of noise in the area. Consequently this parameter is only described qualitatively in terms of existing sources of noise. The sources of noise are the same as the sources of air pollution in the area.

Waste Management: By 2008, the daily generation of household waste was estimated to be 437 ton. About 63% of the waste generated in Kisumu is organic; hence there is enormous potential for composting. Many households, particularly in the peri-urban areas, have no access to public services and are unable to access private waste collection due to fees levied. Some common dumping grounds have developed on open lands within densely populated neighborhoods. The poor management of solid waste blocks sewers and drainage systems provides a breeding ground for disease vectors and contributes to the generation of leachates, which pollute the ground water and further contribute to waste related diseases. A few enterprises within the city and some residents salvage such materials as plastic bags and bottles, but their use is considered unhygienic.

Liquid Waste: The main sewage treatment plant in Kisumu is the Kisat Conventional Sewage Treatment Plant (STW), built in 1958. There are three main private industrial wastewater treatment plants, but two of these are pre-treatment facilities only, with just one a full treatment plant. As the population increases and more septic tanks are installed in Kisumu, and as industrial production increases, wastewater production is likely to increase. The wastewater collected in sewers will require treatment before it can be reused for industrial and domestic use.

Commercial activities and institutions: Fishing is the main economic activity serving shoreline communities in Kisumu County. Water hyacinth chokes Lake Victoria, making it difficult for the community to develop the economic livelihood. Use of old technologies also hampers the full development of the industry. Rice is grown under irrigation in the Kano Plains. The northern and eastern fringes of the Kano Plains also play host to some of Kenya's most productive sugarcane fields. Kisumu County also produces maize, beans, sweet

potatoes, poultry and fresh vegetables. The community also keeps local cattle, sheep, Goats, dairy cows, donkeys and pigs in small scales.

There are several light industries. These include textiles, molasses, fish processing plants and agricultural produce processors. Kisumu has 4 sugar factories, at Chemelil, Muhoroni, Kibos and Miwani. Also present in the main industrial area is a large scale maize milling company. Several backyard industries also thrive in the county, including tailoring, making of handicrafts and boat-building. Kisumu County project area has approximately 19 Medium Class Hotels, 63 low class Hotels, 51 Bars and Restaurants, and a mix of small scale enterprises spread within.

Transport in Kisumu County: Kisumu County has several paved roads, the major one being the Nairobi-Bondo road, which has a branch at Kisian heading to Busia. Important roads are paved with asphalt. County roads are mostly murram but provide all weather movement all year. Public transport services are provided by matatus and buses either operating singly or as parts of franchises and companies. Bicycle and motorcycle boda-bodas also exist in significant quantities for short distance travel.

The city of Kisumu was founded as a terminal for the railway, and therefore has an important railway station. Water transport on the lake is provided mostly by private operators in wooden boats with outboard engines, although a ferry service exists. They also link the county with the other three lakeside counties and the countries of Tanzania and Uganda. Kisumu International Airport has been upgraded and now has the potential to be an entry port for the entire region.

The proposed water project by activities: By implementing the project, the developer will be engaged in a project cycle involving water abstraction from the source environment (kosida spring in Mikendwa and Kajulu Spring Water which will be pumped to a tank at RIAT Hills), laying of delivery pipes to users, establishing water holding facilities at selected points and distribution to prospective users. Methods will involve few trenched sections (under roads), construction of masonry tanks and development of environmental abstraction points. Logically, the project will bear some degree of impact at the tangent environments, and will entail watering large areas which initially had little settlement and were without consistent supply of water resources, thus will attract a lot of new settlement.

Negative impacts by project activities: Some of the negative impacts most likely to occur include reduced water flow downstream, Destruction of upper catchment may impact productivity and Water Pollution at source. The project may impact a wider community at supply ends on account of developing and abstraction spring, cause loss of biodiversity, Obstruction of businesses for access and Risk of electrocution Injuries from associated works during trenching works. Reduced Aesthetics and Loss of biodiversity on account of fixing the satellite supply tanks will be inevitable as well as environmental noise during operation. At the user end, depending on scope of use, there could emerge cases of electrocution through water, drowning, Fugitive flows from bursts, Fugitive flows into social waste collection points and water borne diseases from vectors.

Identified environmental issues related to the project

No.	Major Project Activities	Remarks	Potential Impacts
1	Environmental Abstraction	Water will be catalyzed to flow out of springs (source) by enhancing bank protection. Most of the water will be channeled into the pipeline	Reduced water flow downstream
			Destruction of upper catchment may impact productivity
			Water Pollution at source may impact a wider community at supply ends
2	**Trenching**	**Clearing of path to pave way for creation of the trench using machinery or manual labour.**	**Loss of biodiversity**
			Obstruction of businesses for access
			Risk of electrocution
			Injuries from associated works
			Risks from insect, snakes or animal bites
			Dust emission
			Trip and falls into holes
			Ergonomics
3	Laying Pipes		See under general
4	Fixing Satellite tanks	These will take some space and will be visible	Reduced Aesthetics
			Loss of biodiversity
5	Pumping	Depending on model	Noise during operation
6	Implementation	These are generic to the project	Injuries from associated works
			Risks from insect, snakes or animal bites
			Fatigue
			Dust emission
			Trip and falls into holes
			Ergonomics
			Risk of electrocution
			Air pollution from machinery
			Soil pollution from oils
			Waste generation from project components
			Social Conflicts and way-leave access issues
7	End User	Potential attributes by the project water or system	Shock (electrocution)
			Drowning
			Fugitive flows from bursts
			Fugitive flows from waste
			Waterborne Diseases

Project Cost: The estimated Phase 1 cost of the proposed project is **Ksh.69, 212, 237 (**Sixty Nine Million, Two Hundred And Twelve Thousand, Two Hundred And Thirty Seven Kenya Shillings).

Public Consultation: A group consultative meeting was held at Obunga Hall Kisumu, County. About 50 No. people attended the meeting. Attendants included members of the community, local administrative heads and community elder's consultative groups, other key stakeholders (Lake Victoria Service Board, Lake Basin Development Authority, Water

Resources Management Authority and Representatives of Lake Victoria North Water Resources Users Association). A number of key issues were discussed, including project introduction and plans, water sources, supply and storage scopes. The sources of these water was said to have been assessed and found to be enough and sustainable for the project. Also, sanitation and the acute water shortages currently in the area were discussed. The general comments for action were: Much public participation for the project making it to be well informed in the ESIA report, Needed spring protection at Mkendwa, Proper treatment of water supplied to the community, Formation of a local committee to facilitate inspection and maintenance of the water system for efficient water supply and free from illegal connections, Environment, Health and Safety in Operative stage and conservation of the environment in all stages of the project and, Appropriate collaboration with all stakeholders in the area, local, county and national levels to ensure efficiency in water supply in the region.

Project Alternatives: A number of project alternatives looked into included The "No-Action" Alternative; The proposed development as described in the EIA; The proposed development as described but with alternative routing and; EIA With/Without an EMP. The proposed development as described in the EIA was found to be most favourable following technical consideration of the issues brought forth. The EMP at this stage would be useful for proponent's consideration ahead of the physical implementation of the project.

Environmental Impact matrix: An impact matrix is a simple but effective tool for identifying the possible impacts of project activities on the environment and this has been done for the proposed project. Here, the activities carried out during the construction, operational phases and decommissioning phase are arrayed against a selection of environmental factors that are deemed relevant to the site, or which may be affected indirectly as a result of project activities.

The impact matrix should not be misinterpreted to mean that all the identified impacts would occur during implementation of the project. However, the matrix does serve to identify the potential impacts and significant concerns and this leads to the next step of the EIA process, mitigation, which considers the appropriate measures to remove or ameliorate the adverse impacts that have been identified. At this stage measures to enhance the positive aspects of the development can also be devised.

A summary of the potential environmental impacts is provided below in the form of an impact matrix which is a simple but effective tool for identifying the possible impacts of project activities on the environment.

Impact Matrix (Construction)

Ref. to impacts section	ENVIRONMENTAL IMPACT	IMPACT TYPE								MITIGATION		
		Positive		Negative								
		Significant	Not Significant	Significant	Not Significant	Short Term	Long Term	Irreversible	Cumulative	No mitigation required	Mitigation required	Ref. to mitigation section
CONSTRUCTION PHASE IMPACTS												
7.1.1	Soil and Solid Waste – Environmental pollution				X	X					X	**7.3.1**
7.1.2	Air Pollution				X	X					X	
7.1.3	Water quality				X	X					X	
7.1.4	Flooding				X	X					X	
7.1.5	Noise				X	X					X	
7.1.6	Destruction of Indigenous Vegetation				X	X					X	
7.1.7	Cultural Chance Find Procedures			X		X					X	
7.1.8	Intake spring interference with aquatic organisms biodiversity			X		x					X	

Impact Matrix (Operation and decommission)

Ref. to impacts section	ENVIRONMENTAL IMPACT	IMPACT TYPE								MITIGATION		
		Positive		Negative								
		Significant	Not Significant	Significant	Not Significant	Short Term	Long Term	Irreversible	Cumulative	No mitigation required	Mitigation required	Ref. to mitigation section
OPERATION PHASE IMPACTS												
7.2.1	Noise				X		x		X		x	**7.3.2**
7.2.2	Solid Waste			x			X		x		X	
7.2.3	Air pollution				x		X				X	
7.2.4	Disease hazards			x			X				X	
7.2.5	Insecurity				x		X				X	
7.2.6	Water management conflicts			x		X					X	
7.2.7	Increased traffic – unnecessary congestion				x		X				X	

The result of the EIA study has indicated that there are no significant and permanent negative impacts likely to be generated by activities of the proposed project. All potential negative impacts identified are either short-term or may be easily and safely mitigated. The overall direct and indirect creation and sustenance of water provision, weighed against the potential negative impacts make this project positive overall. Most of the envisaged negative impacts can only cause damage to the physical environment and/or human health only if mitigation measures are not implemented as recommended in this project report. To address the possible negative environmental impacts, the EIA team has developed a comprehensive environmental management and monitoring plan that will ensure environmentally sustainable development.

Mitigation Measures: In order to address these main impacts the following mitigation measures have been suggested:

- Development of a code of practice to minimize construction noise, vibration, dust
- and disturbance;
- Environmental Impact Assessment Project Report-KIWASCO-OBA Water Project)
- Closing open tunnels and Planting of grass, trees, shrubs and wild flowers
- Application of soil conservation measures to reduce runoff from the hill during wet seasons
- Developing measures for the recovery of all debris and waste water and soil material generated.
- Undertake routine Water Quality Assessment for drinking water-Quarterly
- Recycling, rethink, recovery and reuse of appropriate mining materials
- Provision of security measures to deter intruders and protect them from the risk of injury and exposure;
- Fencing off the open pits with scenes of accident tapes, use of shed nets as high as 10 meters above ground surface, tree planting to reduce dust emissions
- Fitting of noise silencers on generator exhausts
- Installation of oil/diesel separators on site to keep oils from storm runoff
- Establishing a frame work for liaising with residents; e.g. Environment Management Committee (EMC), through Water Resource Users Association (WARUAs) and WARMA
- Putting in place measures to reduce all kinds of pollution (water, air, soil)
- Backfill areas where top soil is disturbed with good quality soils and plant trees.
- Organize disposal of all wastes generated during construction in an environmentally acceptable manner and through a NEMA registered waste handler. This shall include consideration of the nature and location of disposal sites, so as to cause least environmental impact.
- Take all precautionary measures when handling and storing fuels and lubricants, to avoid causing environmental pollution. This is to include establishment of contingency plans for clean up in the event of spillage.
- Monitor periodically (Bi-weekly, Monthly, Quarterly) by sampling and testing waste recipients such as soil and water to ascertain the quality of water at source springs and wastewater in the drainage areas periodic sampling and testing in an accredited laboratory as per WHO and KEBs standards.
- Educate and sensitize project neighbors to plant agro-forest trees around homesteads to prevent or minimize potential emissions impacts
- Plant nippier grass and other leguminous grass around the hilly areas to prevent surface soil erosion
- Excavation works should be carried out safely by ensuring that safety procedures are followed at all times during project operation phase.

Recommendations: This development has the support of the community. The developers are willing to work with the regulatory agencies and community to insure that the development is pleasing and acceptable to all involved. Additionally, this development will have no major negative environmental impact and will result in several major positive socio-economic impacts on the surrounding communities and country as a whole. It is our recommendation that this project be approved for development and a permit granted. The potential impacts identified if realized will be mitigated using proven technologies. No new or unfamiliar environmental impacts or risks have been identified with the proposed project. The proposed project represents a continuance of the investment in the water sector in Kenya and promises to bear substantial macro and micro economic growth and development to specifically the city of Kisumu.

Conclusions: Considering the positive socio-economic and environmental benefits to accrue as a result of the proposed mining project, and the EIA study has put in place appropriate mechanisms using the preventive principle to mitigate major impacts that could arise from the development, it is the recommendation of the Environment expert team that the project be allowed to proceed on the understanding that the proponent will adhere to the mitigation measures recommended herein, approval conditions to be provided by NEMA and will further still implement the proposed Environmental & Social Management Plan (ESMP) and Environment Health and Safety Plan, and Environment Monitoring Plan during project operation phase, decommissioning phase and post project lifecycle phase.

1 INTRODUCTION

The history of Kisumu can be traced back to early 1901, then known as Port Florence. Today Kisumu is popularly referred to as the lakeside city because of its strategic proximity to the Lake Victoria, the second largest Fresh water lake in the world. It is Kenya's third largest city with a population of over 520,000 people and is situated on the north tip of Winam gulf, which in itself is part of Kavirondo Gulf of Lake Victoria. Kisumu was the major port of Lake Victoria during the commonwealth of East Africa. It was also a transportation center with a railroad line from Mombasa and the water routes of Lake Victoria, and a military and administrative center.

1.1 Brief History of KIWASCO and the project

KIWASCO was established through the reforms that took place in the water sector nationally and based on the decision to privatise essential services. The Company was established in July 2003 as an independent company after the transformation of the water and sewerage department of the Kisumu Municipal Council. The core objective of KIWASCO is to make the water and sewerage services provision a commercial activity that generates sufficient revenue to sustain operations. The Kisumu Water & Sewerage Co. Ltd is mandated by Lake Victoria South Water Services Board (LVSWSB) to provide water services to Kisumu City and its environs. The Company has a Service Provision Agreement (SPA) with the LVSWSB.

KIWASCO has commissioned FINIX CONSULTANTS LTD Ltd to undertake Detailed Engineering study and an Environmental Impact Assessment Study and Construction supervision for the proposed Implementation of Phase 1 Kisumu City (seven sub-locations) OBA (Output Based Aid) water and sewerage supply project Kisumu county. As part of study process, FINIX CONSULTANTS LTD undertook socio-economic study of the principal area covered by the project which is Kisumu County urban and peri-urban areas.

Although Kisumu County has a piped water supply, the demands of water consumption in peri-urban is still a severe problem due to increase in population over time. Thus this has led to a number of households buying water from private vendors for domestic consumption in addition to the existing sources from the supply system. The general population in the town has been facing obstacles to access water and thus relies on informal sector, which is both socially and economically expensive.

Current Remedial measures:
The improvement works in the water supply network under the Long Term Action Plan (LTAP) intended to supply sufficient water to the City up to 2030 is now complete and functional. The recently executed LTAP project estimates the water production of the Kajulu water source at 36,000 m3 per day. Additionally there is now a newly laid DN 300 transmission mains in Kogony and Kanyakwar up to the Kanyametha tank and the DN 250 extending parallel to the Kisumu-Busia road up to Korando B ward. The provision of adequate bulk water has presented the need to improve the existing water supply network to distribute water to underserved and un-served areas.

1.2 Project Objectives

The main objective of this proposed project is to expand a community water access project through KIWASCO targeting specific number of households in seven sub-locations. The project shall improve the living standards; earn revenue to the state, county government and overall improvement in livelihoods, health and socio-economic status of the local community. This will be done through strategic installation of water tanks, laying of water pipes, installations of water pumps and a handover to KIWASCO who will run the water supply system through the project operation phase.

1.3 Spatial Scope of the project

The water supply project will cover three divisions which are: - Kisumu Central (Korando A), Kisumu East (Kogony, Dago, Kanyakwar and Mkendwa) and Kajulu West (Koya and Wathorego). The project area lies on the northern side of Kisumu City Centre and the inhabitants are generally native community thus it is majorly semi urban. The area fall within the mountainous side of the city, thus water resource is quite vital.

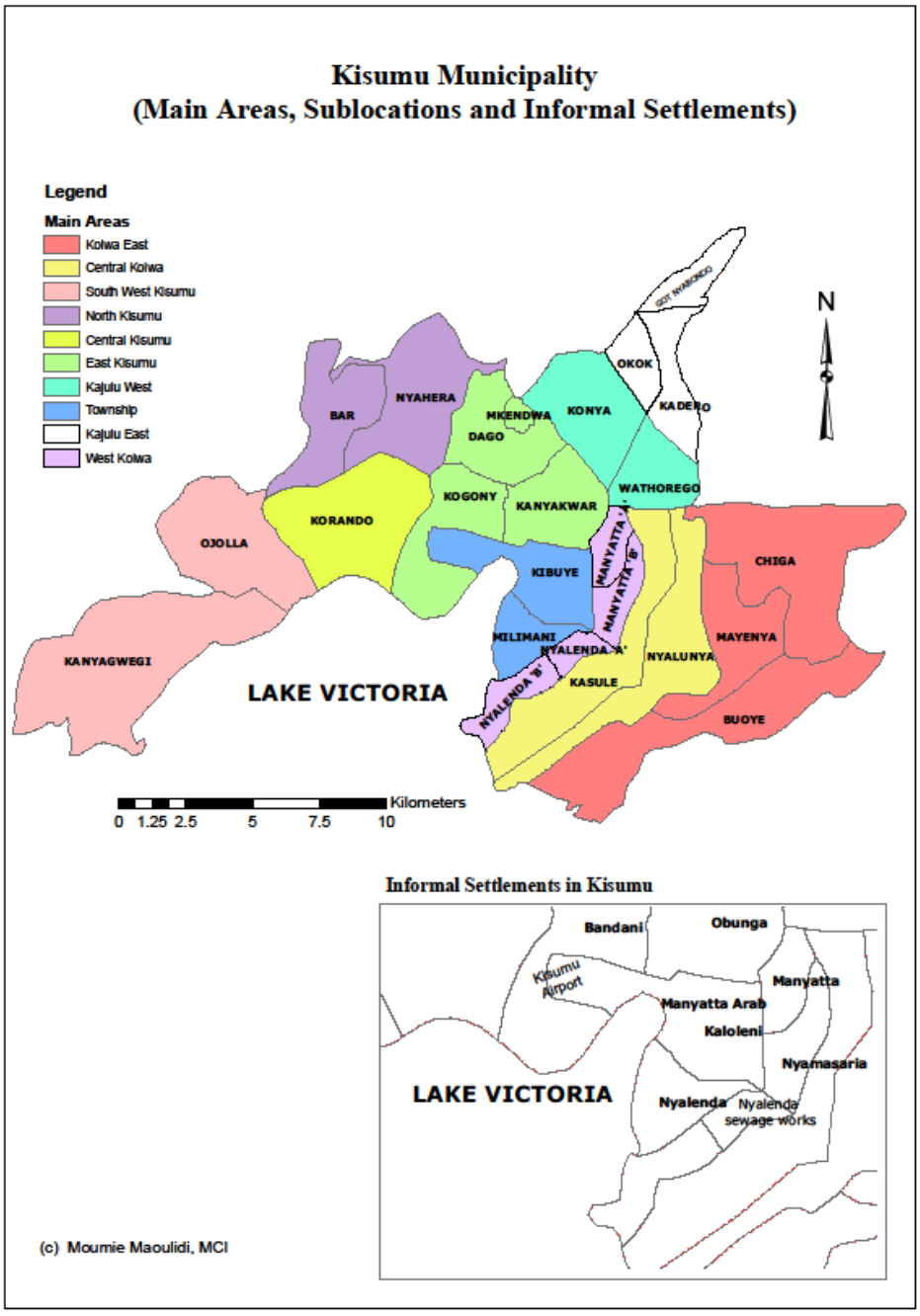

Figure 1-1: Administrative boundaries of Kisumu City County

Kisumu City County project area comprises the following sub-locations:

- Kanyakwar;
- Kogony;
- Dago;
- Mkendwa;
- Korando A;
- Wathorego; and
- Konya.

