ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PROJECT REPORT

PROPOSED KIKUYU WATER SUPPLY IMPROVEMENT PROJECT

April 2015

P.O. BOX 313-00900,

KIKUYU

Prepared by: Eng. Arthur Makanga (Lead expert)
Mr. Andrew Lomosi (Associate)
SUBMISSION OF DOCUMENT

LEAD EXPERT

I, Eng. Arthur Makanga (Lead Expert), Mr. Andrew Lomosi on behalf of Big Dig Technology Ltd of P. O. Box 74791 – 00200 Nairobi, submit this Environmental Impact Assessment (EIA) project report, for the Proposed Kikuyu Water Supply Improvement Project. To our knowledge the information contained herein is a correct representation of the findings of the assessment.

Lead Expert’s Signature: ……………………………… Date: ……………………………
NEMA Reg. No. 2369

PROJECT PROPONENT

I, …………………………………………………………… (Project Proponent) of Kikuyu Water Company Ltd P. O BOX 313 – 00900, Kikuyu, submit this Environmental Impact Assessment (EIA) project report, for the Proposed Kikuyu Water Supply Improvement Project. To my knowledge the information contained herein is a correct representation of the findings of the assessment.

Proponent’s Signature: …………………………………… Date: ……………………………
EXECUTIVE SUMMARY

The requirement for an EIA license is obligated by section 58 of the Environmental Management and Coordination Act (EMCA), 1999 which stipulates that a proponent must seek an Environmental Impact Assessment (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 purpose of EIA is to identify potential positive and negative environmental impacts associated with the proposed project and provide recommendations on how to take advantage of the positive impacts on one hand and how to mitigate the negative environmental impacts on the other.

The project proponent, Kikuyu Water Co. Ltd consulted the EIA experts under an EIA lead expert registered with the National Environment Management Authority (NEMA) to conduct an EIA study for the proposed project and prepare a project report for submission to NEMA. This is in line with section 58 of the EMCA, 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. The proposed site is situated in Kikuyu springs.

The EIA team carried out the assessment using a combination of methods including ground surveys and interviews with the neighbours, project management and other interested people and parties. Existing literature on statutory and other requirements were also reviewed. During the assessment, various Acts and Regulations were reviewed to gather information which would help in preparing the project.

The following information was derived from the assessment of the proposed project:

- Public consultations revealed that there were no significant negative environmental or social impacts resulting from the proposed project;
- The project has environmental socio-economic impacts of importance;
- The project is being developed in a sub-urban setting and is thus compatible with existing residential facilities and has the potential for employment generation and provision of better water supply services.
The objective of the proposed development is to provide better water supply service to KWCL clientele, offer employment opportunities, improve development within Kikuyu County and improve revenue collection through paying tax to the government. The proposed site will require ground preparation and excavations to pave way for construction and laying of pipes. The decommissioning phase will consider restoring the site to its nearest original status.

The assessment was undertaken in June 2012 and the main findings from the assessment were highlighted. Below is a summary of the areas of concern from the assessment and their possible mitigation measures:

- **Adverse Construction Activities**: Supervision of construction personnel by a qualified contractor taking into consideration general sources of pollution, accidents, incidences and construction wastes;
- **Traffic Safety**: The will be a warning sign to indicate there is work in progress;
- **Water-use and Management**: Wise use of water resource and harvesting rain water for some uses;
- **Air Quality Management**: To maintain air quality within and outside the facility, good housekeeping, proper landscaping;
- **Fire, Accidents and Incidences**: Ensure availability of fire fighting equipments such as fire extinguishers, sand buckets or fire horse reel at the site, post hazard-warning signs and safety instructions and install of hazard notification equipments such as audible alarm systems;
- **Noise Management**: Workers in areas with high noise concentrations of noise should be issued with ear muffs and should work in shifts;
- **Occupational Health and Safety (OHS)**: Provide first aid equipment on the site, ensure staff training on health, safety and emergency handling procedures and follow the provisions of the OHS Act, 2007;
- **Public Health**: Ensure all wastes from the facility are disposed off appropriately, and that no nuisance is posed to the general public as result of the proposed project and carefully follow the provisions of the Public Health Act (Cap 242) of the laws of Kenya;
- **Excessive Energy Consumption**: Installation of energy efficient lighting fluorescent tubes/bulbs and a backup generator at the pump house.
• **Waste Water and Sewerage Management:** Installation of a septic tank/sock pit to handle sewage and waste water from the operators house and construction of waste water drainage channels to direct waste water into sewerage manholes before the waste water joins the septic tank/sock pit;

• **Wastes:** Solid wastes should be segregated into recyclable and non-recyclable wastes at the sources and managed on-site while liquid and gaseous wastes should be manage appropriately by authorized handlers

• **Material Handling and Storage:** Maintain properly designed stores and storage mechanisms for materials both during construction and operation of the water system;

• **Fencing and Accessibility:** A perimeter wall with a lockable gate to be erected for security purposes and prevent entry of unauthorized persons during the construction and operational phases;

• **Records:** Prepare, keep and avail appropriate records as required under EMCA, 1999. The management should develop procedures for documentation and record-keeping on all environmental concerns

• **Environmental Policy:** There is need to develop an environmental policy as a guiding principle for corporate environmental management and encompass an elaborate environmental management plan as a framework;

Generally, if the proposed mitigation measures are implemented during design, construction and operation of the proposed project, the potential negative environmental impacts will be off-set. Mechanisms for implementation and monitoring have been recommended in Environmental Management and Monitoring Plan (EMP) presented in the last pages of this report.
## DEFINITION OF TERMS AND ABBREVIATIONS

<table>
<thead>
<tr>
<th>Definition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Environmental Auditor:</strong></td>
<td>Means an expert or a firm of experts registered in accordance with regulation 14 of Legal Notice No. 101 of 2003 (Environmental Audit and Impact Assessment Regulations).</td>
</tr>
<tr>
<td><strong>Environmental Impact Assessment (EIA):</strong></td>
<td>A systematic evaluation of activities and processes of an upcoming project/facility to determine how far these activities and programs conform to the approved environmental management plan of that specific project and sound environmental management practices.</td>
</tr>
<tr>
<td><strong>Environmental Management and Monitoring Plan (EMP):</strong></td>
<td>Means all details of project activities, impacts, mitigation measure, time, schedule, costs, impact or activities, including monitoring and environmental audit during implementation and decommissioning phase of a project.</td>
</tr>
<tr>
<td><strong>Mitigation:</strong></td>
<td>Measures which include engineering works, technology improvement management ways and means of minimizing negative aspects, including socio-economic and cultural losses suffered by communities and individuals, whilst enhancing positive aspects of the project.</td>
</tr>
<tr>
<td><strong>Proponent:</strong></td>
<td>Means a person proposing or executing a project, program or an undertaking specified in the second schedule of the Environmental Co-ordination and Management Act.</td>
</tr>
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<td><strong>Standards:</strong></td>
<td>Means the limit of discharge or emission established under the Act or under Regulations.</td>
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Waste: Includes any matter whether liquid, solid, gaseous or radioactive, which is discharged, emitted or disposed in the environmental in such a volume composition or manner likely to cause an alteration of the environment.

Social Analysis: Means assessing or estimating in advance the social consequences from specific policy actions or project development including social justice and equity, social uncertainty, social cohesion, social networks and interactions, social status and gender desegregation.

Water Reservoir: Includes drinking water, river, stream, watercourse, reservoir, well, dam, canal, channel, lake, swamp, open drain or underground water.

Scoping: Is the process of determining the content and extent of the matters which should be covered in the environmental information to be submitted to a competent authority for projects which are subject to EIA.

Screening: It is a coarse analysis of the possible impacts of an action with a view to identifying those impacts which are worthy of detailed study for a project to be considered for an EIA process or not.

Decommissioning: This is the permanent withdrawal from a site or close down of a facility for restoration.
## ACRONYMS & ABBREVIATIONS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>°C</td>
<td>Degrees Celsius</td>
</tr>
<tr>
<td>ASL</td>
<td>Above Sea Level</td>
</tr>
<tr>
<td>DEMC</td>
<td>District Environment Management Committee</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<tr>
<td>EMCA</td>
<td>Environmental Management Coordination Act</td>
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<tr>
<td>EMP</td>
<td>Environmental Management and Monitoring Plan</td>
</tr>
<tr>
<td>Km²</td>
<td>Square kilometres</td>
</tr>
<tr>
<td>KP</td>
<td>Kenya Power (Formerly Kenya Power and Lighting Company, KPLC)</td>
</tr>
<tr>
<td>KWCL</td>
<td>Kikuyu Water Company Ltd</td>
</tr>
<tr>
<td>KWS</td>
<td>Kenya Wildlife Services</td>
</tr>
<tr>
<td>M²</td>
<td>Square metre</td>
</tr>
<tr>
<td>NEAP</td>
<td>National Environment Action Plan</td>
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<td>NEC</td>
<td>National Environment Council</td>
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<td>NET</td>
<td>National Environment Tribunal</td>
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<tr>
<td>NEMA</td>
<td>National Environment Management Authority</td>
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<tr>
<td>NPEP</td>
<td>National Poverty Eradication Plan</td>
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<tr>
<td>OHS</td>
<td>Occupational Health and Safety</td>
</tr>
<tr>
<td>PPE</td>
<td>Personal Protective Equipment</td>
</tr>
<tr>
<td>PMTCT</td>
<td>Prevention of Mother to Child Therapy</td>
</tr>
<tr>
<td>RVR</td>
<td>Rift Valley Railways (Formerly Kenya Railways Corporation)</td>
</tr>
<tr>
<td>SHE</td>
<td>Safety Health and Environment</td>
</tr>
<tr>
<td>Sp</td>
<td>Species</td>
</tr>
<tr>
<td>TOR</td>
<td>Terms of Reference</td>
</tr>
<tr>
<td>W.H.O</td>
<td>World Health Organization</td>
</tr>
<tr>
<td>WRMA</td>
<td>Water Resource Management Authority</td>
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1. INTRODUCTION

1.1 BACKGROUND

The Government of Kenya through Athi Water Services Board (AWSB) has received additional financing from the World Bank for the Water and Sanitation Services Improvement Project (WaSSIP AF). Parts of this funds will be used for the construction of the proposed Kikuyu Water Supply Improvement Project. AWSB, the Proponent, provides Water and Sewerage services in Nairobi City, Kiambua and Murang’a (Gatanga sub-county) Counties, and some of its satellite towns, whose water demand is increasing rapidly due to population increase into the City coupled with increased water demands from the industries. The proposed project will be under Kikuyu Water Company.

1.2 PROJECT SUMMARY

Project Name: Proposed Kikuyu Water Supply Improvement Project

Proponent: Kikuyu Water Co. Ltd,

P. O. Box 313– 00902 Nairobi,
TEL 066 – 33786, 0728 – 578098
E-mail: kikuyuwater@yahoo.com

Nature of Development: Construction of: a water intake weir, a 100m³ capacity sump, a pump house, Grade nine operators house, gabions, erection of a perimeter fence and construction of 8 inch diameter UPVC pipeline from the springs to booster station 2.5 km away.

Cost of the Project: Kshs. 46,000,000

Location of the Project: The project area can be accessed through the Nairobi – Nakuru dual highway or the Nairobi-Kikuyu tarmac road. The area of study covers both schemes within Kikuyu and Kabete Divisions of Kikuyu District

Land Size: 12 Ha available and belonging to Kikuyu Water Company

Power: To be installed and supplied by the Kenya Power and Lighting Company (KPLC) and supplemented by a stand-by generator

Water supply: To be pumped from Kikuyu Springs

Neighbourhood: Residential houses and farms and a forest plantation
1.3 PURPOSE OF THE ASSESSMENT

The proposed project falls under the second schedule of EMCA, 1999 section 58 (1), (5) and with that it requires an EIA study. As stipulated by the legal notice No. 101, 2003, Part VI, Section 31 (3 (a) (i) and (ii) the upcoming project, requires an EIA study which will provide baseline information upon which subsequent environmental control assessments shall be based. The proposed development is to be located within a sub-urban and intensive agricultural setting of Kikuyu District. The report is to define the proposed project in relation to three phases (Construction, Operation and Decommissioning) examining various characteristics of the site – specifically the soil, geology, hydrology, flora, fauna and ecological makeup of the site, as well as processes during construction, operation and decommissioning.

The main purpose of this report is therefore to provide an analytical insight into the project with view to providing the approving authorities and other stakeholders with a basis for making informed decisions with regard to the proposed project. The report therefore intends to present the findings of the assessment, discuss all the mitigation options to be considered to protect the environment and as well ensure possible options are recognized and implemented. The report further provides the enhancement measures for any positive impacts to be realized from the project.

1.4 SCOPE OF THE ASSESSMENT

Construction is set to commence when the required documents have been obtained from relevant authorities including NEMA. The report is part of the legislative requirements for facilities falling under Schedule II of the EMCA, 1999. The assessment has taken into account relevant government legislation such as the Water Act, Public Health Act, the Local Government by-laws, and other applicable local and international laws on standards and best practices. It was within this context that this EIA study was conducted and this report prepared. This report is to assist NEMA, the government and public in understanding the potential environmental consequences of the project. The report further addresses mitigation options for any significant impacts and residual effects from the project which would assist the management in sound decision-making regarding this project. The assessment seeks to evaluate impacts that could arise from its design and construction works, standards and associated installations, and vulnerability of the proposed development to any accidents, or
insufficiencies in operation that may cause adverse effects on the environment, health of the workers or any nuisance to the facilities or persons in the neighborhood

1.5 OBJECTIVES OF THE ASSESSMENT

These include the following:

- To examine, evaluate and assess the likely environmental impacts that would arise with the implementation of the proposed project;
- Establish a benchmark for the various environmental aspects relating to the project;
- Establish a framework for the environmental management system that aims at sustainability of the environment;
- To comply with EMCA, 1999.

1.6 TERMS OF REFERENCE (TOR)

The terms of reference developed for this study covered the following:

- To review existing legal and institutional framework related to the proposed development;
- To collect baseline information of the project area relevant to the proposed development;
- To collect primary data and views from people through the community participatory process;
- Describe the potential negative and positive impacts that may occur during the construction, operational and decommissioning phases of the project;
- To identify and analyze alternative options for the proposed project;
- To develop mitigation measures and cost estimates for the negative impacts of the proposed development;
- To develop a comprehensive EMP;
- Provide a decommissioning plan and offer conclusion and recommendations.

To accomplish the above TOR, the following was undertaken:

- Description of the area to generate baseline information;
• Description of the construction and operational activities to be undertaken and the changes that will occur;
• Public consultation to obtain views and comments from the neighbours; Identification of areas of possible conflicts;
• Identification of both positive and negative impacts that may arise;
• Development of an EMP.

1.7 ASSESSMENT METHODOLOGY

This EIA was carried out in June-July 2012 in accordance with the procedures and protocols in the Legal Notice No. 101 of Environmental (Impact Assessment and Audit) Regulations, 2003. The assessment involved the following:

• Extensive site tours to physically inspect and document existing facilities on the site, natural and socio-economic features of importance through direct observations;
• Interviews with the project proponent, staff, government officials especially from the District Physical Planning Office and other parties of interest, including residents in the vicinity of the project site;
• Review of relevant documents relating to the project
• Analysis and production of the EIA project report.

1.8 LIMITATIONS

Some of the information contained in this report was compiled based on responses of the proponent, staff and the public. There are difficulties in verification of this kind of information. During this assessment, the consultants have attempted to independently evaluate information obtained within the limits of the established scope of work.
2. RELEVANT LEGISLATIVE AND REGULATORY FRAMEWORK

2.1 INTRODUCTION

According to Sections 58 and 138 of the EMCA No. 8 of 1999 and Section 3 of the Environmental (Impact Assessment and Audit) Regulations 2003 (Legal No. 101), residential complexes require an EIA project/study report prepared and submitted to the NEMA for review and eventual licensing before the development commences. This was necessary as many forms of developmental activities cause damage to the environment and hence the greatest challenge today is to maintain sustainable development without interfering with the environment. This section underscores relevant legal and institutional frameworks relevant for the project at local, national and regional and global level.

2.2 ENVIRONMENTAL CHALLENGES IN KENYA

There are many environmental challenges in Kenya today. Among the cardinal environmental challenges include: loss of biodiversity and habitat, land degradation, land use conflicts, human animal conflicts, water management and environmental pollution. These have been aggravated by lack of awareness amongst the public on the consequences of their interactions with the environment.

