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African Development Bank (AfDB)

MINISTRY OF AGRICULTURE, LIVESTOCK AND FISHERIES

STATE DEPARTMENT OF CROP DEVELOPMENT

**SMALL SCALE IRRIGATION AND VALUE ADDITION
PROGRAMME (S-I-V-A-P)
P.O Box 30028-00100 Nairobi Kenya**

**ENVIRONMENTAL IMPACT ASSESMENT
STUDY REPORT FOR THE PROPOSED
KAGONGO WEDANI IRRIGATION
SCHEME**

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CERTIFICATION

This Environmental Study Report was prepared by a team NEMA registered EIA/Audit Lead Experts lead Mr. Paul Njuguna;. The EIA report was prepared in accordance with the requirements of the Environmental (Impact Assessment and Audit; amended) Regulations, 2009, pursuant to The Environmental Management and Coordination Act, (EMCA) 1999. The Environmental Impact Assessment (EIA) Study Report is submitted to the National Environment Management Authority (NEMA) in conformity with the requirements of the Environmental Management and Coordination Act, 1999, Section 58 and Part II of the Environmental (Impact Assessment and Audit) (amended) Regulations, 2016. The study is of kagongo wendani irrigation project by the Ministry Of Agriculyure in Oljorok ward in nyadurua county. It assess for existing or potential environmental concerns that may pose a risk to human health or the environmentas a result of project implementation

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EXECUTIVE SUMMARY

Kagongo Wendani Irrigation Scheme is a proposed upcoming development project by the State Department of Agriculture through Small-Scale Small Scale Irrigation and Value Addition Project (SSIVAP)). The project is located at Kagongo Wendani village about 12 km from Nyahururu town along the Nairobi –Nyahururu Highway road and about 3km from Oljororok town. The project area can be accessed by all-weather from Kasuku Market although the road has impassable sections when it is rainy. The project entails the rehabilitation of the Ex-Jacob dam for irrigation water supply, and constructing a closed irrigation system to improve the food security status by providing water for irrigation. It is estimated to have a gross and net irrigable area of 392.72 and 333.80 hectares respectively. There will be no major displacement during construction of the project. The Ex-Jacob Dam is on **GPS coordinates; S00⁰ 08'17.9" and E036⁰19'35.5" it is 2559masl**

The ESIA study was conducted in accordance with the Legal requirement stipulated in the Environmental Management and Coordination Act (EMCA) of 1999 and its subsequent supplements; the Environmental (Impact Assessment and Audit) Regulation, 2003; EMCA (Waste Management) Regulations, 2006 and EMCA (Water Quality) Regulations, 2006; EMCA (Controlled Substance) Regulations, 2007; EMCA (Noise and Vibration Control) Regulations, 2009; EMCA (Emissions Control) Regulations, 2006; EMCA (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, 2009; EMC(Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006; the Land Acts, Water Act, Irrigation Act among other pertinent legal and institutional framework regulating irrigation development.

This report describes the project including project activities and possible environmental impacts likely arise during the construction and operation phase of the project. In addition the report proposes appropriate mitigation measures where negative impacts are likely to occur and ways to enhance the positive impacts if any. Environmental concerns needs to be part of the planning and development process and not an afterthought; it is therefore advisable to ensure sustainability in the implementation of projects. The findings of the study conclude that, the project will have both negative and positive environmental impacts. The negative impacts are generally medium in magnitude and can be easily mitigated. The positive impacts are numerous and should be enhanced. The ESIA study team has given an environmental management plan to guide the proponent in mitigating the negative impacts. From the assessment done and the EMP put in place, it is recommended that the project proceed as planned with the mitigation measures integrated in the implementation.

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LIST OF ACRONYMS

AEZ	Agro-Ecological Zone
AfDB	African Development Bank
CBOs	Community Based Organizations
DEP	District Environmental Plan
EA	Environmental Audit
EIA	Environmental Impact Assessment
EISR	Environmental Impact Assessment Study Report
EMCA	Environmental Management and Coordination Act
EMoP	Environmental Monitoring Plan
EMP	Environmental Management Plan
ESIA	Environmental and Social; Impact Assessment
ESMP	Environmental and Social Management Plan
FAO	Food and Agricultural Organization
FGD	Focused Group Discussion
GOK	Government of Kenya
IWUA	Irrigation Water Users Association
KFS	Kenya forest services
KW	Kenya Wildlife Services
MOA	Ministry of Agriculture
NEAP	National Environmental Action Plan
NEMA	National Environment Management Authority
NGOs	Non-Governmental Organizations
NIB	National Irrigation Board
PPE	Personal Protective Equipment
PPP	Polluter Pays Principle
PRSP	The poverty reduction strategy paper
RGS	River Gauging Stations
SCAO	Sub-County District Agricultural Officer
TOR	Terms of Reference
WB	World Bank
WFP	World Food Programme
WRA	Water Resources Authority
WUA	Water Users Association

CHAPTER ONE

1. INTRODUCTION

1.1 Project Background

The Ministry of agriculture Livestock, Fisheries and Irrigation (MOALF & I) through the State Department of Agriculture in the Small-Scale Irrigation and Value Addition Project (SSIVAP) intends to reduce poverty and food insecurity among the rural poor households by improving the performance of irrigation and marketing infrastructure as well as enhanced methods of horticultural productivity. MOALF&I has the responsibility of overseeing development and improvement of agricultural projects in the country. In response to this mandate, the Ministry has proposed to develop an irrigation project in Kagongo, Nyandarua County which has a net irrigable area of 333.80 Ha through this proposed irrigation project, the Ministry aims to reduce poverty and food insecurity among the rural poor households by improving the performance of irrigation and marketing infrastructure as well as enhanced methods of horticultural productivity.

The aim of the proponent is to assess the possible irrigation technologies e.g. Sprinkler system, that can be suitable in enhancing agriculture and supply adequate irrigation water to the people living within the project area since the area is facing acute water shortage. The area rely on rains which are not adequate to meet the water demands of the farmers of Kagongo, Nyandarua West Sub-County. Agriculture in Kagongo area where the project is located is undertaken by small holder farmers wheretheir main food crops grown include: maize, potatoes, cabbages.

Irrigation in the area will invariably result in many far-reaching ecological changes. Some of these will benefit human population, while others threaten the long term productivity of the irrigation project itself as well as the natural resource base. The undesirable changes are not solely restricted to increasing pollution or loss of habitat for native plants and animals; they cover the entire range of environmental components, such as soil, water, air, and the socio-economic system. It is in this regard that Kenya has accepted the principle of environmental screening of development projects at the planning stage and undertaking ESIA for those that are recommended following the screening process

In order to conform to the requirements spelt out under section 58 of the Environmental Management and Coordination Act, 1999 (EMCA) which stipulates in part that —a project proponent must seek a NEMA license notwithstanding any approval, permit or license granted under this Act or any other law in force in Kenya...‖ and the requirement for NEMA license for all projects listed in the Second Schedule of the Act.

1.2 Justification for the Project

The Expansion of irrigation and drainage infrastructure is considered a priority by the government in enhancing agricultural productivity and thereby contributing to food security and poverty alleviation. Indeed, the development of this irrigation infrastructure in the County is considered very beneficial and cost effective given the vast water resources present. As a result, the local communities are expected to engage in more productive agricultural farming which would lead to food security and reduced poverty. Equally, a significant segment of households in the project areas will benefit from resulting jobs created at on-farm management and income from sale of agricultural produce.

1.3 Objectives

The objective of the study is to carry out an environmental impact study of the proposed development to determine whether or not the project activities will have any adverse impacts on the environment, taking into account environmental, social, cultural, economic and legal considerations.

The specific objectives include: -

- To establish the baseline environment of the proposed irrigation project
- Identifying the impacts of the project and project activities on the environment
- Proposing mitigation measures for the significant negative impacts on the environment
- Generating the baseline data for monitoring and evaluating impacts, including mitigation
- measures during the project cycle.

1.4 Study Methodology and Field Findings

1.4.1 Overview

This study process adopted an integrated approach where data and information evaluation, field investigations, consultations among the team of experts, interviews and discussions with stakeholders and affected parties were undertaken at the same time. The study begun with intensive documentary and literature review of the proposed project documentation, County Integrated Development Plan (CIDP), County Environmental Action Plan, regulations and guidelines (Environmental Management and Co-ordination Act and other related statutes and international codes such as the Water Act and Land Act and other relevant literature.

Physical evaluation of the areas was also carried out with specific focus on the biophysical and socio-economic environments. The sensitive environmental receptors, biodiversity, land use and development trends, hydrology, physiographical features and climatic conditions along

the project route were evaluated and analyzed. The social and economic status was also evaluated through organized consultative meetings at the administrative and communal levels in order to collect perceived information on the impacts associated with biophysical and socio-economic dimensions of project implementation.

The ESIA study team made field visits to the proposed site and conducted desktop study to establish the following:

- Baseline data which included; biodiversity, socio-economic and environmental assessment
- Legal Policies, Legislative and Institutional Framework governing the proposed project
- Perception of the proposed project from the local communities
- Compatibility of the proposed project with the environment
- Types of waste to be generated, proposed management and disposal methods
- Potential positive and negative impacts of the project.

The study assessed and quantified the possible impacts of the proposed project to the residents in general and other administrative areas that share resources with the project beneficiaries.

1.4.2 Site Visits

Information gathering was conducted through site visits at the project and its surrounding areas including households. This involved a systematic field traversing to quantify perceived impacts of project on:-

- Existing land uses;
- Land conflicts and ownership;
- Institutions and organizations in the area;
- Vegetation cover of the area;
- Existing sensitive environmental receptors including underground and surface waters; animal
- feeding grounds and routes, and methods of protection from destruction, interference,
- contamination and extinction; and
- Waste management and disposal methods

1.4.3 Consultative Forums

Socio-economic impact assessment fora were held at the county and sub-county offices. In attendance were the; county director of water and irrigation, Sub-County Agriculture Officer, and Sub-County Livestock Production Officer, Assistant County Commissioner among others. At the

community level talks were held with the chiefs, community elder's religious leaders, and the public at large. The community members were receptive with regard to the project implementation and also emphasized on the need to implement the mitigation measures.

1.5 Scope and Content of the ESIA Report

Environmental and social impact Study included: -

1. Reviewing relevant project documents and related literature.
2. Description of the baseline conditions of the project areas.
3. The analysis of the socio-economic and socio-environmental status of the affected areas during pre and post construction and thus justify development of the irrigation project.
4. Impact identification, evaluation and mitigation measures.
5. Project alternative analysis.
6. Preparation of Environmental and Social Management Plan (ESMP) and Environmental Monitoring plan (EMP).
7. Undertaking public consultation

1.6 Terms of Reference

This ESIA study was undertaken in accordance with provisions of EMCA and requirements of the Environmental (Impact and Audit Regulations) 2003 Legal Notice No. 101, and all relevant national and international legislations and regulations. The ToR agreed between the proponent and consultants in line with EMCA and EIA regulations and submitted and approved by NEMA as per attached approval letter(Annex 1). Some of the pertinent issues in the TOR included but not limited to the following.

1.6.1 Environmental & Social Impact Assessment (EIA)

Identification and description of policy and legal framework, guidelines and standards.

Description of baseline environmental conditions and mitigation measures.

Collection and analysis of environmental, health and safety aspects of the proposed project.

Analysis of the social aspects and beneficiary participation.

1.6.2 Social Impact Assessment water delivery and irrigation infrastructure

- Assessment of socio-cultural aspects including present and projected impacts by use of
- qualitative and quantitative methods.
- Study land tenure status and willingness of owners to provide land for proposed irrigation
- development.

- Conduct adequate public consultation.
- Assess the institutional capacity of agencies that will be involved in implementation of
- mitigation measures.

1.7 ESIA Study Methodology

The general steps followed during the study were:

- a) Screening: The proponent had already identified the project as among those requiring environmental impact assessment as per schedule 2 of EMCA, 1999.
- b) Scoping: During scoping key issues and potential environmental and socio-economic impacts were established, evaluated and their severity determined.
- c) Desktop review of baseline environmental and socio-economic information, legislative framework and project implementation requirements.
- d) Fieldwork involving land surveys, census surveys, physical assessment of environmentally sensitive sites, proposed intake sites and surrounding areas.
- e) Public consultations through public barazas, stakeholder meetings, focus group discussions, interviews and administration of questionnaires to affected persons and/or groups
- f) Reporting of ESIA study findings.

CHAPTER TWO

2 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

2.1 General Overview

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

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

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

Environmental auditing (EA) is a tool for environmental conservation and has been identified as a key requirement for existing facilities to ensure sustainable operations with respect to environmental resources and socio-economic activities in the project neighborhoods. The government has established regulations to facilitate the process on ESIAs and environmental audits. The regulations are contained in the Kenya Gazette Supplement No. 56, legislative supplement No. 31, and legal notice No. 101 of 13th June 2003. In the past, the government has established a number of National policies and legal statutes to enhance environmental conservation and sustainable development.

The proponent and the local Water Users Association groupings will have to observe the provisions of the various statutes and regulations that are aimed at maintaining a clean and healthy environment during the entire project lifecycle.

2.2 Overview of the policy framework

2.2.1 National water policy

The National Policy of Water which was promulgated in April 1999 as Sessional Paper No. 1 of 1999 calls for decentralization of operational activities from the central government to other sectors, including local authorities, the private sector and increased involvement of communities in order to improve efficiency in service delivery. It also tackles issues pertaining to water supply and sanitation facilities development, institutional framework and financing of the sector. According to the policy, in order to enable sustainable water supply and sanitation services, there is need to apply alternative

management options that are participatory through enhanced involvement of others in the provision of these services but particularly the private sector.

The overall objective of the National Water Policy is to lay the foundation for the rational and efficient framework for meeting the water needs for national economic development, poverty alleviation, environmental protection and social wellbeing of the people through sustainable water resource management.

2.2.2 Water Catchment Management Policies

The policy on water catchments management has been shaped over time by two Sessional Papers as listed below:

- (i) Sessional paper No. 1 of 1968; and
- (ii) Kenya Forest Development Policy Sessional paper No. 9 of May 2005

Sessional Paper No. 9 encourages the involvement of the private sector, communities and other stakeholders' participation in forest management in order to conserve water catchments areas and reduce poverty.

2.2.3 Policy on Environment and Development

This is presented as the Sessional paper No. 6 of 1999 on Environment and Development. The overall goal is to integrate environmental concerns into the national planning and management process and provide guidelines for environmentally sustainable development. Under section 4.3 of the document, Provision of potable water and water for sanitation is viewed as being central to satisfying basic human needs. It is indicated that the current water development programmes focus almost entirely on water delivery with little concern for demand management and conservation. Water resources have an extremely high value and effective mechanisms for managing and conserving water could result unto economic benefits as well as sustainable use of this vital resource. Some of the key objectives of the policy are:

- To protect water catchments;
- To ensure all development policies, programmes and projects take environmental considerations into accounts, and
- To enhance, review regularly, harmonize, implement and enforce laws for the management, sustainable utilization and conservation of natural resources.

Under this policy, broad categories of development issues have been covered that require sustainable approach. The policy recommends the need for enhanced re-use/recycling of residues including water and wastewater as well as increased public awareness raising and appreciation of clean environment. It also enhances participation of stakeholders in the management of natural resources within their respective localities.

2.3 Overview of Legislative Framework

2.3.1 The Constitution of Kenya

The Constitution is the supreme law of the Republic and binds all persons and all State organs at all levels of government. The Constitution of Kenya, 2010 provides the broad framework regulating all existence and development aspects of interest to the people of Kenya, and along which all national and sectoral legislative documents are drawn.

In relation to the environment, article 42 of chapter four, The Bill Of Rights, confers to every person the right to a clean and healthy environment, which includes the right to have the environment protected for the benefit of present and future generations through legislative measures, particularly those contemplated in Article 69, and to have obligations relating to the environment fulfilled under Article 70.

Chapter 5 of the document provides the main pillars on which the 77 environmental statutes are hinged. Part 1 of the chapter dwells on land, outlining the principles informing land policy, land classification as well as land use and property. The second part of this chapter directs focus on the environment and natural resources. It provides a clear outline of the state's obligation with respect to the environment, thus;

“The state shall:

- Ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;
- Work to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya;
- Protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of the communities;
- Encourage public participation in the management, protection and conservation of the environment;
- Protect genetic resources and biological diversity;
- Establish systems of environmental impact assessment, environmental audit and monitoring of the environment;
- Eliminate processes and activities that are likely to endanger the environment;
- And utilize the environment and natural resources for the benefit of the people of Kenya.”

There are further provisions on enforcement of environmental rights as well as establishment of legislation relating to the environment in accordance to the guidelines provided in this chapter.

In conformity with the Constitution of Kenya, every activity or project undertaken within the republic must be in tandem with the state's vision for the national environment as well as adherence to the right of every individual to a clean and healthy environment. The proposed project is a central development activity that utilizes sensitive components of the physical and natural environment

hence need for a clearly spelt out environmental management plan to curb probable adverse effects to the environment

2.3.2 The Environmental Management and Coordination (amendment) Act 2015

This Act of Parliament, also known as EMCA, is the parent Act of Parliament that provides for the establishment of appropriate legal and institutional framework for the management of the environment and for matters connected therewith and incidental thereto.