1.4 Justification for the Proposed Water Project

The project area that fits these requirements has been identified under this study to lie partially or wholly within the wards of Kogony, Kanyakwar, Konya, Wathorego, Korando A, Dago and Mkendwa. The areas in reference are undergoing significant growth in all the categories i.e residential, commercial and institutional. It is noteworthy that a larger section of target area of this project lies within with identified potential high growth area identified under the Kisumu Integrated Development Plan of 2014. The other section is adjoining and extends into the Riat Hills but lies outside the scope of consideration of the ISUD plan.

According to KIWASCO, most of the proposed project area considered under this assignment is not adequately served. The tertiary and secondary water network distribution is not well developed despite being near the major transmission mains commissioned under the LPAP project. Arising out of the above considerations, this study has proposed to serve the identified project area by dividing it into three supply zones depending on the commanding supply source.

The major challenges affecting the project area include:

- Lack of access to clean drinking water
- Poor water management and maintenance
- Increased housing development
- Inadequate public water access kiosks
- Poor management of springs water sources
- Low recognition of Water Resource Users Associations (WRUAS)
- Insecurity

1.5 Public Involvement

To understand how the proposed project will help economic development of the project area, needs assessment water demand survey was commissioned at both household level and institutional level.

This survey gathered information that was representative of the target population. A sample of 200 households was reached.

The distance covered by most of the respondents is less than one kilometer. It's therefore expected that there will be a great improvement in access to clean water and as such the human productivity that is lost through travelling in search of water will be redirected towards more productive economic activities. This will then mean that the overall quality of life will be improved.

Main problems respondents encounter in accessing water are many with the key one being accessing unsafe water due to lack of tapped water. Distance covered to get water was also mentioned by the responses as a major setback. Water is also very unreliable in its supply in the surveyed areas.

Nonetheless, majority of the respondents are willing to pay for water services with 77.5% percent preferring to have home water supply (individual connect). Slightly 4.0% percent of those willing to pay for water service would be comfortable buying water through kiosks as 11.5% percent proposing for a shared tap. A number of consultative meetings were also held with members of the public.

1.6 Scope of this Environmental Study

The project proposed the following scope to be considered for the EIA Process.

- Project Screening and Scoping of project components and site
- Discussions in association with Lead agencies and other affiliated lead agencies to confirm the scope of the environmental issues and studies for this proposal.
- Environmental studies (desk and new field baseline investigations and community consultation as required) to identify anticipated environmental impacts of the proposed project.
- Identification of potential mitigation measures and discussion of these with KIWASCO, WARMA, the county natural resource executive/officers, NEMA and others so as to analyze practicality and likely cost.
- Finalization of recommended mitigation measures required during design, construction and operation of the project.
- Development of cost estimates of the mitigation measures.
- Preparation of a project-specific Environment Management Plan / Mitigation Management Action Plan that meshes with EMCA overall Integrated Environment Management Plan.
- Assistance of KIWASCO in submission of findings to NEMA and subsequent discussions with NEMA and other agencies as required during their assessment procedures.
- Identification of socio- economic impacts of the project to the stakeholders.

1.7 Terms of reference according to EMCA 1999 (rev 2015)

This EIA study has been undertaken in accordance with provisions of EMCA and requirements of the Environmental (Impact and Audit Regulations) 2003 Legal Notice No. 101, and all relevant national and international legislations and regulations. The

ToR agreed between the proponent and consultants in line with EMCA and EIA regulations and submitted to NEMA are given herein below:

- The proposed location of the project
- A concise description of the national environmental legislative and regulatory framework, baseline information,/ any other relevant information related to the project.
- The technology, procedures/ processes to be used, in the implementation of the project.
- The materials to be used in the construction and implementation of the project.
- The products, by-products and waste to be generated by the project.
- A description of the potentially affected environment.
- The environmental effects of the project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated.
- To recommend a specific environmentally sound and affordable wastewater management system.
- Provide alternative technologies and processes available and reasons for preferring the chosen technology and processes.
- Analysis of alternatives including project site, design and technologies.
- An environmental management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment, including the cost, timeframe and responsibility to implement the measures.
- Provide an action plan for the prevention and management of the foreseeable accidents and hazardous activities in the cause of carrying out development activities.
- Propose measures to prevent health hazards and to ensure security in the working environment for the employees and the management in case of emergencies.
- An identification of gaps in knowledge and uncertainties which were encountered in compiling the information.
- An economic and social analysis of the project.

1.8 EIA Methodology

The methodology consisted of site visits, photographs, GPS mapping, literature review, and discussion with technical personnel from Finix and KIWSCO Engineers, Kisumu County Government, County Commissioners Office and the local administration, village community, The ESIA took into account the nature, scale and duration of effects on the environment and whether such effects are positive (beneficial) or negative. Each issue / impact was also assessed according to the project stages from planning, through to the construction and operation phase. Where

necessary, the proposal for mitigation or optimization of an impact is noted. A brief discussion of the impact and the rationale behind the assessing of its significance has been included.

During field work, the EIA team collected information through observations, photography and key Interviews were held with the local people around the project area to obtain information regarding use, values and environmental significance. As part of the field appraisal, the project identified the major stakeholders /community groups that are likely to be impacted by the project.

The general steps followed during the study were:

a. Screening in which the project was already identified by the Proponent as among those requiring environmental impact assessment as per schedule 2 of EMCA, 1999.
b. Scoping in which key issues and potential environmental and socio-economic impacts were established, evaluated and their severity determined.
c. Desktop review of baseline environmental and socio-economic information, legislative framework and project implementation requirements.
d. Fieldwork involving land surveys, census surveys, physical assessment of environmentally sensitive sites, proposed intake sites and surrounding areas.
e. Public consultations through public interviews, questionnaires to community.
f. Reporting of EIA study findings.

2 BASELINE INFORMATION ON THE EXISTING ENVIRONMENT

2.1 Background of the project area

Kisumu is the third largest town in Kenya. It is the headquarters Kisumu County in Western Kenya, and lies generally on latitude 00o6 N and longitude 34o 45' E and is located about 340 km by road to the North-West of Nairobi on the Northern Corridor highway to Uganda and the Eastern parts of the Democratic Republic of Congo. Kisumu borders Lake Victoria to the South West, the sugar belt and Kano irrigation scheme to the East.

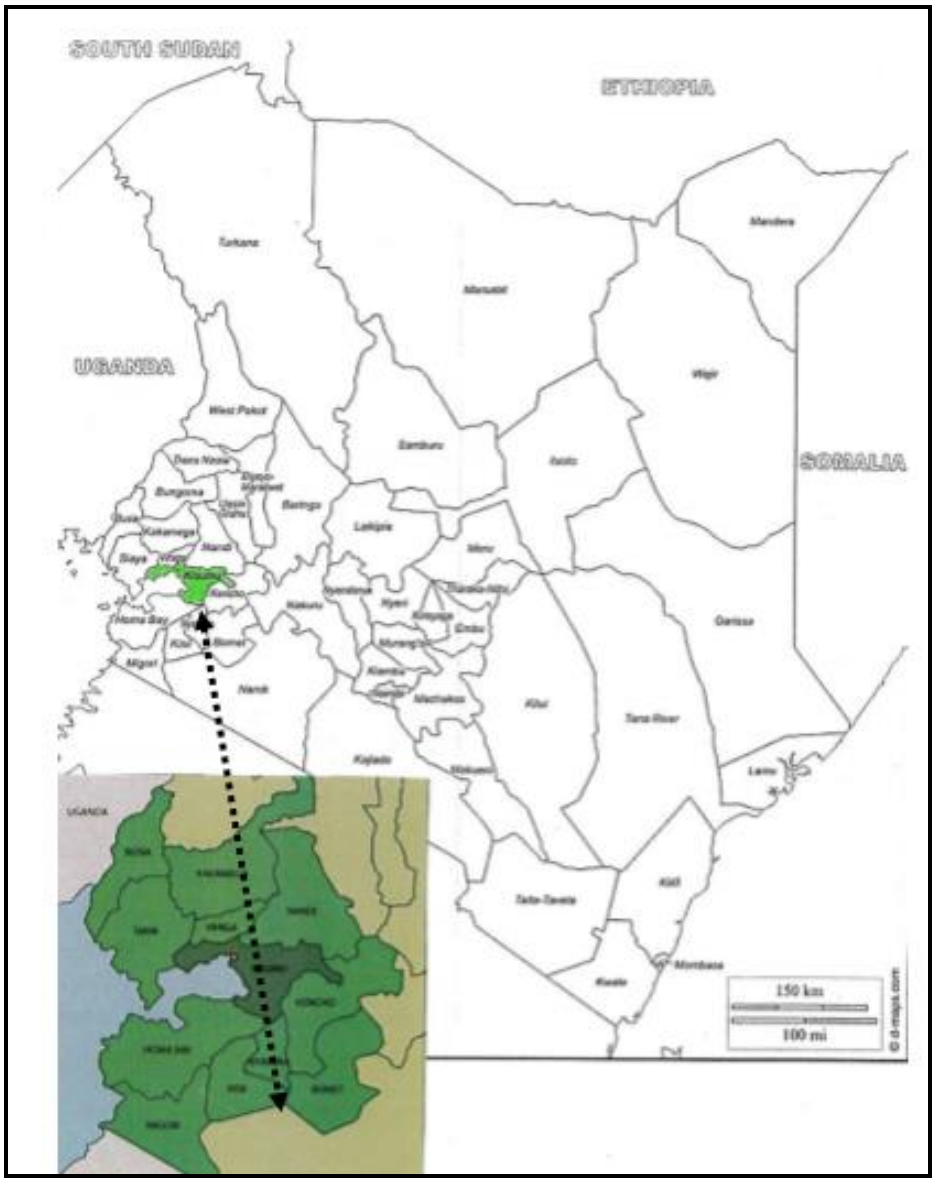

Figure 2.1: *Project Location*

2.2 Location of the project study area

The proposed OBA project covers the following in Kisumu City County comprises the following sub-locations:

- Kanyakwar;
- Kogony;
- Dago;
- Mkendwa;
- Korando A;
- Wathorego; and
- Konya.

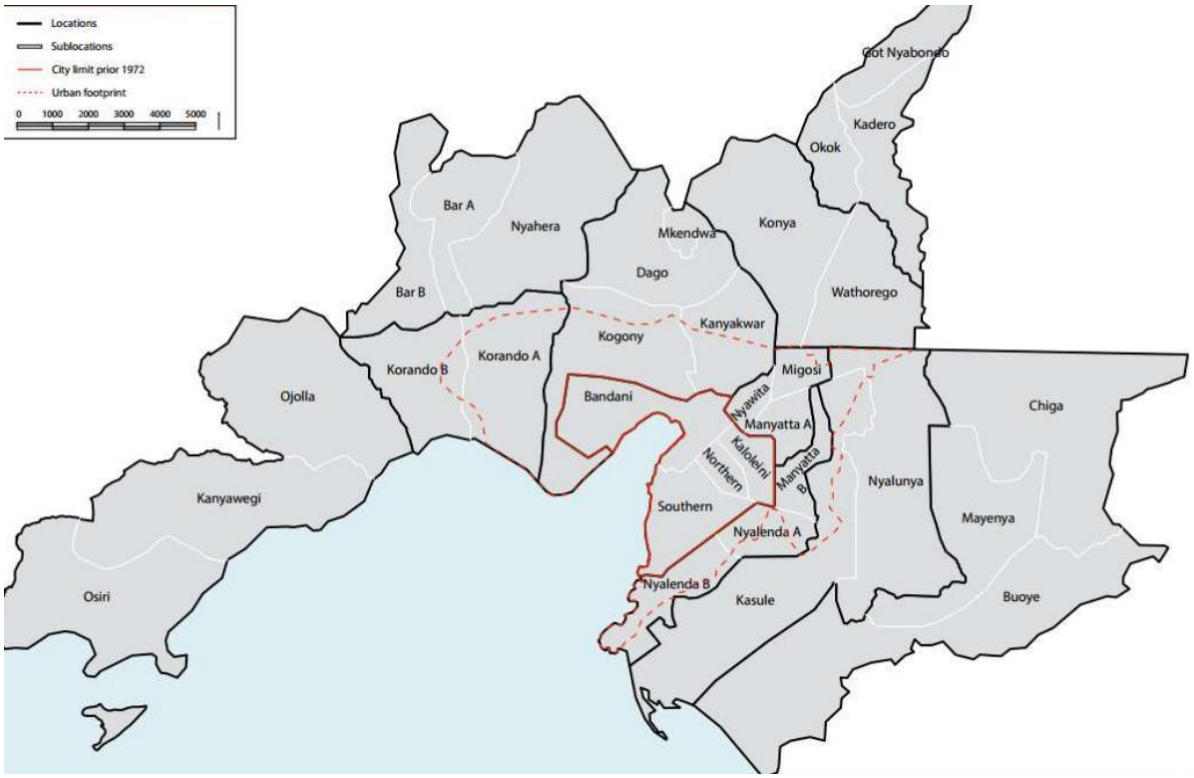

Figure 2.2: In tangent sub-Locations to the project area

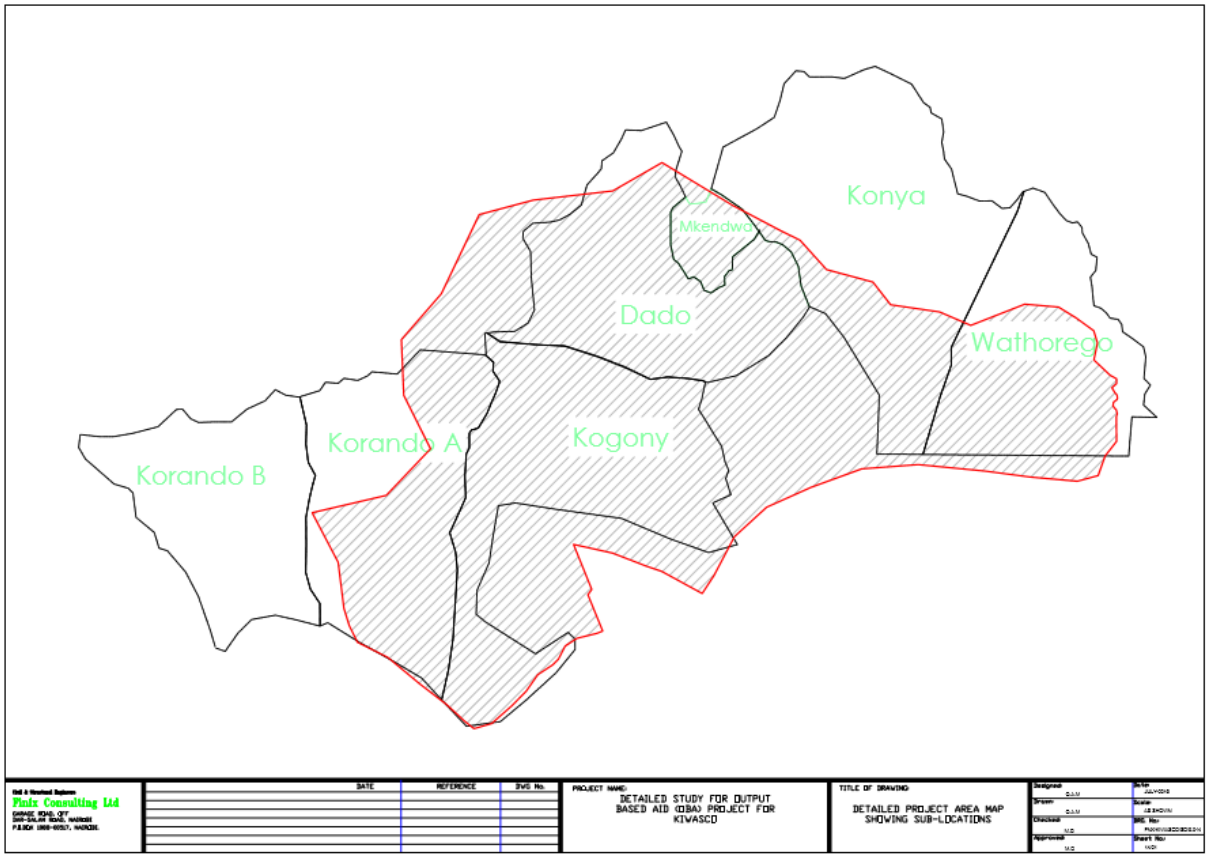

Figure 2.3: Extent of the project area

2.3 Project area population profile

Table 2-1: 2009 Population Figures for Kisumu County Municipality

Location	Sub location	1999 Census	2010	2011	2015	Area (SqKm.)
Kisumu Central		**14,950**	**20,327**	**20,920**	**23,399**	**17.2**
	Korando A	9,538	12,968	13,347	14,929	9.5
	Korando B	5,412	7,358	7,573	8,471	7.7
Central Kolwa		**19,387**	**26,360**	**27,129**	**30,344**	**36**
	Kasule	**10,701**	14,550	14,974	16,749	20.4
	Nyalunya	8,686	11,810	12,155	13,595	15.3
East Kajulu		**12,064**	**16,403**	**16,882**	**18,882**	**15.3**
	Got Nyabondo	3,483	4,736	4,874	5,452	5.1
	Kadero	5,304	7,212	7,422	8,302	6.6
	Okok	3,277	4,456	4,586	5,129	3.6

Location	Sub location	1999 Census	2010	2011	2015	Area (SqKm.)
East Kisumu		**27,626**	**37,562**	**38,658**	**43,240**	**32.6**
	Dago	4,422	6,012	6,188	6,921	10.2
	Kanyakwar (Obunga)	8,576	11,660	12,001	13,423	8.5
	Kogony (Bandani)	13,961	18,982	19,536	21,851	13.1
	Mkendwa	667	906.89108	933	1,044	0.8
East Kolwa		**15,843**	**21,541**	**22,170**	**24,797**	**56**
	Buoye	4,586	6,235	6,417	7,178	22.2
	Chiga	7,109	9,666	9,948	11,127	22.2
	Mayenya	4,148	5,640	5,804	6,492	11.6
Kondele		**69,521**	**94,525**	**97,283**	**108,813**	**4.8**
	Manyatta A	41,910	56,983	58,646	65,597	2
	Migosi	14,771	20,083	20,670	23,119	1.7
	Nyawita	12,840	17,458	17,968	20,097	1.1
North Kisumu		**16,337**	**22,213**	**22,861**	**25,570**	**30**
	Bar A	3,709	5,043	5,190	5,805	6.5
	Bar B	3,605	4,902	5,045	5,642	7.9
	Nyahera	9,023	12,268	12,626	14,123	15.9
South West Kisumu		**18,831**	**25,604**	**26,351**	**29,474**	**50**
	Kanyawegi	5,846	7,949	8,181	9,150	17.1
	Ojolla	6,841	9,301	9,573	10,707	17
	Osiri	6,144	8,354	8,598	9,616	16
Township		**40,295**	**54,787**	**56,386**	**63,069**	**14.2**
	Bandari	7,039	9,571	9,850	11,017	5.7
	Kaloleni	13,515	18,376	18,912	21,153	2.1
	Northern	10,117	13,756	14,157	15,835	1.3
	Southern	9,624	13,085	13,467	15,063	5.1
West Kajulu		**17,478**	**23,764**	**24,458**	**27,356**	**22**
	Konya	10,308	14,015	14,424	16,134	11.9

Location	Sub location	1999 Census	2010	2011	2015	Area (SqKm.)
	Wathorego	7,170	9,749	10,033	11,222	9.8
West Kolwa		**70,402**	**95,723**	**98,516**	**110,192**	**12.2**
	Manyatta B	21,027	28,590	29,424	32,911	3.3
	Nyalenda A	23,731	32,266	33,208	37,143	2.8
	Nyalenda B	25,644	34,867	35,885	40,137	6.1
Total		**322,734**	**438,807**	**451,614**	**505,136**	**290**
				-Project Area in blue		

2.4 Kisumu County Baseline Information

2.4.1 Population

The last Kenya National Population and Housing Census year of 2009 estimated the population of Kisumu to be 404,160. The current population (year 2015) population has been estimated by extrapolation to be approximately 471, 452 and projected to reach 692,864 in 2030 According to the Kenya National Housing Survey Census Data of 2009, the population growth rate is 2.6% per annum with a density of approximately 975 persons per km. The population is young with 73% aged below 30 years old.