2.3 ENVIRONMENTAL POLICY FRAMEWORK

EIA critically examines the effects of a development project on the environment. It identifies both negative and positive impacts of any development activity or project, how it affects people, their property and the environment. EIA also identifies measures to mitigate the negative impacts, while maximizing on the positive ones. EIA is basically a preventive process that seeks to minimize adverse impacts on the environment and reduce risks. If a proper EIA is carried out, then the safety of the environment can be properly managed at all stages of a project planning, design, construction, operation, monitoring and evaluation as well as decommissioning. The assessment is required at all stages of project development with a view to ensuring environmentally sustainable development for both existing and proposed public and private sector development ventures. The national EIA regulations were issued in accordance with the provisions of EMCA 1999 and must be adhered to taking into cognizance provisions of the Act and other relevant national laws.
2.4 INSTITUTIONAL FRAMEWORK

At present there are over twenty (20) institutions and departments which deal with environmental issues in Kenya. Some of the key institutions include the National Environmental Council (NEC), NEMA, the Kenya Forest Service (KFS), and the Kenya Wildlife Services (KWS) among others.

2.4.1 National Environmental Action Plan (NEAP) Committee

This Committee is responsible for the development of a five – year Environment Action Plan among other things. The National Environment Action Plan shall:

- Contain an analysis of the Natural Resources of Kenya with an indication as to any pattern of change in their distribution and quantity over time;
- Contain an analytical profile of the various uses and value of the natural resources incorporating considerations of intergenerational and intra-generational equity;
- Recommend appropriate legal and fiscal incentives that may be used to encourage the business community to incorporate environmental requirements into their planning and operational processes;
- Recommend methods for building national awareness through environmental education on the importance of sustainable use of the environment and natural resources for national development;
- Set out operational guidelines for the planning and management of the environment and natural resources;
- Identify actual or likely problems as may affect the natural resources and the broader environment context in which they exist;
- Identify and appraise trends in the development of urban and rural settlements, their impact on the environment, and strategies for the amelioration of their negative impacts;
- Propose guidelines for the integration of standards of environmental protection into development planning and management;
- Identify and recommend policy and legislative approaches for preventing, controlling or mitigating specific as well as general diverse impacts on the environment;
- Prioritise areas of environmental research and outline methods of using such research findings;
• Without prejudice to the foregoing, be reviewed and modified from time to time to incorporate emerging knowledge and realities and
• Be binding on all persons and all government departments, agencies, States Corporation or other organ of government upon adoption by the national assembly.

2.4.2 The National Environment Management Authority (NEMA)

The objective and purpose for which NEMA is established is to exercise general supervision and co-ordinate over all matters relating to the environment and to be the principal instrument of the government in the implementation of all policies relating to the environment. However, NEMA is mandated and designated to work with the following committees:

2.4.3 Provincial and District Environment Committees

According to EMCA, 1999 No. 8, the minister by notice in the gazette appoints Provincial and District Environment Committees of the authority in respect of every province and district respectively. The committees are responsible for the proper management of the environment within their areas of jurisdiction. They are also to perform such additional functions as are prescribed by the Act or as may, from time to time be assigned by the minister by notice in the gazette. The decisions of these committees are legal and it is an offence not to implement them.

2.4.4 Public Complaints Committee

The Committee performs the following functions:

• Investigate any allegations or complaints against any person or against the authority in relation to the condition of the environment in Kenya and on its own motion, any suspected case of environmental degradation and to make a report of its findings together with its recommendations thereon to the Council;
• Prepare and submit to the council periodic reports of its activities which shall form part of the annual report on the state of the environment under section 9 (3) and
• To perform such other functions and excise such powers as may be assigned to it by the Council.
2.4.5 Standards and Enforcement Review Committee

This is a technical Committee responsible for environmental standards formulation methods of analysis, inspection, monitoring and technical advice on necessary mitigation measures.

2.4.6 The National Environmental Tribunal (NET)

This tribunal guides the handling of cases and offences related to the environment in the Republic of Kenya.

2.4.7 The National Environmental Council (NEC)

EMCA, 1999 No. 8 Part III section 4 outlines the establishment of the NEC. NEC is responsible for policy formulation and directions for purposes of EMCA; sets national goals and objectives and determines policies and priorities for the protection of the environment and promote co-operation among public departments, local authorities, private sector, non-governmental organisations and such other organisations engaged in environmental protection programmes.

2.5 SECTORAL LEGISLATION

Some important legislation of environmental importance reviewed for the purpose of this project is discussed below:

2.5.1 The Environmental Management and Coordination Act (EMCA) No. 8 of 1999

The Environmental Management and Coordination Act (EMCA) of 1999, and its attendant Environmental (Impact Assessment and Audit) Regulations of 2003 provides for the establishment of an appropriate legal and institutional framework for the management of environment in Kenya. Section 58 (I) has underscored that any person being a proponent of a project shall before financing, commencing or proceeding with submit an EIA report to the NEMA of Kenya. Section 68 (I) gives NEMA the mandate for carrying out all environmental audits of all activities that are likely to have significant impacts on the environment. It authorizes environmental inspectors, as appointed by NEMA to enter in any premise and determine how far the activities carried out conform to statements in EIA study.
2.5.2 Session Paper No. 6 of 1999 on Environment and Development

Every person in Kenya is entitled to a clean and healthy environment and has a duty to safeguard and enhance the environment. As envisioned in the paper, Kenya should strive to move along the path of sustainable development which aims at meeting the needs of the current generation without compromising the ability of the resource base to meet those of future generations. The overall goal is hence to integrate environmental concerns into the national planning and management processes and provide guidelines for environmentally sustainable development. The policy paper emphasizes that EIA must be undertaken by the developers as an integral part of a project preparation. It also proposes for periodic environmental auditing to investigate if developer is fully mitigating the impacts identified in the assessment report.

2.5.3 National Policy on Water Resources Management and Development

It enhances a systematic development of water facilities in all sectors for the promotion of the country’s socio-economic progress. According to Water Resources Management Authority (WRMA) rules Part 37, any storage structures “shall be subject to prior rights to its uninterrupted flow for so much as is required for use, and to the obligations imposed by the Act”.

2.5.4 The Water Act 2002

The Water Act 2002 commenced by virtue of Legal Notice No. 31 of 18th March 2003 and Legal Notice No. 158 of 29th August 2003 provided for a reformed Legal Ministry operations. The Act vests the water in the state: the Water Services Department is mandated to plan and develop water services and sewerage services, planning WSS Services and guiding the development of technical and managerial capacity. Article No. 8 of 2002 section 107(2) provides for public consultation on water resource management. It is the main legislation governing the use of water especially through water permit system. The Act provides for national monitoring and information systems on water resources. The Act regulates abstraction and storage of water from water courses, depressions or channels.

In addition, the Water Resource Management Authority (WRMA) is a state corporation under the Ministry of Water and Irrigation established under the Water Act 2002 and charged with being the lead agency in water resources management.
The Water Act 2002 stipulates the duties of WRMA to include:

- Water apportionment and allocation, catchment
- Catchment protection and conservation,
- Water resource assessments and conservation,
- Delineation of catchment areas,
- Gazette water protected areas,
- Protection of wetlands,
- Gazette water schemes to be state and community owned,
- Establishing Catchment Management Strategies (CMS)
- Collecting water use and effluent discharges.

In order for WRMA to undertake its stipulated responsibilities, the Act provides for decentralized and stakeholder involvement. This will be implemented through regional offices of the Authority based on drainage basins (catchment areas) assisted by Catchment Area Advisory Committees (CAACs). At the grassroots level, stakeholder engagement will be through Water Resource User Associations (WRUAs).

2.5.5 The Occupational Safety and Health Act, 2007

This is an Act of Parliament to provide for the safety, health and welfare of workers and all persons lawfully present at workplaces. This Act applies to all workplaces where any person is at work, whether temporarily or permanently. Part II (1) states that; Every occupier shall ensure the safety, health and welfare at work of all persons working in his workplace. Part II (2) (b) provides the duties of an occupier as; Arrangements for ensuring safety and absence of risks to health in connection with the use, handling, storage and transport of articles and substances. Part V of the Act states that before any person occupies or uses any premises as a workplace, he shall apply for the registration of the premises by sending to the Director a written notice containing the particulars set out in the Fourth Schedule. The act further states that; Every workplace shall be kept in a clean state, and free from effluvia arising from any drain, sanitary convenience or nuisance. An occupier shall ensure that his workplace shall not, while work is carried on, be so overcrowded as to cause risk of injury to the health of the persons employed therein. An occupier shall ensure that effective and suitable provision is made for securing and maintaining, by the circulation of fresh air in each workroom, adequate ventilation of the room. An occupier shall ensure that effective provision is made for securing
and maintaining sufficient and suitable lighting, whether natural or artificial, in every part of his workplace in which persons are working or passing.

Sufficient and suitable sanitary conveniences for the persons employed in the workplace shall be provided, maintained and kept clean, and effective provision shall be made for lighting the conveniences; and, where persons of both sexes are or are intended to be employed (except in the case of workplaces where the only persons employed are members of the same family dwelling there), such conveniences shall afford proper separate accommodation for persons of each sex.

2.5.6 The Public Health Act (Cap. 242)

Environmental degradation may pose a health hazard to the general public. This is among the factors considered by the Public Health Act. Section 15 (IX) of the Public Health Act indicates that any noxious matter, or wastewater discharged from any premise, such as a building constitutes nuisance. Any premise not kept in a clean and free from offensive smell such as gases which are injurious to health such as those from commercial establishments shall therefore generate nuisance.

The act stresses that no person shall cause a nuisance to exit from any land or premise occupied by him/her. Because of the above, the Act acknowledge that it shall be the duty of all local authorities to take all lawful measures for maintaining its district at all times in a clean and sanitary condition for remedy of any nuisance or condition liable to be injurious to health. To safeguard against this, Part X of the act states that where in the opinion of the Medical Officer of Health that food stuffs within a warehouse, or a building are insufficiently protected, the owner shall be compelled to observe the require regulations, otherwise he/she shall be guilty of an offense.

2.5.7 The County Governments Act 2012

The local government act was repealed after the final announcement of all the results of the first elections held under the Constitution as per the County Governments Act of 2012. Under section 134 subsection (1), The Local Government Act is repealed upon the final announcement of all the results of the first elections held under the Constitution. It further states in section 134, subsection (2) reads “All issues that may arise as a consequence of the
repeal under subsection (1) shall be dealt with and discharged by the body responsible for matters relating to transition”.

The project will according to the County Government act of 2012 ensure that the project activities conform to the regulation that shall be passed.(section 135 (1) The Cabinet Secretary may make regulations for the better carrying out of the purposes and provisions of this Act and such Regulations may be made in respect of all county governments and further units of decentralization generally or for any class of county governments and further units of decentralization) comply to the set regulations and by laws.

2.5.8  The Physical Planning Act (Cap. 286)

Building/construction of houses constitutes making of material change to land; the activity constitutes “development”, hence need to be controlled by local authorities. From the foregoing, the Physical Planning Act (Cap. 286) has made specific provisions in respect to the mandate of local authorities in the need for physical planning.

As concerns, city, municipal, town and urban councils: Section 24(1) states that the Director may prepare with reference to any Government land, trust land or private land within the area of authority of a city, municipal, town or urban council or with reference to any trading or marketing center, a local physical development plan; Section 24(3) states that the Director may prepare a local physical development plan for the general purpose of guiding and co-coordinating development of infrastructure facilities and services for an area referred to in subsection (1), and for the specific control of the use and development of land or for the provision of any land in such area for public purpose and Section 25(b) states that a local physical development plan shall consist of such maps and description as may be necessary to indicate the manner in which the land in the area may be used.

According to Section 33 of the Physical Planning (Building and Development Control) Regulations, the Director of Physical Planning shall decline to recommend any new building or proposed development, or alteration or addition to any existing building if: The proposal is not in conformity with approved development plan; Such plans discloses a contravention of the physical planning (Building and Development) rules; The plans are not correctly drawn or omit to show information required; The building is likely to become objectable on environmental grounds; Roads of access, parking bays, vehicular and pedestrian circulation spaces or other services to the plot or premises are inadequate; The system of drainage,
including soil, waste and surface water of the plot, or subplot upon which the building is to or stand, is not satisfactory; Provision has not been made for adequate natural light and ventilation, or Any other physical planning issue.

2.5.9 The Penal Code (Cap. 63)

The chapter on “Offences against Health and Conveniences” contained in the Penal Code enacted in 1930 strictly prohibits the release of foul air into the environment, which affects the health of other persons. Any person who voluntarily violates the atmosphere at any place, to make it noxious to health of persons in general dwelling or carrying out business in the neighborhood or passing along public ways is guilty of misdemeanor, i.e. imprisonment not exceeding two years with no option of fine.

Under this code, any person who for the purpose of trade or otherwise makes loud noise or offensive awful smell in such places and circumstances as to annoy any considerable number of persons in the exercise of their rights, commit any offence, and is liable to be punished for a common nuisance, i.e. imprisonment not exceeding one year with no option of fine.

2.5.10 The Land Act, 2012

This is an Act of Parliament intended to give effect to Article 68 of the Constitution, to revise, consolidate and rationalize land laws; to provide for the sustainable administration and management of land and land based resources, and for connected purposes. Parts 1 and 2 of section 4 of the Act outline the main guiding principles in land management and administration, binding to all land actors including state officers. These principles are to be applied when enacting, applying or interpreting any provisions of this Act; and when making or implementing public policy decisions. The act vests management of land on National Land Commission (NLC). In discharging their functions and exercising of their powers under this Act, the Commission and any State officer or public officer shall be guided by the following values and principles;

i. Equitable access to land;
ii. Security of land rights;
iii. Sustainable and productive management of land resources;
iv. Transparent and cost effective administration of land;
v. Conservation and protection of ecologically sensitive areas;
vi. Elimination of gender discrimination in law, customs and practices related to land and property in land;

vii. Encouragement of communities to settle land disputes through recognized local community initiatives;

viii. Participation, accountability and democratic decision making within communities, the public and the Government;

ix. Technical and financial sustainability;

x. Affording equal opportunities to members of all ethnic groups;

xi. Non-discrimination and protection of the marginalized; and

xii. Democracy, inclusiveness and participation of the people; and

xiii. Alternative dispute resolution mechanisms in land dispute handling and management.

2.5.11 Land Control Act (Cap 302)

Section 6 (1) (a) provides for the sale, transfer, lease, mortgage, exchange, partition, or other disposal of or dealing with any agricultural land which is situated within a land control area; Section 6 (1) (b) provides for the division of any such agricultural land into two or more parcels to be held under separate titles, other than the division of an area of less than twenty acres into plots in an area to which the Development and Use of Land (Planning) Regulations, 1961 for the time being apply and Section 6 (1) (c) provides for the issue, sale, transfer, mortgage or any other disposal of or dealing with any share in a private company or co-operative society which for the time being owns agricultural land situated within a land control area; is void for all purposes unless the land control board for the land control area or division in which the land is situated has given its consent in respect of that transaction in accordance with this Act.

2.5.12 The Land Registration Act, Act No. 3 of 2012

This is an Act of Parliament intended to revise, consolidate and rationalize the registration of titles to land, to give effect to the principles and objects of devolved government in land registration, and for connected purposes.

Land Registry

Section 7(1) of the Act provides for establishment of a land registry in each registration unit which shall keep registers of the following regarding land:
• A land register, in the form to be determined by the Commission;
• The cadastral map;
• Parcel files containing the instruments and documents that support subsisting entries in the land register.
• Any plans which shall, after a date appointed by the Commission, be georeferenced;
• The presentation book, in which shall be kept a record of all applications numbered consecutively in the order in which they are presented to the registry;
• An index, in alphabetical order, of the names of the proprietors; and
• A register and a file of powers of attorney.

Maintenance of documents, including land title deeds

Further, section 9(1) provides that the Registrar shall maintain the register and any document required to be kept under this Act in a secure, accessible and reliable format. These documents include

• Publications, or any matter written, expressed, or inscribed on any substance by means of letters, figures or marks, or by more than one of those means, that may be used for the purpose of recording that matter;
• Electronic files; and
• An integrated land resource registers.

The register, as provided for in part 2 of section 9, shall contain the following particulars;

• Name, personal identification number, national identity card number, and address of the proprietor;
• In the case of a body corporate, name, postal and physical address, certified copy of certificate of incorporation, personal identification numbers and passport size photographs of persons authorized and where necessary attesting the affixing of the common seal;
• Names and addresses of the previous proprietors;
• Size, location, user and reference number of the parcel; and
• Any other particulars as the Registrar may, from time to time, determine.