EMCA, in its 13 interrelated parts, provides regulatory provisions for all levels of environmental conservation and management. The first four parts provide legislative guidelines on administrative and planning components of environmental management. They include:

- (i) General Principles
- (ii) Administration;
- (iii) Environmental planning;
- (iv) Protection and Conservation of the Environment. Parts five to seven focus on on-field management of the environment as an integral component of actual or proposed projects;
- (v) Environmental impact assessments (EIA), audits and monitoring;
- (vi) Environmental Audit and monitoring; and
- (vii) Environmental quality standards.

The last five parts of the Act regulate on enforcement of provisions outlined in the Act and recognition of international agreements along which the EMCA has been established. They are; Environmental Restoration orders, Environmental Easements, Inspection, analysis and records, Inspection Analysis and Records, International Treaties, Conventions and Agreements, National Environment Tribunal, Environmental Offences.

All the chapters 1 to 13 apply to the proposed project at one stage or the other and therefore the project proponent is required to understand and conform with the Act accordingly. One such area is Environmental Impact Assessment. This is expressly stated in section 58(2) of the Act.

“The proponent of a project shall undertake or cause to be undertaken at his own expense an Environmental Impact Assessment study and prepare a report thereof where the authority, being satisfied, after studying the project report under sub-section (1), that the intended project may or is likely to have or will have a significant impact on the environment, so directs.”

EMCA has set out several regulations for managing the environment which include the following;

2.3.3 Environmental Management and Co-ordination (Amendment) Act, 2015

This is an act of parliament to amend the environmental management and co-ordination act, 1999 enacted by the Parliament of Kenya, which amends the Environmental Management and Coordination Act, 1999, which is referred to as the "principal Act". It amends the act to conform to

the Kenyan constitution of 2010. It inserts sections that for example establish the county environmental committees to and remove other structures to conform to the devolved units. , It directs that every person shall cooperate with state organs to protect and conserve the environment and to ensure the ecological sustainable development and use of natural resources. The amendment act also states that, any person who contravenes any conservation measure prescribed by the Authority (NEMA), or fails to comply with a lawful conservation directive issued by the Authority or its Environment Committee At the counties commits an offence ". It encourages voluntary environmental conservation practices and natural resource conservancies, and endeavours to recognize, protect and enhance of indigenous knowledge and associated practices in the conservation of the environment and natural resources.

2.3.4 The Environmental (Impact Assessment and Audit) Regulations, 2003

This is a supplementary legislation to the EMCA. It gives additional “punch” by providing guidelines for conducting Environmental Impact Assessments and Audits. It offers guidance on the fundamental aspects on which emphasis must be laid during field study and outlines the nature and structure of Environmental Impact Assessments and Audit reports. The legislation further explains the legal consequences of partial or non-compliance to the provisions of the Act.

Relevance

The water bottling plant establishment as an activity is listed in the second schedule of EMCA as among projects that require an Environmental Impact Assessments before commencement. The project implementation cannot commence before the license is granted, upon conducting the EIA. For this reason, this report provides the legal requirements for the project approval.

Impacts of the proposed project involve major elements of the environment, including land, water and human health and safety. Therefore there is need to evaluate these impacts and establish the most sustainable approach to benefit both the current and the future generations and mitigate projected negative impacts to people and the environment through conducting Environmental and Social Impact Assessment and subsequent audits.

2.3.5 The Environmental Management and Coordination (Water Quality) Regulations, 2006

Described in Legal Notice No. 120 of the Kenya Gazette Supplement No. 68 of September 2006, these regulations apply to drinking water, water used for industrial purposes, agricultural purposes, recreational purposes fisheries and wildlife and any other purposes. It stipulates quality standards for sources and discharge of water to any environmental receptors within an activity area.

The Regulations outline various water quality standards in relation to use and discharge,

Such aspects provided for are;

- Quality standards for sources of domestic water;

- Quality monitoring for sources of domestic water;
- Standards for effluent discharge into the environment;
- Monitoring guide for discharge into the environment;
- Standards for effluent discharge into public sewers; and
- Monitoring for discharge of treated effluent into the environment

Relevance

The proposed project will impound and abstract significant quantity of groundwater. It is thus fundamental to regularly analyze water quality and check for conformity to stipulated legal standards in this supplementary legislation. Moreover, the quality of water discharges into any environmental receptor must be ascertained for safety and if not, treated

2.3.6 Environmental Management and Co-ordination (Waste Management) Regulations, 2006

Regulations guiding waste management are described in Legal Notice No. 121 of the Kenya Gazette Supplement No. 69 of September 2006. They offer legal provisions on handling of a variety of wastes emanating from various projects and activities. The waste categories covered by the regulations include:

- Industrial wastes;
- Hazardous and toxic wastes;
- Pesticides and toxic substances;
- Biomedical wastes; and
- Radio-active substances.

These Regulations outline requirements for handling, storing, transporting, and treatment / disposal of all waste categories as provided therein.

Relevance

The proposed project, during construction phase may involve the use of materials that release hazardous waste i.e. cement, oil spillage from vehicles, hence the need for all project actors to abide by these regulations in dealing with such wastes, especially the provisions of industrial, hazardous and toxic wastes which may be handled in the course of the project life.

2.3.7 Environmental Management and Coordination (Fossil Fuel Emission Control) Regulations 2006

These regulations are described in Legal Notice No. 131 of the Kenya Gazette Supplement No. 74 of October 2006 and will apply to all internal combustion engine emission standards, emission

inspections, the power of emission inspectors, fuel catalysts, licensing to treat fuel, cost of clearing pollution and partnerships to control fossil fuel emissions.

Relevance

The fossil fuels considered are petrol, engine oil and diesel. This will be applicable to equipment and machinery used in the project during construction phases of the project.

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

These Regulations prohibit making or causing any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment.

Relevance

Under the regulation the Contractor is prohibited from producing excessive noise and vibrations which annoy, disturb, injure or endanger the comfort, repose, health or safety of others and the environment or excessive vibrations which exceed 0.5 centimeters per second beyond any source property boundary or 30 meters from any moving source. Under the regulation the Contractor will be required to undertake daily monitoring of the noise levels within the project area during construction period to maintain compliance.

2.3.9 Water Act 2016

Water in Kenya is owned by the National Government, subject to any right of the user, legally acquired. However; this Act regulates utilization, conservation and management of all water resources within the republic, and related purposes it states that every person in Kenya has the right to clean and safe water in adequate quantities and to reasonable standards of sanitation as stipulated in Article 43 of the Constitution. It provides for the Cabinet Secretary in charge resources of water to make Regulations with respect to any matter which by this Act is required or permitted to be prescribed, or which is necessary or expedient to be prescribed for the carrying out or giving effect to this Act. And among these is at section 142 (2) (e) on the requirements in respect to bottled or mineral waters. The act establishes the water resources authority and the water harvesting and storage authority. The acts also gives power to a water inspector appointed by the Authority may, without a warrant, enter onto any land and inspect any water resource located within or accessible from the land concerned, in order to take such measures as the Authority may consider necessary for the purpose of.

2.3.10 The Water Resources Management Rules, 2007

As a subsidiary to the Act, a legislative supplement, The Water Resources Management Rules, 2007 was gazetted to guide all policies, plans, programmes and activities that are subject to the Water Act,

2002. The Water Resources Management Rules empower Water Resources Management Authority (WRMA) to impose management controls on land use falling under riparian land.

Relevance

Provision of water is the sole driving factor in the establishment of the proposed irrigation scheme. In the proposed project, damming of surface will be the main source of water whose abstraction must comply with the provisions and legal procedures in this Act. The Act will thus play a central role in guiding the exploitation of the ground water resource throughout the project life.

2.3.11 Land Acquisition Act (cap 295)

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

2.3.12 The Public Health Act (Cap. 242)

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

2.3.13 The Physical Planning Act, Cap 286

The Act provides for the preparation and implementation of physical development plans and for related purposes. It gives provisions for the development of local physical development plan for guiding and coordinating development of infrastructure facilities and services within the area of authority of County, municipal and town council and for specific control of the use and development of land. This Act requires that a person who wishes to carry out development shall seek permission from the relevant agency before commencement of any works or risk punitive measures which include among others requirement to restore the land to its original condition. This Act further requires that a development application be sought from the relevant local authority accompanied by an environmental impact assessment report of the proposed development. The site layout plan appended to this report shows the route of the entire proposed canal route. The proponent shall secure all mandatory approvals and permits as required by the law.

2.3.14 Laws on Property and Land Rights in Kenya

The new Kenya Constitution 2010 has a comprehensive Bill of Rights in Chapter Four (4) and a well elaborated Chapter Five (5) on Land and Environment. These two chapters provide constitutional basis for land ownership, expropriation and protection of rights to land. Land in Kenya is classified as public, community or private. Prior to the new Constitution, there were over 70 pieces of legislations, Acts and subsidiary law governing land and land matters. Under the new Constitution they are being consolidated and rationalized to four pieces of legislation as follows:

National Land Act, 2012 – discusses Land issues in general and establishes mechanisms for Land acquisition;

Land and Environmental Court – this establishes a court to deal with all disputes;

Land Registration Act, 2012; and

The Community Land Act.

Article 60 (1) states that that “Land in Kenya shall be held, used and managed in a manner that is equitable, efficient, productive and sustainable, and in accordance to the following 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) Sound conservation and protection of ecological sensitive areas;
- (vi) Elimination of gender discrimination in law, customs and practices related to land and property in land; and
- (vii) Encouragement of communities to settle land disputes through the recognized local community initiatives consistent with this Constitution.

The State is permitted to regulate the use of any land, or any interest in or right over any land in the interest of defense, public safety, public order, public morality, public health, or land use planning.

According to Article 61 (1), all land in Kenya belongs to the people of Kenya collectively as a nation, as communities and as individuals.

Land is classified as public land, community land or private land and each category is defined in the subsequent articles. Public land is defined to include all minerals and mineral oils; government forests, government game reserves, water catchment areas, national parks, government animal sanctuaries and specially protected areas, gazetted roads and thoroughfares, all rivers, lakes and other water bodies as defined by law; the territorial sea, continental shelf, exclusive economic zone and the sea bed, all land between the high and low water marks, any land not classified as community or private land under the Constitution-such public land shall vest and be held in trust by the national government in trust for the people of Kenya and shall be administered by the National Land Commission.

Community land includes land that is “lawfully held, managed or used by specific communities as community forest, grazing areas or shrines,” and “ancestral lands and lands traditionally occupied by hunter-gatherer communities.” Rights are also held through traditional African systems, and rights that derive from the English system introduced and maintained through laws enacted by colonial and then the national parliament. The former is loosely known as customary tenure bound through traditional rules (customary law). The latter body of law is referred to as statutory tenure, secured and expressed through national law, in various Act of parliament e.g. Land Act 2012, Land Registration Act, 2012, Trust Land Act (cap 288) of the Laws of Kenya.

The right to property is protected in Article 40 (1) Subject to Article 65; “every person has the right, either individually or in association with others, to acquire and own property of any description; and in any part of Kenya”. The following land tenure systems exist in Kenya.

(i) Customary Land Tenure

This refers to unwritten land ownership practices by certain communities under customary law. Kenya being a diverse country in terms of its ethnic composition has multiple customary tenure systems, which vary mainly due to different agricultural practices, climatic conditions and cultural practices. However most customary tenure systems exhibit a number of similar characteristics as follows: First, individuals or groups by virtue of their membership in some social unit of production or political community have guaranteed rights of access to land and other natural resources. Individuals or families thus claim property rights by virtue of their affiliation to the group.

(ii) Freehold Tenure

This tenure confers the greatest interest in land called absolute right of ownership or possession of land for an indefinite period of time, or in perpetuity. Freehold land is governed by the Land Registration Act, 2012. The Act provides that the registration of a person as the proprietor of the land vests in that person the absolute ownership of that land together with all rights, privileges relating thereto. A freehold title generally has no restriction as to the use and occupation but in practice there are conditional freeholds, which restrict the use for say agricultural or ranching purposes only. Land individualization was demanded by the colonial settlers who required legal guarantee for the private ownership of land without which they were reluctant to invest.

(iii) Leasehold Tenure

Leasehold is an interest in land for a definite term of years and may be granted by a freeholder usually subject to the payment of a fee or rent and is subject also to certain conditions which must be observed e.g. relating to developments and usage. Leases are also granted by the government for government land, the local authorities for trust land and by individuals or organizations owning freehold land. The maximum term of government leases granted in Kenya is 99 years for agricultural

land and urban plots. There are few cases of 33 years leases granted by government in respect of urban trust lands. The local authorities have granted leases for 50 and 30 years as appropriate.

(iv) Public Tenure

This is where land owned by the Government for its own purpose and which includes unutilized or un-alienated government land reserved for future use by the Government itself or may be available to the general public for various uses. The land is administered under the Land Act 2012. These lands were vested in the president and who has, normally exercised this power through the Commissioner of Lands, to allocate or make grants of any estates, interests or rights in or over un-alienated government land. However the new constitution grants those rights to the National Land Commission (NLC) which is governed by the National Land Commission Act, 2012 that specifies the role of NLC.

The Land Act 2012, Part III, Section 27 recognizes the capacity of a child as being capable of holding title to land. However this can only happen through a trustee and such a child shall be in the same position as an adult with regard to child's liability and obligation to the land. A notice of setting apart published under section 7 of this Act shall also be published by displaying a copy at the District Commissioner's office and at some other public or conspicuous place in the area concerned. Under section 9(1), a person who claims to be entitled to compensation under section 8 of Cap 288 shall apply therefore to the District Commissioner once satisfied after consultation shall award the applicant a sum of compensation in accordance with subsection (3) of this section; and if he is not so satisfied the County Commissioner shall reject the application.

The compensation to be awarded shall be assessed by the District Commissioner after consultation with the Divisional Board, and shall be assessed in respect of the loss of the right of occupation referred to in paragraph (a), or in respect of the applicant having been otherwise prejudicially affected as referred to in paragraph (b), of section 8 (1) of the Act. The District Commissioner shall give notice in writing to the applicant of the award or of the rejection of the application as the case may be.

2.3.15 Way Leaves Act (Cap. 292)

Way Leaves Act (Cap. 292) Section 3 of the Act states that the Government may carry any works through, over or under any land whatsoever provided it shall not interfere with any existing building or structures of an ongoing activity. Notice, however, will be given one month before carrying out any such works (section 4) with full description of the intended works and targeted place for inspection. Any damages caused by the works would then be compensated to the owner as per the section. Finally section 8 states that any person without consent causes any building to be newly erected on a way leave, or cause hindrance along the way leave shall be guilty of an offence

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

2.3.16 Registration of Titles Act, Cap 281

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

2.3.17 The Land Adjudication Act, Cap 95

This Act provides for ascertainment of interests prior to land registrations under the Registered Land Act. The Proponent has undertaken a survey and commissioned this Resettlement Action Plan (RAP) study which complies with the provisions of the Act. Public consultations were also undertaken in the affected project area.

2.3.18 Valuation and Related Legal Issues

The valuation practice in Kenya is governed by the Valuers Act Cap 532, which provides for a Valuers Registration Board that regulates the activities and conduct of registered Valuers. Valuers in Kenya are registered upon application to the Board and are required to be full members of the Institution of Surveyors of Kenya (ISK). The Act governs the formation and composition of valuation practices including the qualification of partners and directors in charge of valuation. The Board also deals with discipline and complaints in respect to valuation practice. Other statutes that govern valuation are the Government Lands Act Cap 280 that regulates the valuation for land rent while valuation for rating is governed by the Rating Act Cap 267. Land Acquisition Act Cap 295 governs valuations for compulsory acquisition purposes. This Act is triggered as the valuer and financial analyst of the consulting team have applied the requirements of these laws and other market indicators to come up with the RAP budget and the market rate or replacement cost of compensating the PAP.

2.3.19 The Penal Code, Cap 63

The Penal Code prohibits any person or institution from voluntarily corrupting or foiling water for

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

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

These rules require the contractor to ensure health, safety and welfare of employees and states. It further requires the main contractor to notify the chief inspector within 7 days of commencing or undertaking building operation or works of engineering. The rules require that walls of excavations deeper than 1.2m be reinforced with timber of suitable quality or with other suitable material to prevent so far as is reasonable practicable the danger or injury resulting from a fall or dislodgement of earthwork. The rules further require that a scaffold of good construction and suitable strength shall be made available for any construction site where working at height is to be undertaken. A first aid box shall also be provided and be distinctively marked "FIRST AID" and placed under the charge of a responsible person whose name shall be plainly indicated in a prominent place or near the box.

2.3.21 Overall Legal Compliance Statement

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

2.4 International Policy Framework

Kenya is a signatory as well as a party to various international conventions, treaties and protocols relating to the environment and aimed at achieving sustainable development. According to the Registrar of International Treaties and other Agreements in Environment (UNEP 1999), there are 216 treaties, 29 of which are of interest to Kenya. The country is a signatory to 16 such agreements, which range from use of oil, protection of natural resources and protection of the atmosphere. The agreements are both regional and international and became legally binding on Kenya upon ratification thereof by the rightfully designated Kenyan Authority. The agreements of interest to Kenya can be categorized as those for protecting natural resources, atmosphere and social well being of man.