The projected urban growth also means increasing demand for infrastructure and urban services. Expanding the tax base and enhancing local revenues are important areas. Lack of proper planning has led to severe infrastructure backlog in the town. The population lacks access to basic services like water, electricity, healthcare etc. According to information obtained, sewerage coverage stands at 40%. Over half (52%) of the population use water from piped connections, either through individual household connections, yard tap or residential resale, while 26% rely on water vendors. 20% of residential waste is collected and disposed of by the City of Kisumu and private waste collectors. The City lacks adequate shelter, with approximately 60 % of the urban population who reside in the peri-urban and informal settlements lacking basic service.

2.4.2 Age structure and distribution

Demography of Population: Kisumu County constitutes 3% of the national population ranked 49% of the population are male while 51% are female. Kisumu town is the largest urban population taking 40% of the county's population, Awasi 10%, Ahero 5%, Muhoroni 4%, Chemelil 1% and Maseno 1% respectively1.

The disabled population is 2.01%, higher than the national disabled percentage of 3.46. 1.86% has visual disability, 1.02% hearing disability, 0.64% speech disability, 2.11% physical and self-care disability, 0.47 mental disability and 0.43% with other disabilities. It has a population density of 402.5 which is higher than the national population density of 401.1 per square kilometer. The average household size in Kisumu is 4.3, 0.1 lower than the national household size of 4.4.

The county's age distribution is 20% between 0-5 years, 24% (6 – 14 yrs), 12% (15-19yrs), 13% (20-25 yrs), majority 29% (26-65 yrs) and 35 are above 66 years old. It is estimated that the county's deprived child population is 45.39%.

The household respondent composition shows that 45.5% interviewed were household heads, 42.5% were spouse to house hold heads, 6.5% are either sons or daughters, 4.0% were siblings, 1.0 were other relatives and 0.5% were non relatives either house helps. These shows over 88% of the respondents were partners in the household management. Thus, the report conveys the true picture of what is happening in their households. All the respondents were over eighteen years of age.

2.4.3 Employment

According to the household survey over half (78.5.8%) of people aged between 18 years and 60 years in the surveyed population are employed in the informally and 9.5% are formally employed. Nine in ten, (88%) of the households indicated as being employed at the time of the survey. One out of ten (9.5%) of those employed were in paid employment, as 78.5% working under self-employment category. Type of employment was further categorized either as formal or informal employment. Informal service was the main type of employment as reported by 78.5percent of the households.

2.4.4 Sources of income

Self-employment stands out as the main source of income for the households at 78.5 per cent. This is followed at a distance second by income from others at 12% and income from Salary at 9.5%.

2.4.5 Income and Expenditure

Overall average monthly income for the surveyed households is estimated at Ksh. 53,520. Income distribution further shows that about 39 per cent of the households have an average income of below Ksh. 10,000, while 45.5 per cent have an average income of between Ksh. 10,001 and Ksh. 24,000. This shows the income of the community is a bit high, this fact may be apportioned a larger sample of households

surveyed are within the town centre than the rural population. As evidenced, rural area have a higher proportion of people earning less than Ksh. 5,000 than the town area.

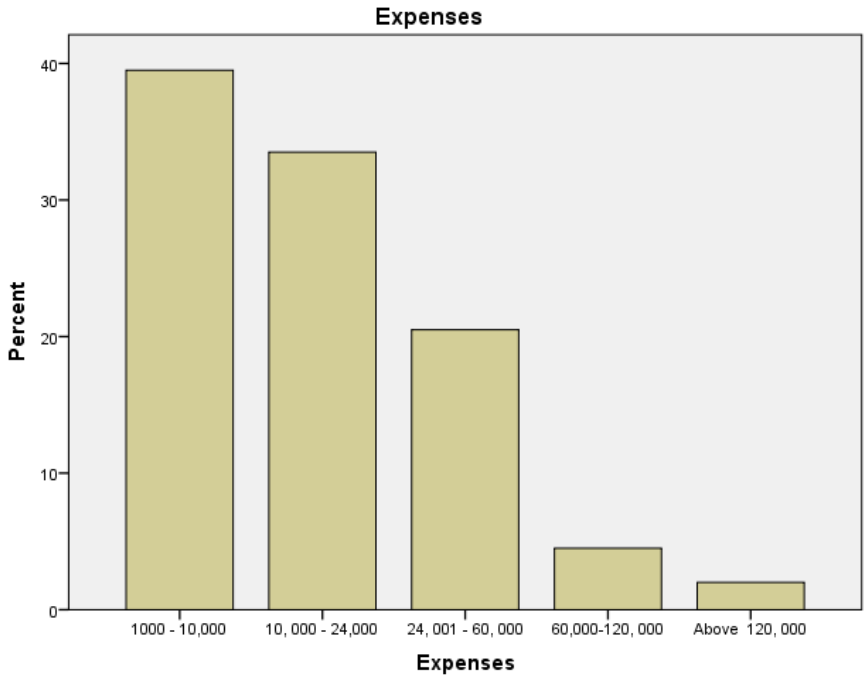

Figure 2.4: Expenses

2.4.6 Education

Kisumu County has several colleges and universities, including a campus of Kenya's largest university, Nairobi University. Other universities include Maseno University (best known for its IT department), Great Lakes University and several teaching and nursing colleges. Primary and secondary education is provided by 706 primary schools and 173 public secondary schools, including two of the oldest secondary schools in Kenya; Maseno School . A substantial number of private institutions also exist within the county.

The enrollment in primary school and secondary school stood at 240, 538 and 38, 815 as of 2009. The teacher to pupil ratio was 1:51 for primary and 1:30 for secondary. Kisumu Polytechnic provides several technical courses for young adults and also professionals, including some diploma courses. 5 youth polytechnics also exist in various parts of the county.

The survey collected data on the number of schools, their categories and number of pupils and teachers. There are several educational facilities within the project area. The main schools include St. Paul's Kanyakwar, Bar Owal Primary, Kudho primary, Nyawita Project Primary, Gee primary School, Dago Kokore primary school, mkendwa primary, Highland Academy, Salem Secondary, Kudho Secondary, Bar Korumba secondary St. Antony dago secondary. Both Boarding and Mixed Day Primary Schools. In the project area has a total number of 6,388 currently in school

from nursery to secondary school. Population currently in school as provided by the education office.

7.5% of the respondents did not attend school, 52.5% reached primary level, and 29.5% attained secondary level, 9.5% college / polytechnic level while 1% attained university level.

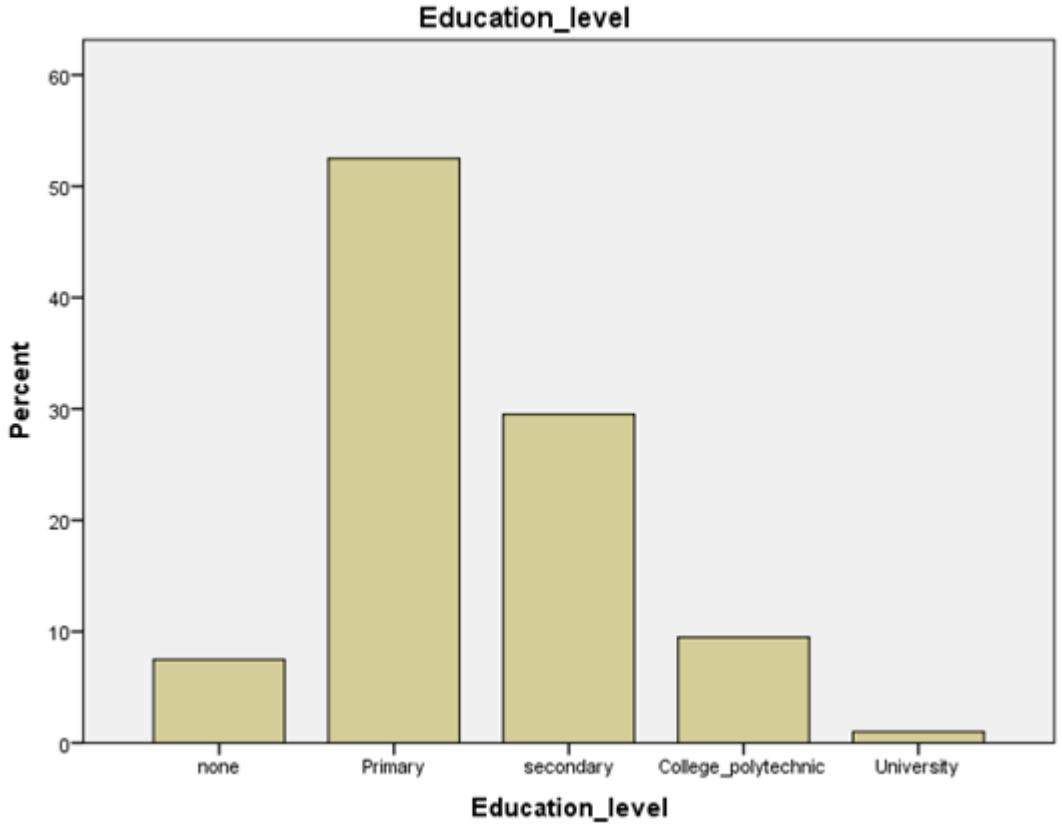

Figure 2.5: Education Level

2.4.7 Health

Health in Kisumu County is provided by several institutions that are either private or government funded. There is one teaching and referral hospital, 5 County referral hospital, 14 sub-county hospitals, 74 dispensaries and 18 health centres in the county. The naming system has been changed due to the fact that the system of government has changed and Kenya is now operating a devolved system of government. The county government shall now fully responsible for health service delivery to residents in the county through health facilities and pharmacies as enshrined in Schedule 4 of the Constitution of Kenya (2010). . The Infant Mortality Rates for Kisumu County is relatively high, at 95/1000. The under-five mortality rates for the county are 149/1000. The maternal mortality has been estimated to be 590 per 100,000 live births.

The location of Kisumu County puts it in major breeding ground for mosquitos, and malaria has been a perennial problem since time immemorial. Another health problem that majorly affects the county is the relatively high rates of HIV infection. But the rate has stabilised at 19.0%. Key health facilities in the county are Jaramogi Oginga Odinga Teaching and Referral Hospital (popularly known as Russia since it was built by the Soviets), the Kisumu County Referral Hospital and the Aga Khan Hospital Kisumu. All facilities are located in Kisumu City. There are two CDC funded centres in Kisumu, one in Kisian and the other in Kombewa. They engage in research in several diseases which affect the local communities, including HIV and malaria.

The health facilities provide a wide range of health services. The health sector comprises the public system and the private sector. Under the public sector, the Ministries of Medical Services and Public Health and Sanitation are major players. The private sector includes private for-profit, NGO, and Faith Based facilities.

The public delivery system is organized in a traditional pyramidal structure. First level care is provided at the dispensaries and medical clinics that are normally the smallest health facilities in Kenya. The next level comprises health centers and sub-district hospitals. Third level care is provided at district hospitals and provincial general hospitals. National referral hospitals are at the apex of the health care system, providing sophisticated diagnostic.

There are various health facilities in the area categorized in the form of clinics, dispensaries, sub-district hospitals and district hospitals as indicated in Table 2.9 below:

Table 2-2: Health Intuitions

Health Intuitions	Bed Capacity	Outpatient staff
Kodiaga Health Centre	24	76
Airport Health Centre	7	37
Nyahera Health Centre		63
7 private Hospitals		
TOTALS	**31**	**176**

2.4.8 Ambient Air Quality

As the project is not expected to generate major air pollution, this parameter is only described qualitatively in terms of existing sources of air pollution. The major existing source of emissions in proximity to the site is the moderately busy main road (Kisumu-Busia and Kisumu – Kakamega roads with associated service lanes).

The main air pollutants in this area are associated with minimal exhaust emissions and fugitive dust (from trucks and heavy construction equipment using this roadway). Dustiness in the area is related to wind and rainfall conditions, and is predicted to be at its maximum levels during dryer periods of the year (June to October and, January to February).

2.4.9 Ambient Noise Levels

As in the case of ambient air quality, this project is not expected to result in a significant change to ambient levels of noise in the area. Consequently this parameter is only described qualitatively in terms of existing sources of noise. The sources of noise are the same as the sources of air pollution in the area, and include:

a) Vehicular traffic along the major roads.
b) Construction material haulage operations and,
c) Any potential project component depending on intention of use (ie mechanical pumps)

2.4.10 Waste Management

In 2001 it was estimated that only 20% of the 400 tons of solid waste generated each day in Kisumu City was collected (MCK and UN-HABITAT, 2004). By 2008, the daily generation of household waste was estimated to be 437 tons (Nodalis Conseil, 2009). Fortunately, about 63% of the waste generated in Kisumu is organic; hence there is enormous potential for composting (UN-HABITAT, 2008). The county authority has a limited number of trucks for collecting waste. Many households, particularly in the peri-urban areas, have no access to public services and are unable to access private waste collection due to fees levied. They therefore resort to burning or burying their waste (CRC, 2007). Some common dumping grounds have developed on open lands within densely populated neighborhoods.

The poor management of solid waste blocks sewers and drainage systems provides a breeding ground for disease vectors and contributes to the generation of leachates, which pollute the ground water and further contribute to waste related diseases. The city can significantly reduce the waste taken to the existing dumpsite—located near Moi stadium— by composting and recycling, methods not widely practiced in Kisumu, even though adopting these measures would also alleviate environmental pollution and provide informal employment through the resale of the recyclables.

There are other numerous smaller dumping spots in many parts of the city. A few enterprises within the city and some residents salvage such materials as plastic bags and bottles, but these are not properly sanitized or disinfected before they are sold in informal settlements, where residents used them for food storage and wrapping. These possibilities indicate that a public awareness campaign promoting a culture of recycling needs to be undertaken.

2.4.11 Liquid Waste

The main sewage treatment plant in Kisumu is the Kisat Conventional Sewage Treatment Plant (STW), built in 1958. In addition, there are three main private industrial wastewater treatment plants, but two of these are pre-treatment facilities only, with just one a full treatment plant. Another plant, serving the eastern part of the city, is the Nyalenda Waste Stabilization Pond (WSP), located adjacent to the Nyalenda low-income area. However, this plant has not been properly maintained and is not fully operational (LVSWSB, 2008). As the population increases and more septic tanks are installed in Kisumu, and as industrial production increases, wastewater production is likely to increase. The wastewater collected in sewers will require treatment before it can be reused for industrial and domestic use. Usually, the most appropriate treatment process is carried out by waste stabilization ponds.

2.4.12 Water Distribution Points-Kisumu County

This map explores the spatial distribution of water source points in Kisumu County. Displaying specifically the different types of water source points in their own classes. The data is sourced from Water point mapping (WPM) project in Kenya, under the leadership of the Ministry of Environment, Water and Natural Resources (MEWNR), SNV-Netherlands and TWAWEZA aimed at improving post construction sustainability of rural water supplies. Over 8,000 water points had been mapped in 8 Counties by December 2013.

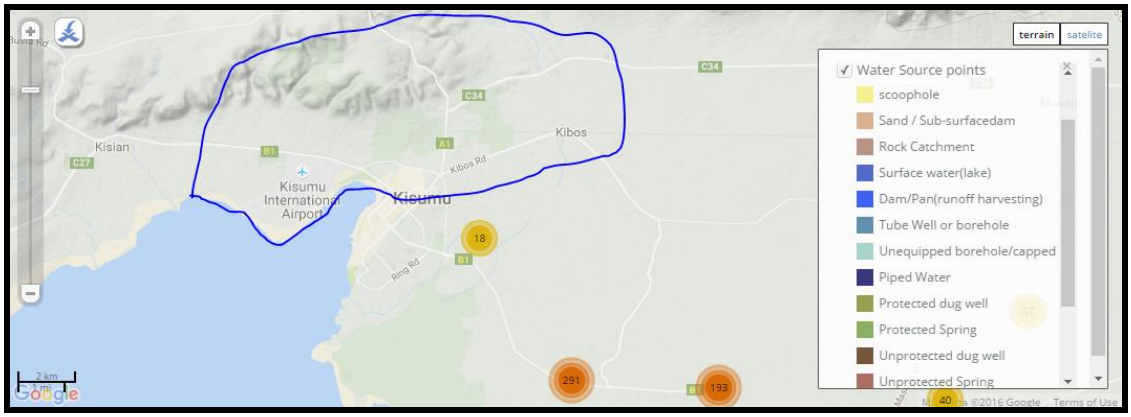

Figure 2.6: Water Distribution points in Kisumu County

The most prominent water distribution type is by private individuals (455 points), Community CBOs (367 points), Institutional supply (148 points), Water service providers with 91 and parastatals at about 30 points. Others in less quantities are NGO/FBO and Churches. This distribution pattern is illustrated in table 2.7 Below:

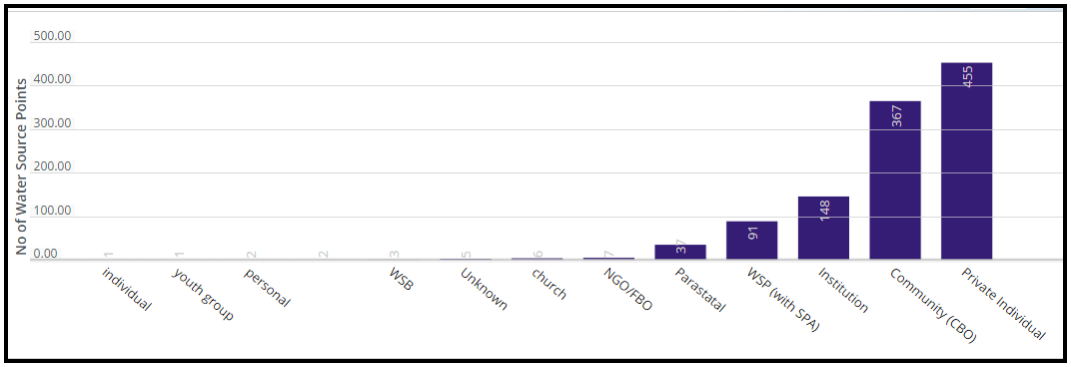

Figure 2.7: Water point by type in Kisumu County

2.4.13 Cost Recovery Status of Water Source Points in Kisumu County

An analysis to test the efficiency of water billing was carried out in the county to categorize the nature of billing system according to those billed, those not billed, the unknown leakages and those which were known but were not in the system. The figure below shows the indications:

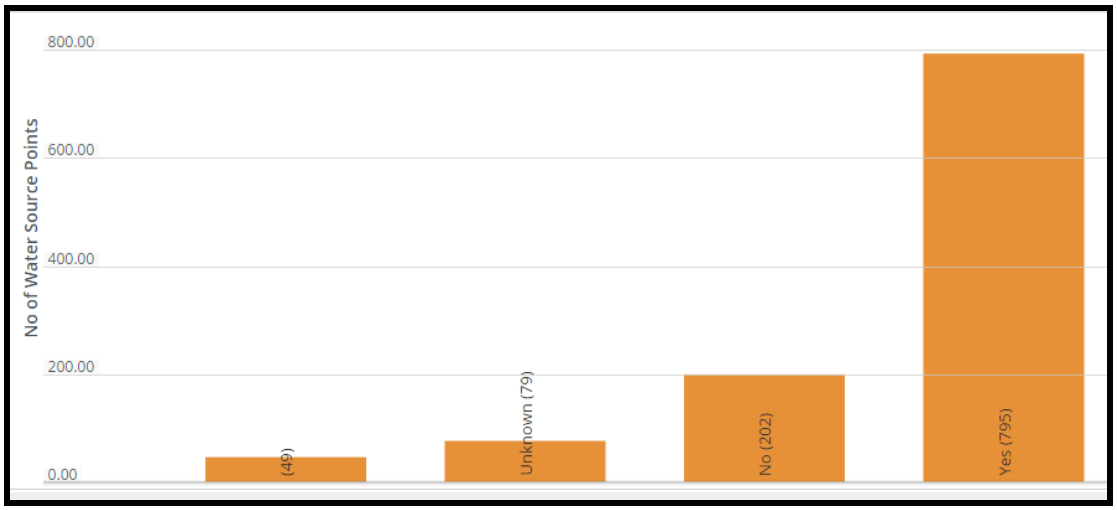

Figure 2.8: Cost Recovery Status of Water Sources Pints in Kisumu County

According to the table, 795 points (about 71%) were billed. This is relatively a small number considering the non-billed amount of almost 30%. 202 points were not billed (About 18%). 79 points were unknown while 49 (total of about 12%) were uncharacterized.