These provisions are essential to any new land acquisition or transaction processes arising from implementation of the water project.
2.5.13 The Wildlife Conservation and Management Act, 2013

This Act became operational on 10 January 2014. One of its guiding principles is the devolution of conservation and management of wildlife to landowners and managers in areas where wildlife occurs, through in particular the recognition of wildlife conservation as a form of land-use, better access to benefits from wildlife conservation, and adherence to the principles of sustainable utilization. Section 25 of the act provides for compensation for injuries and damages caused by wildlife (species listed in its third schedule) to humans and their properties respectively. Such compensation claims are to be reviewed and awarded by County Wildlife Conservation and Compensation Committees at the ruling market rates: provided that no compensation shall be paid where the owner of the livestock, crops or other property failed to take reasonable measures to protect the properties from damage by wildlife or land use practices are incompatible with the ecosystem-based management plan for the area. The act in its sixth schedule list various animal and tree species that are nationally considered as critically endangered, vulnerable, nearly threatened and protected. It also lists in its seventh schedule, national invasive species for which control is required.

Section 48 restricts activities involving the above listed species without a permit from KWS. KWS can make recommendations to the responsible cabinet secretary, to prohibit carrying out of any activity which: is of a nature that may negatively impact on the survival of species listed in sixth schedule; or is specified in the notice or prohibit the carrying out of such activity without a permit issued by KWS.

Any critically endangered, vulnerable, nearly threatened or protected species if found within the project area will have to be managed in line with this Act.

2.5.14 Traffic Act (Cap 403)

This Act was reviewed in relation to traffic safety, where it prohibits obstruction of traffic either by persons or facilities constructed in such a way to as to interfere with flow of traffic, or on road reserves. Since the Filling station is to be built along the road, it must subject to the requirements of this act.
2.6 THE INTERNATIONAL FRAMEWORK

This EIA is based on internationally accepted and respected procedures recommended by the International Standards Organization (ISO 9001) which provides for the relevant sectoral guidelines. This EIA is intended to meet the expectations of international supporters through the government of Kenya. Some international legislation relevant to this project and to which Kenya is a signatory were reviewed for the purpose of writing this report. The World Commission on Environment and Development and The Rio Declaration on Environment and Development are discussed below:

2.6.1 The World Commission on Environment and Development

The commission commonly referred to as “the Brundtland Commission” focuses on the environmental aspects of development, in particular, the emphasis on sustainable development that produces no lasting damage to biosphere, and to particular ecosystems. In addition, environmental sustainability is the economic and social sustainability. Economic sustainable development is development for which progress towards environmental and social sustainability occurs within available financial resources. Social sustainable development maintains the cohesion of a society and its ability to help its members work together to achieve common goals, while at the same time meeting individual needs for health and well-being, adequate nutrition, and shelter, cultural expression and political involvement.

2.6.2 The Rio Declaration on Environment and Development

Agenda 21 – a programme of action for sustainable development worldwide in the Rio Declaration on Environment and Development was adopted by more than 178 governments at the United Nations Conference on Environment and Development (UNCED), known as the Earth Summit, held in Rio de Janeiro, Brazil from 3rd to 14th June 1992. Kenya is a third-world country and therefore its plans falls into the Agenda 21 whereby the government, local authorities, donors and other stakeholders have committed large amounts of resources to facilitate sustainable developments.

Principle No. 10 of the declaration underscored that environmental issues are best handled with participation of all concerned citizens at all the relevant levels. At the national level, each individual shall have appropriate access to information that is concerning environment that is
held by public authorities. The states shall encourage and facilitate public participation by making information widely available.

2.7 WORLD BANK OPERATION POLICIES

2.7.1 OP/BP 4.01 Environmental Assessment (January 1999)

Environmental Assessment is one of the 10 safeguard policies of the World Bank. The objective of the World Bank Environment and Social Safeguard Policies is to improve decision making, to ensure that project options under consideration are sound and sustainable, and that project affected people have been properly consulted.

The World Bank’s environmental assessment policy and recommended processing are described in Operational Policy (OP)/Bank Procedure (BP) 4.01. The World Bank system assigns a project to one of three project categories, as defined below:

**Category A:** An EIA is normally required because the project may have diverse significant impacts (projects in this category are forestry, large industrial plants, irrigation and drainage, mineral development (including oil and gas), pipelines (oil, gas, and water), resettlement, rural roads, tourism, urban development, large transmission lines, etc.).

**Category B:** A limited environmental analysis is appropriate, as the project may have specific environmental impacts. Projects in this category include agro-industries (small scale), aquaculture & marine culture, small industries, mini-hydropower station, public facilities (hospitals, schools, housing complexes, rural electrification, telecommunications, small-scale tourism, rural water supply, etc.)

**Category C:** Environmental analysis is normally unnecessary, as the project is unlikely to have significant environmental impacts. Projects in this category include education, family planning, nutrition, institutional development, technical assistance, etc.

This project is therefore category B.
2.7.2  OP/BP 4.04 Natural Habitats (June 2001)

Supports the conservation of natural habitats and the maintenance of ecological functions as a basis for sustainable development. The Bank does not support projects that involve the significant conversion or degradation of critical natural habitats. This policy will not be triggered as the project is not within a natural habitat.

2.7.3  OP 4.36 Forests (November 2002)

Aims to reduce deforestation and enhance, through sustainable economic development, the environmental and social contribution of forests. The Bank does not support projects which involve significant conversion or degradation of critical forest areas or related critical natural habitats. This policy will not be triggered as the project is not within a forest.

2.7.4  OP/BP 4.11 Physical Cultural Resource (July 2006)

Cultural property is defined to include both remains left by previous human inhabitants (e.g. graves, shrines) and unique natural environmental features such as canyons and waterfalls. The Bank does not support projects that will significantly damage non-replicable cultural property and assists only those projects that are sited or designed so as to prevent such damage.

2.7.5  OP 4.10 Indigenous Peoples (July 2005)

Indigenous peoples in particular geographical areas are identified by having: a close attachment to ancestral territories and to the natural resources in these areas; self-identification and identification by others as members of a distinct cultural group; an indigenous language, often different from the natural language; presence of customary social and political institutions; and primarily subsistence-oriented production.

The Bank’s objective is to ensure that indigenous peoples do not suffer adverse effects from Bank financed projects and that they receive culturally compatible social and economic benefits. Effectively the World Bank requires a project to develop a program for addressing issues based on the informed participation of the indigenous people themselves. Any project that affects indigenous peoples is expected to include components or provisions that
incorporate an “Indigenous Peoples Plan”. The majority of the residents within the project area are Kikuyu and are not classified as indigenous.

2.7.6  **OP/BP 4.12 Involuntary Resettlement (December 2001)**

Details involuntary resettlement, emphasizing the severe economic, social and environmental risks, if unmitigated. It ensures that the population displaced by a project receives benefits from it and also covers those with usufruct or customary rights to land or other resources taken for the project. The Operational Policy is specifically inclusive, ensuring that all those affected both directly and indirectly by project developments are compensated as part of the project. Affected populations include those with income derived from informal sector and non-farm activities, and from common property resources. The absence of legal title does not limit rights to compensation.

The World Bank’s Policy objectives urge that involuntary resettlement be avoided whenever possible. If unavoidable, displaced persons need to:

- Share in project benefits,
- Participate in planning and implementation of resettlement programs, and
- Be assisted in their efforts to improve their livelihoods or standard of livings or at least to restore them, in real terms, to pre-displacement levels or levels prevailing prior to the beginning of project implementation, whichever is higher.

This project will be constructed majorly on public land, therefore this policy will not be triggered.
3. PROJECT BACKGROUND AND ENVIRONMENTAL SET-UP AND BASELINE INFORMATION

3.1 PROJECT BACKGROUND AND ENVIRONMENTAL SET-UP

3.1.1 Project Cost

The estimated cost of the proposed project is Kshs. 46,000,000.00 (Forty Six million Kenya Shillings). The proponent will hence be required to pay to NEMA a fee equivalent to 0.1% of the project cost. The payment will be made in form of a banker’s cheque to the NEMA Revenue Account.

3.1.2 Expected Operations of the Proposed Project

The proposed Kikuyu Springs project will entail:

i. Construction of 1No intake weir and intake chamberto abstract 1200m³/day flow from springs

ii. Construction of a 100 m³ capacity sump

iii. Construction of a pump house

iv. Construction of a Grade 9 operators house equipped with a septic tank for collection of waste

v. Soil protection measures by constructing gabions on the erosion prone area

vi. Erection of a perimeter fencing around the facility

vii. Construction of a 8 inch diameter UPVC pipeline from springs to our elevated tank at booster station 2.5km away.

The proponent intends to improve water supply in the area. The project will also provide better accommodation for the operator and security agents at the source. The project is also envisioned to provide a wide range of job opportunities right from construction through operation.
3.1.3  Site Conditions

Currently, there are old operator’s and pump houses. The pipeline in use is 4 inches in diameter. There are no wild animals or big plants apart from a close by forest and farmland, the rest are grasses and forbs. It is expected that there are small soil dwelling organisms at the site that will be affected with the excavation activities. The site is relatively gentle sloping. There will be no major changes and modifications required as regards the gradient and drainable of the land at the site.

3.1.4  Land-use in the neighbourhood

The site for the proposed development is in a sub-urban setting characterized by residential houses and intensive agriculture with crops and livestock. There are small-scale farms with Napier grass and residential houses surrounding the spring. There are no ecologically sensitive environments at the site or in the neighbourhood which can easily be affected by the activities of the proposed development.

3.1.5  Nature, Design and Components of the Proposed Project

The proposed project is a water supply improvement project. The main objective is to reinforce the existing facilities to meet the escalating demand of water in the area. The project is designed to undertake the following activities:

i. Construction of an intake weir

ii. Construction of a 100 m³ capacity sump

iii. Construction of a pump house

iv. Construction of a Grade 9 operators house equipped with a septic tank for collection of waste

v. Soil protection measures by constructing gabions on the erosion prone area

vi. Erection of a perimeter fencing around the facility

vii. Construction of an 8 inch diameter UPVC pipeline from springs to our elevated tank at booster station 2.5km away.
The facility will be provided with the following facilities and services:

- Power supply from the Kenya Power and a stand-by generator;
- Surface water disposal by an open drain;
- Solid wastes to be collected and managed on-site;
- Sewage and waste water will be directed to sewage manholes then to a septic tank/soak pit;
- Security from a registered security firm;
- Water supply from KWCL, water for construction will be sourced from directly from the spring.

3.2 BASELINE INFORMATION

3.2.1 District Development Concerns

Kikuyu District is a cosmopolitan district in Central province. It lies within the Nairobi metropolis and Kikuyu town is approximately 25km from the city centre. There are 4 divisions, 14 locations and 30 sub locations in the newly created Kikuyu district. The divisions are; Kikuyu which has 3 locations and 6 sub locations; Kabete which has 4 locations and 8 sub locations; Karai which has 4 locations and 8 sub locations; and Kinoo which has 3 locations and 6 sub locations. It has a large network of roads with the main Nairobi-Nakuru road cutting right across the constituency. The southern by pass which is currently under construction cuts right across Kikuyu town and is foreseen to boost the trading activities once completed. The district is also privileged to have a railway line (with an active station) connecting it to the city and western region. The high speed internet fibre optic cable also runs through it.
Figure 3.1: Map of the proposed project and other water developments within the proposed project area
The main economic activity of Kikuyu district is mainly agriculture and commerce. The constituency is a main supplier of horticultural produce like vegetables to the city of Nairobi. Besides, it is well known for poultry rearing and dairy farming. Other constituents have invested in rental houses while a lot others engage in small scale farming. It has one of the largest closed air markets (Wangige market) and several slaughter houses that supply meat to the locals and city dwellers in Nairobi and plans are underway in the economic stimulus programme to construct a fresh produce market at Kikuyu town. There are many stakeholders within the district who are working closely with the constituency office.

At the heart of development initiatives in the district is the District Development Committee (DDC) composed of all departmental heads, Member of Parliament, NGOs, District officers, Religious leaders, Chairman of local authorities, parastatals and business community representatives.

### 3.2.2 Population

According to 1999 national census, the district then a division had a total population of 234,309. This figure has since grown to an estimated figure of about 265,829 according to the raw data, with 130,370 males and 135,459 females. The population density is 1,126 persons per sq Km. It has a total of 77,045 households with an average of 3 to 4 people per household (KNBS, 2010).

### 3.2.3 Flora and Fauna

The district has both exotic and indigenous vegetation. Kikuyu is privileged to have relatively high forest coverage of more than 60 ha of 37ehavio forest (Thogoto, and Muguga forest). The Kenya Forest Service and Kenya Wildlife Service are keen on protecting and managing the forests coverage in the constituency. Some forests however have been cleared for firewood, agriculture and settlement posing a threat to water catchments in the area.

Trees are used mainly for shade, boundary demarcation, fencing, and production of fruits, timber, and fuel wood and for ornamental purposes. Common trees in the district include: *Eucalyptus spp*, *Markhamia lutea*, *Cupressus lusitanica*, *Bischovia javonica*, *Croton megalocarpus* and *Pinup* sp. Common fruit trees are *Persea 37ehavior37*, *Syzygium guminii*.
and *Eryobotria japonica*. Shrubs include *lantana camara*, *Tethonia diversifolia* and *Solanum incanum*. Animals in the district are mainly domestic animals such as cattle, sheep, goats, pigs and poultry. There are no animals or resources of wildlife and tourism importance.

Kikuyu springs vegetation comprises of reeds and water grass. Some of the animals found at the springs include insects, crustaceans and amphibians. Consultations with Kikuyu Water Company Limited confirmed there are no fish in the stream. This ecosystem has been facing destruction due to extensive deforestation. The spring is threatened by various activities within both the spring and riparian land including encroachment of riparian areas.

### 3.2.4 Topography

The general topography of the area is characterized by Lower Midland and Highland with wide spaced parallel ridges. Plateaus and high–level structural plains characterize it and its altitude ranges between 1,500 and 1,800m above sea level.

### 3.2.5 Geology and Soils

The principal rocks distinguished in this area are basalts, basaltic agglomerates (autobreccias), trachytes, phonolites, pyroclastic rocks and lacustrine deposits. Soils resulting from tertiary volcanic rocks are dark reddish brown, well drained. The area is mainly covered by the volcanic footbridges and plateaus soils. Soils on volcanic footbridges are of moderate to high fertility and are found in most parts of the district. They are well drained, red to dark brown friable clays.

### 3.2.6 Water Resources

The district has vast ground water potential because of high amounts of rainfall. The water table is very high in most parts. However, the resource has not been fully exploited due to financial and technical resource constraints. Water for domestic use is mainly supplied by KWCL. Except for the Kikuyu Springs, the area has no surface water resources and relies mostly on groundwater resources to meet its water demands.

The constituency lacks sufficient water storage facilities, wetlands have been encroached by farmers, poor distribution systems and non functional pumps in the boreholes. There is need to replace existing distribution systems with new and bigger diameter pipes, and re-test pumps.
to confirm their actual capacities and service them accordingly to enhance production. The current water storage tank of 50m³ is not adequate. There is a proposal to increase the storage to 150-200 m³ once the new proposal is up and running. Conservation of water catchments areas is paramount as well as building of dams and directing water into those dams.

3.2.7 Climate

The area lies mainly in the sub – humid and semi arid climate with small pocket of humid climate around. The rainfall pattern is bimodal with the short rains occurring between October and December and the long rains between April and May.

A mean annual rainfall of 969mm, as per record at the Muguga KARI Meteorological station is recorded. The temperatures vary between a mean maximum of 21°C and a mean of 11°C. The annual mean evaporation rate in the project area recorded is 1,721.

3.2.8 Air Quality and Ambient Noise

The project site environs are predominantly agricultural and residential with some institutions including schools and churches. As such, air and noise pollution levels are low with the only major source of emissions being vehicular emissions from traffic along the busy southern bypass and other tarmac roads within the project area.

3.2.9 Health

There is an established public health department in Kikuyu district. It has numerous health facilities including 3 health centres (Nyathuna, Lusigetti, Wangige), 2 Dispensaries (Gichuru, Uthiru), 52 private clinics, 2 nursing homes and 2 faith based clinics. The public health department has established community units each with 5000 individuals. So far 8 units have been established and 25 units are anticipated in the future. In each of these units community health workers are assigned to train 20 households on treatment on minor ailments, homecare for patients, referral cases, use of first aid kits and jigger treatment.