2.4.1 Protection of Natural Resources

There are 12 agreements of significance to Kenya under this category which the country has signed and ratified. This section reviews a number of policies that are triggered or met by the proposed project.

2.4.2 United Nations Convention to Combat Desertification (UNFCCC) of 1994

The convention requires parties to take climate change considerations into account in their relevant social, economic and environmental policies and actions. The proponent has undertaken this EIA with the aim of minimizing adverse effects of the project on the economy, on public health and on the quality of the environment. The requirements of this convention can be mitigated against to reduce impacts of climate change by growing trees suitable for the area. The proponent is advised to enhance the positive impacts of the project through engaging in activities that control climate change for example planting of trees and conserving the catchment through water conservation.

2.4.3 The World Commission on Environmental and Development

The commission focuses on the environmental aspects related to development and requires all development projects to be sustainable economically, socially and environmentally. The principle of the organization emphasizes that development projects should have no permanent negative impact on the biosphere and in particular the ecosystems. It is recommended that the project proponent incorporate mitigation measures to ensure that the project impacts on the ecosystem are reduced. The consultants used participatory methods to involve the target group and concerned stakeholders in order to inform and enlighten them on the likely negative environmental and social impacts for them to prepare mitigation measures so as to ensure the proposed project is sustainable throughout its life span.

2.4.4 The Convention of Control of Desertification-UCCD (1992)

This convention requires Parties to promote cooperation among affected parties in the fields of environmental protection and the conservation of land and water resources, as they relate to desertification and drought. The proponent is advised to engage in activities geared towards eradicating drought through engaging in tree planting activities, encouraging clean energy use and water conservation.

2.4.5 African Development Bank Policies

African Development Bank Group policy on environmental sustainable development in Africa is based on an assessment of environmental constraints and opportunities that affect medium and long-term development objectives across the continent. It sets out the broad strategic and policy framework under which all Bank lending and non-lending operations will henceforth be made. In addition, it serves to guide policy and decision-making in those key sectors that depend upon the utilization of natural resources. It stresses that sustainable development and conservation of the environment cannot be achieved through good environmental planning of development projects alone. Environmental issues will, therefore, be addressed by the Bank within a more open and

inclusive approach, which relies as much on effective partnerships, networking, awareness-building, institutional development and technical support as it does on the strict application of operational objectives.

2.4.6 AfDB Safeguard

The Bank's Strategy for 2013-2022 emphasises the need to assist regional member countries in their efforts to achieve inclusive growth and transition to green growth. In addition, the Bank is committed to ensuring the social and environmental sustainability of the projects it supports. Statement sets out the basic tenets that guide and underpin the Bank's approach to environmental safeguards. In addition, the Bank has adopted five OSs, limiting their number to just what is required to achieve the goals and optimal functioning of the ISS: •

Operational Safeguard 1: *Environmental and social assessment*:- This overarching safeguard governs the process of determining a project's environmental and social category and the resulting environmental and social assessment requirements.

Operational Safeguard 2: *Involuntary resettlement land acquisition, population displacement and compensation*:- This safeguard consolidates the policy commitments and requirements set out in the Bank's policy on involuntary resettlement, and incorporates a number of refinements designed to improve the operational effectiveness of those requirements.

Operational Safeguard 3: *Biodiversity and ecosystem services*:- This safeguard aims to conserve biological diversity and promote the sustainable use of natural resources. It also translates the commitments in the Bank's policy on integrated water resources management into operational requirements.

Operational Safeguard 4: *Pollution prevention and control, hazardous materials and resource efficiency*:- This safeguard covers the range of key impacts of pollution, waste, and hazardous materials for which there are agreed international conventions, as well as comprehensive industry-specific and regional standards, including greenhouse gas accounting, that other multilateral development banks follow.

Operational Safeguard 5: *Labour conditions, health and safety*:- This safeguard establishes the Bank's requirements for its borrowers or clients concerning workers' conditions, rights and protection from abuse or exploitation. It brings harmonisation with other multilateral development banks.

CHAPTER THREE

3 BASELINE INFORMATION OF THE STUDY AREA

This section gives the baseline information of the proposed project area based on available literature materials.

3.1 Description of the Project Area

3.1.1 Project Location

Kagongo is located about 12 km from Nyahururu town along the Nairobi – Nyahururu Highway road and about 3km from Oljororok town. The project area can be accessed by all-weather road from Kasuku Market although the road has impassable sections when it is rainy. The main access roads within the Project area include:

- Nairobi - Nyahururu Highway
- All-weather roads.

3.1.2 Topography

Land slopes in the proposed project area range from 2 - 5% on the lower areas to 12% in the upper sections. Land generally slopes from North to South. The altitude ranges from 2360 - 2570m a.ms.l. The upper areas are mainly rolling (slopes of 10 - 12%). The lower areas have gently undulating to flat topography towards the gullies. Numerous dry gullies form a network of drainage channels that empty into each other up to Lake Ol Bollosat beyond Nairobi - Nyahururu Road.



Figure 1: A view of the topography of project area

3.1.3 Climate

The Project area lies in agro-ecological zones UM2 (pyrethrum – wheat zone) and UM3 (wheat -barley zone) according to the Farm Management Handbook. The rainfall pattern is bimodal with long rains from April to early September and short rains from October to December. The annual average rainfall varies between 700 - 1200 mm in the upper areas.

3.1.4 Rainfall and evaporation

The rainfall pattern is bimodal with long rains from April to early September and short rains from October to December. The annual average rainfall varies between 700 - 1200 mm in the upper areas. The mean annual evapo-transpiration is 1485 mm and therefore exceeds the rainfall.

3.1.5 Temperature

The temperatures are low ranging from 16°C to 20°C.

3.1.6 Soils

The soils of the project area lie in the unit UBPI which can be described as well drained, deep to very deep, dark reddish brown to dark red, firm clay; with inclusions of imperfectly drained, moderately deep, dark grayish brown clay – nito-ferric/chromic Luvisols with gleyic Luvisols (Farm Management Hand Book).

3.1.7 Vegetation

The area has forests which have been degraded through human activities leaving scattered relics of forest patches. Indigenous trees spotted in the area include: *Prunus africana* (muri) *Kigelia africana* (muratina) *Fagara macrophylla* (munganga). Exotic tree species such as *Grevillea robusta* and *Eucalyptus* species have grown robustly in the area. The wildlife in this area include the bushbuck, Sykes monkeys, baboons, Columbus monkeys, tree and ground squirrels, porcupines and many species of birds. The Sharpes claw is one of the threatened birds' species found here. Hippopotamus are also found at the Lake Ol Bollossat.



Figure 2: View of Biodiversity in the Area

3.2 SOCIAL-ECONOMIC BACKGROUND

3.2.1 Introduction

Social research provides an understanding of the development and consequent social impacts of irrigation schemes. Changes in the attitudes and adaptations of farm families, subsequent livelihood changes, and consequent demographic changes, are of particular interest to the social impact assessment expert. Social research from a number of sources provides an understanding of the development and consequent social impacts of developments such as the proposed irrigation development. Changes in the attitudes and adaptations of farm families, subsequent ownership changes, and consequent demographic changes, are of particular interest to a social impact assessment framework for irrigation. The baseline survey was executed under the Kagongo Wendani Irrigation Development Project. The project objectives are; to ensure food security at the local level and contribute towards the same at national level; create employment and income generation at the local and national levels; contribute to sustainable supply of raw materials for agro-based industries; and contribute to foreign exchange generation through export of surplus food and cash crops. The objective of the baseline survey was to reveal typical farmers' conditions and to set the baseline in the command area of the Kagongo irrigation development area as a part of project benefit to be monitored.

3.3 Findings of the Socio Economic Study

3.3.1 Household Characteristics

According to survey findings, average age of the respondents was 50 years. The Central Bureau of Statistics considers the productive working age bracket to be 15 – 64 years (CBS, 2002). 53% of the respondents were male while 47% were female (See Figure 3)

From the survey conducted, 54% of the respondents interviewed were the heads of the households, 43% being the spouses while 3% were off-springs. (See Figure 4)

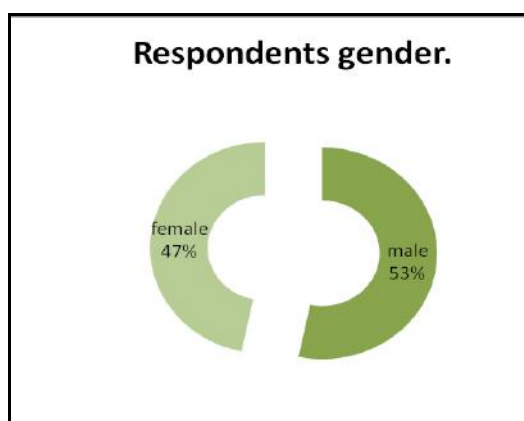


Figure 3 Respondents by gender

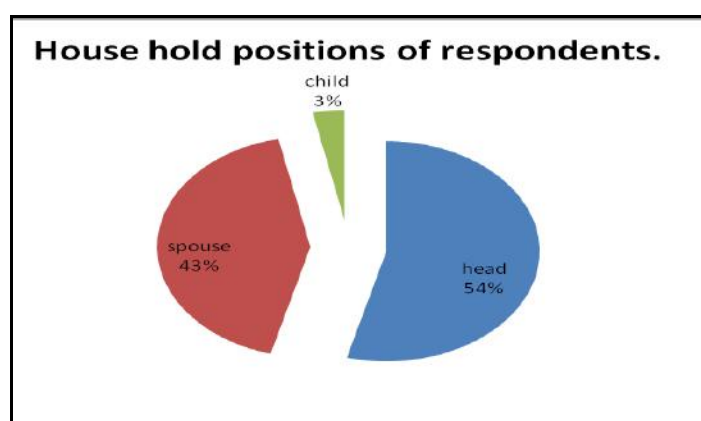


Figure 4: Respondent's relationship to the household

3.3.2 Education

Education plays an important role in Human Development by empowering people, improving their well-being and enabling them to actively participate in nation building. Education strengthens people’s abilities to meet their basic needs and those of their families by increasing their productivity and potential to achieve higher standards of welfare and thereby improving their quality of life. From the survey conducted, 47% had attained formal education up to primary school level, 31% had attained secondary school level education 10% of the household heads had no formal education, while only 9% had acquired tertiary level education. 3 had attained university education. Figure 5 below gives a summary of level of education attained by household head within the Kagongo project area.

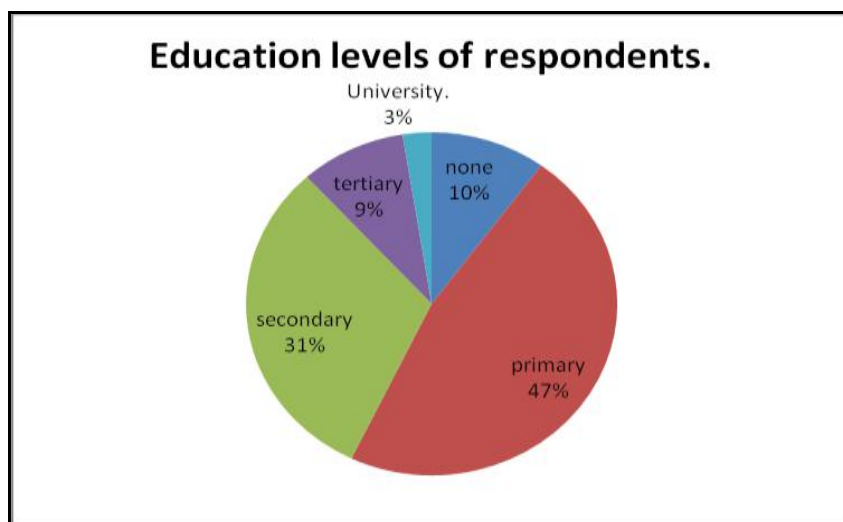


Figure 5: Education levels of household head

There is an urgent need for development of school infrastructure including classrooms, toilets and libraries for quality education and performance improvement. All stakeholders should facilitate more awareness campaigns on child rights as well as empowering parents on the values of education so as to encourage children’s enrolment in schools. Government and NGOs operating in the area should facilitate more events to support girl child education for example provision of support through provision of sanitary towels to girls amongst other support. Pupils in both primary and secondary schools should be motivated on the values of education. This can be achieved through exchange visits and mentorship programs. This will improve their performance.

3.3.3 Household Ownership and Assets

From the survey conducted, most respondents lived in semi temporary. 58 percent lived in houses

that had walls made up from timber, 23 percent had houses with walls made up of mud, 14 percent lived in stone houses and 5 percent lived in houses whose walls were made of bricks (See Figure 6).

93 percent had houses with corrugated iron sheets making the roofs while 7 percent had thatched houses. (See Figure 7). Most of the respondents owned at least a jembe/fork and a panga as their farming tools.

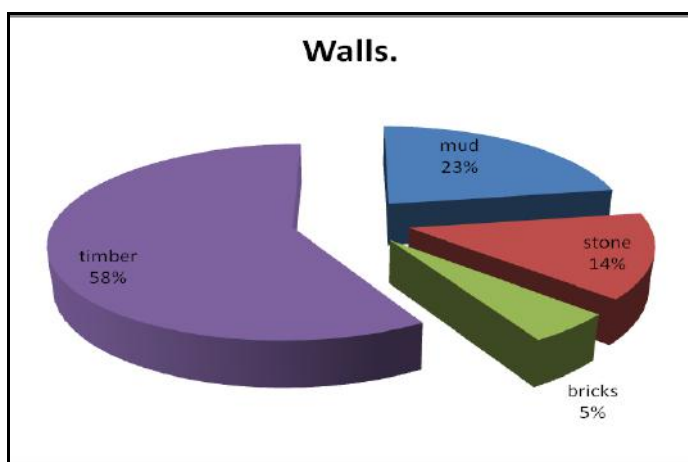


Figure 6: Walling Materials of houses

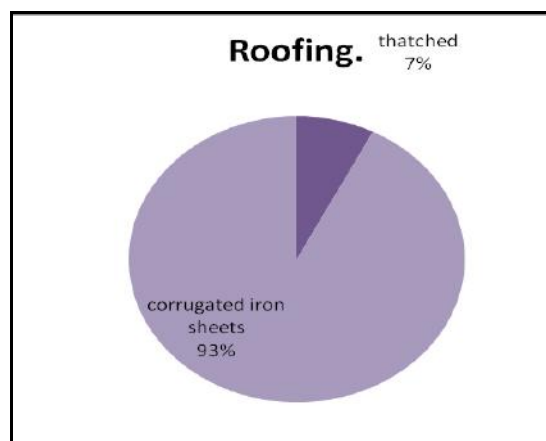


Figure 7: Roofing Materials of houses

3.3.4 Sources of Energy

The lack of electricity connection in most rural areas has hampered the local producers to undertake value-addition ventures. With less than 20 per cent of the Kenyan population connected to the national electric grid (10.5 per cent for the county) and the high cost of connections, access to electricity remains a luxury in the county (Nyandarua County Development Profile, 2013). From the survey conducted, most of the respondents use firewood for cooking.