2.4.14 Source of drinking water

According to the definition proposed by WHO / UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation, households in urban areas are considered to have "access to an improved water source" if they are located within half a kilometer of such sources as piped water, public taps, boreholes and protected wells/springs. Since it is difficult to measure distance to such water sources, an alternative working definition is given: "A household is considered to have access to improved water supply if it has sufficient amount of water for family use, at an

affordable price, available to household members without being subject to extreme effort, especially to women and children."

Figure 2.9: A burst section of the existing water pipe

Surface water sources (Taps, lakes, Boreholes, Springs, Rivers and Streams) are generally unprotected and often deemed to be 'unsafe' for drinking, contaminated by animal, human and agricultural waste. Households using surface water sources make up a large component of those using unprotected sources. However, only 43.5 per cent of the households access water through the pipes either directly from Kiwasco water kiosks or from private household with tap water connection. (18.5%) got their drinking and cooking water directly from water private operators or water vendors. 11% get water from boreholes, 16% get water directly from the rivers/lake/streams/Springs. 5% get water from the rain water. 6% from other sources. 56.5% use unsafe water showing clearly why water borne diseases are common among the population in the survey area. Water during rainy season is largely from collection points which are within the homestead such as ponds and running water along the roads. However, streams and river still remain the main water source during dry season. This means that the town is in dire need of a water treatment system.

It should be noted, however, that in informal settlements, although some residents have access to piped water, most residents rely on water kiosks, handcart vendors and boreholes for their water supply. The reliance on shallow wells and boreholes in these neighborhoods is problematic because water from these sources is of poor quality.

Table 2-3: Distribution of Water Source

Sources of Water	Percentage
Kisumu city water and sewerage company	43.5
Private operators/vendors	18.5
Borehole	11.0
river/stream	16.0
Rainwater	5.0
other specify	6.0

The nature of distribution of water sources was probed according to clusters of Kisumu City Water and Sewerage Company Sources, private operators and vendors, boreholes, rivers and streams, rain water and other sources. The outcome were categorized as below.

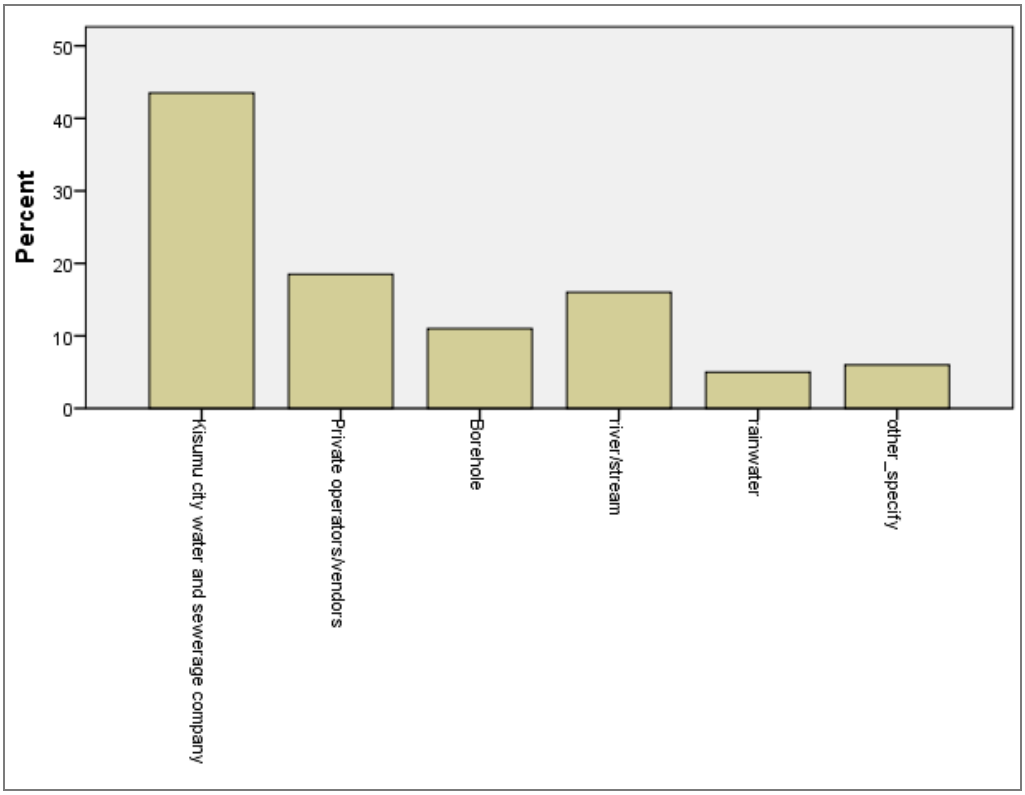

Figure 2.10: Water Sources

The most prominent water source in the County is from Kisumu City Water and Sewerage Company at about 43%, then private operators and vendors distributed about 18%. Almost 17% sourced water from streams an rivers, while about 12% sourced from borehole suppl. Less than 5% rely on rain water while other sources amounted to about 7%.

The study also probed respondents on their degree of access to certain water sources in the project area. The access point being probed had been pre-determined for respondents to select by providing appropriate measures by scale. The results are as presented below:

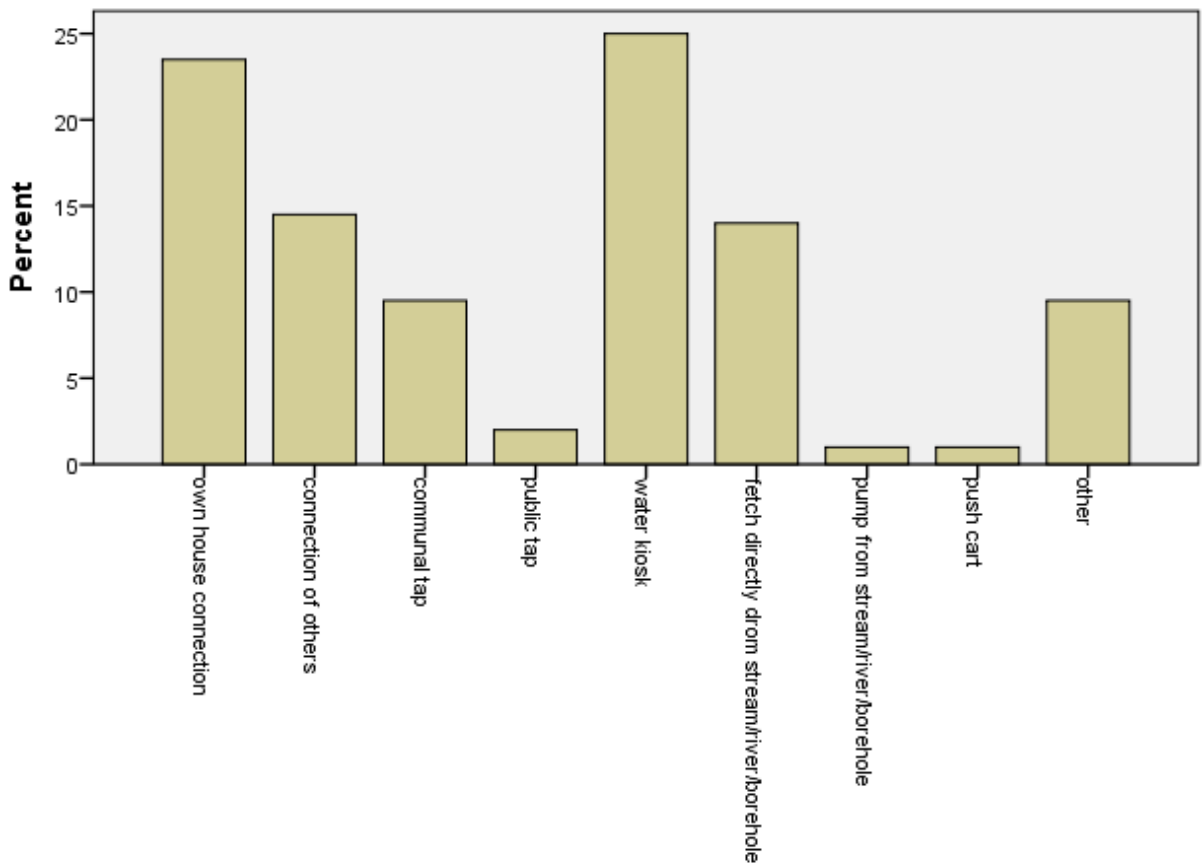

Figure 2.11: water Access in the project Area

Most residents were able to access Water Kiosks and own water connections at about 24 and 23% respectively. Those who fetched directly from streams as well as those who acquired water through others registered about 14% each respectively. 9% accessed communal taps, another 9% accessed other sources. The least accessed water points were public taps, push carts and pumped water from streams, rivers, springs, ets, the later three registering less than 3% each.

Access to water in the study is dependent on a number of factors some of which include affordability, proximity, user perception and matters to do with quantities required.

2.4.15 Combined willingness to pay

A combined willingness to pay for water services was derived at as shown in the curve below.

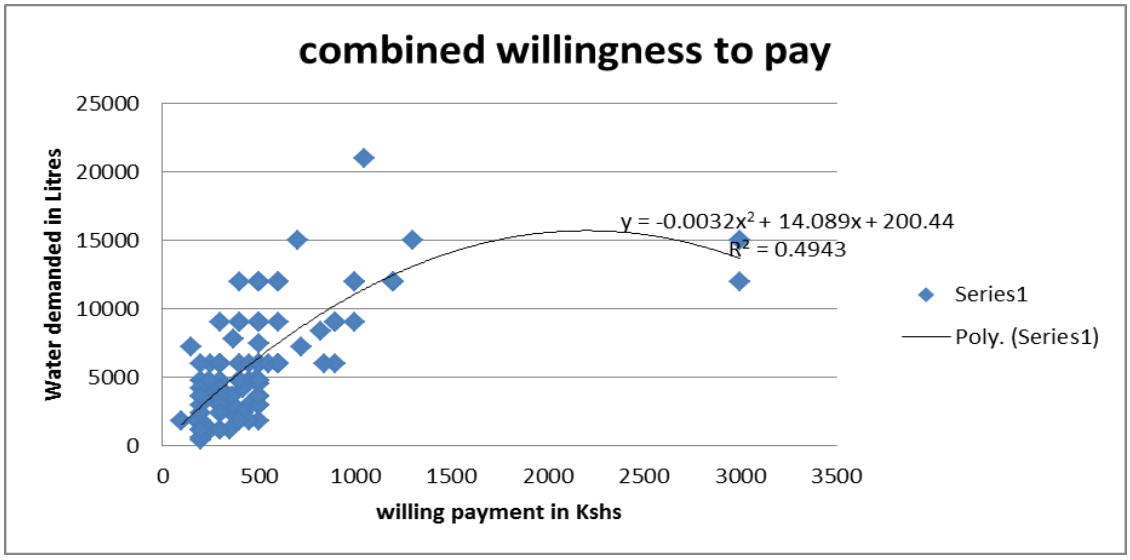

Figure 2.12: All Sub location Willingness to pay

The combined willingness to pay for the project area was derived at through the polynomial equation:

y=-0.0042x2 + 17.872x – 1037.4. The R2 =0.54, therefore the curve explains atleast 54% of the variations in the model. From the equation we get y=17963.94litres and X= Kshs 2127. Therefore at the maximum point, the maximum amount residents in the project area are willing to pay is Kshs 118/m3.

2.4.16 Ability to pay

A combined analysis was conducted in order to determine how much the residents are able to pay for water services measured through their incomes and current payment of water. The results are presented as follows:

a) Ability to pay as measured by the current payment of water

The ability to pay of residents in the project area was measured by their current payment of water from the various sources that were captured in the questionnaire. The results were as follows:

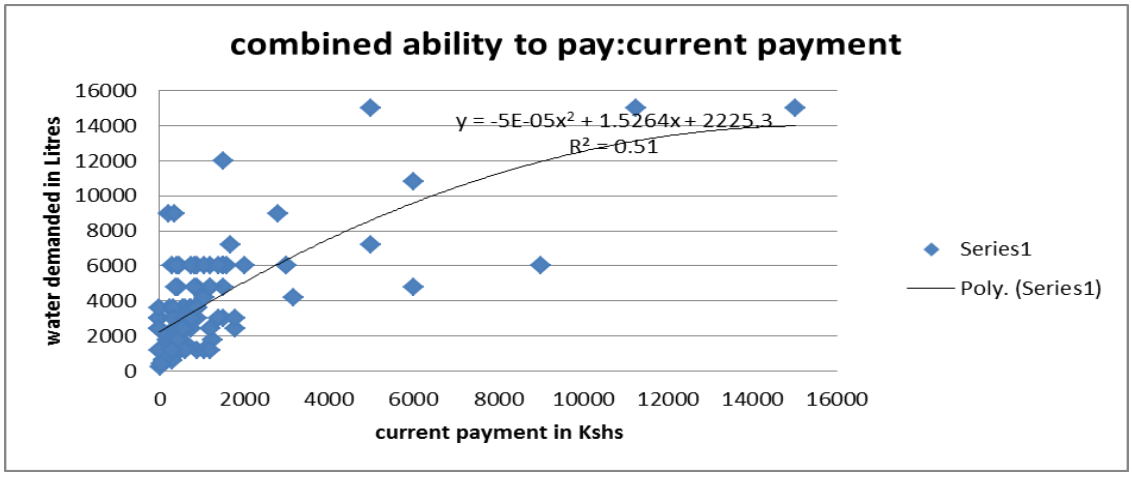

Figure 2.13: Combined Ability to pay

The combined willingness to pay for the project area was derived at through the polynomial equation:

y=-0.00005x2 + 1.5264x – 2225.3. The R2 =0.51, therefore the curve explains atleast 51% of the variations in the model. From the equation we get y=15264litres and X= Kshs 13874. Therefore at the maximum point, the maximum amount residents in the project area are willing to pay is Kshs 1100/m^3.

b) Ability to pay as measured by income levels

The ability to pay of residents in the project area was measured by the income levels of the residents in the project area. The residents are not supposed to use more than 5% of their incomes on water expenses. The result from this analysis is presented as follows:

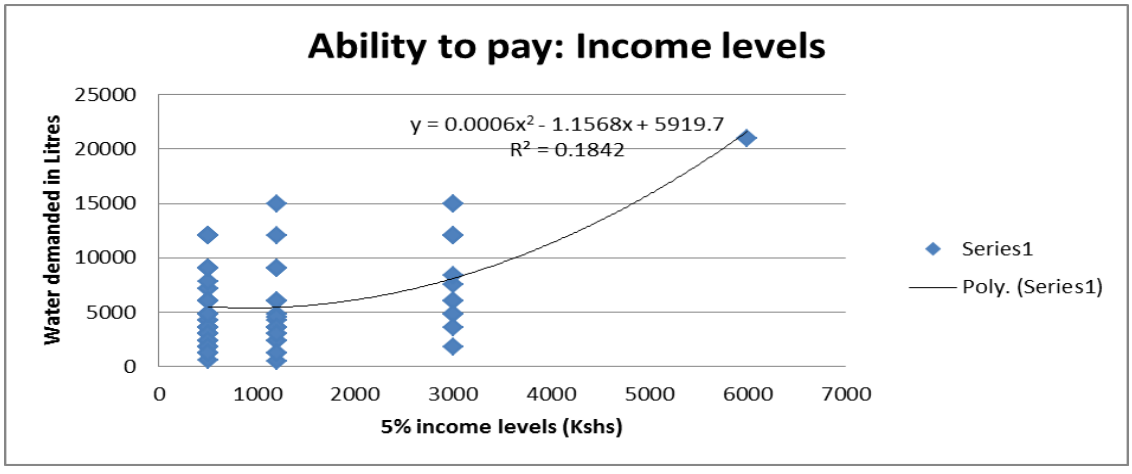

Figure 2.14: Ability to pay, Income level

The combined ability to pay for the project area was derived at through the polynomial equation:

y=-0.0006x2 – 1.1568x + 5919.7. The R2 =0.18, therefore the curve explains atleast 18% of the variations in the model. From the equation we get y=5919.7litres and X= Kshs 964. Therefore at the maximum point, the maximum amount residents are able to pay according to their income levels is Kshs 162/m^3.

2.4.17 Net benefit from improved Water Supply

Most of the people in the project area are engaged gainful employment. This is a good indication that most household have the ability to pay for these services. Given that the least of the expenses they incur is on water, shows that water is still an accessible commodity to majority of the people within the community. It is expected that the incidence of water borne diseases will greatly reduce by the improvement of water supply systems.

The distance covered by most of the respondents is less than one kilometer. Its therefore expected that there will be a great improvement in access to clean water and as such the human productivity that is lost through travelling in search of water will be redirected towards more productive economic activities. This will then mean that the overall quality of life will be improved.

2.5 Climate

2.5.1 Ecological Zone

Kisumu County is an area falling in the ecological zone II & III.

2.5.2 Temperature, rainfall & Micro-climate

Kisumu is situated on the equator, leading to a hot and humid year-round climate and annual rainfall of approximately 1,200 mm. The City has two rainy seasons-from March through June, and November through December. The temperatures are relatively cool, high average monthly maximum temperature of 30 oC and average minimum monthly temperature of 16 oC at night. Morning humidity levels in Kisumu are between 80 percent and 90 percent, with evening humidity percentage levels dropping into the 40s and 50s.

2.5.3 General Geology of The Project Area

Deposits of Pleistocene to recent age include hill wash gravels (colluvium), semi consolidated river alluvium, quartz rubble and lateritic ironstone capping. Brown sandy soils with occasional and locally distributed deposits (laterites) occur in the project areas. The subsurface geology of the project area comprises of intrusive rock. Outcrops of these granites are noted within the vicinity confirming them as the host rock. In hand specimen they are dense, coarse grained felsic rocks. Occasionally,

minute feldspar crystals are recognizable to unaided eye. Those intrusions are mainly granite rocks that are locally sheared. The rocks have little primary porosity and secondary porosity may be due to fracturing, faulting or the existence of old land surfaces. Through time they may undergo repeated processes of denudation and weathering and may have developed a weathered zone on the upper layer which sometimes retains water that can supply a well.

2.5.4 Biodiversity of the Project Area

The Victoria Lake basin is rich in biodiversity although natural habitats are under threat from rapidly increasing human population. Biodiversity in the main consists of fish species, birds and higher vertebrates like amphibians, reptiles and mammals as well as several plant species. A total of 31 amphibians, 28 reptilian and 44 mammalian species have been recorded on various sites in the Lake Victoria basin. Inshore waters, satellite water bodies and fringe wetlands support several species of reptiles, the commonest of which are the Nile crocodile (crocodylus niloticus, Laurent 1769) and snakes such as African rock python (Python sebae, Gmelin 1789), mambas and cobras (Chisara et al.001).

The dominant terrestrial vegetation comprises of dry, peripheral, semi- evergreen rainforest and scrub forest in the eastern parts of the basin. Several species are currently threatened, particularly those in fragile areas such as wetlands. Much of the lake margin is swampy and vegetated mainly by the cyanobacteria Cylindrospermopsis and Planktolynghya, and the diatom Nitzchia (Komarek and Kling 1991; Hecky 199). Zooplanktons consist of abundant copepods and cladorerans (Branstrator and others 1996). As recently as the 1960s, Lake Victoria supported an endemic cichlid fish species flock of over 500 species (Seehausen 1996), but these have progressively disappeared from the catches to become poorly represented today. The losses are attributed to habitat degradation in the catchment area, land use changes, introduction of exotic species (particularly Nile perch) and heavy fishing pressure.

Lake Victoria experienced dramatic changes in the past century as a result of land use and land cover changes, industrialization, agricultural developments, introduction of invasive alien species and non-selective fishing. These, among other factors, have led to the destruction of native and endemic biota specific to the Lake Victoria basin.

2.5.5 Sewerage

The area is not served by local Kisumu Water & Sewerage Company sewerage system. Most facilities around the site are either connected to septic tanks or use pit latrines. Electricity

The area is well covered in terms of electricity supply, with an established KPLC company grid system along the road reserve.

2.5.6 Solid Waste Management

The nearest and the only waste dumping facility in Kisumu, is the Open-dumping Kachok waste management facility. Private waste collection companies collect waste

from commercial and residential areas near the project area. The system adopted for managing this waste must be efficient and environmentally dependable. In terms of waste management, volumes are more useful quantity to consider than weight. Waste in the project area is minimal be collected onsite and disposed at designated areas. Waste collection will be undertaken privately by contracted garbage collectors.