The district has a high prevalence rate of HIV/AIDS estimated to be about 4.6% in tandem with the central province rates. The negative impacts of it are also high such as orphans; opportunistic infections, death etc are very high. The Constituency Aids Control Committee (CACC) consisting of 21 members, a coordinator and a patron facilitates HIV/AIDS mitigation initiatives. Some of the initiatives under implementation include community
mobilization and advocacy through information, education and communication (IEC), orphan management, supervision of VCT centre, ARV and ART management, establishment of PMTCT, behavior change initiatives etc.

3.2.10 Physical Infrastructure

Lack of physical planning and housing in the district has resulted to lack of supportive infrastructure such as drainage and sewerage, and irregular land grabbing of public property. It is foreseen that if planning does not take place within the next ten years it will be one huge slum. This is because there are numerous unplanned structures coming up in the constituency as many people are turning their ‘shambas’ into residential plots. Most road reserves have been encroached on by agricultural activities, human settlements, kiosks and stalls following irregular allocation of public land to individuals. There is increased subdivision of land and an increase in the number of inhabitants despite the lack of a sewerage system.

The town council of Kikuyu is at the forefront in curbing this trend by ensuring efficient and effective land use by identifying residential areas, industries, public areas, as well as commercial areas so as to ensure that land use is effective and efficient. Plans are underway for some areas such as Mwimuto which has no public utility to purchase or compulsorily acquire land to be able to offer people better lifestyles. There is need to plan for recreation facilities in each sub location so as to engage the youth and have a healthy and fit populace.

3.2.11 Commerce and Trade

The people of Kikuyu district are largely dependent on agriculture for income majority of who have very small pieces of land. The district has a fully fledged department of Agriculture and department of Livestock and fisheries that support the farmers especially by training farmers on crop management, soil conservation, animal husbandry and agribusiness. There is a dairy cooperative in Wangige processing milk. Fish farming will soon become a reality with the implementation of the government initiative of improving the food security by rearing fish. Farmers will be encouraged to plant strawberries, mushrooms, silkworms and jatropha so as to increase their incomes
3.2.12 Education Sector

Kikuyu constituency has 27 public secondary schools in the constituency 2 of which are national, 4 are provincial, and 21 are District schools. In addition there are 18 private secondary schools in the constituency. There are 55 public primary schools and there are more than 100 private primary schools of which more than 50 are less than eight years old. There are 5 colleges and 135 pre – primary schools in the constituency. By the end of 2009, the enrolment to primary school stood at 27,669 pupils in public schools out of which 13,931 were boys and 13,738 were girls. In the private primary schools, a total of 11,225 pupils had been enrolled out of which 5,582 were boys. On the other hand, the enrolment of students to public secondary schools by end of 2009 stood at a total of 10,101 out of which 5,131 were boys. The private schools however the figures stood at a total of 2,759 students out of which only 882 were boys.
4. PROJECT MATERIALS AND PRODUCTS

4.1 PROJECT MATERIALS

The proposed development will take in a considerable amount of artificial and natural material in all its phases. The material input into the project will have both beneficial and adverse impacts on the environment. Both on-site and off-site impacts are anticipated from usage of materials. The table 5.1 below is a summary of the main material inputs into the project, there sources, anticipated impacts and possible mitigation measures.

4.2 PROJECT PRODUCTS

The main products from the project are:

- The proposed building (operator’s house and pump house);
- Gabions;
- Perimeter fence;
- Water weir;
- Landscaped site;
- Increased surface run-off;
- Increased wastewater discharge volumes;
- Increased solid waste generation.
### Table 5.1: Summary of the Main Material Inputs into the Project

<table>
<thead>
<tr>
<th>Materials</th>
<th>Sources</th>
<th>Uses</th>
<th>Impacts</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stones</td>
<td>Quarries near the project site</td>
<td>To reinforce the foundation and construct gabions</td>
<td>• Off-site depletion of raw materials and&lt;br&gt;• Land degradation&lt;br&gt;• Resultant solid wastes&lt;br&gt;• Excessive consumption</td>
<td>• Re-evaluation of the project to ensure that the design optimizes the use of stones&lt;br&gt;• A detailed material plan should be prepared as part of the initial design review</td>
</tr>
<tr>
<td>Sand</td>
<td>Suppliers within the project area</td>
<td>Preparation of concrete for joining masonry stone and aggregate</td>
<td>• Off-site depletion of raw materials and&lt;br&gt;• Land degradation especially destruction of the river beds</td>
<td>• Re-evaluation of the project to ensure that the design optimizes the use of sand&lt;br&gt;• A detailed material plan should be prepared as part of the initial design review</td>
</tr>
<tr>
<td>Cement</td>
<td>Will be tendered</td>
<td>Mixed with sand to prepare concrete for joinery and ballast to make aggregate for constructing slabs and columns</td>
<td>• Excessive consumption of cement&lt;br&gt;• Off-site depletion of limestone for making cement&lt;br&gt;• Land degradation&lt;br&gt;• Dust pollution</td>
<td>• Re-evaluation of the project to ensure that the design optimizes the use of cement&lt;br&gt;• A detailed material plan should be prepared as part of the initial design review&lt;br&gt;• Careful use of cement to avoid unnecessary spills</td>
</tr>
<tr>
<td>Gravel</td>
<td>Quarries near the project site</td>
<td>Preparation of aggregate for making ballast</td>
<td>• Off-site depletion of gravel land degradation</td>
<td>• Re-evaluation of the project to ensure that the design optimizes the use of gravel&lt;br&gt;• A detailed material plan should be prepared as part of the initial design review</td>
</tr>
<tr>
<td>Soil</td>
<td>From site</td>
<td>Leveling and landscaping works</td>
<td>Resultant solid wastes and dust pollution</td>
<td>• Careful planning landscaping programme&lt;br&gt;• Spraying dusty areas with water</td>
</tr>
<tr>
<td>Timber</td>
<td>Suppliers within the project area</td>
<td>Roofing and making doors</td>
<td>Off-site deforestation and resultant soil erosion</td>
<td>• Reforestation Programme&lt;br&gt;• Re-evaluation of the project to ensure that the design optimizes the use of timber&lt;br&gt;• A detailed material plan should be prepared as part of the initial design review</td>
</tr>
<tr>
<td>Material</td>
<td>Source</td>
<td>Use</td>
<td>Problems</td>
<td>Solutions</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Poles</td>
<td>Woodlots in the area</td>
<td>Supporting structural works</td>
<td>Off-site deforestation and resultant soil erosion</td>
<td>Reforestation Programme</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Re-evaluation of the project to ensure that the design optimizes the use of poles</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A detailed material plan should be prepared as part of the initial design review</td>
</tr>
<tr>
<td>Steel bars</td>
<td>Will be tendered</td>
<td>Reinforcement and casement</td>
<td>Health hazard</td>
<td>Re-evaluation of the project to ensure that the design optimizes the use of steel bars</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Excessive demand on steel</td>
<td>Re-using and recycling of waste metals</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Resultant solid waste</td>
<td>Practice effective occupational health and safety practices</td>
</tr>
<tr>
<td>Glass</td>
<td>Will be tendered</td>
<td>For windows</td>
<td>Health hazard</td>
<td>A detailed material plan should be prepared as part of the initial design review</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Heavy demand on glass</td>
<td>Practice effective occupational health and safety practices</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Resultant solid waste</td>
<td>Careful handling of glass</td>
</tr>
<tr>
<td>PVC material</td>
<td>Will be tendered</td>
<td>For water and wastewater piping systems, insulations</td>
<td>Non-biodegradable solid wastes and resultant breeding grounds for rats</td>
<td>Re-using and recycling of wastes</td>
</tr>
<tr>
<td>(pipes, conduits and</td>
<td></td>
<td></td>
<td>and disease vectors such as mosquitoes</td>
<td>Proper handling of the wastes</td>
</tr>
<tr>
<td>fittings)</td>
<td></td>
<td></td>
<td></td>
<td>Practice effective occupational health and safety practices</td>
</tr>
<tr>
<td>Paint</td>
<td>Hardwares within the Town</td>
<td>For colourful external and internal finishes</td>
<td>Health hazard</td>
<td>Careful use of paint to avoid unnecessary spills</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Excessive use of paint</td>
<td>Re-evaluation of the project to ensure that the design optimizes the use of paint</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Resultant pollution</td>
<td>Practice effective occupational health and safety practices</td>
</tr>
<tr>
<td>Water</td>
<td>Kikuyu Water Co. Ltd</td>
<td>Input in the construction works for dust suppression, concrete and</td>
<td>Excessive consumption of water</td>
<td>Careful management of water use</td>
</tr>
<tr>
<td></td>
<td></td>
<td>aggregate preparation and sanitation/cleaning</td>
<td>Wastewater and pollution</td>
<td>Regular maintenance of pipes and taps to fix leakages</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Conflicts with other water users in the area</td>
<td>Maximization on other sources of water such as rainwater harvesting and storage in larger tanks</td>
</tr>
</tbody>
</table>
5. PUBLIC CONSULTATIONS

Members of the public are supposed to participate and get involved because the project being carried out will affect them. Reference is made to Section 17 of the Environmental (Impact Assessment and Audit) Regulations, 2003, which states that: The proponent shall in consultation with the authority, seek the views of persons who may be affected by the project. Public participation hence formed a major component of the study. The role of public consultation and involvement in EIA process is to assure the quality, comprehensiveness and effectiveness of the assessment and ensure that the public views are adequately taken into consideration in decision making process. This public consultation covered members of the public with no discrimination of any kind.

One public consultation meeting (baraza) was held on site on 27th September 2013. During the meeting, members of the community appreciated the project as it will ease the water shortage problems being experienced in the area. The minutes of meeting and attendance sheet is as shown in Appendix 1.

The public were also consulted through questionnaire administration (a sample is provided in Appendix 2). Though all the members of the public interviewed were positive about the project, the following is a summary of issues raised by the respondents:

a) The locals greatly appreciated that the proponent had given them a chance to participate in the decision making process concerning the proposed project and were happy that the project will partly solve the problems of unemployment in the area among the school leavers;
b) Members of the public were grateful that there will a reliable water to meet their needs;
c) All interviewed members of the public were positive about the project and agreed that it should continue.
6. ENVIRONMENTAL IMPACTS AND MITIGATION

6.1 IMPACTS ON LAND FROM CONSTRUCTION ACTIVITIES

6.1.1 Assessment

The main impact-generating activities on land during construction will be clearing of the site and excavation. Clearing of the land will remove the available plants and animal species from the site and along the pipeline. This means that there will be ecosystem disruption and habitat alteration. Leveling will change the direction of flow of surface run-off on land. The soil structure and profile will be altered by the digging up of the ground during site excavation and pipeline replacement. The Project will require significant amounts of materials. The overall environmental impacts will be significant because of amount required. Many construction materials are components of natural resources and their extraction has an effect of depletion of land resources and the subsequent off-site degradation of land. No significant impact is predicted on land during the operation other than those resulting from neglected mitigation measures in disposing of spoiled materials, erosion and tree planting. It is, therefore, necessary to undertake regular monitoring to ensure that all required mitigation measures are implemented.

6.1.2 Mitigation

The following are proposed:

a) Visual changes to the landscape will have no mitigation measures but the project design should consider aesthetic concerns. This will be through planting of trees at the site. Planting of grass strips will also be another measure against the changed aesthetic qualities of the land;
b) To minimize the impact associated with depletion of raw materials, the project will be re-evaluated to ensure that the design optimizes the use of materials. A detailed material plan should be prepared as part of the initial design review;

6.2 EXCESSIVE WATER CONSUMPTION

6.2.1 Assessment

Water is to be supplied by the KWCL and direct abstraction from the spring during construction. As a measure to determine water consumption levels, water meters will be installed. This will help monitoring of the consumption over time and in turn assist in designing measures to reduce
consumption. This assessment takes care of water usage for construction activities and during the operation of the project.

a) Water-use during Construction

The project will use considerably large amounts of water. The construction will require water for spraying dusty areas, mixing construction materials, curing, washing and in general construction. Water is scarce and expensive. Water will have to be fetched from the nearby Kikuyu spring. Water will also be required by the construction workers to facilitate their daily activities such as preparing food, bathing and drinking. This may place a strain on the local water supply and cause conflicts with other users of the water from the spring.

b) Water use during Operation

Water will be used in cleaning, bathing and preparing of the meals. The project will need to dispose off water as sewerage from the washrooms, general cleaning and the kitchen. Sewage disposal will require the construction of a septic tank.

6.2.2 Mitigation

The following shall be considered:

a. To mitigate the impacts, it is necessary to ensure that installation of water supply system follows local government requirements;
b. The contract for construction should indicate the scarcity of water and requirement for the contractor to carefully manage water use;
c. The management should consider the Water Act, 2000 and EMCA Act, 1999, which may in certain circumstances, govern water abstraction and use and require permits for abstraction of large volumes of water for commercial/residential uses;
d. Maximization on other sources of water for some uses such as rainwater harvesting and storage in larger tanks;
e. Construction of bigger storage facilities to be able to cope with potential stresses in supply;
f. Conducting of regular maintenance of pipes and taps to fix leakages.
6.3 IMPACTS ON DRAINAGE AND HYDROLOGY

6.3.1 Assessment

Construction of the 1200m³/day weir and subsequent abstraction of water from the spring might reduce flow level downstream due to ineffective compensation. However, this impact is expected to be minimal since the results of the hydrological survey indicated that the production from the springs is generally stable throughout the year. Reduced water level will affect water temperature which may in turn affect some aquatic plants and animals as it may exceed their biologically viable temps. Lower flow levels will also mean that water will not be available for downstream users.

6.3.2 Mitigation

The following should be undertaken to mitigate against this impact:

a) There should be due adherence to the safest maximum abstractable water quantities of throughout the project life;

b) Ensure a minimum reserve flow of 72.0144m³/day is maintained throughout the operation period of the project.

c) Adhere to WRMA water use permits.

6.4 IMPACTS TO AIR QUALITY

6.4.1 Assessment

Construction work will involve digging, transporting and dumping large quantities of dry material. The work will generate large quantities of dust from the soil and cement. It will inevitably lead to an increase in suspended particulate matter (SPM) in and around the construction zones.

6.4.2 Mitigation

Proponent shall consider the following:

d) Spraying of dry dusty surfaces with water is the main way of controlling dust and should be undertaken regularly during construction;

e) Dust masks should be issued to workers and use them especially whenever SPM exceeds 200-mg/cubic meter;
6.5 NOISE

6.5.1 Assessment

A significant increase in noise is expected during the construction and laying of the pipeline. The main sources are heavy machinery such as, excavators, stabilizers, concrete mixers, and drills. Vehicles transporting materials to the site will generate noise. However, in open areas, traffic noise will disperse and will create a minor impact. Noise can cause hearing damage. It can interfere with communication, cause fatigue, reduce efficiency and affect staff morale. Noise is unavoidable during the construction period, although it may cause disruption to nearby residents and facilities.

6.5.2 Mitigation

The following need to be considered during construction and operational phase:

- Proper equipment maintenance and restricted operation only during daytime hours so as to reduce noise;
- Reasonable working hours (only during the day) should be maintained whenever possible to reduce the number of complaints concerning noise from the neighbouring residents;
- Consider the rule which states that, ‘No worker shall be exposed to noise level in excess of the continuous equivalent of 90 dBA for more than 8 hours within any 24 hours duration’ by the Kenya Noise Prevention and Control Council which was passed in 1996 under legal notice No. 296, as a subsidiary legislation to the Occupational Health and Safety Act;
- Operation of shorter shift period for workers who come in direct contact with high concentrations of noise;
- Provision of ear protective devices to workers in noise dense areas to prevent high frequencies noise emitted by the high frequency machines during construction.

6.6 SEWAGE AND WASTEWATER

6.6.1 Assessment

Waste water and sewage from the facility will be directed into a septic tank. Accidental flooding of the sewerage system can flush into the storm water drainage system thereby creating biological hazards. Sewage and wastewater have associated problems when they leak into the environment. Such
problems include poor sanitation, nuisance and associated diarrheal diseases. The Town Council of Kikuyu has the responsibility and standards for de-sludging the raw sewage.