3.3.5 Farmer's roles and responsibilities in the proposed project

Respondents were asked whether any individuals in the household belonged to any farmer/community organizations. 12 per cent stated that they belonged to a local co operative society while 88 percent were not members of any co operative society. (See Figure 8) Only 8 percent belonged to farmer's organizations. (See Figure 9)

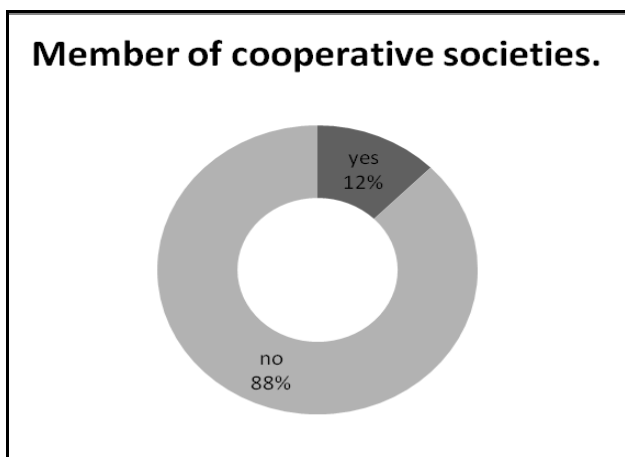


Figure 8: Membership to co operative society

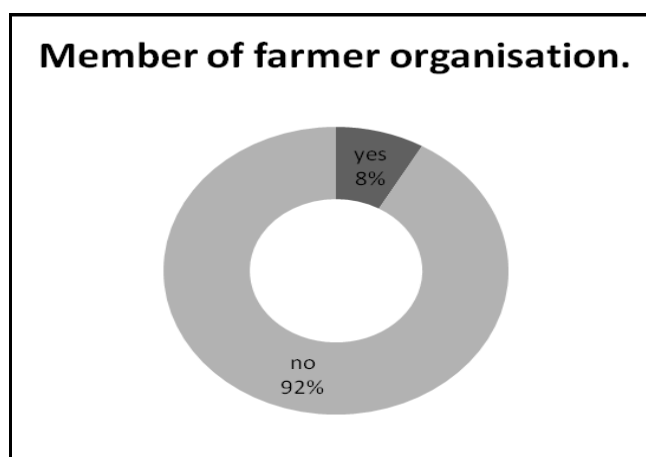


Figure 9: Membership to farmer's organizations

3.3.6 Employment and Income Sources

Major sources of income are through farming and farming related employment. Respondents interviewed indicated that they have other sources of income. 39 percent drew their extra income from casual labour on farms and other forms, 14 percent from businesses and 15 percent enjoyed remittances. Only 3 percent were in salaried employment. (Figure 11)

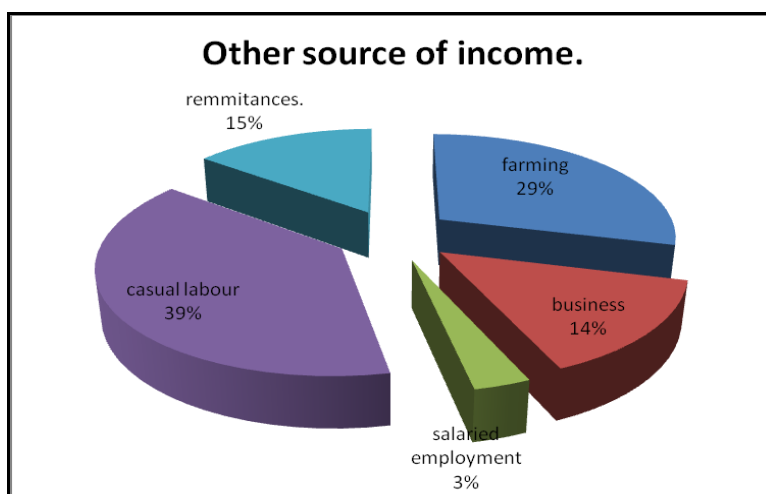


Figure 10: Major economic activities Source

3.3.7 Income and Expenditure

Expenses on individual items vary depending on a farmer's preference and demand at the household level. Most expenses are on non food items such as school fees, transport, medical, clothing and communication. From the survey conducted, most of the households had a monthly income of approximately Ksh. 8,700. Food items formed the highest expenditures for most of these households.

3.3.8 Poverty Index

Due to a steady decline in economic performance during the last two decades, the level of poverty in Kenya is steadily increasing, especially in semi-arid and arid areas. The welfare monitoring

survey indicated that between 1994 and 1997 poverty level rose from 47 to 53 per cent in rural areas and from 29 to 49 per cent in urban areas. As of 2005, approximately 42 per cent of the population lived below the national poverty line. The poverty line for urban settlements was about US \$35 per adult per month and US \$16 for rural settlements. According to the integrated household budget survey (Revised 2007); an average of 37.6 per cent of the population in the county lives in absolute poverty. The largest proportion of the poor resides in the rural areas. The key causes of poverty as it emerged from the Poverty Reduction Strategy Paper (PRSP) consultation process are: landlessness, unemployment, poor access to markets for farm produce, exploitation by middlemen, inadequate credit facilities, HIV/AIDS pandemic, high cost of farm inputs and collapse of cooperative societies.

Poverty levels are even higher among the female headed households. There is threat of rise in the number of child-headed families due to the HIV AIDS pandemic. The county has had several projects aimed at increasing household food production and incomes. These are: National Agriculture and Livestock Extension program (NALEP), Njaa Marufuku, Orphaned crops, Kenya Agricultural Productivity and Agribusiness Project, and the poverty eradication programme which are ongoing. (Nyandarua County Development Profile, 2013).

3.3.9 Water Supplies

The quantity and quality of water affects human welfare through several channels. Water availability influences the pattern of human settlement and the distribution of various development activities including agriculture and industry. When water and sanitation is sub-optimal, mortality and morbidity in a population are likely high. This partially explains why, as a prerequisite, promotional and preventive health services usually take into account the provision of water and sanitation

One of the paramount factors for determining whether irrigation can be developed is the availability of water in a particular location or region. The common approaches are often based on observations on stream flow and/or groundwater availability. The surface water resources in the project area consist of one seasonal River and a dam. When respondents were asked to state where they source for their drinking water, they stated various sources. 43 per cent stated that they source water from shallow wells, 19% from nearby river, 12 % from the streams, 14% had piped water while 9% sourced from a borehole. 3% relied on other sources of water like dams and rain water. (Figure 3.12)

From the survey conducted, 55% were satisfied with the quality of water as good, 23% felt that the quality of the water they use is fair, while 15% felt the quality was very good. 7% were dissatisfied with the quality of drinking water. (Figure 13)

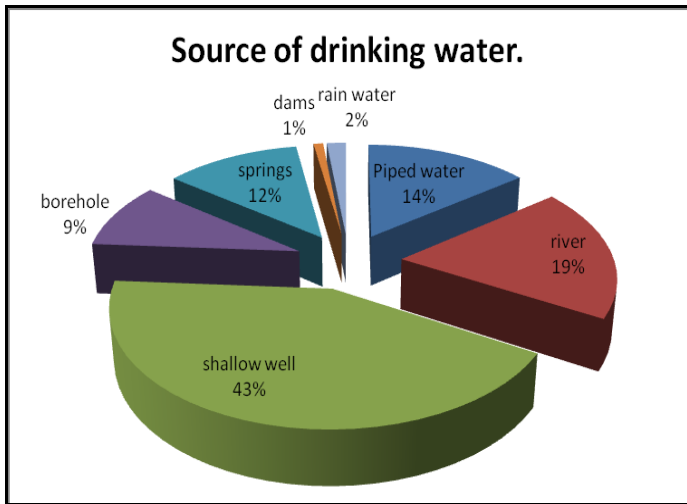


Figure 11: Sources of drinking water

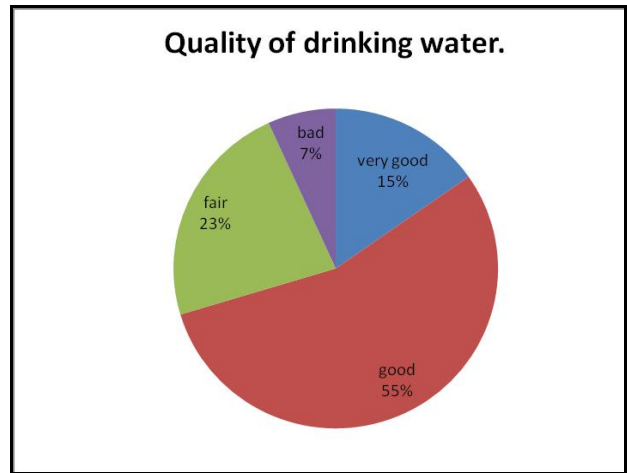


Figure 12: Quality of drinking water Source

The government together with other stakeholders should join hands and invest more on provision of safe water for drinking to the community. There is also need to encourage strengthening and formation of more water users associations so as to improve the operation and maintenance function. Where the community is far from the existing rivers, consideration should be on exploitation of ground water supply. There is need to emphasize on continued public education to empower people wash hands when necessary to help the community get rid of germs and other diseases related to unhygienic practices. 44% source water for livestock from shallow wells, 21% of the respondents' drive their livestock to the neighbouring river, 14% rely on piped water, 10% from springs, and 10% from boreholes while the rest 1% source from other sources. (Figure 14) From the study conducted 54% of those interviewed do not have challenges in accessing water during the dry seasons while 46% experienced acute water shortage during the dry spells. (Figure 15)

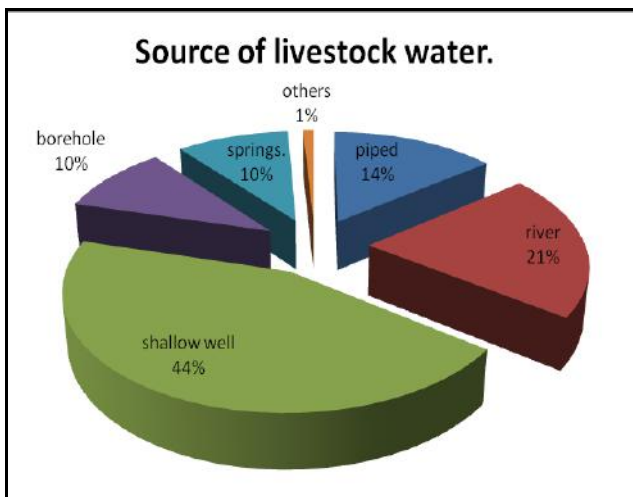


Figure 13: Source of water for livestock

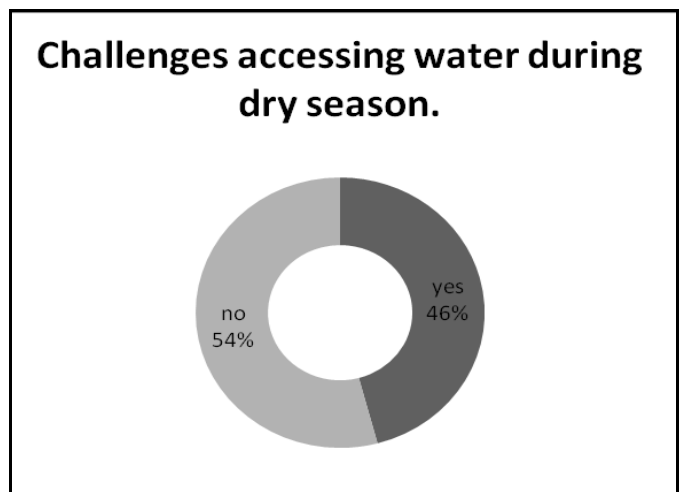


Figure 14: Respondents facing challenges during the dry season

Majority of those who experience water shortage during the dry season sources water from the local shallow wells. (Figure 3.15)

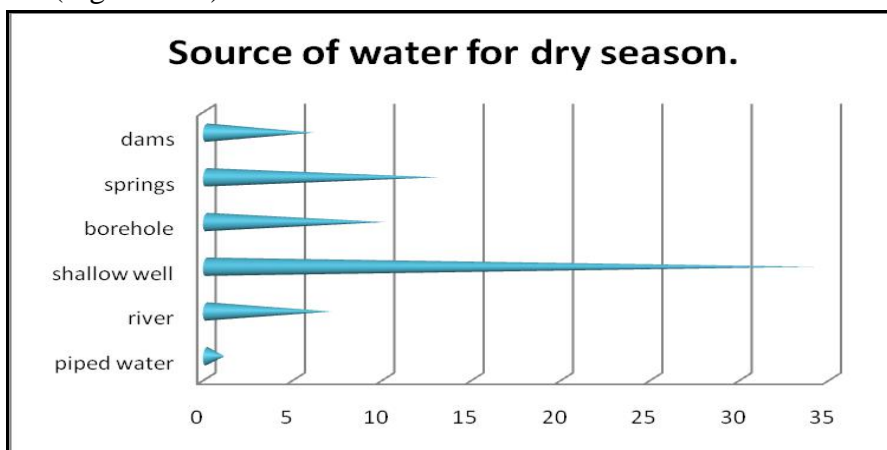


Figure 15: Sources of water during the dry seasons

3.3.10 Sanitation

Most water sources in the county are not protected hence contaminated. Human habitation along catchment areas, lack of proper sanitation and sewerage services in the major urban centers are major source of water contamination. From the survey conducted, all the respondents interviewed had access to a toilet within the compound. 36 percent burned their solid waste, 39 percent disposed their solid waste in the open land while 25 percent had a compost pit. (Figure 3.16)

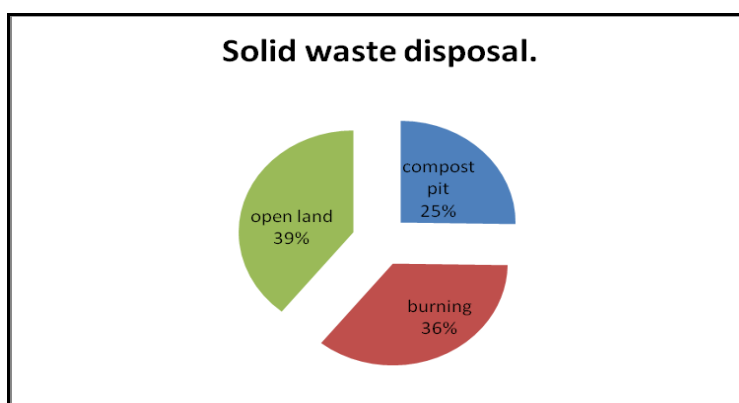


Figure 16: Methods of solid waste disposal

All the respondents interviewed disposed waste water in the open land.

3.3.11 Availability of Health Services

According to the Kenya National Bureau of Statistics (KNBS) 2008, good health is considered a pre-requisite to the socio-economic development of any country, since a healthy population is capable of participating in economic, social and political development. Health constitutes the physical, mental and social well-being of the people and not merely the absence of disease or infirmity. During the study, respondents were asked about main illnesses suffered by members of the family. Most of the respondents cited malaria at 70 percent as the major disease affecting their

households. This is consistent with the Kenya Demographic and Health Survey 2008-09 which established that malaria is the leading cause of morbidity and mortality in Kenya with close to 70% of the population at risk of infection. Other diseases mentioned include flu, pneumonia and typhoid. (Figure 18)

When respondents were asked where they go to hospital whenever sick, 70 per cent stated that they go to the nearest dispensary, 17 percent prefer attending health clinics while 13 percent seek medical attention from Hospitals. (Figure 19)

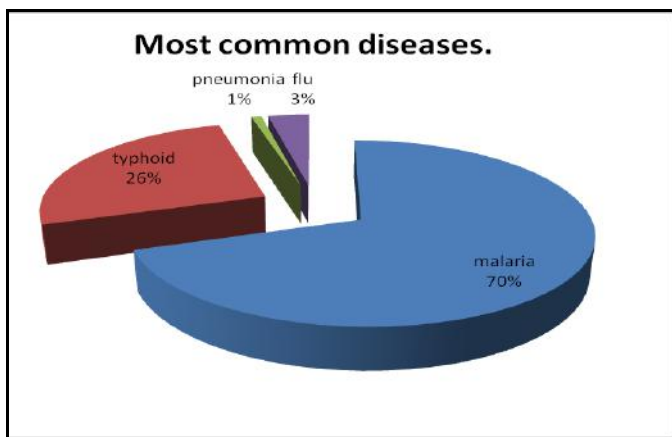


Figure 17: Most common diseases

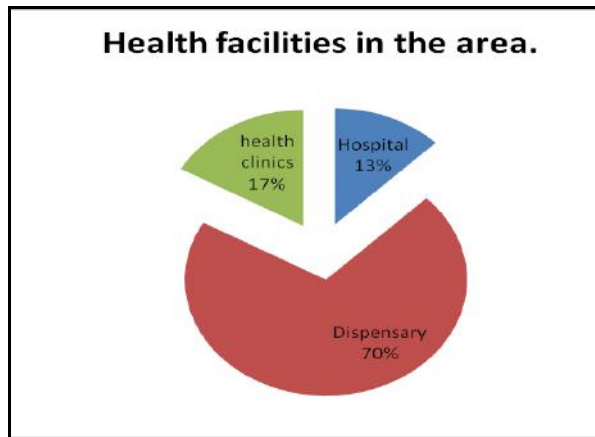


Figure 18: Health facilities in the area

3.3.12 Accessibility of Health Services

From the survey findings, all the respondents walk for less than one hour to the health facility of their choice. (Figure 20)

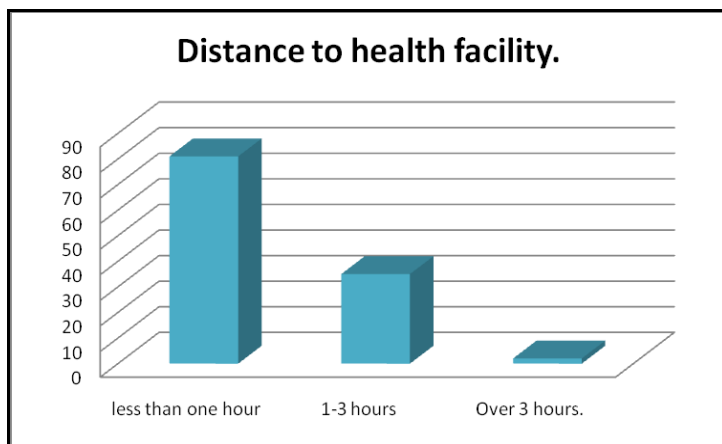


Figure 19: Distance to the nearest health facility of choice

Given that most of the diseases experienced in Kagongo Wendani area is malaria and water borne diseases, there is a great need for water and sanitation project to address the issue on safe water for drinking. There is also a need for more intervention for improving water coverage of which water quality and sanitation component should be factored in. Additionally, there should be continuous capacity building activities for both health and community personnel and also

strengthening of the various targeted groups.