2.5.7 Security

Security services are undertaken privately, in addition to the public police patrols.

2.5.8 Topography, drainages and soil

In the upper reaches from the foot of the Riat Hills to the upper plains of Kisian the elevation within the project area varies boundaries varies generally from 1340m asl to 1550 m asl. Within the lowlands at the foot of the hills to the lake shores and railway reserve ranges from 1160 m asl to 1240 m asl. The upper reaches are within rocky areas particularly on the steep slopes of the hills. The soil profile changes to loamy soils with rocky patches in the gentler slopes after the steeps. The lower reaches have soils which are a combination of laterites (Murrum), loamy and clay soils. The progressive change in the soil types occurs with movement from the hills towards the lake shores. The general project area is generally well drained with run off and discharges eventually draining into Lake Victoria. The predominant soils are black cotton soils.

Figure 2.15: Black Cotton Soil Type

2.6 Commercial activities and institutions

2.6.1 Fishing in Kisumu County

The water hyacinth that chokes Lake Victoria, a major source of fishing in the area. Kisumu County sits on the shores of Lake Victoria, providing it with the potential to be a major centre of fishing. However, the use of old technologies hampers the full

development of the industry. Also, the recent water hyacinth menace on the lake has reduced fish catches significantly. The new county government has pledged to fight the hyacinth problem.

2.6.2 Agriculture in Kisumu County

Rice is grown under irrigation in the Kano Plains. Most of the water for irrigation comes from River Nyando, whose annual floods displaces huge numbers of people but also deposit a lot of fertile silt all across the plain. The northern and eastern fringes of the Kano Plains also play host to some of Kenya's most productive sugarcane fields. Towns like Kibos, Miwani and Chemelil are centres of sugarcane production. Kisumu County also produces maize, beans, sweet potatoes, poultry and fresh vegetables.

2.6.3 Industries in Kisumu County

Kisumu city and the surrounding areas have several light industries. These include textiles, molasses, fish processing plants and agricultural produce processors. Kisumu has 4 sugar factories, at Chemelil, Muhoroni, Kibos and Miwani. However, the mill at Miwani is not operational after its original owners abandoned it in the year 1988. Also present in the main industrial area is a large scale maize milling company. Several backyard industries also thrive in the county, including tailoring, making of handicrafts and boat-building.

2.6.4 Livestock

The project area has local cattle, sheep, Goats, dairy cows

- **Kanyakwar:** local cattle-1,500, Sheep-500, goats- 210 and dairy cows-38
- **Dago:** local cattle-2,500, sheep-280, goats-120 and dairy cows-57
- **Mkendwa:** local cattle-1,400, sheep-120, goats-620 and dairy cows-50
- **Kogony:** local cattle-2,000, sheep-150, goats-300 and dairy cows-40
- **Wathorego:** local cattle-3,250, sheep-450, goats-510, dairy cows- 48
- **Korando A:** Local cattle 2, 320, sheep 340, Goats 710, Dairy cows 71
- **Konya:** local cattle- 1,950, sheep- 650, goats- 630, dairy cattle-27

2.6.5 Commercial Enterprises, Hotels, Bars and Restaurants

Kisumu County town does have several industries namely Molasses Plant, Tuff foam mattresses. Kisumu County project area has approximately 19 Medium Class Hotels, 63 low class Hotels, 51 Bars and Restaurants, 494 retail shops, 18 Wholesales, 6 Supermarkets, 13 local centres, 11 market centres, 25 workshops, 8 Hardwares', and 1 slaughter house.

2.7 Infrastructure

2.7.1 Transport in Kisumu County

Kisumu County has several paved roads, the major one being the Nairobi-Bondo road, which has a branch at Kisian heading to Busia. Important roads are paved with asphalt. County roads are mostly murram but provide all weather movement all year. Public transport services are provided by matatus and buses either operating singly or as parts of franchises and companies. Bicycle and motorcycle boda-bodas also exist in significant quantities for short distance travel.

The city of Kisumu was founded as a terminal for the railway, and therefore has an important railway station. The narrow gauge railway moves both passengers and cargo, linking Kisumu with other cities and towns along the line. The new national government has pledged to build a new modern metro network for the city.

Water transport on the lake is provided mostly by private operators in wooden boats with outboard engines, although a ferry service exists. The services connect towns on the shores and also help in crossing the lake. They also link the county with the other three lakeside counties and the countries of Tanzania and Uganda. The port of Kisumu is very inactive at the moment but has the potential to become a regional centre of lake transport and a gateway for Kenya into the rest of the African Great Lakes region.

Kisumu International Airport has been upgraded and now has the potential to be an entry port for the entire region. Schedule flights land from Nairobi, Mombasa and several cities in neighboring countries.

Figure 2.16: Boating in Lake Victoria near the project area

2.7.2 Housing

Housing is a basic need and owing a house gives one a sense of dignity and security. Proper and adequate housing contribute significantly to better living standards and

household welfare. Household members were asked a number of questions about the sanitation facilities and the type of roofing, wall and flooring materials of their dwellings.

The project area housed were categorized according to three major clusters of high class, medium class and low class houses. The results were as indicated below.

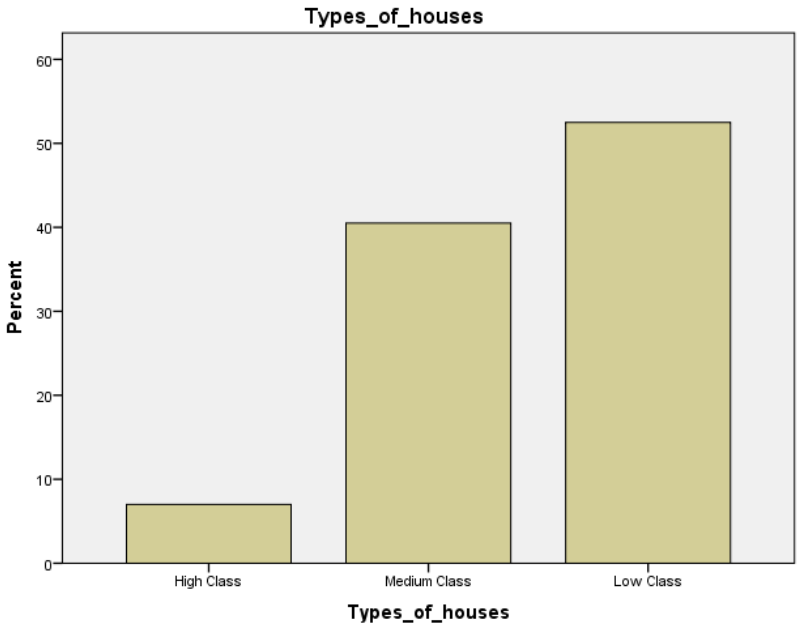

Figure 2.17: Houses Types

The high class forms 14% of the community, the middle class forms 40.5% while the low class forms 52.5%

3 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

3.1 General Overview

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

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

According to section 68 of the environmental management and coordination Act (EMCA) 1999, the Authority shall be responsible for carrying out environmental audits on all activities that are likely to have a significant effect on the environment.

Environmental auditing (EA) is a tool for environmental conservation and has been identified as a key requirement for existing facilities to ensure sustainable operations with respect to environmental resources and socio-economic activities in the project neighborhood.

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

In the past, the government has established a number of National policies and legal statutes to enhance environmental conservation and sustainable development.

NIB and the local WUA groupings will have to observe the provisions of the various statutes and regulations that are aimed at maintaining a clean and healthy environment during the entire project lifecycle.

3.2 Policies

3.2.1 National Environmental Action Plan (NEAP)

According to the Kenya National Environment Action Plan (NEAP, 1994) the Government recognized the negative impacts on ecosystems emanating from industrial, economic and social development programmes that disregarded environmental sustainability. Following this, establishment of appropriate policies and legal guidelines as well as harmonization of existing policies have either been accomplished and/or are in the process of development. Under the NEAP process Environmental Impact Assessments were introduced targeting the industrialists, business community and local authorities.

3.2.2 National Policy on Water Resources Management and Development

While the National Policy on Water Resources Management and Development (1999) enhances a systematic development of water facilities in all sectors for promotion of the country's socio-economic progress, it also recognizes the by-products of this process as wastewater. It, therefore, calls for development of appropriate sanitation systems to protect people's health and water resources from institutional pollution.

Industrial, business and large scale agricultural development activities, therefore, should be accompanied by corresponding waste management systems to handle the wastewater and other waste emanating there from. The same policy requires that such projects should also undergo comprehensive EIAs that will provide suitable measures to be taken to ensure environmental resources and people's health in the immediate neighborhood and further downstream are not negatively impacted by the discharges. As a follow-up to this, EMCA 1999 requires annual environmental audits to be conducted in order to ensure that mitigation measures and other improvements identified during Elias are implemented.

In addition, the policy provides for charging levies on wastewater on the basis of quantity and quality. The "polluter-pays-principle" applies in which case parties contaminating water are required to meet the appropriate cost of remediation. The policy provides for establishment of standards to protect water bodies receiving wastewater, a process that is ongoing.

3.2.3 Sessional Paper on Environment and Development (No. 6 of 1999)

The key objectives of the Policy include:

i. To ensure that from the onset, all development policies, programmes and projects take environmental considerations into account,

ii. To ensure that an independent environmental impact assessment (EIA) report is prepared for any industrial venture or other development before implementation,

iii. To come up with effluent treatment standards that will conform to acceptable health guidelines.

Under this paper, broad categories of development issues have been covered that require a "sustainable development" approach. These issues relate to waste management and human settlement. The policy recommends the need for enhanced re-use/recycling of residues including wastewater, use of low or non-waste technologies, increased public awareness raising and appreciation of a clean environment. It also encourages participation of stakeholders in the management of wastes within their localities. Regarding human settlement, the paper encourages better planning in both rural and urban areas and provision of basic needs such as water, drainage and waste disposal facilities among others.

3.3 Legal Aspects

The key national laws that govern the management of environmental resources in the country have been briefly discussed in the following paragraphs. Note that wherever any of the laws contradict each other, the Environmental Management and Coordination Act 1999 supersedes.

3.3.1 The Environment Management and Coordination Act, 1999

The Environmental Management & Coordination Act, 1999 generally provides for enjoyment by every person in Kenya to a clean and healthy environment while also placing responsibility to safeguard and enhance the environment.

According to the Act an Environmental impact assessment study needs to be carried out on projects specified in the second schedule of the Act that are likely to have a significant impact on the environment. This proposed project has been rightly classified among those that must be subjected to an ESIA study under the second schedule of the Act.

It further stipulates that operators of projects should carry out annual environmental audits in order to determine level of compliance with statements made during the EIA. The audit report should be submitted to NEMA.

The Act prohibits discharging or applying poisonous, toxic, noxious or obstructing matter, radioactive or any other pollutants into aquatic environment. It further places responsibility on operators of project which discharges effluent or other pollutants to submit to NEMA accurate information about the quantity and quality of the effluent and to seek effluent discharge licenses.

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

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

These regulations prohibits discharge or application of any poison, toxic, noxious or obstructing matter, radioactive wastes, or other pollutants into water meant for fisheries, wildlife, recreational purposes or any other purposes. The regulations provide for the creation of a buffer zone for irrigation schemes of at least fifty (50) metres in width between the irrigation scheme and the natural water body.

3.3.3 The Water Act, 2002

This Act has placed overall responsibility for water management with the Ministry of Water Resources and Irrigation. This Act has provided for the formation of a Water Resources Management Authority (WRMA) responsible for the management of lakes, aquifers and rivers, among other functions.

The Act empowers the minister in charge to promote the conservation and proper use of water resources and the conservation of water catchments, water sources and courses. It further prohibits the draining or interfering with wetlands for any purpose without proper authority.

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

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

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

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

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

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

3.3.5 Land Acquisition Act (cap 295)

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

3.3.6 The Public Health Act (Cap. 242)

This Act prohibits any person or institution from causing nuisance or conditions liable to be injurious or dangerous to human health. It further forbids discharge of any noxious matter or wastewater flowing or discharged from any premises into a public street or into the gutter or side channel or watercourse, irrigation channel or bed not approved for discharge.

3.3.7 The Agriculture, Fisheries and Food Authority Act No. 13 Of 2013

The Act of Parliament to provide for the consolidation of the laws on the regulation and promotion of agriculture generally, to provide for the establishment of the Agriculture, Fisheries and Food Authority, to make provision for the respective roles of the national and county governments in agriculture excluding livestock and related matters in furtherance of the relevant provisions of the Fourth Schedule to the Constitution and for connected purposes.

Definition “agriculture” in the ACT, refers agriculture as means cultivation of land and the use of land (whether or not covered by water) for any purpose of husbandry, aquaculture and food production and includes— (a) cultivation of crops and horticultural practice within the meaning of the Crops Act; (b) breeding of aquatic animals and plants in the Kenya fishery waters and sea ranching and fish farming in the sea as provided for in the Fisheries Act; (c) the use of land, meadow land, market gardens or nursery grounds; (d) fish harvesting within the meaning of the Fisheries Act; and (e) the use of land for agroforestry, when that use is ancillary to the use of land for other agricultural purposes; (f) transgenic and microbial formulations for use

and application in agricultural systems; and "agricultural" shall be construed accordingly.

PART IV – POLICY GUIDELINES ON DEVELOPMENT, PRESERVATION AND UTILIZATION OF AGRICULTURAL LAND 21. Land development guidelines

(1) The Cabinet Secretary shall, on the advice of the Authority, and in consultation with the National Land Commission, provide general guidelines, in this Act referred to as land development guidelines, applicable in respect of any category of agricultural land to the owners or the occupiers thereof.

(2) The land development guidelines contemplated under subsection (1) shall be implemented by the respective county governments taking into account the circumstances of the respective areas under their jurisdiction.

(3) The guidelines referred to in this section may require the adoption of such system of management or farming practice or other system in relation to land in question (including the execution of such work and the placing of such things in, on or over the land, from time to time) as may be necessary for the proper development of land for agricultural and fishing purposes.

Chapter 22 of the Act stipulates the rules on preservation, utilization and development of agricultural land (1) The Act mandates the Cabinet Secretary shall, on the advice of the Authority, and in consultation with the National Land Commission, make general rules for the preservation, utilization and development of agricultural land and aquatic resources, either in Kenya generally or in any particular part thereof.

(2) Without prejudice to the generality of subsection (1), rules made thereunder may—

(a) Prescribe the manner in which owners (whether or not also occupiers) shall manage their land in accordance with rules of good estate management;

(b) Prescribe the manner in which occupiers shall farm their land in accordance with the rules of good husbandry:

(c) Advise on the control or prohibition of the cultivation of land or the keeping of stock or any particular kind of stock thereon;

(d) Advise on the kinds of crops which may be grown on land;

(e) Provide for controlling the erection of buildings and other works on agricultural land;

(f) Provide for such exemptions or conditional exemptions from the provisions thereof as may be desirable or necessary;

(g) Provide for ex situ fish breeding to supplement in situ fish breeding and thereby outlaw seasonal bans on fishing;

(h) Provide for efficient and effective fishing methods that are sensitive to the social-economic status of local communities; and (i) provide for technical and other assistance to fishing communities to enhance their socio-economic development, especially that of vulnerable groups, including women.

(3) For the purposes of this section and of any rules made thereunder, and of any legislation of any county government—

(a) an owner of agricultural land shall be deemed to fulfil his or her responsibilities to manage it in accordance with the rules of good estate management if, having regard to the character and situation of the land and other relevant circumstances, it enables an occupier of the land reasonably skilled in husbandry to maintain efficient production as respects both the kind of produce and the quality and quantity thereof;

(b) the occupier of agricultural land shall be deemed to fulfil his or her responsibilities to farm it in accordance with the rules of good husbandry if the occupier is maintaining a reasonable standard of efficient production, as respects both the kind of produce and the quality and quantity thereof, while keeping the land in a condition to enable such a standard to be maintained in the future;

(c) "relevant circumstances", in relation to an owner or occupier, includes all circumstances affecting management or farming other than the personal circumstances of the owner or occupier.

3.3.8 Trust land Acquisition Act Chapter 288

This Act guides the acquisition of land under the custodian of the councils and allows for the expropriation of Trust Land on condition that:

- The development and utilization of the property will promote public benefit among other things.
- The necessity for expropriation is great enough to justify any hardship caused to any persons
- Law prompts for payment of full compensation The procedures of land acquisition under this Act are as described in the steps below;

Step 1: The process starts with a proposal at a Full Council Meeting where proposed acquisition is deliberated and consent given vide a Council Minute.

Step 2: The "County Director" in charge of the affected area will then proceed to ascertain interests, determine areas and assess compensation for the land after which he is to issue an award.

Step 3: Provision for compensation; section 8.(1) of Cap 288 allows for compensation as follows:- Where land is set apart under section 7 of this Act, full compensation shall be promptly paid by the Government to any resident of the area of land set apart who:-

- under African customary law for the time being in force and applicable to the land has any right to occupy any part thereof; or
- Is otherwise than in common with all other residents of the land, in some other way prejudicially affected by the setting apart.

- A notice of setting apart published under section 7 of this Act shall also be published by displaying a copy at the County Director office and at some other public or conspicuous place in the area concerned.

Under section 9(1), a person who claims to be entitled to compensation under section 8 of Cap 288 shall apply therefore to the County Director once satisfied after consultation shall award the applicant a sum of compensation in accordance with subsection (3) of this section; and if he is not so satisfied the County Director shall reject the application.

3.3.9 Way Leaves Act (Cap. 292)

Way Leaves Act (Cap. 292) Section 3 of the Act states that the Government may carry any works through, over or under any land whatsoever provided it shall not interfere with any existing building or structures of an ongoing activity. Notice, however, will be given one month before carrying out any such works (section 4) with full description of the intended works and targeted place for inspection. Any damages caused by the works would then be compensated to the owner as per the section.

Finally section 8 states that any person without consent causes any building to be newly erected on a way leave, or cause hindrance along the way leave shall be guilty of an offence and any alterations will be done at his/her costs.

In accordance with the Act (section 4), notice will be given before carrying out works with full description of the intended works and targeted place for inspection. Any damages caused by the works would then be compensated to the owner as per this section.

3.3.10 Registration of Titles Act, Cap 281

The Registration of Titles Act is an act of Parliament that provides for the transfer of land by registration of titles. When the County Director of land issues a letter of allotment to any person in respect of any land, one of the laws under which the title to that land is issued is the Registration of Titles Act. A freehold title issued under this act confers absolute control upon individuals or other legal entities upon a given parcel of land. It also confers upon them power to determine the use to which such land can be put. A leasehold title contains conditions such as the term of the lease, commencement date thereof, the user of the land etc. Private ownership of land is embodied in this Act

3.3.11 The Land Adjudication Act, Cap 95

This Act provides for ascertainment of interests prior to land registrations under the Registered Land Act. The Proponent has consulted the neighboring land owners who have expressed willingness use their own farms for their irrigation of water from the proposed dam for Public consultations were also undertaken in the affected project area.

3.3.12 Land Titles Act Cap 282

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

3.3.13 Valuation and Related Legal Issues

The valuation practice in Kenya is governed by the Valuers Act Cap 532, which provides for a Valuers Registration Board that regulates the activities and conduct of registered valuers. Valuers in Kenya are registered upon application to the Board and are required to be full members of the Institution of Surveyors of Kenya (ISK).

The Act governs the formation and composition of valuation practices including the qualification of partners and directors in charge of valuation. The Board also deals with discipline and complaints in respect to valuation practice. Other statutes that govern valuation are the Government Lands Act Cap 280 that regulates the valuation for land rent while valuation for rating is governed by the Rating Act Cap 267. Land Acquisition Act Cap 295 governs valuations for compulsory acquisition purposes.

This Act is triggered as the valuer and financial analyst of the consulting team have applied the requirements of these laws and other market indicators to come up with the RAP budget and the market rate or replacement cost of compensating the PAP.

3.3.14 The Penal Code, Cap 63

The Penal Code prohibits any person or institution from voluntarily corrupting or foiling water for public springs or reservoirs, rendering it less fit for its ordinary use. In addition, the same act says a person who makes or vitiates the atmosphere in any place to make it noxious to health of persons/institution in dwellings or business premises in the neighborhood or those passing along public way commit an offence.

3.3.15 Legal Notice 40 (Building, Operation & Work of Engineering) Rules 1984

These rules require the contractor to ensure health, safety and welfare of employees and states. It further requires the main contractor to notify the chief inspector within 7 days of commencing or undertaking building operation or works of engineering.