6.6.2 Mitigation

The following mitigation measures are possible for the reduction of these problems:

a) The diameter of the sewage pipes serving the pump house should be large enough and the pipes should be regularly maintained;
b) Inspection of the sewerage and drainage systems from the premises to minimize risk of flushing;
c) All sewage wastes will be managed according to controlled discharge standards;
d) Monitoring of effluent should be carried regularly according to Kikuyu Town Council by-laws;
e) Periodic checks and regular maintenance should be carried out on all drainage channels and lines to the main sewer on the site;
f) De-sludging of the septic tank should be done regularly or whenever the septic tank appears to be filling.

6.7 SOLID WASTES

6.7.1 Assessment

The project is expected to generate solid wastes. Wastes can be injurious to the environment through blockage of drainage systems, choking of water bodies and negative impacts on animal health as they can be potential breeding grounds for disease causing pathogens. Some of these waste materials especially the plastics and polythene bags are not biodegradable hence may cause long-term injurious effects to the environment. This assessment takes care of solid wastes from the construction activities and from the operation activities.

a) Solid Wastes from Construction Activities

During the construction phase, the left-overs of the construction materials will be the main source of solid wastes. These will include soil, broken blocks, sand, empty cement bags, broken pipes, and empty paint containers among others.

b) Solid Wastes from Operation Activities
The bulk of the solid waste generated during the operation of the project will consist of wastes produced in the operator’s house, pump house repairs and pipe repairs. These wastes will include waste papers, plastic, soap wrappings, packaging material, broken piping, pump repairs and inorganic wastes.

6.7.2 Mitigation

The management intends to put litter bins in the houses. The broken pipes will be collected by KWCL for recycling. Other possible mitigation measures are:

a) The construction engineer and supervisor should ensure that all construction wastes are removed from the site after the construction;
b) Part of the wastes can be reused or recycled. For instance, waste metals can be sold as scrape metal; soil can be used to fill pot holes on the site or on the road; biodegradable wastes can be converted into manure for use in landscaping and plastic bags and containers can be given to the residents for free for use in carrying things such as paraffin;
c) The waste collection areas such as the compost pits should be secured and contained to minimize the risk of invasion by pests and rodents;
d) Separation should be done at the source through provision of two waste bins for the separate collection of biodegradable and non-biodegradable wastes.

6.8 INCREASED RUN-OFF

6.8.1 Assessment

Due to expected ground surface sealing by the construction, it is expected that there will be greater volume of run-off into the drainage ditches. Discharges from the roofs and sealed areas will be directed into open drainage systems. The open drains will then be directed into the market drainage system.

6.8.2 Mitigation

The following measures apply:

a) Gabions will be constructed around the spring to control run-off
b) Ensure adequacy of receiving drains;
c) Use of porous pavements and/or spaced slabs on pavements;
d) Plant trees and grass strips as a measure to increase the resident time of storm water on the ground to facilitate percolation and infiltration.

6.9 EXCESSIVE ENERGY CONSUMPTION

6.9.1 Assessment

The facility is to be supplied with electricity from the Kenya Power which is to be installed later. Since the water pump will be running round the clock, a substantial amount of electrical power will be needed. Power will also be required for lighting and other electrical appliances in the operator’s house. The management intends to put florescent tubes for lighting purposes.

6.9.2 Mitigation

It is the government policy to minimize energy consumption. Thus the following mitigation measures are suggested to help minimize the consumption of energy:

a) Energy efficient lighting to be used at the facility;

b) Light sensor switches are to be provided to ensure outdoors lights are not used in daytime;

c) All energy using equipments such as water heaters and bulbs should be switched off when not in use;

 d) Alternative energy sources need to be installed such as solar energy and generator for power backup.

6.10 LAND TAKE

6.10.1 Assessment

The project will affect one farmer whose land will be acquired in order for the contractor and the operator to gain access to the intake works. A valuation exercise was undertake on Mr. James Nganga Njonde’s piece of land to ensure that the affected person is adequately compensated. The area affected is 0.0656 Ha.

6.10.2 Mitigation

The proponent should ensure that the affected person is compensated on a willing-buyer-willing-seller basis to avoid future complaints.
6.11 FIRES AND ACCIDENTS

6.11.1 Assessment

Fires and accidents are unpredictable. Accidents may result from moving vehicles and when working. They affect health and may result into death. Fires result into property damage. The fire protection measures proposed for the design comply with the recommended measures for the facility. The management intends to install fire extinguishers and in the building.

6.11.2 Mitigation

The following measures are important in mitigation of fires and accidents:

a) Regular training of the personnel in case of any emergency including those involving fire outbreaks and accidents;
b) Regular inspection of the fire fighting equipment and the First Aid box which must be available on the site at all times;
c) An inventory should be made detailing all fire protection measures;
d) “NO SMOKING” signs should be prominently displayed in the operator’s and pump houses;
e) Apart from the fire extinguishers and the fire exit, the management should consider installation of a hose reel and fire blanket;
f) Fire alarms, incorporating smoke sensors should be installed;
g) Adequate space should be created at the entrance and exit along the road to give drivers enough room to maneuver into and out of the project site;
h) A fire assembly point should be established outside the facility;

6.12 IMPACTS RELATED TO OCCUPATIONAL HEALTH AND SAFETY

6.12.1 Assessment

The Public Health Act, Cap 242, covers the law governing occupational health and living condition. It is vital that the contractor and proponent, in accordance with the law, take the appropriate health and safety measures. Under the act, Public Health Officers are empowered to make inspections and to take action in case of any violations and in the case of nuisance. Employees of the project are likely to be affected by exposure to hazardous chemicals, dust, pollution, accidents, fire and other related risks. It
is important that mitigation measures are put in place to avoid effects that may result from such impacts. In addition, records should be kept of accidents and incidents occurring at the premises for future monitoring.

Poor construction may lead to accidents to the pump operators and building occupants. Necessary measures need to be put in place to avoid such incidents. As per the Occupational Health and Safety Act (2007), every person in a working space is entitled to at least $10m^3$ of space excluding space above 4m high. Free circulation of air in any work environment is necessary. If natural ventilation in any structure is not adequate, artificial ventilation is advisable. Most mitigation measures have been discussed above. Other possible mitigation measures to reduce impacts related to occupational health and safety are:

a) **Provision of Fire Fighting Equipment**

A fire fighting system should be available within the site. These consist of well equipped firefighting equipment, fire protective clothing and procedures for handling fire.

b) **Training of Workers**

All workers are to be briefed on causes and risks that are likely to occur at any working place and on safe practice within the construction site. Workers should also be trained on the work that they do and on handling specific equipments and tools.

c) **Provision of Personal Protective Equipment**

The contractor and the proprietor need to provide personal protective equipment to all his employees during construction phase and to the management staff during the operation phase of the facility. Protective clothing must be worn in all situations where the body and skin are potentially exposed to hazards such as chemicals, harmful dusts and sharp objects. Basic protection includes gloves, nose masks, dust coat and overalls.

d) **Provision of First Aid Facilities**
First aid facilities are required within the facility to aid in first aiding in case of injuries. During construction, workers are at a risk of injuring themselves from such things as stepping on nails, falling and cuts. First Aid Kits are equipped with bandages and sterile tapes to assist in preventing excessive blood loss before medical attention is given. A typical First Aid Kit contains a First aid manual, and is equipped with sterile adhesive bandages, safety pins, cleansing agent/soap, latex gloves; sterile gauze pads triangular bandages, non-prescription drugs, scissors, tweezers and antiseptic amongst others.

e) Precautions

Every person at the facility should take precaution not to cause any effect on his/ her own health or to the health of any other person. This will involve following instructions on how to handle some tasks and equipments. Any burning must be controlled.

f) Building Design

The proponent is to put in place the following factors as regards ventilation, accidents and congestion.

- Construction of the building as recommended in the structural drawing;
- Provision of enough windows, installation exhaust fans in strategic points to allow good air circulation into and out of the buildings.

g) General Employee Welfare

Employee welfare issues include free medical attendance if injured on work. The contractor should also have provisions for sick leaves and offs for employees.

h) Hazard Notification, Signage and Warning

Notices to warn visitors and staff of potential dangers that may exist in different areas of the facility, or warn the persons on potential consequences of their actions should be put in place.
6.13 POSITIVE IMPACTS

6.13.1 Employment Opportunities

The quantifiable benefits from the project are the employment opportunities that will be created. People will be employed at the site in all the phases of the project. The project has provided employment to the people right from the planning through to the assessment. Others to be employed are the contractor, the supervisors and the construction workers during the construction phase and the management staff during the operation phase. Self employment will be realized with the people who will come to the site to sell foodstuffs to the workers.

6.13.2 Improved Living Standards

Employment will improve the living standards of the employees and their families as they will be able to acquire basic needs from the income that they will earn from the employment.

6.13.3 Improved and reliable water supply

The development will involve replacing of 4 inch pipes with 8 inch thus increased water flow to the storage tanks. This will provide a large water reserve therefore enhance water security in the area and ensuring the supply is reliable due to construction of the modern facility.

6.13.4 Increased Economic Activity

There will be increased economic activity due to the project. The supply of materials for the construction, food businesses to operate at the site in all the phases and the commercial activities to be carried out within the facility are examples of the economic activities to take place. The workers at the facility will offer market for locally produced farm products such as vegetables.

6.13.5 Increased Revenue Collection

This development will be a right step because the investment will able to pay a little more tax to the Kenya Revenue Authority (KRA) and also the Kikuyu Water Company will be able to improve on revenue collection.
6.13.6 Enhanced gender and participation in development

Women form a high percentage of the project areas’ population but are inadequately participating in development activities due burden of fetching water. Increased availability of water will relieve them and thereby give them an opportunity to engage in development activities. Availability of water will also remove the burden of collecting water for girl child leading to academic pursuits. Academic pursuit of the girl child at early stage leads to further education and competitiveness in the job market which is an exit route from poverty.

6.13.7 Enhancement

a) The management should not evade paying taxes as this affects the economy;
b) The operators and pump houses plus equipment and the pipeline should be regularly maintained;
c) Employment should be done on equal basis; taking into consideration physical fitness, gender and age. Older people, people with disabilities and expectant women should not be exposed to very hard labour.
d) Running of the project should follow laid down guidelines and procedures;
e) The supply of food stuffs should be from the local community to provide market to the locally produced farm products.

6.14 PROJECT DECOMMISSIONING

6.14.1 Assessment

Decommissioning is the permanent withdrawal from a site or close down of the facility for restoration. Due to constraints in resources or approach changes in the core operations of the facility the project may require decommissioning.

6.14.2 Mitigation

The following apply:

- The decommissioning and alternative land use need to be facilitated by appropriate professional personnel incorporating environmental experts, Local Council Planning Department and Government Health Department.
• If the decommissioning has to involve demolition of the structure, then the contractor for demolition has to ensure that all possible mitigation measures are put in place to minimize adverse impacts.

• In addition any wastes must be removed from the site after the process of demolition.

6.15 RECORD KEEPING AND ENVIRONMENTAL POLICY

In accordance with the EMCA, 1999, proper record keeping at any facility is necessary for transparency in accounting, monitoring and for administrative purposes. Such records include licenses, operational permits and facility user transfer approval. In addition to the above, the project owner is required to keep records on events of environmental significance that include inspection records, training/workshops/seminars, records on fire and safety, waste disposal records, discharge monitoring reports, hazardous materials amongst others where applicable. Reports are to be made based on the aforementioned as audit findings and monitoring programs and submitted to NEMA annually.

For efficient management of the facility; to facilitate future audits and to comply with the law, it is recommended that the following records must be prepared and kept available:

• Document on emergency management procedures;
• Diary detailing incidents and accidents at the site;
• List of materials at the site according to approved classification schedule;
• Record of violations and notification of authorities’ correspondence.

The management of the facility in consultation with the NEMA EIA consultants should develop an effective environmental policy.
7. ANALYSIS OF PROJECT ALTERNATIVES

The purpose of this section is to examine feasible alternatives to the project and highlight the benefits of and general rationale for the proposed 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 social, environmental and 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 NEMA and is critical in consideration of the ideal development with minimal environmental disturbance. 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 were considered:

- “No-action” Alternative
- Relocation Alternative
- Alternative Land-uses
- The Proposed Development as described in the EIA Report

7.1 “NO-ACTION” ALTERNATIVE

The selection of the “No-action” alternative would mean the discontinuation of project designs and result in the site being retained in its existing form. 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 on the site will not be severely affected though through re-vegetation and landscaping this will result into better and admirable aesthetic value of the area.

This option would imply economic loss to the proponent, local and national economies. If the site is left undeveloped, the proponent would loose in terms of financial commitments already made in design and planning of the project: professional fees to the project managers, architects, quantity surveyors, EIA lead experts, physical planners and application for EIA approval and licensing from NEMA at 0.05% of total project cost. This option would similarly result in the loss of jobs that the project was to create. The local and central government will also loose the tax income that the project
would generate if implemented. The option will also hinder the supply of water in the area which is highly strained due to the increase in demand.

7.2 RELOCATION ALTERNATIVE

This option is based on the criteria that the proposed development is to be sited in a zone planned for other developments or there is need to preserve any threatened, endangered, rare or unique species of plants or animals found at the site or the site is in or close to ecologically sensitive area. There are other similar facilities in the neighbourhood. Thus, the proposed development cannot be an impediment to any other developments since it is compatible with adjacent facilities. There are no physical, biological, cultural and socio-economic features of special concern at the site.

If this option is selected the proponent is required to look for an alternative site either within or outside the zone. This implies that the proponent has to buy or lease another piece of land elsewhere since at the moment, the proponent does not have an alternative site. It might take a very long time looking for and finding a similar sized land and completing all official transactions relating to change of land ownership. There is also no guarantee that the land would be available, and if such land is available, its cost might be beyond affordable for the proponent.

The processes of designing and planning will have to be started over again. The proponent will need to re-engage professionals like architects, EIA lead experts, land surveyors and physical planners to assess the viability of the new site. Additional costs will arise from the design and approval of the building plans for the new site. This means that the proponent will have to undergo an extra expense. New costs will also arise from seeking an EIA approval from NEMA for the new site at 0.05% of development cost to the authority. With the changing demand and supply at the market, the prices and availability of materials to be used may not be promising to the proponent at the time the proposal is finally approved by the authorities. This might discourage the proponent and any other local and international investors from investing in water projects.

7.3 ALTERNATIVE LAND-USES

The option allows the developer to explore other alternative land uses for the site other than the proposed water supply project. This will require application for change or extension of use to allow for the alternative development. This is costly and might take a long time to mature since it also requires
relevant authorities to approve the change of land-use. This site is in a sub-urban area with small-scale farming operations. Any other commercial, industrial and recreational would mean user incompatibility with current neighbourhood land uses. The change might also be massively objected by the residents in the neighborhood. The site is too sensitive to support large-scale commercial activities.

7.4 THE PROPOSED DEVELOPMENT AS DESCRIBED IN THE EIA REPORT

The impacts and mitigation measures for this alternative are discussed in detail throughout this report. The positive impacts have been identified. This alternative will have minimal impacts on the physical environment and has considered the necessary measures to eliminate the identified issues of concern. The alternative is likely to have the greatest implications on socio-economic 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 area development, security status, employment opportunities via business environment and accessibility to services to both the residents and non-residents of the area. In addition, a development of this caliber will add to the locality’s ability to fuel the growth and development of the wider environment. The Merits of this alternative are as follows:

- There will be stable and reliable water supply
- The property (land) value will appreciate;
- Optimal economic and spatial land-use;
- Security will be alleviated;
- Visual and aesthetic amenities will be improved;
- The community will have potential source of income through the supply of materials at the site, self sustainability, employment opportunities and better service delivery in the long run;
- The local and national economies will improve from the revenue collected from the facility.
8. PROPOSED ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN (EMP)

At the time of the Assessment, the proposed project did not have an Environmental Management and Monitoring Plan (EMP). This plan is required to provide a concise structure of actions with specific priority level of action for the management of the environment during project construction, operations and decommissioning of the proposed project.

8.1 PROPOSED DEVELOPMENT WITHOUT AN EMP

This scenario is based upon the assumption that the proposed development would go on without any environmental management options being provided. The total project impact for the scenario is on the appreciably adverse side. This will show that if the project goes ahead without EMP, the adverse impact on the existing environment would be major. Thus, the EMP described will have to be implemented to minimize the potential negative impact due to the proposed project.