3.3.13 Land sizes and Tenure system

Most of the land in the county has been adjudicated. Most of the land held by farmers is in small scale with few large farms that are spread throughout the county. The mean holding size per household is 3.7ha. Approximately 77.8 per cent of farmers in the county have title deeds. However in some areas most farmers in the former settlement schemes have no title deeds while others have allotment letters. There are few incidences of landlessness in the county. (Figure 21)

98 percent of the respondents were living on their own land by the time of the field survey while 2% were not the owners of the land where they were dwelling. Due to the foregoing, 71% of the respondents have Title deeds for their land while 29 percent don't have title deeds.

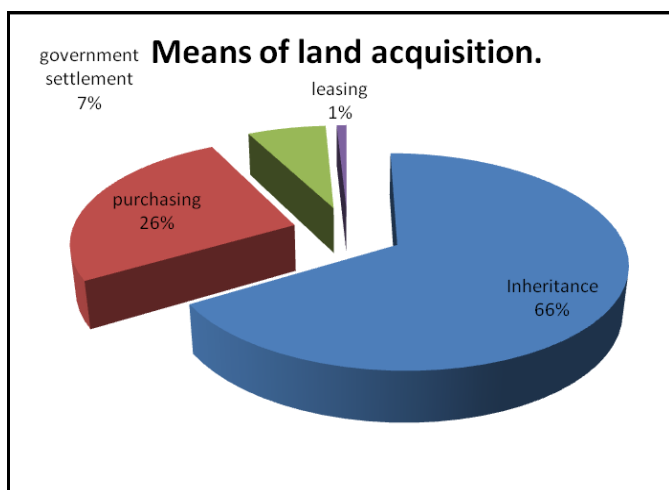


Figure 20: Means of land ownership

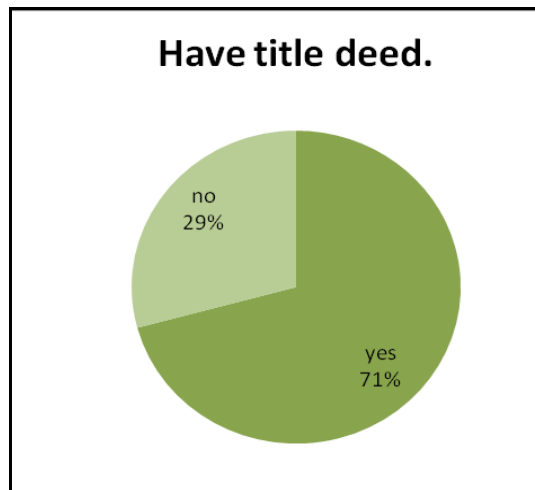


Figure 21: Possession of title deeds

3.3.14 Food production

The average land size per household in the project area is approximately 3.7ha. However, the average land size under production per household is approximately 1acre. It is envisaged that with the introduction of the irrigation system, the average acreage under irrigation per household will grow. It emerged from the survey conducted that 74% of the respondents produce enough food from their farms. (Figure 23)

Nationally, 53.9 percent of food consumed in rural areas comes from purchases. (KNBS, 2007) When asked how they fill in the food deficit, 97 percent respondents said that they buy from the nearby markets while 3 percent relied on other plots not within the project area. (Figure 24)

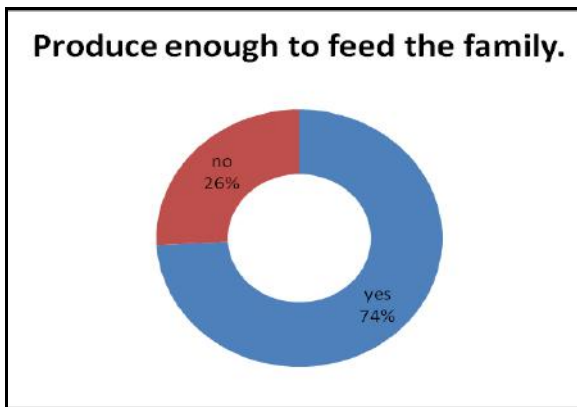


Figure 22: Levels of food production from the farms

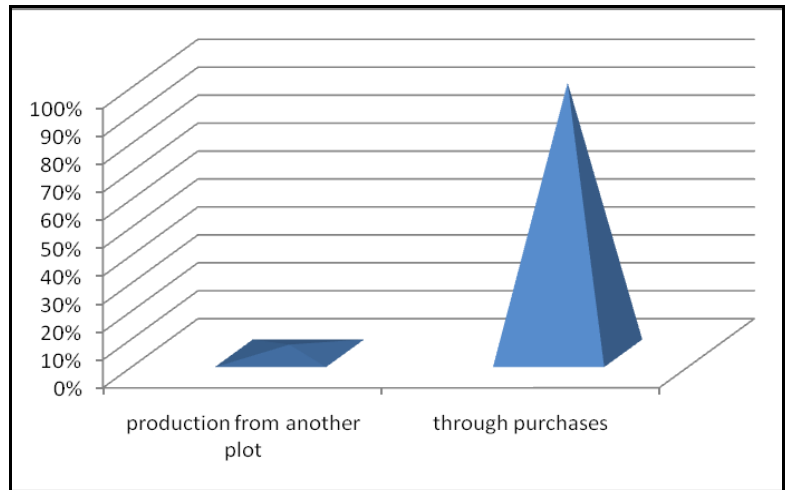


Figure 23: Other off the farm food sources

3.3.15 Cropping Patterns and Yields

Agricultural production in the county is low relative to its potential. Crop production is constrained by limited access to agricultural inputs. From the survey conducted, most of the respondents grow maize and potatoes. Livestock keeping is also common among the farmers.

3.3.16 Livestock Inventory

Livestock rearing is an important agricultural activity in the area. Culturally, livestock plays a very important role in the study area including production of milk, dowry, meat acts as savings. The common livestock include local cattle, sheep, goats and poultry. Grade cows dominate the available species. Sheep is more preferred to goats due to the cold weather in the project area while indigenous chicken dominate poultry production. Inventory of average livestock per house hold is shown in the table below.

3.3.17 Cultural/historical sites

On awareness of any sites of special/particular cultural interests in the region such as sacred places, graveyards, cultural places, archaeological places, and recreational places among others that could hinder successful implementation of the proposed project, majority of respondents had no knowledge of such sites

3.3.18 Purpose for keeping Livestock

Cattle are the main livestock production enterprise in the project area. The cattle are mainly kept for Investment. Other uses include milk and meat production, income generation, manure and status of wealth. Sheep and goats are for income diversification, meat and milk production and manure production. Poultry especially chicken are for meat and source of household incomes.

3.3.19 Agricultural Production

Agricultural production in the county is low relative to its potential. Most of the respondents interviewed practice subsistence farming. None of them use fertilizers while most rely on rainfall. Extension services hardly reach the farmers. This has led to low productivity.

3.3.20 Gender in relation to irrigated agriculture

The term gender refers to the socially and culturally constructed difference between men and women. Gender concerns the socially constructed roles and the resulting relationships between women and men, girls and boys etc in terms of their rights, obligations and opportunities in a specified group. The relevance of gender concerns in irrigated agriculture emanates from the fact that in many socio-economic settings, gender has been observed to constrain increased productivity. Although resource endowment and other social factors may have a greater influence on agricultural production than gender, it is also true that within a given social and economic group, gender roles dictate the response to change and can therefore reinforce the constraints on women and men. The economic viability of irrigation systems is frequently undermined due to:

- Insufficient consideration of gender relations in the planning phase of Irrigation and Drainage
- development Failure to recognize women direct stake holder's
- Men and women have different interests and needs as water users
- Their motivation to participate in an Irrigation and Drainage development is based on different
- criteria for investing their time, labour and capital.
- Lack of a mechanism to enable women to improve their position and opportunities

Indeed, Women and the youth provide much of the agricultural labour. They supervise the family owned gardens involving tasks such as sowing, weeding, harvesting, marketing, storage and processing of agricultural and animal products. While women and the young people do most of the agricultural activities, adult men control most of the farm assets. Among the Kagongo community, as is the case with other Kenyan communities, adult men own all the assets, including land and livestock. They also control all the income accrued from farm produce such as maize and beans as well as the income fro.

3.3.21 Expected project benefits

Majority of respondents were optimistic that the project will yield positive results in their households. Some of the positive impacts cited by respondents include; more water for crop production through irrigation, reliable water for domestic consumption as well as more water for livestock, increased household food security, more job opportunities, high incomes and increase in

crop diversification. However, some expressed fear of land alienation and reduction in pasture upon project implementation.

3.3.22 Existing Agricultural Practices

According to Nyandarua County Development Profile, 2013, the County has high potential for agricultural production. Crop production is constrained by limited access to agricultural inputs (fertilizer, seeds, chemicals, and machinery), lack of credit facilities, and inappropriate farming practices. Further, weak extension service delivery means that most farmers are unable to take up modern forms of farming to cater for the rising population and changing weather patterns. Concomitantly, poor marketing systems combined with weak technologies stifle value addition in farm production. From the survey conducted, 96 percent of the farmers interviewed use fertilisers when planting while 4 percent did not. All respondent acquire fertilisers from the local agro-vet shops. (Figure 25) 94 percent of the respondents use farm manure from their own farms to boost their soil fertility. (Figure 26)

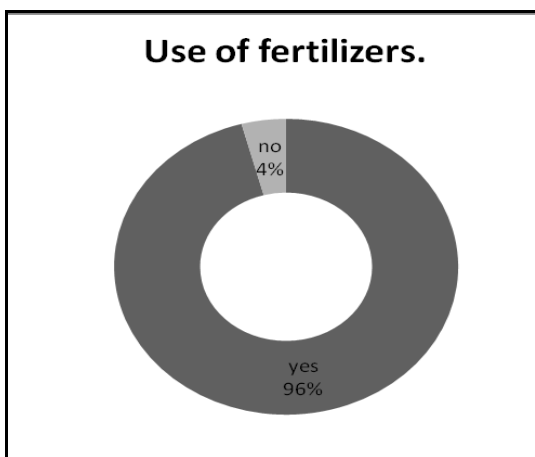


Figure 24: % of farmers who use organic manure

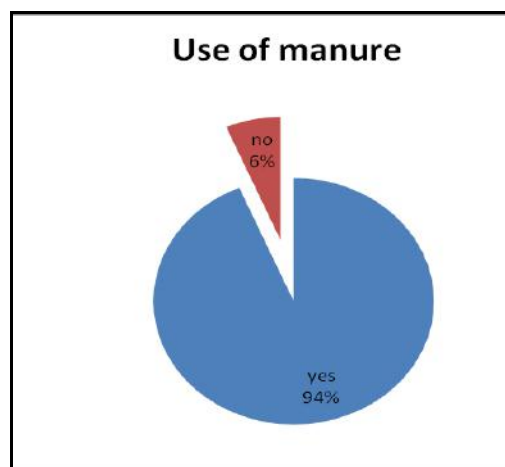


Figure 25: % of farmers using chemical fertilizers

For those farmers who irrigate their farms 67 percent use furrow method while 33 percent use other methods. On average, they have been practising irrigated farming for 4.5 years. (Figure 3.27)

76 percent of the respondents said that their farms do not experience soil erosion. Various preventive measures have been employed to prevent soil erosions within the project area. 49 percent of the respondents have practised agro forestry as a control measure, 19 percent have inter cropped while 17 percent have applied manure as a soil conservation measure. (Figure 28)

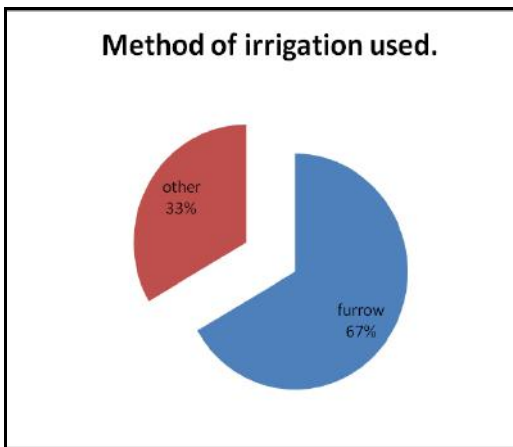


Figure 26: Methods of irrigation used

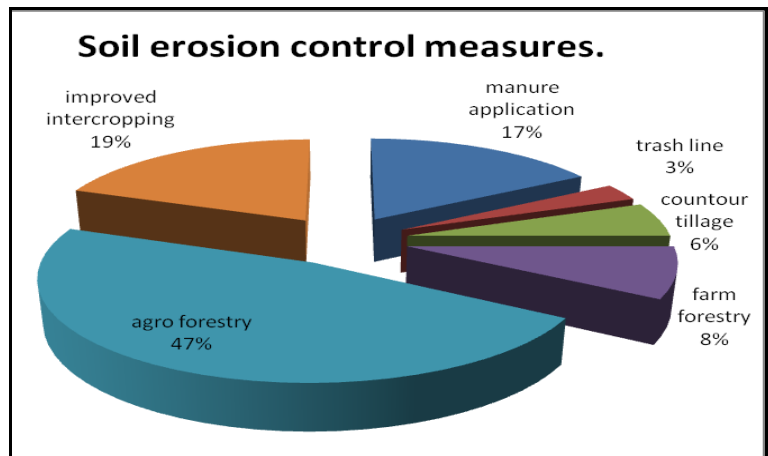


Figure 27: Measures to control soil erosion

3.3.23 Farm Labour and demand

The main source of farm labour within the project area is family labour. Each household has an average of 3 members available for farm labour. Those who employ permanent farm labour pay an average monthly wage of Ksh. 4500. 76 percent of the respondents employ casual labour at an average wage of Ksh. 200 per day. It is important to note that there were no gender differentials in casual labour payments. (Figure 29). Farm labour highly demanded mainly during the month of October (Land preparation time) when extra labour is normally hired. When respondents were asked whether they experienced labour shortage, 79 percent of them stated that they did not. (Figure 30)

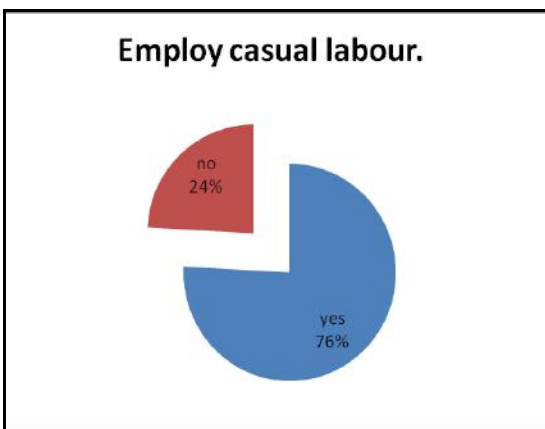


Figure 28: Respondent facing labour shortage

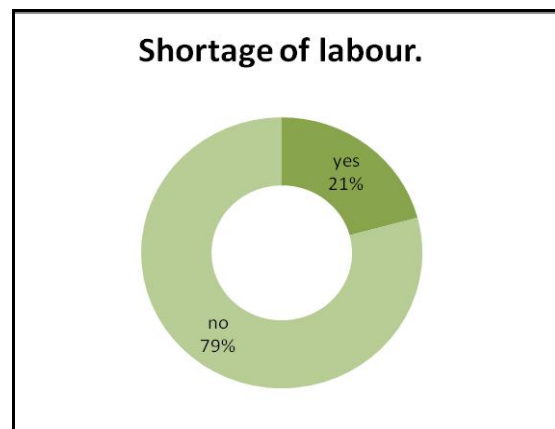


Figure 29: Respondents who employ casual labour

3.3.24 Market for Farm Produce and Livestock

There are 157 trading centers and one town, Mairo inya, and three other urban centers in the county. The three urban centers are Njambini, Engineer and Ol_kalou. Most of the trading centres have scheduled market days where buyers and sellers congregate for trading purposes on retail basis. Major goods traded in these markets include potatoes, cabbages, and tomatoes among other agricultural produce, second hand clothes and household items. There are 537 registered wholesale traders and 12,900 retailers in the county .This imply that the bulk of the trade is in retail.