The rules require that walls of excavations deeper than 1.2m be reinforced with timber of suitable quality or with other suitable material to prevent so far as is reasonable practicable the danger or injury resulting from a fall or dislodgement of earthwork.

The rules further require that a scaffold of good construction and suitable strength shall be made available for any construction site where working at height is to be undertaken.

A first aid box shall also be provided and be distinctively marked 'FIRST AID' and placed under the charge of a responsible person whose name shall be plainly indicated in a prominent place or near the box.

3.4 Overall Legal Compliance Statement

The proponent being a government agency has taken cognizance of the applicable legal obligations pertaining to this proposed development by demonstrating full commitment to compliances with applicable laws and regulations applicable to the implementation of this proposed project.

3.3.16 Penal Code Act (Cap.63)

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

3.3.17 World Bank safeguard Policy

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

10 SAFEGUARD POLICIES

Environmental Policies

OP 4.01 Environmental Assessment

Objectives:

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

OP 4.04 Natural Habitats

Objectives:

- Safeguard natural habitats and their biodiversity
- Ensure sustainability of services and products which natural habitats provide to human society
- Bank does not finance projects that convert critical Natural Habitats.

- Requires inclusion of mitigation measures if significant conversion or degradation of a (Non-Critical) Natural Habitat is needed to achieve project's objectives; includes establishing or strengthening an ecologically similar compensatory protected area.

OP 1.03 Cultural Property

Objectives:

To ensure that;

- Physical cultural resources are identified and protected in World Bank Projects
- National laws governing the protection of physical cultural property are compiled with
- Covers archaeological and historical sites, historic urban areas, sacred sited, graveyards and burials

Rural Development Policies

OP 4.36 Forests

Objectives;

- Aims to reduce deforestation, promote reforestation, enhance the environmental contribution of forested areas, reduce poverty and encourage economic development.
- Forests are managed in a sustainable manner
- Significant areas of forest are not encroached upon
- The rights of communities to use their traditional forest areas in a sustainable manner are not compromised

OP 4.09 Pest Management

Objectives;

- Promote the use of biological or environmental control methods and reduce the use of synthetic chemical pesticides.
- Ensure pest management activities follow an Integrated Pest Management (IPM) approach
- Minimize environmental and health hazards due to pesticide use
- Develop national capacity to implement IPM and to regulate and monitor the distribution and use of pesticides

OP 4.39 Safety of Dams

Objective;

- To ensure due consideration is given to the safety of dams in projects involving construction of new dams, or that may be affected by the safety or performance of an existing dam or dams under construction
    - Important considerations: (Dam Height and Reservoir Capacity)

Social Policies

OP 4.12 Indigenous Peoples

Objectives;

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

OP 4.20 Involuntary Resettlement

Covers both:

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

ii. The measures for mitigating the impacts of displacement.

Objectives:

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

Legal Policies

OP 7.60 Disputed Areas

Objective:

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

OP 7.50 International Waters

Applies to the following types of projects:

i. Hydroelectric, irrigation, flood control, navigation, drainage, water and sewage, industrial.

ii. International water ways that include: Any river, canal, lake or similar body of water that forms the boundary between any other rivers or body of surface water that flows through, two or more states.

Objectives:

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

4 DESCRIPTION OF PROPOSED DESIGN OF THE WATER PROJECT

4.1 Proposed project Area

The project area that fits these requirements has been identified under this study to lie partially or wholly within the wards of Kogony, Kanyakwar, Konya, Wathorego, Korando A, Dago and Mkendwa. The areas in reference are undergoing significant growth in all the categories i.e. residential, commercial and institutional. It is noteworthy that a larger section of target area of this project lies within with identified potential high growth area identified under the Kisumu Integrated Development Plan of 2014. The other section is adjoining and extends into the Riat Hills but lies outside the scope of consideration of the ISUD plan.

According to KIWASCO, most of the proposed project area considered under this assignment is not adequately served. The tertiary and secondary water network distribution is not well developed despite being near the major transmission mains commissioned under the LPAP project. Arising out of the above considerations, this study has proposed to serve the identified project area by dividing it into three supply zones depending on the commanding supply source.

Three such supply zones have been identified under this study, namely

a) **Upper zone (Zone A)** comprising the area served by gravity from a new tank proposed at RIAT Hills. This tank will be in turn supplied by pumping from the lower area (Zone 2). The pump station is to be located within Kanyakwar area at contour 1220 m asl and will pump water to Riat Hill tank at 1380masl

b) **Lower zone (Zone B)** comprising the area served by gravity directly from the clear water tank at Kajulu Clear Water Tank head and additionally by the Kanyametha Tank. It is noted that the Kanyametha which is supplied under Kajulu Clear Water Tank head.

c) **Zone C** consisting of the area above the 1340 Contour within the project area and incorporating upper Dago, Mkendwa and Middle Konya. Water source will be the existing Mkendwa springs although additional source upstream of contour 1500 can be explored in future so as to allow for distribution of supply entire by gravity

To allow for efficiency in supply distribution, operations and maintenance, the above zones have been further divided into sub zones on the basis of:

a) Commanding source head; whether ground or high level source tank

b) Zone boundaries

c) Limit of effective pressure head which is set at 70m d) Administrative considerations where applicable e.g. buffer zone/ zone boundary at the bottom of Riat Hills, ward boundaries etc.

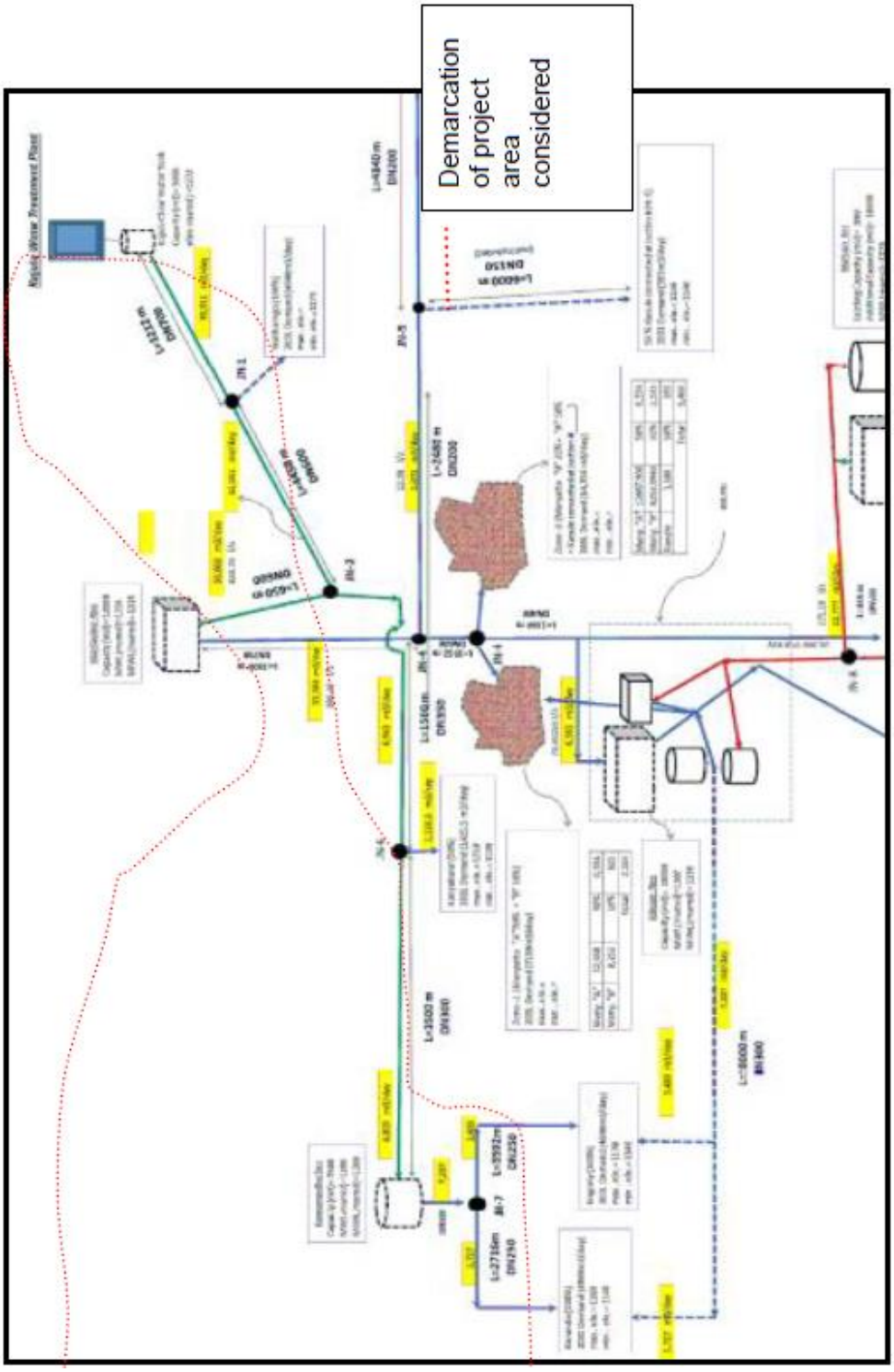

Figure 4.1: Extract of Drwg/005 schematic layout of water distribution component-revised arrangement (Suereca, 2011)

4.2 Project design by Period

Since source of water for this assignment at Kajulu Source works is the same as the LTAP works, it has been considered prudent to match the ultimate year for this project with the LTAP one given that these proposed works are essentially and extension of the same project while considering that part of the flow shall now be extended outside of the original boundaries under LTAP. **The initial year is therefore has been taken as year 2015 and the ultimate year as 2030.**

4.3 Project Construction components and steps

Part of the proposed works will be based on the existing water supply system, which will be augmented to supply targeted areas. The project will also develop a new abstraction point to feed into the supply system. There will be water tanks constructed at several locations to hold reserve supplies for satellite clients. The design shall incorporate water pumps and valves. Steps for project implementation will be as follows:

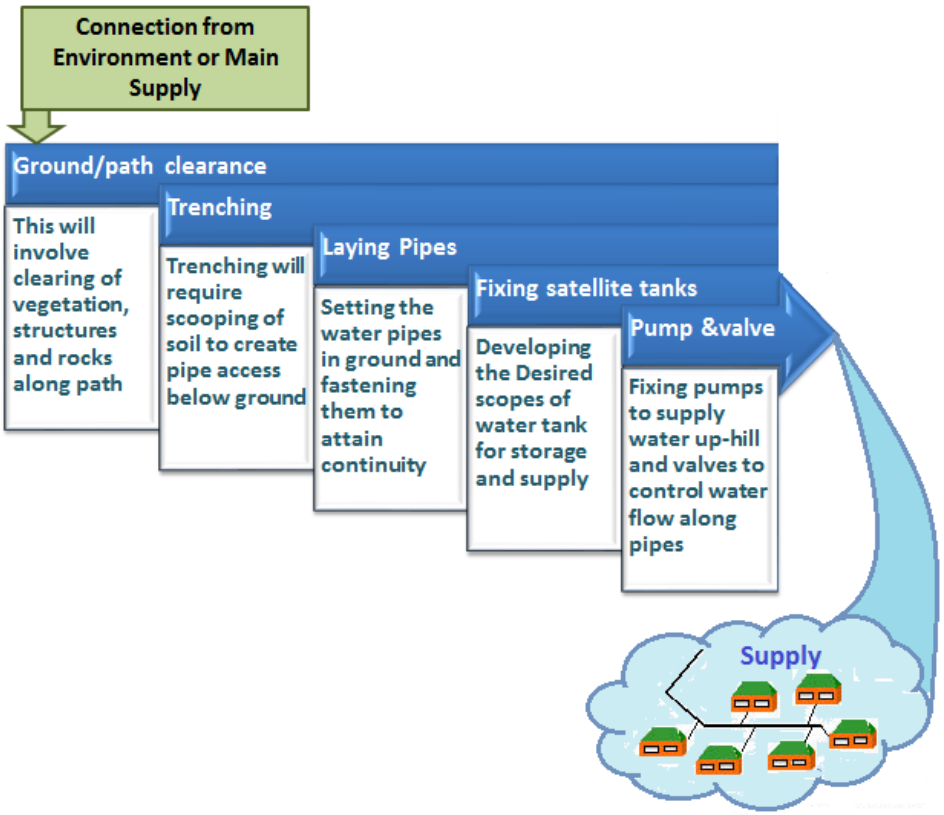

Figure 4.2: Project Components and Steps

4.4 Population and Water Demand

The population growth rate based on the 2009 KNBS census data of 2009 is 2.6%. However, a growth rate of 3.0% has been used for projection of the population in the project area to the ultimate year based on projections by UN-Habitat Urban Planning and Design branch on projected growth scenarios for Kisumu in their 2012 publication entitled "Kisumu- Rapid Urban Planning Studio Workshop Results" Using the above data, the population in the project area is projected to rise from 69,065 in 2017 to reach 101,424 in year 2030. The table below refers.

Table 4.1: Population Projection

Sub-location	*Census (2009)*	*% total of sub location in Project Area*	*Proportion of sub location in Project Area*	*Initial (2017)*	*Future (2025)*	*Ultimate (2030)*
Korando A	*12,057*	*28%*	*3,376*	*4,227*	*5,417*	*6,280*
Kogony	*19,625*	*71%*	*13,934*	*17,651*	*22,360*	*25,921*
Kanyakwar	*12,554*	*100%*	*12,554*	*15,903*	*20,145*	*23,354*
Wathorego	*11,823*	*85%*	*10,050*	*12,730*	*16,127*	*18,695*
Dago	*5,724*	*100%*	*5,724*	*7,251*	*9,185*	*10,648*
Mkendwa	*1,032*	*100%*	*1,032*	*1,307*	*1,656*	*1,920*
Konya	*14,275*	*55%*	*7,851*	*9,946*	*12,599*	*14,606*
Sub Total	***77,090***		***54,521***	***69,065***	***87,489***	***101,424***

On the basis of the above population and projected demand, the total water consumption in the project area in the zones A, B and C in the year 2030 add up to 14,833m3/day . A tally of the water demand per zone/ward are presented in Table 3.5-3.8 which are 3,696 m3/day for the upper Zone, 7,577 m3/day for the lower Zone and 3,052 m3/day for the sum of Zone C spring and tank sources An additional demand of 600 m3/d has been included to take care of institutions and industries that are expected in the project area within the design period. Particular attention is given to the industrial zone along the Kisumu - Busia road in the neighborhood of the Airport and surrounding areas of Bandani, Kanyakwar and Kogony.

4.5 Water Supply System Demand

The design of the Water supply network has been carried out on the basis of the Ministry of Water and Irrigation – Practice Manual for Water Supply Services in Kenya, 2006- as the main reference document. The pipe route alignment has followed the existing roads as far as practically possible. This was facilitated by use of the acquired cadastral maps for the project area acquired for this purpose. Cadastral maps will also be useful in the process of the identification of properties for the purpose of

application for new connections or identifying old connections which require upgrading.

The 3,696 m^3/day supply r the upper Zone s amount of water will be lifted to the new Riat Hill storage tanks from the newly proposed Kanyakwar pumping station to be located at the foot of Riat Hills.

Figure 4.3: Typical water supply pipes. Under ground and suspended

Pumping will be via 4 No active pumps and discharged through 2 x 150mm diameter rising mains 1580m long so as to overcome an elevation difference of 172m. 2 No ground level and 2 No high level tanks will be constructed at the Riat Hill Tank site.

The Ground level tanks will be 4 x 225m3 capacity and high level tanks 2 x 75m3 capacity respectively. In the design of pumping and storage facilities, modular construction has been taken into consideration to allow for construction of the facilities over the design period.

The results of network analysis carried out as above are presented in the main report. A total of 127,902 m of new distribution mains of various pipe diameters are proposed across the project area (DN 40- DN 200). Of this length 89935 is to be laid in zones A & B whilst the balance is in Zone C.

Table 4.2: Network Analysis

PHASE	*DN 40 uPVC*	*DN 50 uPVC*	*DN 63 uPVC*	*DN 75 uPVC*	*DN 90 uPVC*	*DN 110 uPVC*	*DN 150 Upvc*	*DN 200 /150 Steel*	*TOTAL PIPE LENGTH*
PIPE LENGTH (M)	*1009*	*3773 9*	*920*	*1713 7*	*1080*	*23890*	*8058*	*2582*	*89935*

4.6 Construction works

Consideration has been made for modular construction of the system to allow for phasing of the construction works across the design period so as to allow the Client to manage the investment costs over the design period .This consideration will also to allow for growth of critical mass of potential consumers in areas within the project area that are currently not densely inhabited but exhibit potential for such growth. This will provide the necessary economy of scale in extending the water supply network. It is to be noted that the current phase 1 network targets areas that are already adequately settled or projected to undergo rapid development in the coming years and areas bulk water consumer as these promote the early attainment of target sales necessary to recoup investment within the target period of time. The pipe diameters, lengths per sub zone and the scope per phase are additionally provided for ease of planning for implementation.

Table 4.3: Construction phase and zones

Construction phase	***Length of pipes (m) in Zone A& B***	***Length of pipes (m) in Zone C***
Phase 1(to year 2022)	*13,773*	*14,569*
Phase 2 (to year 2030)	*34,310*	*12,656*
Phase 3 (beyond 2030)	*40,642*	*10,742*
	88,725	*37,967*

Zone	***Pipe Length (m)***	***Total Pipe length(m)***
Zone A	*13,773*	
Zone B	*76,162*	*89,935*
Zone C1	*15,569*	
Zone C2	*22,398*	*37,967*
		127,902

4.7 Impacts on the environment at various phases of the project

In the process of executing the project, the environment will be affected in different scopes depending of method and extent of process application, The following is an overview of potential impacts during implementation of the project at the five phases presented under section 4.3:

Tale 4.4: Scoping of environmental issues related to the project

No.	Project Phase	Remarks	Threats
1	Environmental Abstraction	Water will be catalyzed to flow out of springs (source) by enhancing bank protection. Most of the water will be channeled into the pipeline	Reduced water flow downstream
			Destruction of upper catchment mag impact productivity
			Water Pollution at source may impact a wider community at supply ends
2	Trenching	Clearing of path to pave way for creation of the trench using machinery or manual labour.	Loss of biodiversity
			Obstruction of businesses for access
			Risk of electrocution
			Injuries from associated works
			Risks from insect, snakes or animal bites
			Dust emission
			Trip and falls into holes
			Ergonomics
3	Laying Pipes		See under general
4	Fixing Satellite tanks	These will take some space and will be visible	Reduced Aesthetics
			Loss of biodiversity
5	Pumping	Depending on model	Noise during operation
6	General	These are generic to the project	Injuries from associated works
			Risks from insect, snakes or animal bites
			Fatigue
			Dust emission
			Trip and falls into holes
			Ergonomics
			Risk of electrocution
			Air pollution from machinery
			Soil pollution from oils
			Waste generation from project components
7	User End	Potential attributes by the project water or system	Shock (electrocution)
			Drowning
			Fugitive flows from bursts
			Fugitive flows from waste
			Waterborne Diseases

4.8 Cost of the project

The project cost based on phase 1 is as provided in the table below.

Table 4.5: Phase 1 project cost

ITEM	DESCRIPTION	PHASE 1 COST
1	**Distribution Pipes**	
1.1	Zones 1 and 2 pipe network construction	13,751,345.80
1.2	Zone 3 _ Gravity Supply from Springs	19,835,546.15
1.3	Zone 3 Supply from Tank	11,293,139.15
2	Bill No. 2 - Proposed Storage Tanks at RIAT Hills site	6,040,000.00
3	Bill No. 3 - Pump house , Head Tank and rising mains	7,984,000.00
	Preliminary and General Items	4,417,802.33
	Add 15% Contingency	5,890,403.11
	TOTAL PROJECT COSTS FOR PHASE 1	**69,212,236.54**

The estimated ***Phase 1*** cost of the proposed project is **Ksh.69,212,236,54 (SIXTY NINE MILLION, TWO HUNDRED AND TWELVE THOUSAND, TWO HUNDERD AND THIRTY SIX KENYA SHILLINGS).** The proponent will hence be required to pay 0.1% of this amount to NEMA Ksh. **69,212.24 (SIXTY NINE THOUSAND, TWO HUNDRED AND TWELVE KENYA SHILLINGS)** being part of EIA license application fee. Payment shall be done in form of a banker's cheque.