8.2 PROPOSED DEVELOPMENT WITH AN EMP

If the environmental management strategies discussed in the EMP are fully implemented, the adverse impact of the project would be reduced, and there will be an overall improvement in physical, chemical, biological and socio-economic environment of the region.

8.3 CONCLUSION

It is clear from the above, that the proposed water supply project will have negative effect without implementing certain environmental management strategies. If the EMP, as discussed below is adopted and implemented, the adverse impacts will be reduced and the overall environmental quality of the area will improve.

The EMP outlines existing and potential problems that may adversely impact the environment as a result of the project, and recommends remedial measures where required. The plan outlines roles and responsibility of the key personnel and contractors who are charged with the responsibility to manage and control the project during its life cycle, thereby allowing it to contribute to improved environmental quality.
The EMP is generally:

- Prepared in accordance with rules and requirements of the EMCA;
- To ensure that the component of proposed project are operated in accordance with the design;
- Process that confirms proper operation through supervision and monitoring;
- System that addresses public inconvenience during construction and operation of the facility; and
- Plan that ensures remedial measures are implemented immediately.

The key benefits of the EMP are that it provides the organization or the project proponent with means of managing its environmental performance thereby allowing it to contribute to improved environmental quality. The other benefits include cost control as improved relations to the stakeholders.
Table 7.1: Proposed EMP during the Construction Phase of the Project

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Recommended Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vegetation Disturbance</strong></td>
<td>Ensure proper demarcation and delineation of the project area to be affected by construction works.</td>
<td>Contractor</td>
<td>1 month</td>
<td>300,000</td>
</tr>
<tr>
<td></td>
<td>Design and implement an appropriate landscaping programme to help in re-vegetation of part of the project area after construction.</td>
<td>Proponent</td>
<td>2 months</td>
<td>10,000</td>
</tr>
<tr>
<td><strong>Storm Water, Run-off and Soil Erosion</strong></td>
<td>Apply soil erosion control measures such as leveling of the project site to reduce run-off velocity and increase infiltration of storm water into the soil. i.e. gabions Ensure that any compacted areas are ripped to reduce run-off. Interconnected open drains to be provided on site.</td>
<td>Project Management and Contractor</td>
<td>1 month</td>
<td>30,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contractor</td>
<td>1 month</td>
<td>2000</td>
</tr>
<tr>
<td><strong>Impacts on Drainage and Hydrology</strong></td>
<td>There should be due adherence to the safest maximum abstractable water quantities of throughout the project life; Adhere to WRMA water use permits.</td>
<td>Proponent</td>
<td>Throughout project life</td>
<td>Nil</td>
</tr>
<tr>
<td>Impacts</td>
<td>Recommended Measures</td>
<td>Responsible Party</td>
<td>Time Frame</td>
<td>Cost (Ksh)</td>
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</tr>
<tr>
<td>Solid Wastes</td>
<td>Use of an integrated solid waste management system i.e. through, recycling, reuse, combustion and sanitary land filling.</td>
<td>Contractor</td>
<td>Throughout the construction period</td>
<td>20,000</td>
</tr>
<tr>
<td></td>
<td>Comprehensive biological organic matter management</td>
<td>Contractor</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ensure that construction materials left over at the end of construction to be used in other projects rather than being disposed off.</td>
<td>Project Manager &amp; Contractor</td>
<td>One-off</td>
<td>1,000</td>
</tr>
<tr>
<td></td>
<td>Nil</td>
<td>Project Manager &amp; Contractor</td>
<td>Throughout the construction period</td>
<td>Nil</td>
</tr>
<tr>
<td></td>
<td>Ensure that damaged or wasted construction materials including timber made doors, plumbing and lighting fixtures, and glass be recovered for refurbishing and use in other projects</td>
<td>Project Manager &amp; Contractor</td>
<td>One-off</td>
<td>30,000</td>
</tr>
<tr>
<td></td>
<td>Nil</td>
<td>Project Manager &amp; Contractor</td>
<td>Throughout the construction period</td>
<td>Nil</td>
</tr>
<tr>
<td></td>
<td>Provide facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements</td>
<td>Project Manager &amp; Contractor</td>
<td>One-off</td>
<td>30,000</td>
</tr>
<tr>
<td></td>
<td>Purchase of perishable construction materials such as paints should be done incrementally to ensure reduced spoilage of unused materials</td>
<td>Project Manager &amp; Contractor</td>
<td>Throughout the construction period</td>
<td>Nil</td>
</tr>
<tr>
<td></td>
<td>Use building materials that have minimal or no packaging to avoid the generation of excessive packaging waste</td>
<td>Project Manager</td>
<td>Throughout the construction period</td>
<td>Nil</td>
</tr>
<tr>
<td></td>
<td>Waste collection bins to be provided at designated points on site</td>
<td>Project Manager</td>
<td>Throughout the construction period</td>
<td>20,000</td>
</tr>
<tr>
<td></td>
<td>Private waste disposal company to be contracted to transport and dispose the stubborn solid waste from site</td>
<td></td>
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<tr>
<td>Impacts</td>
<td>Recommended Measures</td>
<td>Responsible Party</td>
<td>Time Frame</td>
<td>Cost (Ksh)</td>
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</tr>
<tr>
<td>Dust Emissions</td>
<td>Ensure strict enforcement of on-site speed limit regulations</td>
<td>Project Manager &amp; Contractor</td>
<td>Throughout the construction period</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Avoid excavation works in extremely dry weathers</td>
<td>Project Manager &amp; Contractor</td>
<td></td>
<td>5,000 per month</td>
</tr>
<tr>
<td></td>
<td>Sprinkle water on graded access routes when necessary to reduce dust generation by construction vehicles</td>
<td>Project Manager &amp; Contractor</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Personal Protective equipment to be worn</td>
<td>Project Manager &amp; Contractor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhaust Emissions</td>
<td>Vehicle idling time shall be minimized</td>
<td>Project Manager &amp; Contractor</td>
<td>Throughout the construction period</td>
<td>Nil</td>
</tr>
<tr>
<td></td>
<td>Equipment shall be properly tuned and maintained</td>
<td>Project Manager &amp; Contractor</td>
<td>Throughout the construction period</td>
<td>Nil</td>
</tr>
<tr>
<td></td>
<td>Sensitize truck drivers to avoid unnecessary racing of vehicle engines at loading/offloading points and parking areas, and to switch off or keep vehicle engines at these points</td>
<td>Project Manager &amp; Contractor</td>
<td>Throughout the construction period</td>
<td>Nil</td>
</tr>
<tr>
<td>Noise and Vibration</td>
<td>Sensitize construction vehicle drivers and machinery operators to switch off engines of vehicles or machinery not being used, to avoid gunning of vehicle engines or hooting especially when passing through sensitive areas such as churches, residential areas and hospitals</td>
<td>Project Manager &amp; Contractor</td>
<td>Throughout construction period</td>
<td>Nil</td>
</tr>
<tr>
<td></td>
<td>Ensure that construction machinery are kept in good condition to reduce noise generation</td>
<td>Project Manager &amp; Contractor</td>
<td>Throughout construction period</td>
<td>5,000</td>
</tr>
<tr>
<td>Impacts</td>
<td>Recommended Measures</td>
<td>Responsible Party</td>
<td>Time Frame</td>
<td>Cost (Ksh)</td>
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<tr>
<td></td>
<td>Ensure that all generators and heavy duty equipment are insulated or placed in</td>
<td>Project Manager &amp; Contractor</td>
<td>Throughout construction period</td>
<td>5,000</td>
</tr>
<tr>
<td></td>
<td>enclosures to minimize ambient noise levels.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plant trees around the site so as they can act as buffer against noise propagation</td>
<td>Project Manager &amp; Contractor</td>
<td>Throughout construction period</td>
<td>2,000</td>
</tr>
<tr>
<td></td>
<td>The noisy construction works will entirely be planned to be during day time when most</td>
<td>Project Manager &amp; all site foreman</td>
<td>Throughout construction period</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>of the neighbours will be at work.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy Consumption</td>
<td>Ensure electrical equipment, appliances and lights are switched off when not being</td>
<td>Project Manager &amp; Contractor</td>
<td>Throughout construction period</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>used</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Install energy saving fluorescent tubes at all lighting points instead of bulbs which</td>
<td>Project Manager &amp; Contractor</td>
<td>Throughout construction period</td>
<td>2,000</td>
</tr>
<tr>
<td></td>
<td>consume higher electric energy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Monitor energy use during construction and set targets for reduction of energy use.</td>
<td>Contractor</td>
<td>Throughout construction period</td>
<td>2,000</td>
</tr>
<tr>
<td>Water-use</td>
<td>Promote recycling and reuse of water as much as possible</td>
<td>Project Manager &amp; Contractor</td>
<td>Throughout construction period</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Promptly detect and repair of water pipe and tank leaks</td>
<td>Project Manager &amp; Contractor</td>
<td>Throughout construction period</td>
<td>10,000 per</td>
</tr>
<tr>
<td></td>
<td>Ensure taps are not running when not in use</td>
<td>Project Manager &amp; Contractor</td>
<td></td>
<td>month</td>
</tr>
<tr>
<td>Waste Water</td>
<td>Provide means for handling sewage generated by construction workers</td>
<td>Project Manager</td>
<td>One-off</td>
<td>20,000</td>
</tr>
<tr>
<td>Impacts</td>
<td>Recommended Measures</td>
<td>Responsible Party</td>
<td>Time Frame</td>
<td>Cost (Ksh)</td>
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</tr>
<tr>
<td>Conduct regular checks for sewage pipe blockages or damages since such vices can lead to release of the effluent into the land and water bodies</td>
<td>Provide sanitary facilities for the construction workers</td>
<td></td>
<td>Throughout construction period</td>
<td>1000 per month</td>
</tr>
<tr>
<td>Occupational Health and Safety Risks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approval of Construction Plans</td>
<td>Ensure that all building plans are approved by the Local Authority and the local Occupational Health and Safety Office</td>
<td>Proponent</td>
<td>One-off</td>
<td>-</td>
</tr>
<tr>
<td>Registration of the Premises</td>
<td>Registration of the premises under the Occupational Health and Safety Act Cap 514, of the Laws of Kenya is mandatory</td>
<td>Proponent</td>
<td>One-off</td>
<td>5,000</td>
</tr>
<tr>
<td>General Register</td>
<td>A general register should be kept within the facility as stipulated in Sec 62 (1) of the Occupational Health and Safety Act.</td>
<td>Project Manager &amp; Contractor</td>
<td>One-off</td>
<td>1,000</td>
</tr>
<tr>
<td>Incidents, Accidents and Dangerous Occurrences.</td>
<td>Ensure that provisions for reporting incidents, accidents and dangerous occurrences during construction using prescribed forms obtainable from the local Occupational Health and Safety Office are in place.</td>
<td>Project Manager, Developer &amp; Contractor</td>
<td>Continuous</td>
<td>500/month</td>
</tr>
<tr>
<td></td>
<td>Enforcing adherence to safety procedures and preparing contingency plan for accident response in addition safety education and training be emphasized.</td>
<td>The Contractor, Project Manager &amp; Site Safety Officer</td>
<td>Continuous</td>
<td>50,000</td>
</tr>
<tr>
<td>Insurance</td>
<td>Ensure that the premises are insured as per statutory requirements (third party and workman’s compensation)</td>
<td>Project proponent</td>
<td>Annually</td>
<td>-</td>
</tr>
<tr>
<td>Impacts</td>
<td>Recommended Measures</td>
<td>Responsible Party</td>
<td>Time Frame</td>
<td>Cost (Ksh)</td>
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<tr>
<td>---------------------------------------------</td>
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</tr>
<tr>
<td>Safety Healthy Environment (SHE) Policy</td>
<td>Develop, document and display prominently an appropriate SHE policy for construction works</td>
<td>Project Manager, Developer &amp; Contractor</td>
<td>One-off</td>
<td>1,000</td>
</tr>
<tr>
<td>Sanitary Conveniences</td>
<td>Suitable, efficient, clean, well-lit and adequate sanitary conveniences should be provided for construction workers</td>
<td>Project Manager</td>
<td>One-off</td>
<td>5,000</td>
</tr>
<tr>
<td>Machinery/Equipment Safety</td>
<td>Ensure that machinery, equipment, personal protective equipment, appliances and hand tools used in construction do comply with the prescribed safety and health standards and be appropriately installed maintained and safeguarded</td>
<td>Project Manager, Project Manager</td>
<td>One-off</td>
<td></td>
</tr>
<tr>
<td>Storage of Materials</td>
<td>Ensure that materials are stored or stacked in such manner as to ensure their stability and prevent any fall or collapse</td>
<td>Project Manager</td>
<td>Continuous</td>
<td>10,000</td>
</tr>
<tr>
<td>Safe Means of Access and Safe Place of Employment</td>
<td>All floors, steps, stairs and passages of the premises must be of sound construction and properly maintained</td>
<td>Contractor</td>
<td>Continuous</td>
<td></td>
</tr>
<tr>
<td>Emergency Preparedness and Evacuation Procedures</td>
<td>Design suitable documented emergency preparedness and evacuation procedures to be used during any emergency</td>
<td>Contractor</td>
<td>One-off</td>
<td>1,000</td>
</tr>
<tr>
<td>First Aid</td>
<td>Well stocked first aid box which is easily available and accessible should be provided within the premises</td>
<td>Contractor</td>
<td>One-off</td>
<td>5,000</td>
</tr>
<tr>
<td></td>
<td>Provision must be made for persons to be trained in first aid, with a certificate issued by a recognized body.</td>
<td>Contractor</td>
<td>One-off</td>
<td>10,000</td>
</tr>
<tr>
<td>Impacts</td>
<td>Recommended Measures</td>
<td>Responsible Party</td>
<td>Time Frame</td>
<td>Cost (Ksh)</td>
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</tr>
<tr>
<td><strong>Fire Protection</strong></td>
<td>Fire fighting equipment such as fire extinguishers and hydrant systems should be provided at strategic locations such as stores and construction areas.</td>
<td>Project Manager &amp; Contractor</td>
<td>One-off</td>
<td>30,000</td>
</tr>
<tr>
<td></td>
<td>Regular inspection and servicing of the equipment must be undertaken by a reputable service provider and records of such inspections maintained</td>
<td>Project Manager &amp; Contractor</td>
<td>Every 3 months</td>
<td>5,000</td>
</tr>
<tr>
<td></td>
<td>Signs such as “NO SMOKING” must be prominently displayed within the site, especially in parts where inflammable materials are stored</td>
<td>Project Manager &amp; Contractor</td>
<td>One-off</td>
<td>—</td>
</tr>
<tr>
<td><strong>Ventilation</strong></td>
<td>Enough space must be provided within the premises to allow for adequate natural ventilation through circulation of fresh air</td>
<td>Contractor</td>
<td>One-off</td>
<td>—</td>
</tr>
<tr>
<td><strong>Lighting</strong></td>
<td>There must be adequate provision for artificial or natural lighting in all parts the premises in which persons are working or passing</td>
<td>Contractor</td>
<td>One-off</td>
<td>—</td>
</tr>
<tr>
<td><strong>Electrical Safety</strong></td>
<td>Circuits must not be overloaded</td>
<td>Contractor</td>
<td>Continuous</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Distribution board switches must be clearly marked to indicate respective circuits and pumps</td>
<td>Contractor</td>
<td>One-off</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>There should be no live exposed connections</td>
<td>Project Manager</td>
<td>Continuous</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>All electrical equipment must be earthed</td>
<td>Project Manager</td>
<td>One-off</td>
<td>—</td>
</tr>
<tr>
<td><strong>Vector-borne and Water-borne Disease Incidences</strong></td>
<td>Complete refuse collection and handling service to be provided</td>
<td>Contractor</td>
<td>Continuous</td>
<td>5,000</td>
</tr>
<tr>
<td><strong>Insecurity</strong></td>
<td>Appoint security personnel operating 24 hours</td>
<td>Security guard</td>
<td>Continuous</td>
<td>50,000</td>
</tr>
<tr>
<td></td>
<td>Security alarms will be installed</td>
<td>proponent</td>
<td>Continuous</td>
<td>—</td>
</tr>
</tbody>
</table>
| Air Pollution | Suitable wet suppression techniques need to be utilized in all exposed areas | Site manager | Continuous
| All unnecessary traffic must be strictly limited on site speed controls are to be enforced | Site manager | Continuous
| Land take | The proponent should ensure that the affected person is compensated on a willing-buyer-willing-seller basis to avoid future complaints. | AWSB and Kikuyu Water Company | Before construction | 2,630,000 |
### Table 7.2: Proposed EMP during the Operation Phase of the Project