(Nyandarua County Development Profile, 2013) However, most of the farm produce as well as livestock are collected from the farms by middle men

3.3.25 Extension and Training

The role of agricultural extension is to provide farmers with relevant agricultural information that helps them to optimize their use of limited resources. The Ministry of Agriculture, NGOs, community based organizations (CBOs) offer agricultural extension services but are inadequate and characterized by high farmer to staff ratios, lack of efficient transport facilities for field visits and follow ups. This has led to poor adoption of agricultural technologies, resulting in low crop yields as previously mentioned. When farmers were asked whether they had access to any extension services, 68 per cent stated that they had not accessed extension service with only 32 per cent saying they had sought such services. (Figure 31)

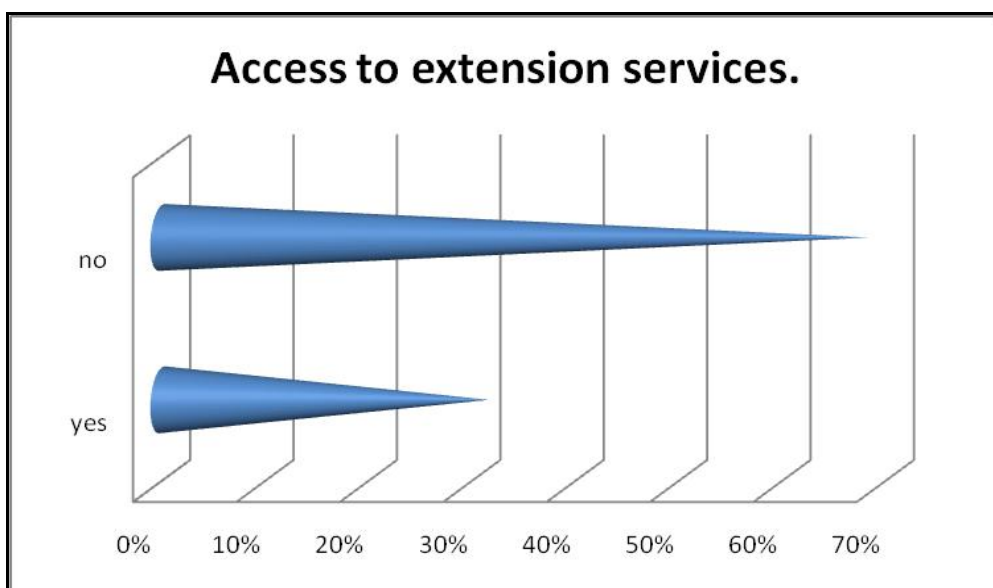


Figure 30: Access to extension services

In general Provision of extension services is constrained by the following:

- Understaffing in the MoA – this has led to inefficient transfer of appropriate technology.
- Farming practices have remained traditional due to poor technology adoption rate;
- Inadequate transport facilities for follow-ups after training farmers;
- Lack of other extension service providers in the area to complement the MoA extension services;
- Lack of training facilities and demonstration farms in the County for farmer training.

3.3.26 Credit and Saving

Need for credit is low since agricultural production is at subsistence level. Most crop enterprises do not attract agricultural financiers. During the field survey, farmers were asked whether they had access to credit for agricultural activities/inputs in the last three cropping years. From the survey conducted, 43 percent got credit from SACCOs, 29 percent from self help groups, 14

percent from banks and another 14 percent from friends. (Figure 32)

The constraints to credit availability and utilization in the proposed project area that have been noted include:

- Lack of collateral.
- Farmers weak organization capacity;
- Credit institutions not interested in funding agricultural programmes due to perceived difficulties;
- Subsistence agriculture which involves low levels of inputs hence a limited to credit demand

From the survey conducted the respondents interviewed experienced acute shortage of cash during the months of January, February and March while it's harvesting season. They also experience shortages during the months of October, November and December when it is land preparation and weeding seasons. (Figure 33)

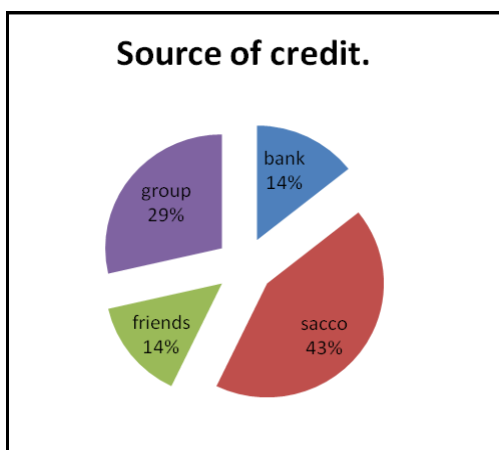


Figure 31: Source of credit

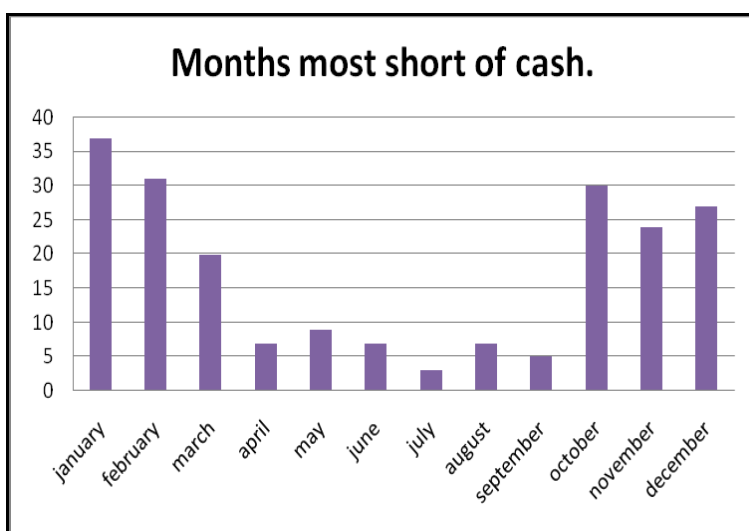


Figure 32: Periods when farmers experience cash shortage

To overcome the cash shortage difficulties, farmers employ various means. When they were asked how they overcome the shortage, 50 percent said they sell food crops, 19 percent delay their purchases, and 10 percent have off farm incomes while 8 percent sell livestock. There are 7 percent who obtained credits while 6 percent had other sources of cash.

3.3.27 Project Awareness and Willingness to Support the Project

Though the community mobilisation exercise was ongoing during the field survey, it was important to note that awareness of the proposed project was high. 78 percent of farmers were aware of the proposed project while 22 per cent were not. (Figure 34)

Chief's barazas were the main source of information to farmers on project awareness. This was cited by 36 percent of the respondents. 35 percent got the information from their friends and neighbours while 15 percent were informed through extension services. The rest had unspecified sources. (see figure 35)

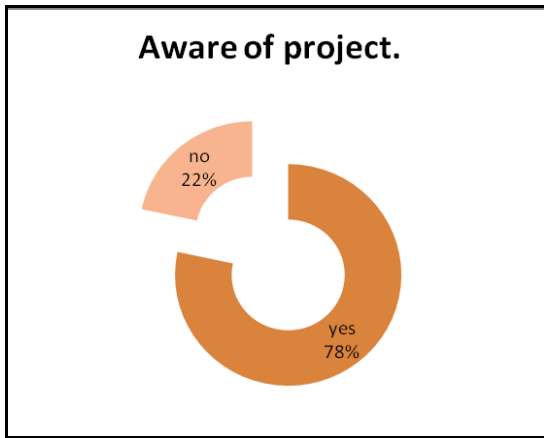


Figure 33: Project awareness Source

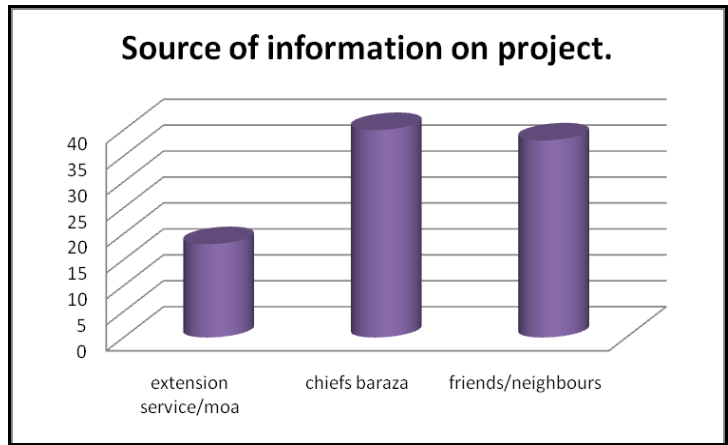


Figure 34: Source of information on project

81 percent of the respondents said they will support the proposed project. Asked how they will contribute, they stated in kind by availing their own labour for free, giving leave way for irrigation canals, and offering locally available materials. Others were willing to offer cash and also contribute in-kind. 19 percent were reluctant to support the project. Some of the reasons advanced for their laxity were previous experiences of stalled community water projects. (Figure 36)

89 percent of the respondents interviewed are willing to contribute part of their land if canal passes by their land while 11 percent were not. Respondents who were unwilling to give way also cited previous experiences of stalled community water projects. (Figure 37)

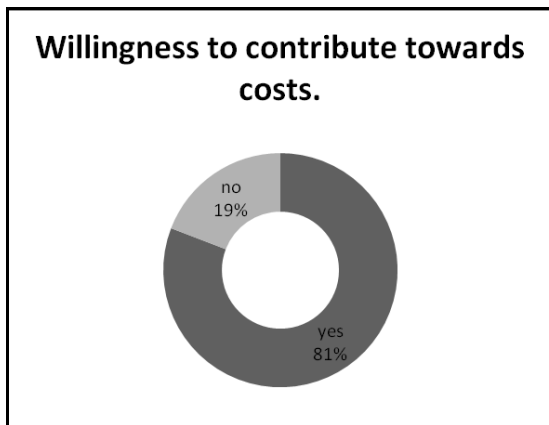


Figure 35: Willingness to contribute to Project cost

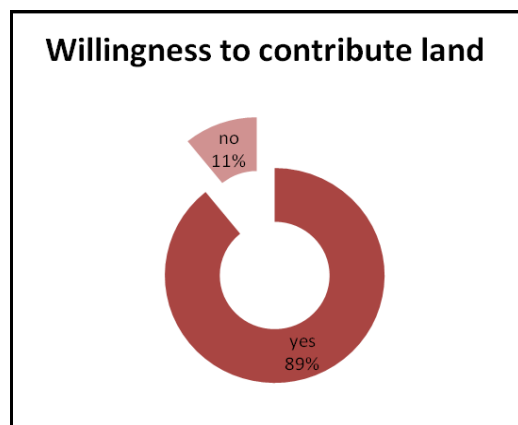


Figure 36: Willingness to contribute land Support the Project

3.3.28 Challenges Facing the Project area Communities

From the survey conducted, community members face the following socio economic challenges;

- Transport difficulties due to the poor state of the roads.
- Lack of extension services
- low literacy levels leading to sub optimal production
- Lack of reliable products markets
- Erratic rains

CHAPTER FOUR

4 PROPOSED PROJECT DESCRIPTION AND IMPLEMENTATION

4.1 Land

The land on which the dam is to be constructed is public land. The community and the local leaders have given the green light for the project to proceed. The proponent will obtain the necessary regulatory documents from the community, and the community leaders on the management of the earth dam. The main line will follow through the riparian area to the targeted farms. The farms to be irrigated are private and the government has put in place the project to provide more water to these individual's farms that vary in size according to individual ownership. There will be no appropriation of land.

4.2 The Water Reservoir

The available water resources in Oljor orok division are rivers, streams, springs and shallow wells. They include Rivers Shamata, Siriba, Ex Shar, Silbwet, Kalewa, Ngare nara, Ngomongo and Simba. The water reservoirs include Gathanji, Ex-Smith, Ex- Jacob, John Phillip, Kamwana, Ex-Colony, and Ex- Kariuki among others. The water from these rivers and water reservoir is primarily used for domestic and livestock purposes.



Figure 37: A view of Ex-Jacob reservoir

The proposed project shall involve major construction works of the core trench and the major barrier in addition to excavation of the reservoir, which shall be done using a bulldozer. The project will as well incorporate environmental conservation, health and safety measures. The dam excavation is expected to last for 3 months. while the construction of the core trench and other off take system is expected to take another 4 months and the training of the water users will take about 2 months. The

project site has an existing dam that is poor condition and need to be rehabilitated asoon as possible. In construction of the new dam wall it is advised that the project design should be subject to a peer review to ensure that that it take into account all the design requirements of the site.

4.2.1 Site and technique selection

Before selecting a specific technique, due social and cultural aspects prevailing in the area must be given consideration. They are paramount and will affect the success or failure of the technique implemented. This is particularly important in the arid and semi-arid regions of Kenya and may help to explain the failure of so many projects that did not take into account the people's priorities. In arid and semi-arid Africa, most of the population has experienced basic subsistence regimes which resulted over the centuries in setting priorities for survival. Until all higher priorities have been satisfied, no lower priority activities can be effectively undertaken. Along with checking the sequence of priorities, the planner must also consider alternate sources of water. These must be compared with water harvesting in cost and in the risk involved. The comparison must take into account the water quality required, operational and maintenance considerations as well as the initial cost. Where alternate water is of better quality, is cheaper to develop, easier to obtain or involves less risk, it be given priority. An example of this is the development of springs or shallow wells for micro-scale irrigation, prior to water harvesting provided there is sufficient energy to give water the required head. The current site has an exising dam and the water is from a peinnial stream

4.2.2 Basic technical criteria

A water harvesting technique will only be sustainable if it fits into the socio-economic context of the area and also fulfills a number of basic technical criteria. Such criteria are based on:

a) Slope:

The ground slope is a key limiting factor to water harvesting. Earth dams are not recommended for areas where slopes are greater than 5% due to uneven distribution of run-off and large quantities of earthwork required which is not economical. Earth dams are better suited for greater slopes and river valleys as they take advantage of the backthrow.

b) Soils:

Should have the main attributes of soils which are suitable for irrigation: they should be deep, not be saline or sodic and ideally possess inherent fertility. A serious limitation for the application of water harvesting is soils with a sandy texture in the catchment. If the infiltration rate is higher than the rainfall intensity, no runoff will occur.

c) Costs:

The quantities of earth/stonework involved in construction directly affects the cost of a project or, if it is implemented on a self help basis, indicates how labour intensive its construction will be.

4.2.3 Description of Construction Works

a) Design and Layout

The project comprises desilting of the reservoir reconstruction of an earth dam (retaining wall) to harvest water for use during the dry season. The initial design of the dam will comprise construction of a total embankment height of 2.5 metres with a 2M deep core trench for stability, the embankment will be 150M in length, and the crest should be at least 6 metres wide and will be used as a road crossing. There should be an allowance of 1.5M high free board to avoid overtopping during heavy storm. A spill way which can comfortably accommodate floods should be designed along the project to direct the discharge back to the natural course. A draw pipe of 150MM diameter should be fixed during the construction of the retention wall for extraction of water from the dam to the animal watering facilities. A second draw pipe of the same diameter should be installed for flashing the reservoir and recharging the stream if need arise.

b) Excavation and Construction of the reservoir

The dam's reservoir will be constructed by excavating/cutting all the earthworks following the indicated contours in order to form a depression that will hold water, while filling the borrowed materials on the downstream of the depression that will act as a barrier. Proper compaction needs to be done in order to safeguard the dam from failure of sliding.

c) Core Trench

A trench of appropriate width and deep will be excavated using the bull dozers or excavator machine on the dam axis. The trench will then be filled back with recommended clay soil material and be successfully compacted with a hammer of not less than 50Tones for every 250MM material fill with the designed right moisture.

d) Dam Embankment

The dam embankment shall be of appropriate width at the base and at the top for the design height. The upstream slope shall have a gradient of 3:1 while the downstream slope of 2:1. Big stones shall be placed on the upstream slope to give wave protection. Grass shall be planted on the downstream slope. **NB:** No trees should be planted on the embankment.

e) Crest Width

The top width of the dam shall be of the appropriate width, over design to have guaranteed strength. It will also act as a road across the two opposite banks of the reservoir.

f) Free Board

The height difference between the maximum flood peak level in the reservoir and the top of settled dam forms the free board. The height should be adequate to ensure no over topping the embankment during flood discharge and wave action.

g) Spillway Design

There will be civil works at the spill way to avoid erosion. The crest of the spill way will determine the storage level. The guard of spill way should have adequate width to accommodate the expected discharge. Spill way will be designed such that it will ensure control of the overflow discharge back to the natural stream.

4.2.4 Resources and accessories works

a) Funding

It is assumed that the proponent has adequate finances to enable timely implementation of the project. The proponent shall set aside adequate funds for the implementation of the environmental management plan (EMP). The construction costs are based on the current market prices for materials, fuels, labour and contract rates for civil engineering works. The farm should also be fenced off. The budget should be adequate for the outlined activities, and it is assumed that the proponent has secured the funds.

b) Machinery

The project will be contracted and hence the proponent will not need to hire or own any machinery. The contracted firm or individual should be qualified and licenced by the relevant authorities to undertake such work. The contractor shall provide machine and the operators who should be technically competent to undertake the dam construction.

c) Pit Latrine Construction

A pit latrine will be put up in the neighborhood of the project area for use by the members of the community especially when they are undertaking their activities in the project site. This will help improve the sanitary conditions and mitigate against water borne diseases that may be caused by human waste. The facility should be kept clean and hygienic at all times

d) Perimeter Fencing

The dam site will be fenced off from animals and persons' access. This will avoid accidental fall in, minimize danger of drowning and fouling of the water by livestock.

e) Recharge and Storage

An earth dam will be constructed on the course of a perennial stream that originates from the neighboring hills that form the catchment. It will harvest the water from the stream and surface runoff during the rains. The stream will be a source or recharge for the reservoir during the dry season. Soil conservation works around the reservoir e.g, planting of trees in the catchment and conservation and respect of the riparian section along the stream and the shores of the reservoir will reduce the silt load in the surface runoff and the stream hence improving the lifespan of the dam. The proponent plans to create a reservoir with a capacity **1,000M³** dead storage. The Catchment has a

capacity in excess of **5000 M³**. The flow rate of the stream is **1.4M³** per second during the dry season and is capable of recharging the dam without major disruption to normal flow of the stream.