5 PUBLIC CONSULTATION

According to Environmental Management and Coordination Act, while undertaking an Environmental Impact Assessment (EIA) study, public consultation is mandatory. This enables the public views, opinions, fears and aspirations to be integrated in the report.

As the planned project is likely to have some impacts on the surrounding community, a varied sample of interviewees from the community was interviewed so that they could shed some light on their perceptions and expectations from the planned project.

Methods used for the consultation include: Community household occupant's consultation, Institutional expert's consultation, Discussions with random informants, Consultative meeting with community elders and a meetings with the host administrative stakeholder.

5.1.1 Community Household Occupant's Consultation

This group comprises the study area household Residents, who were the potential recipients of the project. The exercise was conducted by a team of trained enumerators selected from the community, and headed by a certified team leader. The consultations were carried out through administration of pre-designed questionnaires and by interviewing neighbors surrounding the proposed project site.

The questionnaire issued had details of the proposed project, reasons for conducting public consultation, legal provision pertaining to public consultation and spaces for providing personal details including:

a. Name/Organisation of respondents

b. National Identification or passport number and

c. views regarding the proposed project

The summary questionnaire for various groups is provided below

Table 5-1: Characteristics of Survey Tools

Research Tool	Section	Details
-HH Questionnaire	1. Identification of HHs	Coding, location, respondent name, time of interview, contacts, gender, etc
	2. HH Members	Age, Religion, Sex, Relationship to head, Education, Employment, Income, HH head gender,

Research Tool	Section	Details
		population
	3. HH Income	Pay, Income from activities, Affordability
	4. Land tenure	Duration of stay, if owns other land, type of tenure, mode of acquisition
	5. Water Billing	If supply is metered, how much water costs, associated problems with water supply
	6. HH build design	Walls, roof, floor, toilet, design, windows, doors,
	7. Source of construction Material	Local, imports, type
	8. Source of Energy	Traditional, modern, type, cost, frequency
	9. HH Expenditure	Consumables, fees, rent, Agriculture, fuel, savings, housing materials, etc
	10. Water and Sanitation	Source of water, consumption, duration to obtain, purification method, waste management, etc
	11. HH Disease Incidence	Eye, Respiratory, Skin, Intestinal, Headaches, colds, allergies, others
	12. Cultural Assessment	Sites of significance near living area
	13. Gender	Chores Allocation, HH ownership, Roles
-Institutional Questionnaire	An open discussion method was applied	The random discussion guided by general matters was applied to gather key issues affecting the area, as well as available data where possible.
- Environmental & Social Questionnaire	HH Perception on the proposed project	If good/bad/viable/suggestions, other comments/etc.
	HH Economic dynamics	Key economic indicators
- Environmental Observation Sheet	Hydro-setting, landscape, vegetation, Associated impacts,	Baseline and dynamic transformations under anthropogenic or natural impacts
-Towns, Centers and Market observation sheet	Settlement, power distribution, drainage, solid waste, air quality, drinking water quality, noise	

5.1.2 Group Consultative Meeting (Public Baraza)

A group consultative meeting was held at Obunga Hall Kisumu, County to introduce, sensitize and consult on the project. The groups included members of the community, local administrative heads and community elder's consultative groups. Minutes to the meetings are attached at the appendices section.

Figure 5.1: Public Consultation meeting held at Obunga Hall, Kisumu

The public and institutional participation was attended by the relevant authorities' representatives including fraternities from the county government-ward administrator, NEMA, WRMA, WRUA, LVBS, water officers and the area chiefs and assistant chiefs among others.

Key issues discussed include the following; Introduction of the project and processes to the attendants, briefing on the two phases of the project (phase 1 and 2), to be carried out in the area with the objective of increasing the water provision coverage. Water sources, supply and storage scopes. The storage tanks proposed for Kajulu and Mamboleo together with the spring at Mkendwa sub-location. The sources of these water was said to have been assessed and found to be enough and sustainable to serve the entire community without any problem by the hydrological surveyors before the project.

Recommendations which followed included the conducting of the feasibility and or baseline survey by the experts before the project officially starts, roles and components of the proponent, KIWASCO, collaboration of the stakeholders to meet the common goals/ objectives of the water project, the safety measures of the water to be supplied, methods and mode of the pipe installations in the area, occurrence of the billing costs and the start and completion of the phases to be covered by the project. Also, sanitation and the acute water shortages currently in the area were discussed. The community was assured by the project team of high due diligence level by the lead environmental health and safety expert who also highlighted collaboration within

the water sector and the formation of the water board to manage any water issue. The attendants were also sensitized about a parallel Household Survey that was going on to capture detailed scope of the community.

General Comments for Action

- Much public participation for the project making it to be well informed in the ESIA report.
- Needed spring protection at Mkendwa
- Proper treatment of water supplied to the community
- Formation of a local committee to facilitate inspection and maintenance of the water system for efficient water supply and free from illegal connections
- Environment, Health and Safety in Operative stage and conservation of the environment in all stages of the project.
- Appropriate collaboration with all stakeholders in the area, local, county and national levels to ensure efficiency in water supply in the region.

6 ANALYSIS OF PROJECT ALTERNATIVES

6.1 Section Overview

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

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

6.2 Land Use Options

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

- The "No-Action" Alternative
- The proposed development as described in the ESIA
- The proposed development as described but with alternative routing
- EIA With/Without an EMP

6.2.1 The "No-action" alternative

The selection of the "No Action" alternative would mean the discontinuation of project designs and result in the sites and routes being retained in its existing form. With the exception of the water resources in this project area, the other resources here are neither rare nor unique to this area, and should not impede the development. There are physical, biological and socio-economic implications of this alternative. Physically, the site is unlikely to undergo any major changes from its present condition. Biologically, the vegetation present in the area is unlikely to be severely affected.

The "No Action" Alternative is likely to have the greatest implications on the socioeconomic environment of the area and surrounding communities. Due to the proposed quality of the development it is anticipated that it would provide a major opportunity for clean water provision to the surrounding community, benefits associated with the secondary or tertiary projects and potentially significant business opportunities for existing and new marketing support businesses. In addition, a development of this caliber will add to the locality's ability to fuel the growth and development of the wider Kisumu area.

If this alternative was adopted, the developers would need to forget about the project and continue with their current lifestyle as usual. The Opportunity cost to the project area community is highly significant as there is a relatively low property value under present use while alternative location would not serve the target community to register baseline development.

6.2.2 The proposed development as described in the EIA

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

This alternative will have minimal impact on the physical environment and has considered the necessary measures to almost eliminate the identified issues of drainage, storm water runoff and landslides. The project is also in line with contemporary needs of the housing sector as well as associated service provision.

Advantages:

- The property value appreciates.
- Investment made in the property will be productive. The community will have self-sustainability and clean water provision in long term basis.
- The county earns value in per capita income due to increased sustainability in the area as well as improved social management capacity resulting from community social organisations related to the project.
- Employment opportunity expands since the project will impact on improved and increased water provision.
- Economic and spatial land use
- Will organise the community to observe environmental conservation and reduce the tradition of destruction of water catchment areas such as springs and forests, hence enhancing increased indigenous forest cover within riverine ecosystems and water sources.

Disadvantages:

- There will be increased local population due to increased water supply and over dependence of the resource at the targeted areas consequently leading to slight reduction of water flow if conservation measures are not adequately observed at the recharge points of spring sources.

6.2.3 The proposed development but alternative location

This is a no option because preliminary indications are that there are residents at the target area who are not yet connected to a sustainable water supply system despite having developed their existing property to deserving standards. The population has already invested in their current land of occupancy. The problem statement in this report, supported by earlier publications indicates that there is good potential for local growth in the area if the project is maintained to serve the target population as planned.

A suitable site alternative would once again require the identification of a suitable area with populations facing similar challenges, and would require an extra investment of several million shillings for implementation, preliminary site reports, professional consultation etc. All these have already been done for the current site. The current community would be ignored with the current challenges. This is envisaged to take a long time or might not even be attainable in the long term due to donor requirement.

6.3 EIA With/Without EMP

6.3.1 Without

This scenario was based upon the assumption that the proposed development would go ahead without any environmental management options being implemented. The total project impact for the scenario is on the appreciably adverse side. This shows that if the project goes ahead without EMP, the adverse impact on the existing environment would be several times that of the impact without the project. Thus, the EMP described in Chapter 10 will have to be implemented to minimize the potential negative impact due to the proposed activity.

6.3.2 With

If the environmental management strategies discussed in Chapter 10 is fully implemented, the adverse impact of the project would be reduced, and there will be an overall improvement in physical, chemical, biological and socioeconomic environment of the region. Therefore, the proposed activity will be beneficial for the environment of the area, provided the EMP is in place.

Conclusion: It is clear from the above, that the proposed hotel project would have negative affect without implementing certain environmental management strategies. If EMP, as discussed in Chapter 9, is adopted and implemented, the adverse impacts will be reduced and the overall environmental quality of the area would improve.

7 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

7.1 Construction Phase

7.1.1 Soil and Solid Waste

During trenching for the Pipelines and treatment works site excavation, soil will accumulate and may pose significant negative environmental effects. If left unattended over a long period, the soil may be swept into the nearby rivers resulting in excessive flooding and silting during the rainy seasons. Further, the soil may find its way into the community's farms thereby reducing soil fertility. Other solid wastes include; wasted mortar, ballast, cement and other packaging materials, sand, metals, plastics and parts of PVC pipes, and garbage. These wastes generated during construction may impact negatively on the environment if not properly handled and managed.

7.1.2 Air pollution

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

7.1.3 Water quality

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

7.1.4 Flooding

While it is expected that this will be mitigated effectively during implementation, if not properly managed, silting could also cause significant rise in the water level of the rivers and streams in the project area with ultimate flooding downstream. Further, weir construction at the intake could also result in siltation and consequent flooding especially during the rainy season.

7.1.5 Noise

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

7.1.6 Destruction of Indigenous Vegetation

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

7.1.7 Physical/ Cultural Chance Find Procedures

Chance finds procedures are an integral part of the project ESMP and civil works contracts. If the Contractor discovers archeological sites, historical sites, remains and objects, including graveyards and/or individual graves during excavation or construction, the Contractor shall:

- Stop the construction activities in the area of the chance find;
- Delineate the discovered site or area;
- Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities or the Ministry in charge of managing cultural heritage and related resources in the country (responsible ministry) take over; - Notify the supervisory Project Environmental Officer and Project Engineer who in turn will notify the responsible local authorities and the responsible ministry immediately (within 24 hours or less);

- Responsible local authorities and the responsible ministry would then be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archaeologists assigned by the government. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage, namely the aesthetic, historic, scientific or research, social and economic values. ·

- Decisions on how to handle the finding shall be taken by the responsible authorities and the responsible ministry. This could include changes in the layout (such as when finding irremovable remains of cultural or archaeological importance) conservation, preservation, restoration and salvage.

- Implementation for the authority decision concerning the management of the finding shall be communicated in writing by relevant local authorities.

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

7.1.8 Intake spring interference with aquatic organisms biodiversity

The weir design and construction at the intake should be such that it will not interfere with among other factors fish and other aquatic organism's migration during breeding season thus ensuring uniform aquatic environment.

7.2 Operation Phase

7.2.1 Noise

During operation phase, the source of noise will be limited to electrical pumping sets for filter backwash water at the treatment works. Though the pumps are expected to generate noise during operation, the type of equipment and regular servicing generally can reduce noise to tolerable levels.

7.2.2 Solid Waste

The solid waste generated during operation phase will mainly consist of garbage from the staff houses, few pieces of PVC and metallic materials replacements from repair and maintenance, spent filter media and clarifier sludge waste.

7.2.3 Air pollution

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

7.2.4 Disease hazards

Provision of increased water supply to the targeted residents may have some significant negative impacts arising from water borne sewage leakage from overflowing septic tank systems and pit latrines. If not properly managed, the waste water may overflow and pollute the environment with consequent outbreak of water borne and water washed diseases. Further, the raw sewage may end up percolating into the ground polluting adjacent ground water sources. Excessive discharge of grey water coupled with frequent leakages without proper drainage system may lead to accumulation of stagnant water thereby creating conducive habitat for breeding of mosquitoes.

7.2.5 Insecurity

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

7.2.6 Water management conflicts

Clean water, being scarce in the project area, the management of the new project could result in prolonged conflicts unless properly formulated and consumer driven. This could therefore become a major negative impact.

7.3 Mitigation Measures against potential negative impacts

7.3.1 Construction Phase

- Air pollution

During construction air pollution should be avoided by provision of nose masks to the workers and preferably wetting the dusty surfaces neighboring residences. These are all the areas where the trenches for the pipeline will be excavated and at the site of treatment works. Though the ambient air conditions in the project area is dusty to an extent, effort must be made to reduce dust and particulate emission adjacent to residences. To minimize pollution from hydro – carbon fumes from the excavator, exhaust should be oriented away from neighbors' residences. This should apply throughout the project cycle from construction to decommissioning.

- Noise

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

-Destruction of indigenous trees and vegetation.

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

- Intake protected spring interference with aquatic organism's migration

The protected spring should not inhibit free migration of organisms during breeding season. The spring should be designed in a way to allow free movement of aquatic organisms without accessing the harnessed water. The quality and protection status of the adjacent environment should be well structured

- Flooding

To prevent chances of excavated soil erosion and transport to nearby streams, all these materials should be re-used during landscaping of the site. The soil should be compacted and the appropriate vegetation planted to ensure no chances of erosion and silting of the water sources, which could ultimately cause flooding downstream.

- Accumulation of solid waste

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

- Soil erosion

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

- Prevention and Management of Accidents

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

- The workers should be provided with personal protection gear to avoid cuts on the feet, hands and head during the course of duty. This include helmets, gloves, safety boots overalls, face masks and ear plugs in dusty and noise activities, goggles for welders etc.

- Training: the foreman should train the workers on procedures to prevent accidents while on site.

- The workers or their representatives should be trained on first aid and provided with first aid kits

- Emergencies: the workers should be provided with emergency telephone numbers to request for assistance at any time of accident. In areas of poor cell phone network there should be a stand by means of transmitting information

- The workers should be insured against accidental medical requirements and workmanship compensation.

7.3.2 Operation Phase

Noise

During operation, noise pollution from the treatment works should be minimized by enclosing the site and use of potentially low noise filter backwash pumps. The pumps should be regularly serviced to reduce noise generation. If necessary the pump house inner wall sides could be lined with sound proof material. To ensure noise does not affect the health of the workers, they should wear the necessary protective gear all the time they are on duty in noisy environment from construction to operation and decommissioning phases. Therefore the workers should be provided with ear protection devises for use while on duty.

Solid Waste Management

Solid waste generated during project operation phase will mainly include the clarifier de-sludging waste from water treatment plant, spent filter media, precipitates of powder chlorine products and either lime or soda ash. These waste should be temporary be disposed in drying beds with the works compound before transportation and final disposal in a designated site. Other types of solid waste include garbage, plastics and metal pieces from repairs and waste paper from office. This type of waste should be sorted for recyclables e.g. metals, plastics and paper for sale to recyclers before transportation for disposal at the designated site.

Disease Hazards

Proper maintenance of sewage and grey water handling systems will be required to avoid pollution of environment and consequent spread of diseases. Further proper management of drainage systems will be necessary to eliminate chances of having stagnant water which would otherwise be a breeding site for mosquitoes and resultant outbreak of malaria and bilharzias. This water could be profitably used for irrigating food crops and tree nurseries where community can buy seedlings for various vegetation and trees

Project management conflicts

Owing to the high competition for water in the area, there could occur management conflicts. To prevent such conflicts the project management should follow the guidelines given in water sector reforms and hence in accordance to water act 2002 The Ministry Water and Irrigation should work with the relevant institutions to streamline the management to avoid negative impacts and losses that could arise from conflicts.

Insecurity and Strain on Infrastructure

Rapid increase in population is expected to impact negatively due to resultant over loading of services eg hospitals, schools, housing, security services, solid waste facility, sewage handling facility etc. These impacts should be monitored in order to

advise the relevant institutions on the need to expand service delivery to match rising demands i.e.

- The administration and police on the need to increase surveillance
- The hospital and dispensaries to expand services
- Ministry of Education and private development to invest on schools
- The public to invest more in construction of rental residential buildings
- The water sector to increase investment in water supply and sewage disposal.

Prevention and Management of Accidents

The commissioned water supply project will be run and managed in accordance with reforms in the water sector and Water Act, 2002. The water supply provider will be required to provide the relevant protective gear to the workers in all sections. The water treatment plant personnel should be provided with overcoats/overalls, safety boots, helmets, goggles/masks for protection from accidents while on duty. They should also be provided with medical insurance cover and workman compensation or equivalent. The workers should be trained on first Aid treatment and first Aid kits installed at strategic sites in the water works.

8 SOCIO-ECONOMIC IMPACTS

Loss or damage of property

The members of the community affected by the project may suffer impact of loss of properties on their land. This is the most devastating impact of all in the project area especially where access routes may have to pass through private property. A careful approach should be formulated to reach an irrevocable agreement with satisfaction from all the stake holders.

The community will immensely benefit from the project as follows;

- The cost of water which is currently at an average of Ksh.20 per jerrican in the project area will decrease to the accepted affordable Ksh.2 per 20 litre jerrican.

- The water supply will meet quality standards for domestic water unlike the currently contaminated water bought from various vendors in the project area.

- Diseases related to the quality of water consumed which are currently frequent in the area will decrease e.g. Typhoid, amoebiasis and generally parasitic and bacterial intestinal infections .Others include bilharzia ,malaria, general skin and respiratory infections which are more related to water in Kisumu.

- The community will save time when the project brings water near their homes compared to the current status.

- Time and money saved by the community in the project area will be used in economic activities thereby improving the quality of life.

Therefore, socio-economic impacts arising from implementation of the project are numerous and include those associated with increased investment opportunities, health, cost saving and increase in population and are summarized below;

8.1 Positive impacts

8.1.1 Construction Phase

- Increased wealth creation owing to influx of investors coming to exploit the increased business potential due to availability of hygienically safe and clean water.
- Savings arising from reduced price and time spent fetching water ·
- increase in the government revenue generation ·
- Creation of employment during construction and operation phases of the project

- Boost in business of construction materials and consumables especially during construction phase ·
- Increased value of land and property in the project area and environs

8.1.2 Negative Impacts

Though most of the expected socio-economic impacts are positive, there are also potential negative impacts.

Loss of property

The loss of property to the residents especially between the intake and the main road will mainly include food crop plants which will occupy the pipeline path. Further during construction of the pipeline more plants may be destroyed during delivery of materials to the intake site. Therefore farmers will be required to give way leave for the pipeline and road to the proposed intake works.

Mitigation measures

To mitigate against the losses the residents will need to negotiate and make agreements on the value of losses which must be settled before the project starts implementation.

Population influx

The rapid increase in population may result in strain of infrastructure services e.g. electricity, road network and water supply systems which may get overloaded before the design period.

The high population may also lead to excessive generation of solid waste which does not presently have an elaborate collection and disposal system. The waste will therefore accumulate in the market centres and environs leading to the problems being encountered in other towns such as Nairobi e.g. Emission of malodorous gases and blockage of drainage system ultimately forcing their way into the nearby water sources. Increase in population may result in benefits owing to increased consumer base but may also lead to insecurity problems which overwhelm the current set up. Therefore mitigation measures should be formulated by the relevant institutions before the onset of these impacts;

- The planning department should be involved at all stages of new developments to accommodate changes
- Administration to continuously monitor changes in insecurity levels and formulate new approaches to counter them

9 DECOMISSIONING OF THE PROJECT

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

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

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

The resultant waste should be sorted into re-recyclables and non-recyclables before disposal at the designated site in accordance to NEMA regulations on Solid Waste. The recyclables e.g. pump sets, GI pipes, plastic materials could be re-used in new projects or sold to recyclers.

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

Table 9.1: Environmental Impacts and Mitigation measures

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

10 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

An EMP is a set of management process, steps and procedures that allow an organization to analyze manage and reduce the environmental impacts of its activities, products and services and operate with greater efficiency and control.

The following is a logical framework matrix where a number of mitigation measures are identified. It will be important to note that measures indicated are very specific in nature. It would also be advisable for the proponents to adopt a Cleaner Production Strategy, which would help mainstream the preventive and continuous measures applied to the processes, products and services to reduce various negative environmental impacts. This strategy advocates the reduction of pollution and waste at the source by focusing on reducing impacts along the entire life cycle of the product, from raw materials extraction to ultimate disposal of the products. This would include conserving raw materials and energy, eliminating toxic raw materials, and reducing the quantity and toxicity of all emissions and wastes before they leave a process.