<table>
<thead>
<tr>
<th>Area of Concern</th>
<th>Environmental Impact</th>
<th>Standards and Guidelines</th>
<th>Management and Mitigation</th>
<th>Monitoring Requirements</th>
<th>Responsibilities</th>
<th>Priority/Action Level</th>
<th>Approximate Cost (Kshs)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy Consumption</strong></td>
<td>High Mains-electricity consumption</td>
<td>Ministry of Energy, KPLC</td>
<td>● Use energy-saving lights such as fluorescent tubes</td>
<td>Keep and strive to maintain a low electricity consumption factor (units)</td>
<td>All workers</td>
<td>High</td>
<td>10,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● Use light-sensors for automatic switch-off during the day</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Road Traffic and Safety</strong></td>
<td>Risks of accidents as vehicles are entering or exiting the facility</td>
<td>Traffic Act, Chapter 403, Part VI and VII.</td>
<td>● Place prominent signage alerting parking area for incoming vehicles to the facility</td>
<td>The management should file any accident reports that happen on the site</td>
<td>Management and Local Authority</td>
<td>High</td>
<td>5,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● Provide safety visibility measures for vehicles coming out/in of the premises</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● Erect signage showing location of the facility</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wastewater</strong></td>
<td>Risks of the drainage system blockage due to clogging of wastes in the system.</td>
<td>Public Health Act, Chapter 242 Part IX</td>
<td>● Periodic checks and regular maintenance should be carried out on the functioning of the wastewater system</td>
<td>Recommended measures</td>
<td>Project management</td>
<td>High</td>
<td>2,000 per month</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| **Solid Wastes** | A health hazard may arise from pathogen carriers such as pests and rodents | EMCA, 1999 | • The refuse areas should be secured and enclosed to minimize the risk of pests and rodents  
• If possible, division should be incorporated to enable the source separation of the wastes to enable recycling and resource recovery | Periodic checks and regular maintenance should be carried out on the functioning of the waste management (collection and disposal) system | Facility Management and Local Authority | Medium | 5,000 |
| **Air quality** | Dust pollution | EMCA, 1999 | • Provide adequate ventilation | Full time monitoring and supervision during operation by senior workers | Project Management and Public Health Inspectors | High | 5,000 |
| **Fire and Accident Prevention** | Uncontrolled burning causes risk of fire | The Panel Code Chapter 63 and the Public Health Act, Chapter 242 | • An inventory should be kept for all fire protection measures  
• ‘No smoking’ sign should be prominently displayed  
• Maintain first aid cylinders and kits  
• Regular training of the personnel in relation to fire | Regular inspection and servicing of the fire equipment installed by a licensed contractor and approved by Kikuyu Town Council fire inspector | Project Management | High | 30,000 |
| Water Resource Use and Conservation | Supply of water and conservation | Water Act, 2002 | • Identify alternative sources of water for some uses such as rainwater harvesting and storage in large tanks  
• Construct bigger storage facilities to be able to cope with potential stresses in supply | • Conducting regular maintenance of pipes and taps to fix leakages  
• Use of PVC piping  
• Fix and use self-closing taps with shorter hand-wash cycles at the offices | Project Management | High | 15,000 per month |
| Runoff | Flushing of the sewerage system could increase the risk of pollution to soil and groundwater | EMCA, 1999 | Inspection of the sewerage system and recovery of intercepted volumes during the rainy season to minimize risk of flushing | Periodic checks and regular maintenance should be carried out on the functioning of the sewerage system and cut-off-system | Project Management and Local Authority | Medium | 2,000 |
| Health and Safety Management | Employee fatigue, accidents, exposure to harmful substances such as dust | OHS Act, 2007 | • Provide first aid facilities  
• Develop employee training programmes on health and safety  
• Establish a health and safety plan | Full time routine monitoring | Project Management | Medium | 20,000 |
<table>
<thead>
<tr>
<th><strong>Record Keeping and Documentation</strong></th>
<th>Environmental Degradation</th>
<th>NEMA Regulations, Public Health Act</th>
<th>Develop procedures for documentation of records keeping of all environmental and health concerns</th>
<th>Routine</th>
<th>Project Management, District Environment Officers and Public Health Officers</th>
<th>Medium</th>
<th>10,000</th>
</tr>
</thead>
</table>
| **Environmental Policy**           | Lack of commitment to environmental concerns | EMCA, 1999                        | • Develop an environmental policy as a guiding principle for corporate environmental management  
• Encompass an elaborate environment plan as a framework for monitoring mitigation | Routine | Project Management                                                                 | High   | 15,000 |
Table 7.3: Proposed EMP during the Decommissioning Phase

<table>
<thead>
<tr>
<th>Expected Negative Impacts</th>
<th>Recommended Mitigation Measures</th>
<th>Responsible Party</th>
<th>Time Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid Wastes</td>
<td>Use of an integrated solid waste management system through a hierarchy of options: source reduction, recycling, composting, reuse, combustion and sanitary land filling</td>
<td>Resident Project Manager and Contractor</td>
<td>One-off</td>
</tr>
<tr>
<td></td>
<td>All buildings, machinery, equipment, structures and partitions that will not be used up must be removed and recycled/reused</td>
<td>Resident Project Manager and Contractor</td>
<td>One-off</td>
</tr>
<tr>
<td></td>
<td>All foundations must be removed and recycled, reused or disposed of at a licensed disposal site</td>
<td>Resident Project Manager and Contractor</td>
<td>One-off</td>
</tr>
<tr>
<td></td>
<td>Where recycling/reuse of the machinery, equipment, implements, structures, partitions and other demolition waste is not possible, the materials should be taken to a licensed waste disposal site</td>
<td>Resident Project Manager and Contractor</td>
<td>One-off</td>
</tr>
<tr>
<td></td>
<td>Donate reusable demolition waste to charitable organizations, individuals and institutions</td>
<td>Resident Project Manager and Contractor</td>
<td>One-off</td>
</tr>
<tr>
<td>Vegetation and Animal Disturbance</td>
<td>Implement an appropriate re-vegetation programme to restore the site to its original status</td>
<td>Resident Project Manager and Contractor</td>
<td>One-off</td>
</tr>
<tr>
<td></td>
<td>Consider use of indigenous plant species in re-vegetation</td>
<td>Resident Project Manager and Contractor</td>
<td>One-off</td>
</tr>
<tr>
<td></td>
<td>Trees should be planted at suitable locations so as to interrupt slight lines (screen planting) between the adjacent area and the development</td>
<td>Resident Project Manager and Contractor</td>
<td>Once-off</td>
</tr>
</tbody>
</table>
9. CONCLUSIONS AND RECOMMENDATION

The EMP as set out in the document seeks to point out measures that can be followed to address concerns raised as regards the three phases of the proposed project: Construction, Operational and Decommissioning. These include all the environmental areas of concern some of which are water supply and use, energy-use, solid & liquid waste management, record keeping and health and safety of workers.

Proper management of water and drainage lines around the proposed project will greatly improve quality of sanitation around it. High standards of construction and regular maintenance practices are strongly recommended to reduce the degree of pollution in the water supply system since the quality of water largely depends on these two aspects.

Periodical monitoring of the effluent to ensure conformity to the Kikuyu Town Council standards, are recommended. Record keeping and documentation need to be done. In addition to documentation of emergency and records of environmental importance, the following documents need to be kept; records on, fire & accidents; records on staff training in health & safety. These will assist in building of self-auditing capacity and ensure achievement of proposed environmental management and monitoring plan.

The proposed development management needs to develop a corporate environmental policy stating commitment, intentions and principles of action with respect to the environment including compliance with relevant environmental regulations. This is to form a basis upon which the management of the facility is to set its environmental objectives and targets as in the environmental management plan.

The management is to comprehensively implement the recommendations as given in the EMP to improve on their level of compliance. These mitigations will not only be of benefit to the proposed development, but will also assist other stakeholders in understanding and managing the environment.

The report concludes that if all the suggested mitigation measures and the above recommendations are put in place and if the proposed EMP is followed, the proposed project will have minimal adverse impacts on the environment.
REFERENCES

Reference was made from the following plans and acts:

- Structural plans for the proposed building obtained from the proponent
- The Kikuyu Constituency Strategic Plan (2009 – 2013)
- Ministry of Water and Irrigation Strategic plan (2009-2012)
- Land Planning Act (Cap 303)
- Local Government Act (Cap 265)
- Environmental Management and Coordination Act, 1999
- NEMA (2003); the Environmental Impact Assessment and Audit and Regulation
- Physical Planning Act, 1999
- Way Leaves Act, (Cap 292)
- Public Health Act, Cap 242
- Penal Code (Cap 63)
- Traffic Act (Cap 403)
- Water Act, 2002

The offices and authorities visited to facilitate the study include:

- The Kikuyu District Physical Planning Office
- The Kikuyu District Land Registrar’s Office
- The Kikuyu District Environment Office
- The Town Council of Kikuyu Office
- Central Bureau of Statistics
APPENDICES

- Minutes of meeting and attendance sheet
- EIA Public Consultation Questionnaires
- Hydrological Report
- Valuation Report
Appendix 1: Minutes of meeting and attendance sheet
MINUTES FOR THE MEETING HELD AT THE PROPOSED INTAKE AREA AT KIKUYU SPRINGS, KIDFARMACO FOR KIKUYU WATER PROJECT ON 27TH SEPTEMBER 2013

AGENDA: Public sensitization on the proposed Kikuyu water supply project

The meeting was chaired by the MD Kikuyu Water Company (KWC). It began with prayers from one of the community members followed by introductions from each of the members present. She welcomed everyone to the meeting and informed the gathering that this meeting was to inform them of the proposed Kikuyu Water Supply Project. She then welcomed the consultant to address the meeting.

The meeting was informed that the agenda of the meeting was to inform the meeting and get their opinions on the project. This is as per requirements of National Environment Management Authority (NEMA). The project is funded by World Bank and will include construction of an intake weir, 100m³ capacity sump, pump house, perimeter fencing around the facility, a 8 inch diameter UPVC pipeline from springs to our elevated tank at booster station 2.5km away and soil protection measures by constructing gabions on the erosion prone area.

He said that Athi Water Services Board who will be constructing the project intends to improve water supply in the area. The project will also provide better accommodation for the operator and security agents at the source. The project is also envisioned to provide a wide range of job opportunities right from construction through operation.

The floor was then open for comments, question and answers.

- The members were happy that the project is being implemented as they have been facing water shortages therefore frequent rationing.
- Would the people of the community be able to get the manual labor jobs that may arise from the project? Yes, the contractor will employ locals and more so the youth through manual and unskilled labour.
• Is the water quantity that would be supplied be enough to meet and satisfy the needs of the current population or will it recede as other water quantities from other projects have. The water quantities are enough to serve the residents for a long period of time.

• For those people living far away from the main pipeline would they be able to be supplied with the water. On this note they were informed that the water service provider i.e. KWC who are serving the community in the area are responsible for provision of a pipeline network to all the homesteads in the area.

• The community wanted to know if their land and property will be affected by the project. They were told that the project will majorly be constructed on public land and effects on private property are not envisaged. However, they were informed that incase someone’s property is interfered with during construction, they will be compensated adequately.

There being no other business the meeting adjourned at 12:15PM
<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Org/Area</th>
<th>Contact</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Hannah N. Karanja</td>
<td>Kirimbi</td>
<td>0721457692</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Susan Wambui</td>
<td>Thogoto</td>
<td>0726113006</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Mary W. Muiruri</td>
<td>Thogoto</td>
<td>0720426225</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Nancy N/Aguna Kimani</td>
<td>Kidabo</td>
<td>0723504524</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Peter N. Karanja</td>
<td>Ndukanini</td>
<td>0721777721</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Evan K. Mungai</td>
<td>Kidambezi</td>
<td>0717817182</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>James Njoroge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Mary Waithira</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Benson Nginyi</td>
<td></td>
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</tr>
<tr>
<td>10.</td>
<td>PETER KALORI</td>
<td>Health</td>
<td>0713237977</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Lazaro M. Muli</td>
<td>Thogoto</td>
<td>0722896204</td>
<td>L.N.</td>
</tr>
<tr>
<td>12.</td>
<td>Samuel M. Mwaura</td>
<td>Thogoto</td>
<td>0721457642</td>
<td>S.N.</td>
</tr>
<tr>
<td>13.</td>
<td>Veronica W. Matara</td>
<td>Kiruhyu</td>
<td>0720593327</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>David Kimani</td>
<td>Kiruhyu</td>
<td>0723998571</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Sammy Chacha</td>
<td>Kiriti</td>
<td>0722948807</td>
<td>Chimw</td>
</tr>
<tr>
<td>16.</td>
<td>Geoffrey Karanja</td>
<td>Kikuhyu</td>
<td>0708336163</td>
<td>Galagayi</td>
</tr>
<tr>
<td>17.</td>
<td>Tabitha M. Karunki</td>
<td>KuchCo</td>
<td>0724955880</td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>Susan W. Wawuru</td>
<td>Kidambezi</td>
<td>0725113006</td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>Teresita N. Karanja</td>
<td></td>
<td>0729795429</td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix 2: EIA Public Consultation Questionnaires
Athi Water Services Board is preparing Environmental Impact Assessment project report for proposed Kikuyu water supply improvement project in Kikuyu springs. The process requires adequate community consultations on the anticipated impacts both social economic and environmental that might result due to the construction of the project which includes construction of intake weirs and water distribution pipelines. You are therefore requested to list your concerned in the space provided below for the purposes of inclusion in the EIA report as well as design of the project.

<table>
<thead>
<tr>
<th>Interviewee’s Name</th>
<th>ID Number Interviewee’s</th>
<th>Interviewee’s Contact</th>
<th>Date of Interview</th>
</tr>
</thead>
</table>

**Physical, biological and socio-economic concerns**
1. ………………………………………………………………………………………………………………………………
2. ………………………………………………………………………………………………………………………………
3. ………………………………………………………………………………………………………………………………
4. ………………………………………………………………………………………………………………………………
5. ………………………………………………………………………………………………………………………………
6. ………………………………………………………………………………………………………………………………
7. ………………………………………………………………………………………………………………………………
8. ………………………………………………………………………………………………………………………………

**Respondent Sign**

………………

**Telephone**

………………
Appendix 3: Hydrological Report
HYDROLOGICAL ASSESSMENT REPORT:
KIKUYU SPRINGS
FOR
ATHI WATER SERVICES BOARD

OCTOBER, 2015

Consultant:
James K. Waititu
P.O. Box 55020-00200
Nairobi

Client:
The Chief Executive Officer
Athi Water Services Board
P.O. Box 4828-00100
Nairobi
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Hydrological assessment of Kikuyu Springs

For Athi Water Services Board

J. K. Waititu
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1.0 Introduction

The Athi Water Services Board (AWSB) has engaged Kikuyu Water and Sanitation Company Ltd (KIWASCO) to be a Water Service Provider within Kikuyu Township and its environs through a Service Provision Agreement (SPA) as required by the Water Act 2002. KIWASCO is therefore required to provide water services efficiently and economically in Kikuyu and its environs in compliance with the SPA.

KIWASCO has three water schemes namely Kikuyu, Karai and schemes formerly owned by the Town Council of Kikuyu.

The water company’s designated area of supply is the entire Kikuyu Sub-County with an area of 236.1 km². The population in the entire Sub-County is 265,829 with 77,045 households but only a total of 79,748 persons are currently supplied with water which translates to about 30% supply level. The total area served by the company is 65 km². This means that the existing water demand far outweighs supply; however, there are several self help water projects within the supply area of jurisdiction that supplements the supply, thus reducing the deficit.

The existing water supply serves the Kikuyu town centre and its peripheries only. It has a daily total production of 4,552 m³ while the total water demand in the supply area is estimated at 36,763 m³/day.

Noting the proximity of Kikuyu Township sub-locale to Nairobi, the area has become an important residential area for a large population working in Nairobi. Thus the implementation of water supply projects is a high priority for the company.

To improve on its water supply level, KIWASCO through the Athi Water Services Board, is developing the Kikuyu Springs Water Supply Improvement Works at the outlet of the Kikuyu Springs.

The Kikuyu Springs has also been a dependable source of water for Nairobi City providing a relatively constant amount of water all year round. The Kikuyu Springs is a subterranean water system that is connected to Ondiri Swamp and has a recharge area covering approximately 161 km². The area surrounding the eye of the springs is a patch of a relic forest that was part of the forest system that extended from Ngong Forest to the Aberdare Forest.