4.3 Delineation of Potential Irrigation Areas

4.3.1 Potential irrigation areas

In line with the TOR, the current study focuses on the feasibility for development of a net area of 333.80 ha. During the Inception Stage a gross area of over 1000 ha was identified, further fieldwork and studies during this Stage indicate that the potential gross irrigation area has reduced to about 392.72 ha due to water availability constraints. The boundaries and general layouts for the potential irrigation areas have been prepared taking into consideration the following factors:

- Gravity command from the proposed intakes;
- Topography – blocking of areas with similar topographical features such as same ridge and
- slope class; Existing drainage system (natural waterways/depressions) – used to form boundary between
- major and smaller blocks; Existing road networks – used to separate some major blocks;
- The distribution of gross irrigation areas is shown in the table below.

Irrigation Area Name	Pipeline Name	Length (m)	Gross Irrigation Area (Ha)
PROJECT AREA	Mainline	7506	392.71
	Sub-Mains		
BLOCK - 1	Submain-1	679	57.98
BLOCK - 2	Submain-2	521	45.00
BLOCK - 3	Submain-3	743	25.07
BLOCK - 4	Submain-4	428	36.27
BLOCK - 5	Submain-5	210	20.85
BLOCK - 6	Submain-6	490	53.16
BLOCK - 7	Submain-7	409	24.31
BLOCK - 8	Submain-8	1178	67.58
BLOCK - 9	Submain-9	810	39.11
BLOCK - 10	Submain-10	836	23.38

Table 1: distribution of gross irrigation areas

4.3.2 Net Irrigation Area

Net irrigation area is normally estimated based on deduction of 10 - 30% of the gross area to cater for roads, settlements, pipeline and canal way leaves in case of an open system. With this in mind, the corresponding net irrigation areas are as shown in Table 4.2 below. The net area with 15% reduction

has been adopted for this project.

4.3.3 Irrigation Development Options

Formulation of Irrigation development options for the proposed Kagongo Wendani Irrigation scheme was carried out based on the consideration of the following factors.

- Identification of the most appropriate water use/application method (discussed above).
- Identification of a suitable water delivery method;
- Identification of a suitable water supply method;
- Total irrigable area

The gravity supply system has been identified due to its low operation and maintenance costs; The water application method (Sprinkler) has been selected based on factors presented in the preceding section. The water delivery method has been identified as piped system due to the following considerations:

- A piped system has a higher conveyance efficiency due to minimised losses of water
- resulting from evaporation and seepage;
- A piped system has a lower operation and maintenance labour requirement;
- A piped system is more durable

.During the draft final feasibility study of the proposed Kagongo Wendani Irrigation Development Project, the proposed development options were focused on two development options as summarized below.

- Option 1(Net irrigable area 300 ha)
- Option 2(Net irrigable area 100 ha)

These development options were presented to the stakeholders during the stakeholders Workshop No.1. During the workshop, option 1 (333.8 Ha) was adopted and it was resolved that the option should proceed to final feasibility and detailed design. Furthermore, during additional fieldwork and survey exercises conducted by the consultant, preceding the workshop, an additional area up to 333.8 hectares was identified and delineated. This section of the report mainly focuses on the development of a sprinkler irrigation system for 333.8 hectares as detailed in the subsequent sections.

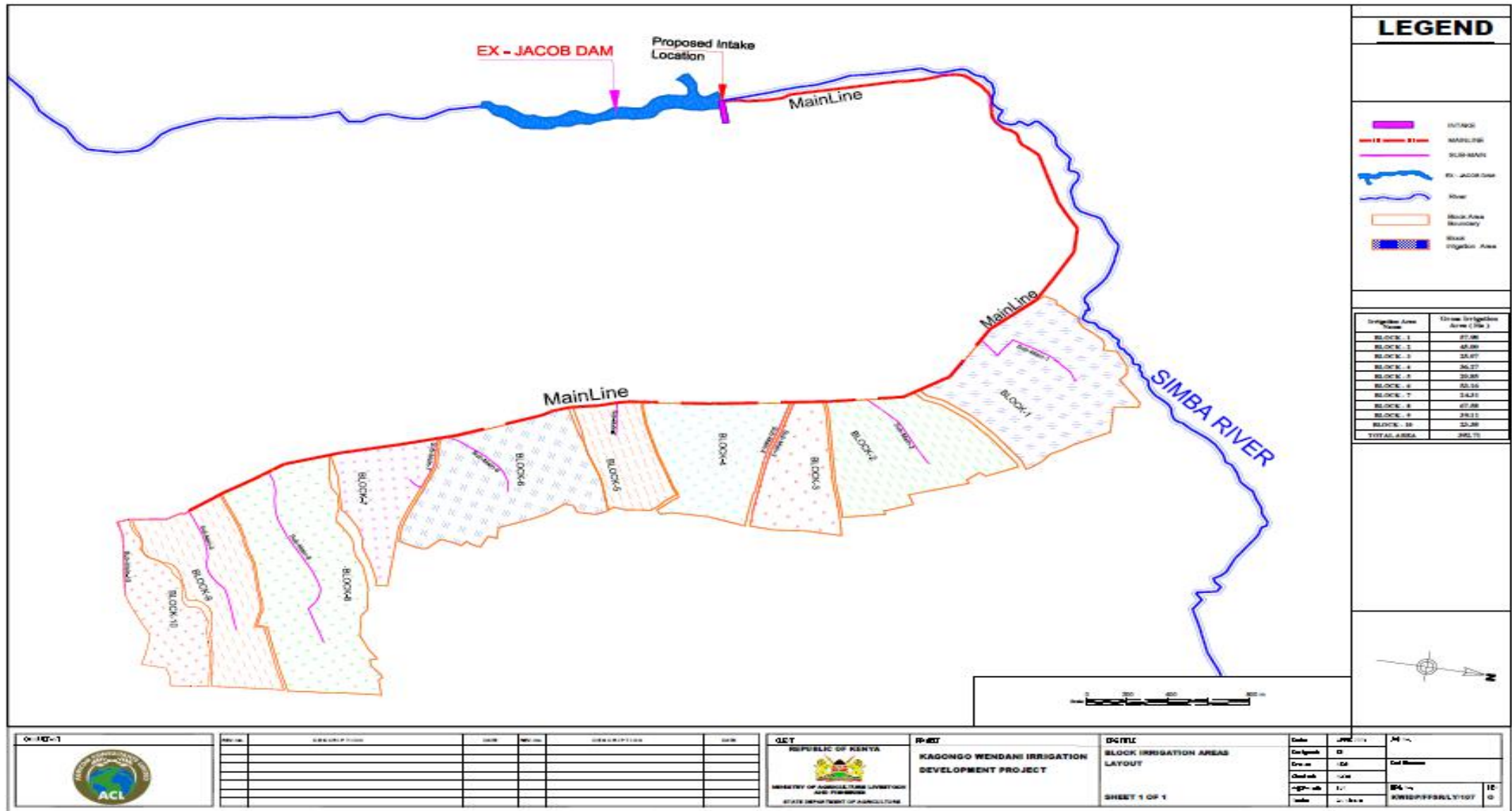
4.3 Layouts of the preferred development option

The general layout within the project area was prepared taking into consideration the following factors:

- Topography – blocking of areas with similar topographical features;
- Existing drainage system (natural waterways/depressions) – used to form boundary between blocks;
- Main rivers – the main rivers formed boundaries between major blocks;
- Existing road networks – used to separate blocks;

The project area was divided into ten blocks for option 1 covering blocks 1-10. The areas under each block have been further sub-divided into smaller units (Tertiary areas). Figure 4.1 shows the preliminary area layout for option 1.

Preliminary Layout for the Project



4.4 Topographic features and slope classes in the main irrigation areas.

The main areas in the current study have been delineated based on topography and existing drainagesystem. The main topographical features and slope classes for the areas are summarized in the Table below

Table 2: Main topographical features and slope classes of the project area

Block Name	Elevation (m)	Slope Class (%)	Description of Topography
1	2495 - 2549	2-17	Undulating slope towards Lake OIBollosat with an average slope of 4.81 %
2	2493-2547	2-13	Undulating slope towards Lake OIBollosat with an average slope of 4.62 %
3	2491-2546	2-14	Undulating slope towards Lake OIBollosat with an average slope of 4.64 %
4	2484-2530	2-12	Undulating slope towards Lake OIBollosat with an average slope of 4.62 %
5	2484-2544	3-17	Undulating slope towards Lake OIBollosat with an average slope of 5.22 %
6	2470-2542	4-15	Undulating slope towards Lake OIBollosat with an average slope of 6.77 %
7	2427-2516	2-11	Undulating slope towards Lake OIBollosat with an average slope of 4.84 %
8	2437-2502	2-11	Undulating slope towards Lake OIBollosat with an average slope of 4.80 %
9	2441-2502	3-11	Undulating slope towards Lake OIBollosat with an average slope of 6.56 %
10	2441-2502	3-11	Undulating slope towards Lake OIBollosat with an average slope of 6.56 %

4.4 Topographic assessment of the irrigation areas

From the slope classifications presented above, all areas are suitable for irrigation. Appropriate soil conservation and farming techniques will need to be employed to make the area suitable for agricultural production, this especially so for areas in the blocks where slopes exceed 12%

4.4.1 Proposed Project Components

The components for Kagongo Wendani scheme are presented below;

- Intake;
- Pipelines (Conveyance, main, sub-mains and distribution);
- Pipeline appurtenances (air valves, washouts, anchor/thrust blocks, pressure regulating valves, etc);
- Road crossings;

- Gully Crossings;
- Infield for Sprinkler Irrigation Systems.

Proposed irrigation pipelines

Table 3: irrigation pipelines for Option

Pipeline Name	Pipeline Length	Pipe Diameter Rang (mm)	Pipe Material	Design Flow (m3/s)
Main Line	7500	300-650	GRP	0.24
Submain-1	684	140 - 250	uPVC	0.04
Submain-2	521	110 - 225	uPVC	0.03
Submain-3	742	75 - 140	uPVC	0.02
Submain-4	428	90 - 140	uPVC	0.02
Submain-5	220	90 - 110	uPVC	0.01
Submain-6	488	140 - 200	uPVC	0.03
Submain-7	408	110 - 125	uPVC	0.01
Submain-8	1177	90 - 200	uPVC	0.04
Submain-9	810	200.000	uPVC	0.02
Submain-10	818	125 -160	uPVC	0.01

4.4.2 Project Development Costs

The preliminary cost estimates is Kshs. **340,200,136.41** while the annual operation and maintenance costs have been considered at 1% of the development costs following the consultant's experience of similar projects in the same region and results into KShs3, 402,001.

CHAPTER FIVE

5 PROJECT ALTERNATIVES

The Environmental and Social Impact Assessment study identified and assessed alternatives to the proposed development/project. The best alternative was selected based on less negative impacts and cost benefit analysis. Listed below are the alternatives considered.

5.1 The ‘NO PROJECT’ Alternative

This is an important analysis as it help the proponent measure impacts from the project visa a vis the impacts without the proposed project. The “No Project” alternative option in respect to the proposed project implies that the status quo is maintained. This implies that the environmental situation will neither improve nor deteriorate. On the other hand the project will improve food security, increase household incomes and provide employment as well as upgrading the regional economy. The No alternative will lead to major negative and long term impacts to the region, these will include:

- (i) The local community will continue to suffer due to lack of water for agricultural use.
- (ii) The productivity will be low and reduced ability to create wealth.
- (iii) This option is not consistent with the Big 4 Agendas one of which is National food security
- (iv) This option will not help in achieving the national target for irrigated agriculture which stands at 100,000 Ha Annually

The NO project alternative is the least preferred from the social economical and environmental aspects.

5.2 Alternative Location of the Project

There is no alternative project site for the proposed Kagongo-Wendani project as the area can generally be characterized to be the same, therefore an alternative would mean complete re—location of the project to a different site. The people in this area need the project as much as those elsewhere, however the presence of the water resource makes this site the most ideal.

5.3 Alternative Irrigation Methods

The type of irrigation methods development greatly depends on the nature of the water sources, topography and relative location to the command area .Various methods can be applied at different levels of an irrigation project in order to achieve the required objective. A combination of techniques can be selected in order to achieve optimum irrigation project. The technology should take into consideration socio and economic aspect of the community involvement, this calls

for their participation during selection and assessments of alternative technologies. The various irrigation options includes-;

- Gravity fed irrigation;
- Lift irrigation;
- Wetland irrigation; and
- Flood irrigation.

Gravity fed irrigation: Water flows to the land by gravity, the irrigation water must be available at higher grounds/ levels than the recommended fields. Water is diverted from the main source by the head works and supplied to the field through a network of conveyance and distribution canals or pipes. Water can be supplied directly to the fields using canals, sprinklers or indirectly from a storage reservoir. Storing water in a reservoir or dam allows for more area to be covered but it's more expensive due to high construction of the dam/reservoir.

Lift irrigation: System's water is lifted to the area by use of pumps or manual methods from the source or distribution system and discharging into a higher canal system, a storage reservoir or directly onto the fields. It is the topography that dictates the use of pump fed irrigation system. Normally water source is lower than the irrigation field. The use of pump-fed irrigation system is governed by the maximum suction lift. Pumps used are normally low head, high discharge. It is a more expensive method than the gravity method due to higher long term running costs of pumping water (fuel, lubricants, repair/operation and maintenance)

Wetland irrigation: Is more common in areas of permanent/seasonally water logged valleys or depressions, due to water inflow from outside. They cover water sheds and head waters of river systems and have a fluctuating water table related to seasonal ground water and surface water flow regimes.

Flood irrigation: Is a form of gravity irrigation from a river without the need for an intake structure to divert the water. Seasonal rains raise the streams and rivers courses and the flow waters can be used by the farmers to irrigate their fields. Bunds and channels can be constructed to maintain the water in the fields for as long as possible, and as the flood recede the residual moisture, is used by the crop. Once the floods and residual moisture have been exhausted the farmer can make use of the shallow water table and construct shallow wells to lift the water by bucket for watering/ irrigating the crops. Gravity irrigation will be the most preferred in our scenario due to the nature of the topography of the project area. The water will be conveyed through pipes to the farms.

The summary results of the consultation were as follows:

- (i) They do not object the proposed project.
- (ii) All confirm that the proposed development will not cause major negative environmental
- (iii) impacts to community at large and to environment in general
- (iv) They do not have any conflict in terms of land ownership.



Photo 4: Meeting with members of the downstream community

CHAPTER SIX

6 ENVIRONMENTAL AND SOCIAL IMPACTS

6.1 Impacts and Mitigation Measures

The tables below shows the impacts and mitigation measures during construction and operational phases of the project

Table 4 Impacts and Mitigation Measures during Construction Phase

Potential Impact 1	Removal of vegetation, loss of habitat
Project Activities	Site preparation and clearance
Environmental Receptor	Land, flora, fauna, endemic species
Duration	Immediate/long term
Magnitude	Low (negative)
Mitigation Measures	-Selective cutting should be adopted during the clearance -tree planting plan during development and construction phase
Significance	Direct/medium negative/reversible impact
Potential Impact 2	Soil compaction and degradation
Project Activities	Earth dam excavation
Environmental Receptor	Land
Duration	Immediate and long term
Magnitude	Low negative
Mitigation Measures	Properly designed spillway to direct water back to natural course Avoid unnecessary movement of machinery beyond the excavation area
Significance	Low and avoidable
Potential Impact 3	Noise, Fugitive dust, Air pollution
Project Activities	Excavation of earth dam
Environmental Receptor	Humans, flora and fauna
Duration	Short term
Magnitude	Medium
Mitigation Measures	-Occupational health and safety guidelines -Proper servicing of machines and equipment to reduce exhaust fumes -Provision of noise and dust protective gear
Significance	Medium negative/direct/avoidable impact
Potential Impact 4	Waste Oils and Spills
Project Activities	Refilling of machines and servicing
Environmental Receptor	Land, water, soils, flora, fauna
Magnitude	Medium
Duration	long term
Mitigation Measures	-Ensure proper disposal of oils during servicing -Proper handling and storage of oil products
Significance	Medium negative/direct/avoidable impact

Table 5 Impacts and Mitigation measures during operation phase

Potential Impact 1	Danger of drowning
Project Activities	Excavated earth dam
Environmental Receptor	Human /animals
Duration	Immediate/long term
Magnitude	High (negative)
Mitigation Measures	-Fencing off the earth dam/ fence maintenance -Awareness creation
Significance	Direct impact/high negative/avoidable
Potential Impact 2	Asset use/ownership conflict
Project Activities	Entire construction/implementation
Environmental Receptor	human
Magnitude	Long-term
Mitigation Measures	-Develop of water use by-laws, meet all statutory requirements, - Outline fines and charges for vandalism
Significance	Medium
Potential Impact 3	Domestic/ Human Waste Pollution
Project Activities	Operation and utilization
Environmental Receptor	Human, surface water, ground water
Duration	Short term/long term
Magnitude	Medium
Mitigation Measures	- Construction of Pit latrine within the earth dam site -Build community capacity on sanitation and hygiene practices
Significance	-Medium negative/ avoidable impact
Potential Impact 4	Water borne and water-related diseases
Project Activities	Implementation and utilization
Environmental Receptor	Human, surface water, ground water
Duration	Short term/long term
Magnitude	Medium
Mitigation Measures	- Construction of Pit latrine within the construction sites -Build community capacity on sanitation and hygiene practices
Significance	-Medium negative/ avoidable impact
Potential Impact 5	Wildlife Human/conflict
Project Activities	Implementation/utilization
Environmental Receptor	Human,
Duration	Long term
Magnitude	Medium
Mitigation Measures	-awareness and monitoring of wildlife movement - Community sensitization on human wildlife interactions -Payment of recommended penalties/compensation - Fencing of farms and Fencing of the water pan
Significance	Direct negative, avoidable impacts

Potential Impact 6	Soil degradation/degradation
Project Activities	Water/ fertilizer/chemical application
Environmental Receptor	Soil
Duration	Long term
Magnitude	Medium
Mitigation Measures	- Timely repair of bust pipes - Farmers' training on GAP and IPM -Training of farmers o operations and maintenance
Significance	Direct negative, avoidable impacts
Potential Impact 7	Livestock/crop conflict
Project Activities	Crop damage by unattended livestock
Environmental Receptor	Human (Social harmony)
Duration	Long term
Magnitude	Medium
Mitigation Measures	- Fencing of farms - Tend to grazing animals at all times -Have rules and regulations on remedial and compensation
Significance	Direct negative, avoidable impacts

6.2 ANTICIPATED IMPACTS OF PROJECT IMPLEMENTATION

The impacts have been outlined as those probable during the construction phase and those probable during the operational phase of the earth dam. Mitigation is for negative impacts only. The report encourages all measures that enhance positive impacts.