The Cleaner Production approach is therefore a congruous corrective/mitigation measure, which will be applied to all activities of the enterprise to mitigate negative environmental impacts across the board. It is impossible to extract all negative impacts within the short period of assessment. However, the following EMP tries to address issues identified as immediate concerns. Environmental concerns are dynamic in nature. It is hoped that the management will continue developing further EMPs as issues emerge.

For the negative impact during setting up phase, mitigation measures are considered along their identification as these are short term impacts.

Mitigation measures required during operation phase of the project are summarized in the following EMP table. These are specific impacts and recommended mitigation measures to be implemented.

Apart from specific description of the mitigation measures in the following table, there is mention of various measures in the report throughout as the relevant topics are discussed. The proponents are urged to isolate them for implementation as they find them relevant. The costs mentioned are only presumptive. These are only mentioned to give an insight into the management of the company and regulatory authorities to assess financial expediency of measures while implementing the Environmental Management Plans.

Table 10.1: Environmental Management Plan During Development

Environmental Social Issues or Impacts	Proposed Mitigation Measures	Procedure for Implementation	Responsibility	Cost Kshs	Time Frame
Solid waste management	Proper solid waste management as per NEMA waste management regulations	Collection, sorting and recycling or disposal at designated site	Contractor Proponent during construction and operation phases respectively	30,000	Throughout construction and operation phases
Air pollution	Control of dust and hydrocarbon fumes during trenching and excavation	➢ Reduce dust generation by wetting using water. ➢ Where diesel mechanical equipment are used, ensure the engines are in good working condition and properly maintained . ➢ Enclose the works and orient exhaust away from the nearby residences	Contractor	50,000	Throughout trenching and excavation activities Continuously during operation and at regular intervals
Noise	Control noise to be within the recommended limits to avoid disturbance of neighbours	➢ Enclose drilling and all excavation sites where mechanical equipment are used ➢ Ensure the work is done during the normal working hours (8.00am-5.00pm) ➢ Use low noise equipment during construction ➢ Ensure the equipment is regularly and properly maintained	Contractor and proponent during construction and operation phases respectively	No costs	Throughout construction phase
Health and safety	Prevention of accidents Protection against advanced health effects	➢ Use of physical barriers and labeled icons to prevent and warn the public on dangers of construction activities ➢ Provision of protective gears to the	Contractor and Proponent during construction and operation phases respectively	In accordance with prevailing costs	Throughout construction and operation

Environmental Social Issues or Impacts	Proposed Mitigation Measures	Procedure for Implementation	Responsibility	Cost Kshs	Time Frame
		workers ➢ Training and Provision of first aid kits to the workers. ➢ Training workers on environmental health and safety procedures and emergency preparedness ➢ Insuring the workers on medical and workman compensation			
Management of conflicts	The water supply management to be done using guidelines for water user association from the Ministry of Environment, Water and Natural Resources	Formation of water users association to manage the water supply kiosks	Proponent	No cost	Once after commissioning
Interference with fish and aquatic bio diversity	Provision of a means to allow migration of fish and other aquatic organism upstream/downstream across the weir	The weir is designed to allow free migration/ movement of aquatic organism across it	Proponent / constant	No cost	Once during construction phase
Loss of property Acquisition of Project land /way leave	Sensitization of the affected members of the public · -Compensation for way leave -Land purchase	Sensitization and consultations Negotiations, agreements and valuation Negotiations, agreements and valuation	Proponent and consultant Proponent Proponent	1 million 2 million	Before the project implementation
Diseases Hazards	Sensitize the public on consequences of accumulation of stagnant water near leakage points	Sensitization, training on spillage waste management	Proponent	No cost	During operation phase
Project acceptance	Consultation and information during open barazas	consultations	Proponent and consultant	Kshs. 200,000 incurred during	During feasibility and

Environmental Social Issues or Impacts	Proposed Mitigation Measures	Procedure for Implementation	Responsibility	Cost Kshs	Time Frame
				project preparation activities	design studies
Insecurity	Sensitize the community and security institutions on the possible impacts of the project	Increased security surveillance	Proponent	In accordance with prevailing costs	During commissioning and operation phase
Physical cultural resources Chance find/discoveries e.g. archaeological site, historical site, graveyard discovery	Chance find procedures Resident Engineer to stop works, secure the site and report to the relevant authority for evaluation and decision.	Meanwhile the Engineer will be required to liaise with authority to allow for project progress e.g. redesigning to avoid the site giving way for preservation, conservation, restoration and salvage as detailed under impacts during construction phase.	Contractor/ proponent /consultant/ relevant authority.	As per evaluation and advice from the relevant authority.	Throughout the project implementation period.
			Total Cost	**3,280,000**	

Table 10.2: Environmental monitoring During Development

Monitoring Issue	Parameter	Monitoring Method	Indicator	Frequency of Measurement	Responsibility
Air Emissions/ Ambient Air quality	Dust	Visual Inspection Feedback from the community	Airborne particles/accumulations	Continuous	Main contractor, NEMA, Local Authority, Community
	Engine exhaust smoke	Ditto	Colour of exhaust smoke/accumulation	Ditto	Main Contractor, NEMA, Local Authority Community
Noise	Noise Level	Auditory impacts Feedback from the community	-Complaints	Ditto	Main Contractor, NEMA, Local Authority Community
Waste Management	Amount of Solid waste produced (sediments and wastes from secondary projects)	Measurement of silt level at the base of dam Visual impacts in drain ways	-Silt level in the dam base and at the weir -Sediment and bio-wastes accumulated	Ditto	Main contractor, NEMA, Local Authority Community
Health and Safety	Occupational Health and Safety monitoring	Reporting of accident and incidents, safety breaches and damage to the facility	Statistical records and safety reports	Ditto	Main contractor NEMA Community
Environmental Quality	Aesthetics, registered complaints, Soil measurements,	Comparative pictorials, visual impacts, recording, photography, lab analysis, Community liaison	Number of complaints and nature of complaints, parametric and qualitative, pictorials, registers	Ditto	Mine Operator , Community County Govt NEMA, Mines & Geology
Community Welfare	Community Health	Community Liaison and meetings	Feedback and records	Ditto	Mine Operator , Community County Govt NEMA, Gender and Social Department

11 CONCLUSION

The Water Supply project will be funded by the World Bank/ Government of Kenya through Lake Victoria South Water Services Board which intends to alleviate the lack of water in the targeted sub-locations of Kisumu where the community normally purchase water which is neither adequate nor safe for human consumption. Potential environmental impacts associated with implementation activities of the project i.e. construction and operation phases have been assessed and analyzed carefully and the necessary mitigation measures have been formulated.

Among the impacts include: soil erosion, generation of dust, noise disturbance, disease hazards, and possible accidents. These including socio-economic benefits, health and safety issues of the workers and neighbouring community have been considered and an Environmental Management and Monitoring Plan has been formulated to guide the proponent and NEMA in future audits.

Among Socio-economic benefits include eradication of waterborne diseases, improved livestock production and time saving for other economic activities. These together with expected improved business in the market centres in the project area are positive impacts that outweigh any negative impacts associated with the project. This is in consideration of the mitigation formulated against the negative impacts as indicated in this EIA project report.

It is therefore our request that NEMA approves the project for implementation to improve the quality lives of the people in the project area.

12 Literature Review

Agenda; Blue print for sustainable development

Kenya gazette supplement Acts 2000, Environmental Management and Coordination Act Number 8 of 1999. Government printer, Nairobi

Kenya gazette supplement number 56. Environmental Impact Assessment and Audit Regulations 2003, Government Printers, Nairobi

Kenya gazette supplement number 57, Environmental Management and Coordination (Controlled Substances) Regulations, 2007, Government printer, Nairobi

Kenya gazette supplement number 68, Environmental Management and Coordination (Water Quality) Regulations, 2006, Government printer, Nairobi

Kenya gazette supplement number 69, Environmental Management and Coordination (Waste management) Regulations, 2006, Government printer, Nairobi

Kenya gazette supplement Acts *Building Code 2000*, Government Printers, Nairobi

Kenya gazette supplement Acts *Local Authority Act (Cap. 265),* Government Printers, Nairobi

Kenya gazette supplement Acts *Land Planning Act (Cap. 303) government printer, Nairobi*

Kenya gazette supplement Acts *Penal Code Act (Cap.63)* Government Printers, Nairobi

Kenya gazette supplement Acts *Physical Planning Act, 1999*, Government Printers, Nairobi

Kenya gazette supplement Acts *Water Act, 2002*, Government Printers, Nairobi

Kenya gazette supplement Acts *Public Health Act (Cap. 242)* government printer, Nairobi

Kenya gazette Supplement Acts *Electric power Act, 1997*, government printer, Nairobi

Kenya gazette Supplement No.22 *Factories and other places of work Act (Cap 14), 200*5, government printer, Nairobi

Kenya gazette Supplement Acts *Land Acquisition Act, (Chapter 295),* government printer, Nairobi

Kenya gazette Supplement Acts Wildlife (Conservation and Management) Act, (Chapter 376), government printer, Nairobi

Kenya gazette Supplement Acts Lakes and Rivers Act, (Chapter 409), government printer, Nairobi

Kenya gazette Supplement Acts Radiation Protection Act, (Chapter 243), government printer, Nairobi

Kenya gazette Supplement Acts Sexual offences bill Act, 2006, government printer, Nairobi

Kenya gazette Supplement Acts Occupational safety and health Act, 2007, government printer, Nairobi

Kenya gazette Supplement Acts Agriculture Act, (Chapter 318), government printer, Nairobi

Noise Prevention and Control Rules 2005, Legal Notice no. 24, Government Printers, Nairobi

Pollution prevention and abatement handbook – Part III, (September 2001)

The Occupational Safety and Health Act, 2007, Government Printers, Nairobi

UNEP and ACTS (2001). The Making of framework Environmental law in Kenya. Acts press, Nairobi

World Bank (1991), Environmental Assessment sourcebook volume I: Policies, procedures and cross-sectoral issues. World Bank, Washington.

World Bank (1991), Environmental Assessment sourcebook volume II:-sectoral guidelines. World Bank, Washington.

World Bank (1991), Environmental Assessment sourcebook volume III: Policies, procedures and cross-sectoral issues. World Bank, Washington.

World Bank (1991). Environmental Assessment Sourcebook volume I: Policies, procedures and cross-sectoral issues. World Bank, Washington.

World Bank (1998). Environmental Assessment Sourcebook volume II: Sectoral Guidelines. World Bank, Washington

Sample Household Environmental Questionnaire

NEMA EIA Public Participation Consultation Form (<10 Minutes)

Proposed project brief: The proponent, Kisumu Water and Sanitation Company (KIWASCO), hereby commits to undertake an Environmental & Social Impact Assessment for the proposed Implementation of Phase I of the Output Based Aid (ODA) Water Supply Project in Korando A (part), Kogony, Kanyakwar, parts of Dago, Mkendwa, Wathorego and Konya Sub-Locations within Kisumu Urban Area, Kisumu County.

As a requirement by the Environmental Management and Coordination Act, 1999, and its revisions made in 2015 to assist NEMA in decision making for project approval and compliance conditions you are required to give your comments in the Environmental Impact assessment process by filling this form for NEMA to make informed decisions before approval.

Q 1: Are you aware of this proposed "ODA" water Supply project by KIWASCO in Kisumu County and what is your view? YES/NO and comment.

Q 2: How close are you and your business, neighbouring the proposed water project? Please tick appropriately.
(a) Less than 100 Metres (b) 100-500Metres (c) More than 500 Meters (d) Within Kisumu County

Q3: How long have you lived/worked in the neighbourhood? ..... (Months or Years) Tick.

Q 4: Is there, or has there been any known water use/access conflict /insecurity over water activities in the project area? YES/NO. Please explain briefly.

Q 5: Are there any positive contributions you feel this proposed development will make towards improvement of the environment/social-economy/services in the neighbourhood? Please explain.

Q 6: Are there any negative contributions (fears) you feel this proposed development will have in the project area or neighbourhood? Please briefly mention/explain.

Q 7: What measures do you feel the proponent or Kisumu County should put in place to protect the environment and people living around the project area?

Q 8: What other comments would you like to make regarding the proposed project?

Name: **Signature:**
ID No.: **Date:**
Occupation: **Age (optional):**
Contact (Postal address/Email and/or Tel. No.)

N/B: The above comments will ONLY be used by NEMA to make an informed decision on Environmental Impact Assessment and advise the proponent accordingly. Thank you.

By: MR.*FRED JUMA -NEMA/EIA LEAD EXPERT NO.*7512; Tel.0720349175
(fjuma20032003@yahoo.com

MINUTES OF A PUBLIC BARAZA ON ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED KIWASCO_OBA WATER EXPANSION PROJECT HELD ON THE 7TH OCTOBER 2016 AT OBUNGA HALL, KISUMU COUNTY FROM 9:00 AM.

In attendance present:

1.	Mr. Fredrick Juma	GIS expert/ NEMA lead expert.(Finix)
2.	Eng.Mark Olonde	Assistant Engineer(Finix)
3.	Mr.Jackton Mangeni:	Field Assistant
4.	Mr. Patrick Odindo	Social expert (Finix)
5.	Mr.Benard Agwa	Environment expert assistant (Finix)
6.	Kimberly Asawo	Social expert assistant (Finix)
7.	Charles Oleko:	WRMA
8.	Asherl Ogembo:	SCDO(WRMA)
9.	Grace Okello:	NEMA representative
10.	Caleb Nyamita:	Admin (LBDA).
11.	Chebet Nelly:	Chemist(LVSWSB)
12.	Joel Ominde	Chairperson(WRUA)
13.	Assistant chiefs:	Hassan Mwinyi-Mkendwa
		John Ndede- Korando A
		Hezekiel Amwago- Kogony

Absent with apology:

Members of the public {refer to the attendance registration forms}

Agenda:

Public participation on the social- economic baseline survey and environmental impact assessment studies based on proposed water supply by KIWASCO in seven sub-locations in Kisumu County.

Min 1/10/2016: Preliminary {prayers and introduction}

The meeting begun at 9:00 a.m. with a prayer and introduction. Each and every one introduced him/ herself according to name and profession.

Min 2/10/2016: Description of the proposed project

Mr. Mark illustrated that this project of water supply is divided into 4 phases whereby Phase one (1) and two (2) are being done concurrently while phase 3 and four will be done later. The two phases would cover areas with acute water shortages which are found in the seven sub-locations namely Dago, Kanyakwar, Wathorego, Konya, Kogony, Korando A and Mkendwa sub-locations. The project is funded by the Water Services Trust Fund and the designing is being done by the Finix consultant company limited on behalf of KIWASCO.

Min 3/10/2016: Clarification on water management and protection

Mr. Nyamita made it clear that there had been water reforms whereby his organization being responsible for the water resource management. He insinuated that they worked together to achieve a common goal which was making water available in quantity, quality and affordable, with other stakeholders such as KFS, KIWASCO and others in the water sector like WRUA which is representing a local catchment for example Lake victoria catchment basin.

And for this case the first assessment was done by WRMA to ensure water table from the sources does not affect the water table; then followed by the authorization and issuance of the permit.

Mr. Juma further explained that according to the water laws, there is water management board with the mandate to protect and manage the water resources via licensing as mandated by the Act. Any licensing is done with appropriate involvement of water users and stakeholders to achieve a common beneficial goal whereby the board plays the overall supervision role. So the purpose of the meeting was to create the public awareness, identify the problem areas and come up with the strategies to curb such problems if any.

Min 4/10/2016: Open session-Discussion

Mr. Ominde, the chairman of Water Resource Users Association representing Dago and Mkendwa wanted appropriate empowerment of the community and the protection of the water resources in the area and further asked how these project goals would be achieved together in collaboration with other interested parties to achieve the same goals.

A member also wanted to know the sources of water which will be supplied by KIWASCO to the households and also how the schools which are not completely served with water would be considered in this proposed project such as Bukna primary and secondary schools.

One village elder also asked to know how the piping or the connection would be done to ensure enough water supplies to the residents since some water pipes are narrow while others

are of wider width. At the same time the conflict at the spring also arose and how the work would be conducted there without any interference.

Mr Amwago, ass. Chief (Kogony) also wanted to know the stage of the project. Other questions raised by the members were why a borehole was drilled in Kogony, analyzed and tested and not being used up to date while another member wanted to know if there would be any effects to the streams due to water collection at the source identified at the Kosida springs.

On answering these Mr. Mark said that appropriate agreement would be made between different stakeholders such as between KIWASCO, WRMA, WRUA and the community to achieve the common goals of water supply to areas of acute shortage as shown in the two phases that is 1 and 2 while the other phases, 3 and 4 would be extended later with time after the completion of the first two.

Sources of water to be supplied would be from the already existing pipes which will be extended from Kajulu area and had been assessed earlier by the WRMA team and was found to be sustainable. The second source would be from tanks which were constructed at Mamboleo and Obuolo area while the third source would be at the Kosida springs at Mkendwa sub-location which will only require some protection to ensure proper water supply. The water from these sources would be supplied to the consumers so what was required of them was to pay some bills to ensure appropriate maintenance and supply cost to ensure the continuity of water provision services. Depending on the demand and water volume appropriate piping would be designed by the engineers for example 2 ft. wide for the already existing pipes in Kajulu to ensure appropriate supply. Even though the project is at the detailed stage and in the next 1-2 months tendering would be done; since the project had already been funded by water service trust fund showing that water is of great demand in the area.

Mr. Mwinyi further made it clear that there is enough water at Kosida springs which could serve the entire local community since it is permanent and never dries up even during the dry season. On the conflicts, he said that the issues had been resolved and there was no any threat at all and just requested a proper construction of water collection point to serve a large area.

Mr Ogembo, the Kisumu central water officer elaborated that the borehole dug and not currently in use is an issue which could be addressed at the sub-county level. He also proposed to the consultant to advice KIWASCO on the formation of a small committee from

the local residents to minimize illegal connections and pipe leakages to ensure proper water supply.

Min 05/10/2016: Social and Economic aspects

Mr. Odindo explained to the participants that the baseline survey of the project was carried out with the aim of determining the community wealth and their way of living together which would otherwise give way forward on pricing and the ability of the water users to pay for the water provision services. Other considered factors included were the morbidity in the area and conflicts if any so that the client who is KIWASCO would be advised appropriately depending on the cost options in providing water services that is private, yard or communal tap connections.

MIN. 06/10/2016. ADJOURNMENT

There being no any other business, Mr. Juma thanked everyone for their participation and the meeting was adjourned at 12:45 pm with a word of prayer.

CONFIRMATION

Chairman……. Sign……. Dates……..

Secretary……. …… Sign……. Date…….

List of participants to the public participation workshop (Obunga Hall)

PARTICIPANTS OF THE PUBLIC WORKSHOP ON ESIA FOR THE PROPOSED WATER EXPANSION WORKS PROJECT AT OBUNGA SOCIAL HALL, KISUMU COUNTY

FRIDAY, 7TH OCTOBER, 2016

NAME	DESIGNATION	CONTACT
Caleb O. Nyamita	Admin-LBDA	0724249499
Paul O. Umaya	SCWO-Water	0715329723
John O. Ndege	Ass. chief	
Hassan A. Mwinyi	Ass. Chief	0723793171
Hezekiel Amwago	Ass. Chief	0717629643
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Asherl M. Ogembo	SCDO-WRMA	0720202649
Seth O. Onyango	COMM. WRMA	0714109099
Charles Oleko	WQPCO-WRMA	0735710232
Grace A. Okello	REP. NEMA	0723599437
Eratus Ajwang Okumu	Chairman-Disabled	07075743227
Julius Obiero	Village Head	0712785096
Ezakiel Onyango	Village Head	07109355545
Michael Ogugu	Village Head	0717742351
Razia M. Hammadi	Village Head	0725892108
Beatrice A. Juma	Village Head	0728865344
Hesbon Ojino Tangaya	Chairman WRUA(SEKE)	0726333618
Dickson Awuoma	Secretary WRUA(Winam)	0721239921
Joel Ominde Ondiek	Chair WRUA (NAWA)	0720342567
Eliazar Ouma Osanya	KISAT-WRUA	0721692918
Ochieng Odindo	Social expert- Finix	0729312677
Fredrick Juma	Environment lead expert-Finix	0720349172
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