In order to meet the requirements of the Water Act 2002 and the Water Resources Management Rules of 2007 with respect to the issuance of water abstraction permits, the Athi Water Services Board intends to make an application to the Water Resources Management Authority, Athi Water Catchment Area for a water permit to abstract 1,200 m³/day of water from the Kikuyu Springs outflow at coordinates 37 M 0240728, UTM 9861980 at an altitude of 1970m.a.s.l. \(\text{(Map Sheet No. SK 148/1, Scale 1:50,000)}\). This report is intended to investigate the availability of water at the Kikuyu Springs for allocation to the project.

2.0 Background Information/Physiography

2.1 Geographical Location

The Kikuyu Water Company is located in Kikuyu Township sub-location, Kikuyu Location in Kikuyu Division of Kikuyu Sub-County in Kiambu County. The Kikuyu Springs are located on the eastern edge of Kikuyu Town at coordinates 37 M 0240549, UTM 9861969. The location of the Kikuyu Springs is shown on figure 1.
The Kikuyu Springs outflow forms the headwaters of Nairobi River.

2.2 Physiography
The surface relief of Kikuyu Springs catchment is dominated by raised horst blocks and narrow down-faulted valleys. Some of the valleys are shallow compared to their breadth and are hence referred to as depressions. Examples of these depressions are the Nyakumu and Nduma Depressions. The depressions become naturally inundated forming swamps.

Studies on the recharge zone for Kikuyu Springs have shown that the highest point in the catchment is found at Kirenga at 2419 m.a.s.l. in the north while the lowest relief is found at the Kikuyu Springs at 1970 m.a.s.l. This makes the springs the natural free outlet of groundwater from the system. To the west, the watershed divide runs above the Kikuyu Escarpment while its eastern boundary is marked by a series of faults from Uplands to Sigona.

2.3 Geology and Soils
Geologically, the project area is characterized by a sequence of Tertiary and Quaternary volcanic lava flows that is extensively faulted and displaced against each other.

The geology determines the soil types developed and the soil texture affects recharge rates; loose-textured soils influencing greater recharge.

The soils developed on these volcanic rocks are deep clay loams which have better recharge rates than pure clay soils. The faults and structured discontinuities further enhance recharge rates.
3.0 Climate and Rainfall

The Kikuyu Springs lies within the Semi-humid agro-climatic zone with cool temperate climate as deduced from the Agro-Climatic classification of Kenya.

The mean annual temperature in the project area varies from 16°C to 18°C. The mean annual maximum temperature varies from 22°C to 24°C, while the mean annual minimum temperatures vary from 10°C to 12°C.

On rainfall trends, analysis of the rainfall records from Kikuyu Agriculture Office indicates that the rainfall exhibits a bimodal pattern with two major rainy peaks in April and November. The July to September period has the lowest monthly rainfall at less than 40mm per month. The mean monthly rainfall for the project area based on the analysis of the rainfall data from Kikuyu Agriculture Office is depicted in Table 1.0 and Figure 2. The project area experiences a mean annual rainfall of 975mm.
Table 1.0: Long-term mean monthly rainfall; Kikuyu Agriculture Office

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF</td>
<td>46.5</td>
<td>46.2</td>
<td>87.2</td>
<td>237.9</td>
<td>163.9</td>
<td>31.9</td>
<td>20.1</td>
<td>26.8</td>
<td>23.1</td>
<td>66.1</td>
<td>140.5</td>
<td>85.4</td>
</tr>
</tbody>
</table>

Figure 2: Kikuyu Agriculture Office: Long-term mean monthly rainfall

4.0 Current Land Use
The project area lies in a semi-humid agro-climatic zone and being a high potential area with fertile red soils, agricultural farming is a major income generating activity for the area residents. Maize, beans, potatoes and a variety of horticultural crops are grown on small land holdings for the Nairobi market.

Dairy farming is practiced mainly through zero grazing due to the relatively small sizes of the farms and due to its proximity to Nairobi, real estate developments are picking up with many apartment blocks coming up in Kikuyu Town and its environs.

5.0 Project Water Demand
Due to the inadequate water supply in Kikuyu Town and its environs, KIWASCO intend to apply for a water permit to abstract 1,200 m³/day of water from Kikuyu Springs outflow. The applicant would have applied for a higher volume but the level of abstraction will be limited by the availability of water at the spring. The abstraction will be the gravity flow from the springs.
6.0 River Water Body

The water body under reference is Kikuyu Springs whose recharge zone has been identified as a 161 km\(^2\) catchment area extending from the Bathi Springs in the north to just beyond Nyakumu Swamp in the south. To the west, the recharge zone runs along the Thigio-Nduini contour while its eastern boundary is marked by a series of faults from Uplands to Sigona.

Studies have shown that the highest point in the catchment is found at Kirenga at 2419 masl in the north while the lowest relief is found at the Kikuyu Springs at 1970 m.a.s.l. This makes the springs the natural free outlet of groundwater from the system and follows the definition of a spring as the surface manifestation of water that has been recharged into the groundwater system and released back into the surface water system as an integral part of the hydrological cycle.

The main recharge rock is the Limuru Trachyte, but groundwater infiltrates way down into the Karura and Kabete trachytes, which form the second of two main aquifers. Tuffs of the Kerichwa Valley Series form the base of the aquifer having somewhat poorer permeability than the overlying rocks. This forces groundwater to flow out under hydrostatic pressure through fractures in the overlying trachytes at the Kikuyu Springs. Figure 3 depicts a hydrogeological section from Lari Swamp to the north to the Kikuyu Springs.

The outflow from the Kikuyu Springs forms the headwaters for Nairobi River, a river that flows through the City of Nairobi before its confluence with Athi River further downstream. The Nairobi River sub-basin comprising Nairobi River subcatchment, the Ngong River subcatchment, the Gitathuru subcatchment, the Rui Ruaka subcatchment and Gatharaini subcatchment form the Nairobi Management Unit as depicted in figure 4.

![Figure 3: Hydrogeological section (Lari Swamp to Kikuyu Springs) (Source: Study of Groundwater Recharge to the Kikuyu Springs)]](image)
7.0 Hydrological Investigations

7.1 Fieldwork
A reconnaissance survey of the project area was carried out in order to assess the resources, note other relevant issues on the ground and get a first hand impression of the project area. During the time of the visits on 19th and 26th September, 2015, spot gauging of the outflow from the springs was undertaken.

7.2 Desk study
The task involved the analysis of the available hydrological data to deduce the possible surface water flow scenarios at the proposed water abstraction point.
8.0 Hydrological Analysis

8.1 Surface water data availability

There is no Regular Gauging Station (RGS) on Nairobi River near its source at the Kikuyu Springs. The proposed Kikuyu Water Project will abstract water from the Kikuyu Springs, at the headwaters of Nairobi River at coordinates 37 M 0240729, UTM 9861983 (E036.67009, S001.24764) at an altitude of 1961 m.a.s.l. Recognizing that the source for the abstraction is a spring, further analysis on water abstraction has been limited to the spring source and its outflow.

The outflow from the spring was gauged on 19<sup>th</sup> September, 2015 and yielded a discharge of 0.01667 m<sup>3</sup>/s equivalent to 1,440.288 m<sup>3</sup>/day. A second gauging was undertaken on 26<sup>th</sup> September, 2015 that yielded the same result.

9.0 The Reserve

The Water Act 2002 and the Water Resources Management Rules 2007 define how water resources may be used, and the aspects the Water Resources Management Authority (WRMA) must consider when making allocations. Of particular importance is the Reserve, part of which is that volume from the water resource required to meet basic human needs.

The Water Act 2002 defines the Reserve as:-

*That quantity and quality of water required:

a) To satisfy basic human needs for all people who are or may be supplied from the water resource;

and,

b) To protect aquatic ecosystems in order to secure ecologically sustainable development and use of the water resource*

The Water Resources Management Rules describe the Reserve as follows:

*The Reserve in all instances will comprise of one element related to the quantity of the resource and the respective probability associated with that quantity and a second element related to the quality of the reserve”.*

The Guidelines for Water Allocation recognizes that spring yields are much less variable than flow from rivers, although where the yield is variable, then spring water resources should be treated as river water. Information availed by the local community of the Kikuyu Springs environs have confirmed that the outflow at the spring outlet does not vary appreciably. This was confirmed by the spot gauging undertaken during this study showing the same output over a one week period.

The Guidelines for Water Allocation proposes that the Reserve from a spring with stable flow may be estimated as at least 5% of the average daily flow in cubic meters per day. Effectively, this implies that up to 95% of average daily flow from a stable spring may be available for allocation.
Accordingly, the Reserve for Kikuyu Springs at the outflow is estimated at 5% of the measured outflow.

As stated above, the spring outflow was gauged on 19th September, 2015 yielding a discharge of 0.01667 m$^3$/s equivalent to 1,440.288 m$^3$/day. A second measurement was undertaken on 26th September, 2015 which gave the same result, i.e. 0.01667 m$^3$/s (1,440.288 m$^3$/day). These measurements indicate stable outflows from the springs, and taking a Reserve of 5% equivalent to 72.0144 m$^3$/day, there would be a balance of 1368.2736 m$^3$/day.

The outflows from the spring go through the spillway – as this is the only outlet from the spring. At the current design level of the spillway, no additional outflow would be expected considering that the total outflow from the spring will remain stable.

10.0 Permitted Abstractions

Recent studies of the Kikuyu Springs including its recharge zone has established that 9 million cubic metres (9 MCM) of water are abstracted annually over the entire zone through boreholes and the springs. This abstraction represents 68% of the estimated 13.2 million cubic metres of the annual recharge. The balance of 4.2 MCM go into the balance as natural flow to the east, west and south out of the system and for maintaining piezometric levels in the system.

11.0 Water Balance

The gauging undertaken on 19th and 26th September, 2015, yielded a discharge of 0.01667 m$^3$/s equivalent to 1,440.288 m$^3$/day from Kikuyu Springs. It is logical to conclude that the production from the springs is generally stable throughout the year. This assumption is supported by information given by the local community who stated that the spring outflows do not vary appreciably throughout the year.

According to the Water Act 2002 and the Water Resources Management Rules 2007, the reserve should not be allocated and should remain in the river to sustain the ecology and meet the basic human needs.

Setting the reserve from springs at 5% of the average daily spring yield implies that 95% of the yield available can be allocated. Based on the measured yields, the spring reserve flow stands at 72.0144 m$^3$/day while the amount available for allocation is 1368.2736 m$^3$/day.

The initial water requirement by the Kikuyu Water Company from the Kikuyu Springs was put at 4,000 m$^3$/day; however, the analysis has established that the this requirement could not be met based on the current design of the retaining weir at the spring.

Noting that the outflow from the spring become polluted soon after the outflow point due anthropogenic activities, it is recommended that most of the outflow should be allocated to Kikuyu Water Project to meet some of the demands in the supply area but at the same time ensuring some environmental flow in the river system. Accordingly, it is recommended that the project be allocated 1,200 m$^3$/day of water leaving a balance of 168 m$^3$/day which is much more than the computed Reserve flow.
12.0 Impacts on the River Regime and Downstream Users

The project intends to abstract 1,200 m$^3$/day of water from the spring outflow which is approximately 87% of the measured spring outflow. This abstraction will have significant impacts on the river regime within the immediate surroundings of the abstraction point but these impacts are mitigated on by additional inflow of water from the Nyongara Stream that flows from Ondiri Swamp and discharges into Nairobi River downstream. On downstream users, the environmental flow is the most important as the river become polluted soon after the spring outlet. However, the reserve released from the spring will be adequate to meet the environmental requirements.

13.0 Conclusions and Recommendations

13.1 Conclusions

The provision of safe water supply and basic sanitation to communities is contributing significantly to the achievement of the Millennium Development Goals as agreed under the United Nations Millennium Declaration in 2000. Towards this end, the provision of adequate and portable water to the residents of Kikuyu location will contribute towards achieving the Millennium Development Goals, in particular Target 10 of the MDGs that address water supply and sanitation and calls upon member states to halve by 2015 the proportion of people without access to safe drinking water and basic sanitation.

The granting of a water permit to the project will go a long way in enhancing the socio-economic status of the residents residing in the project supply area.

13.2 Recommendations

It is recommended that, subject to the project proponents meeting the general and specific permit conditions:

i) The project be allocated 1,200 m$^3$/day of water from the normal spring outflow for public supply;

ii) The project should install water measuring and control devices to ensure that it only abstracts the authorized water volume for public supply;

iii) The project proponents implement water demand management measures to improve water use efficiency by reducing leakages.
Appendix 4: Valuation Report
REPORT AND VALUATION

ON

AN AGRICULTURAL PARCEL OF

L.R. NO. KIKUYU/KIKUYU BLOCK 1/363

KID FARMACO KIKUYU TOWNSHIP

KIKUYU DIVISION

TERMS OF REFERENCE:

Acting on instructions received from Kikuyu Water Company Limited vide letter Reference No. KWC/ADM.GENERAL/VOL. II of 11th October, 2013. We inspected the property with a view to advising on its current open market value for purchase purposes after the shift away from high voltage power line way leave.

Below is our report and valuation.
<table>
<thead>
<tr>
<th><strong>PARCEL</strong></th>
<th>L.R. NO. Kikuyu/Kikuyu block 1/363</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AREA</strong></td>
<td>The parcel under purchase measures approximately (328 x 20) ft. this is approximately – 0.0656 Ha.</td>
</tr>
<tr>
<td><strong>REGISTERED OWNER</strong></td>
<td>The parcel is registered in the name of James Nganga Njonde of ID No. 5187597 according to documents forwarded to us by the Kikuyu Water Company Limited.</td>
</tr>
<tr>
<td><strong>SITUATION</strong></td>
<td>The parcel is located within the Kikuyu Township in Kid Farmco area in Kikuyu town. Access from the town centre is branching to the left after the railway crossing at the bridge for about 1 kilometer towards the river with water pump on spring which supplies water to Kikuyu township in Kip Farmco area of Kikuyu.</td>
</tr>
<tr>
<td><strong>THE PLOT</strong></td>
<td>The land earmarked for purchase is rectangular in shape with very steep gradient, red alluvial and murram soils. The boundaries are not yet marked, but at the steep end are marked by the river and the Kikuyu water supply pump.</td>
</tr>
<tr>
<td></td>
<td>It is important to note that the land lies next to high voltage power line way leave according to what was shown to us and the sketch plan recently provided to us attached to the letter above.</td>
</tr>
<tr>
<td><strong>DEVELOPMENT</strong></td>
<td>This is a vacant land currently with no structural development and is under nippier grass and wild grass only.</td>
</tr>
<tr>
<td><strong>REMARKS</strong></td>
<td>The parcel is within an area where many residential developments of apartments are currently being undertaken. However the subject parcel is very steep and not developed.</td>
</tr>
<tr>
<td></td>
<td>It is important to note that the land earmarked for the purchase according to what was pointed out to us and sketch plans provided to us seems to have been shifted way from the high voltage power line way leave as opposed to the earlier case.</td>
</tr>
<tr>
<td></td>
<td>It's our opinion that survey work of the area under consideration should be completed to mark out the way leave for Kikuyu Water Company Limited.</td>
</tr>
</tbody>
</table>
VALUATION:

In view of the above factors, situation, size and the development potentially of the parcel we value the freehold interest in the portion of the property under consideration measuring approximately 0.0656 Ha. part of L.R. No. Kikuyu/Kikuyu/Block 1/363 free from all encumbrances as at today's date at Kshs. 2,630,000/= (Read: two million six hundred AND thirty thousand) only.

N. OWINO
PRINCIPAL VALUER

FOR: SNR. DEPUTY COMMISSIONER OF LANDS (VALUATION)
KIKUYU DIVISION FAMERS & MARKETING CO.LTD
P.O.BOX 702-00902 KIKUYU Tel 0721-304933

RE: KIKUYUY/KIKUYU BLOCK 1/363 LETTER OF ALLOTMENT

This is to certify that JAMES NGANGA NJONDE, holder of Identity card No. 5187597 at Post office 44595 NAIROBI, is the owner of the above referred subplots.

He/she was not issued with a letter of allotment neither has this received it.

The owner would like to pursue the certificate of lease by his/her, any assistance accorded to him/her is highly appreciated.

Yours faithfully,

MWAURA GITUKUI
CHAIRMAN

SOLOMON NGURE
SECRETARY