6.3 ANALYSIS OF POTENTIAL NEGATIVE EFFECTS

6.3.1 Water Borne Disease

The water body created will act a breeding ground for mosquitoes which are the vectors of malaria. However, the dam is a considerable distance from the village. However, for any household near the dam it is prudent to make sure that they do not get infected by the disease. This is by putting up mitigation measures such creating awareness on malaria prevention and provision of mosquito nets. The other potential diseases are amoebiosis as there is a likelihood of the community using the water for domestic and drinking purposes. The community should be sensitized on water treatments e.g. boil to reduce risk of infection. The proponent proposes to put up one pit latrine in the project area for use by the community

6.3.2 Danger of Drowning

This is a real hazard associated with the dam children are the most vulnerable to drowning if they result to drawing water directly from the pan or go swimming. The proponent has undertaken to fence off the earth dam to mitigate this hazard. The water will also be piped out to a watering point where

the farmer can access the water instead of drawing it directly from the dam. The proponent intends to make hybrid fence of barbed wire and chain link. This will keep away the livestock and other intruders.

6.3.3 Livestock Crop Conflict

The community here has many and diverse type of livestock it is therefore possible for animals left unattended to stray into demonstration plots and damage or graze on the crops. To avoid the crop damage the demonstration plot should also be fenced off to keep out the animals. The fence should also be repaired occasionally to ensure that there are no entry points for livestock or intruders.

6.3.4 Loss of Vegetation cover

During the construction of the earth dam an area equivalent to 7,500M² will be cleared off vegetation to pave way for earth dam and the demonstration plots. This however will have minimal negative impact as there are no established endangered plant species in the project area. The projects also will contribute to improvement of vegetation cover in the adjacent areas and farms by establishing a tree nursery and promoting agro-forestry

6.3.5 Dust and Diesel Fumes Pollution

During the excavation of the dam and the subsequent spreading and compaction of the soil a lot of dust will be raised. The machine will also produce diesel fumes and other exhaust gases that are hazardous to those who will be working in the pan/dam and those in proximity of the project area. To protect the machine operator and workers from dust/fume inhalation dust mask should be provided. Water could also be sprinkle on the surface during the excavation/ spreading and compaction to reduce the amount of dust generated.

6.3.6 Soil degradation

Excessive movement of the machine around the areas beyond the earth dam may lead to soil compaction and destruction of soil structure. The operator should avoid unnecessary movement over this area. During the operation phase there is danger of soil erosion from burst pipes and surface flow from over application of water. This may also lead to leaching of nutrients from the soil excessive use of fertilizers and pesticides may lead to soil and underground water pollution.

6.3.7 Asset Ownership Conflict

Due to the communal land ownership reality in the district, to establish and apportion a community asset will always raise question as to who own the assets. The proponent should consult with the community, the family currently utilizing the earmarked land and the local leader to declare the

project as a communal property and giving access rights to other water user without bias or discrimination. The memorandum should be witnessed by the local administration.

6.3.8 Wildlife human conflict

There are several wild animals that are found in the project area that are usually in conflict with the local community. The most noted are hyenas and foxes that prey on livestock. The community raised the issue during consultation with the EAI team and feared that wild animals might frequent the reservoir for watering and pose danger to both to the human and livestock around the project site. It should be noted However, wild animals should not be denied access to water and the design should cater for this.

6.3.9 Vandalism of Project Properties

This could be in form of damaging of the water delivery system or the fence. This is a potential source of conflict. For any form of vandalism, the normal procedure should be applied to apprehend and punish the culprits.

6.3.10 Erosion of the Spillway and the Discharge Area

The spillway should be wide enough to allow for the flow of discharge with minimum soil loss. It could also be re-enforced with a lining to reduce erosion. The discharge should also be directed to the natural water course as envisioned in the design.

6.3.11 Overtopping and Degradation of the Embankment

Due to the land form and uneven slope of the project site the embankment or the barrier should be designed to cater for the increased volume and backthrow that will result from compounding the runoff water from the streams. In normal circumstances for the pans, the volume of excavated soil is equal to the pan storage capacity. For the case of dams, storage capacity depends on the size of the barrier in relation to the contour line. The design should provide for construction of a barrier of at least 3m height to avoid overtopping with 1:1.5 side slopes and a top width of 6m which will act as a road. Grass should be planted on the outer slope to reduce soil erosion, while large stones should be place on the inner slope to minimize wave action.

6.3.12 Structural failure of the dam

Earth dams are less rigid and hence more susceptible to failure which could be caused by improper design, faulty construction and lack of maintenance. Failure of the dam can lead to catastrophic damage of property downstream and even loss of life. The various causes leading to the failure of earth dams can be grouped into the three classes here under:-

- i) Hydraulic failures

- ii) Seepage failure
- iii) Structural failure

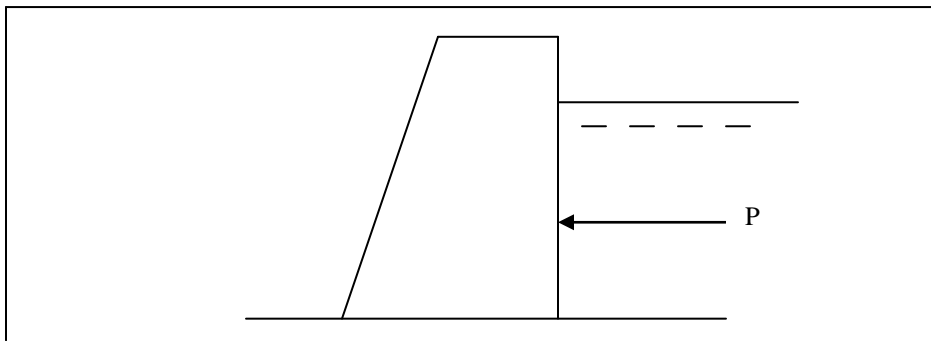
Hydraulic failure could be caused by over-flow due to inadequate freeboard and under-capacity spillway. Also, erosion of upstream face, erosion of downstream face and erosion of toe could also cause hydraulic failure. Uncontrolled or concentrated seepage through the dam body or through the foundation could lead to piping or sloughing and subsequently to dam failure. Seepage may be caused by faulty construction insufficient compaction, cracks developed in the dam due to foundation settlement, shrinkage cracks, animal burrows and the like.

Structural failures are more often than not caused by shear failures, causing slides foundation slide and embankment slide (slope too steep for the strength of the soil).

There are various forces, which affect the stability of a dam. These forces if not checked can lead to failure in the dam wall, and as a result it can be a tragedy to the residents and assets downstream. The forces include the following:

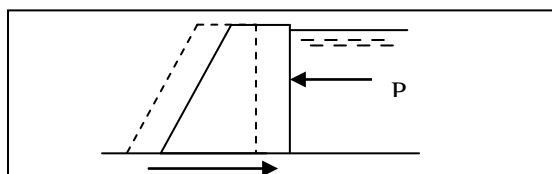
a) Overturning

This occurs when the turning moment due to lateral forces exceeds that due to the self-weight of the dam. See the figure below.



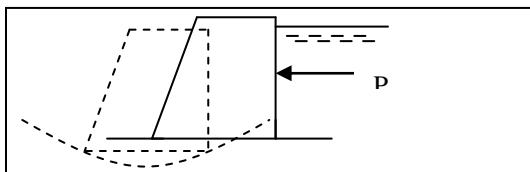
b) Sliding

The dam will slide if the lateral thrust exceeds the frictional resistance developed between the base of the wall and the soil. The factor of safety against sliding should be about two.



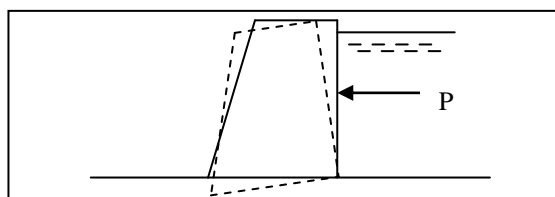
c) Bearing on the ground

The normal pressure between the base of the wall and the soil beneath can cause a bearing failure of the soil, if the ultimate bearing capacity is exceeded. Usually the allowable bearing pressure will be one third of the ultimate value.



d) Rotational slip

The dam and a large amount of the retained material rotate about some point p, if the shear resistance developed along a circular arc is exceeded. See the figure below.



6.4 ANALYSIS POSITIVE ENVIRONMENTAL IMPACTS

6.4.1 Provision of a Reliable Source of Water

Water is one of the limiting factor of farm production in the area. The dam will provide a readily available and convenient source of water both for irrigation and domestic use. The farmers in the area have also complained of crop damage by livestock on their way to watering at the river. The proposed watering trough for livestock will give the alternative watering point and hence the animals will not be going all the way down to the river.

6.4.2 Improved economy

Due to availability of water for irrigation during the off season the farmers will be able to diversify and increase crop production per unit area. They will be able to grow crops that would otherwise not perform if there was no supplementary irrigation. These means the farmers will have more produce to sell in the markets hence getting more household incomes and improving the local economy.

6.4.3 Improved Nutritional Status of the Community

With provision of adequate water for increased crop production and for livestock, it is expected the general animal condition and health will improve. This will lead to increased animal productivity in terms of carcass weight milk and blood production, and better quality hides and skin. With more food

products from their farms and animals in the diet, the community nutritional variety will be enhanced leading to a more health and well feed society.

6.4.4 Improved community health and hygiene

When local community lacks adequate water more priority is given to drinking water for human and livestock. This compromises general body and household hygiene as little water is spared for this crucial basic health needs. There is usually little water for bathing or ablutions that leads to water borne diseases, skin diseases and other ailments. With more water available by this project it is hoped that it will lead to improved status of living for the people.

6.4.5 Catchment Protection

To reduce siltation of the reservoir the proponent plans to introduce a water catchment protection on the upstream of the dam. This is an environmental conservation component should be incorporated in the project design. The proponent will mobilize the community to form a water user and management committee that will also spearhead catchment conservation and planting of trees that should include indigenous varieties that can withstand the climatic conditions of the project area. This will improve catchment, the scenery and the natural beauty of the project area.

CHAPTER SEVEN

7 PROPOSED ENVIRONMENTAL MANAGEMENT PLAN

7.1 Significance of an EMP

The environmental management plan is a logical framework which guides the proponent of a project in mitigating the negative impacts that may arise as a result of undertaking or implementing a project. It outlines the potential negative impacts, the mitigation measures to address the impacts, those that are responsible for undertaking the measures, the monitorable indicators of mitigation measure and where possible the added costs of undertaking such measures. The EMP is a crucial tool as it gives the bench marks for the compliance of a project with the set environmental standards as spelled out by EMCA. It is also the most important part of the EIA as it guides the National Environmental Management Authority (NEMA) in decision -making as to whether a project should be permitted to proceed with or without additional modification, or if it should not be permitted at all. Future environmental audits will strive to determine whether the proponent implemented the EMP or not. The proponent should therefore consult and involve professional and technical experts during the construction and operational phase of the project. It should be noted that a well formulated EMP will in the long run strengthen the project implementation as it will reduce conflict and avoid crisis.

7.2 Environmental Monitoring and Audit

Environmental monitoring during the operation of the project is essential to its sustainability. The proponent should take the leading role during the construction phase of the project. The community should be fully involved and their capacity enhanced to manage environmental issue after the withdrawal of the development agency. They should be made to appreciate environmental conservation and sustainable exploitation or the natural recourses for the project to survive the implementation phase and beyond. To establish the project has complied with environmental management standards for Kenya as set out by EMCA (1999) and the Environmental impact assessment/audit regulation of 2003, environmental audits should be conducted every second year. This will ensure that the identified potential negative impacts are mitigated during the project cycle. The audit will also help in document failure of action on the recommended mitigations and guide in decision making and the corrective measure to be taken.

TABLE 6: ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

Environment Component	Impact	Mitigation measure	Monitoring Method	Indicator	Frequency	Responsibility	Estimated Cost
Planning Phase							
Social/physical	Poor designed /unsustainable project Loss of aesthetic value	Proper Study, survey and design of the project Peer review of the design	Design and drawings, survey report Peer review report	Well laid out project Functional earth dam	One off	Proponent	450,000
Social	High expectations	Public awareness, Community Consultations and involvement	N/A	Community satisfaction	During EMP Implementation	Proponent	150,000
Construction Phase							
Fauna	Noise pollution	Well serviced machines. Provision of adequate protective gear e.g. ear muffs and dust masks.	No complaints from residents No health problems associated with high noise intensity	No recorded complain	Throughout the construction period	Proponent Contractor	26,100
Vegetation cover	Leaving the soil bare occasioning soil erosion	Only remove vegetation on surveyed area. Restricting machinery movement to earth dam area.	Checking the vegetation cleared area. Identifying the space of the ground denuded off cover.	Open ground. Soil erosion.	Site preparation stage.	Proponent Contractor	As per the design/drawings
Air Quality	Respiratory diseases due to dust and exhaust fumes	Sprinkling water around the site to harness dust.	Visual inspection	Airborne particles Smoke colour	Throughout the construction	Proponent Contractor	15,000

Environment Component	Impact	Mitigation measure	Monitoring Method	Indicator	Frequency	Responsibility	Estimated Cost
Human health	Site accidents resulting to injuries occasioning occupational diseases	-Provision of protective gear -Site restrictions especially to the community. -Proper signage -Train workers on manual handling techniques. -Keep records of incidences and accidents	Reporting of accident and incidents, safety breaches and damage to equipment	Statistical records and safety reports	Throughout the construction	Proponent Contractor	15,000
Water Quality	Contamination of groundwater	-Ensuring proper disposal of liquid wastes -Avoid oil spill within the site.	Physical observation to Ensure that no liquid wastes spill	Disposed oil storage containers	Throughout the construction	Proponent Contractor	5000
	Contamination by human waste	Locate latrine more than 30 metres away from camp house Provide Portable toilet	Physical observation	Presence of a latrine on the site	Throughout the construction	Drilling contractor	7,500
Soils	Solid waste accumulation	-Storage and disposal of waste -Recycling	Tracking the volume of solid waste generated	Waste streams and Volumes generated on site	Throughout the construction	Proponent Contractor	2000
Operational phase							
Water Quality	Water contamination and spread of water borne diseases Excessive use of chemical and fertilizers	Timely maintenance draw of system and silt trap Community sensitization Have a draw off system/accessories Fencing of the pan Catchment protection Train farmers on GAP an IPM	Routine water quality checks	Water quality standards	Through the operation phase	Proponent Community management committee	150,000

Environment Component	Impact	Mitigation measure	Monitoring Method	Indicator	Frequency	Responsibility	Estimated Cost
Water Quantity	Reduced flows down stream Have a draw-off for release of water during the dry season	Have spillway back to the natural course	Well conserved spillway Draw-off in place	Routine inspection	Throughout the project's life	Proponent Management committee	50,000
Overtopping and structural failure	Loss of life Destruction of assets downstream	Proper and comprehensive design	Peer review of the design Strict and continuous supervision during construction	Approved and per review of designs in place	One off	Proponent	2,000,000
Social Harmony	Conflict over land use and water rights Vandalism of conveyance structures	land agreement Constitute a water management committee Develop rules and regulations Training of community Have a sub-project for non-benefiting farmers	No conflict Committee meetings Adherence to the rules and regulations	- Agreement contract - Minutes of meetings - Rules and regulations	Throughout the project life	Proponent Water management committee	2,500,000
Soil	Erosion of the spill way Catchment degradation farm soil degradation from bust pipes	Properly designed spillway Catchment protection Train farmers on GAPs and IPM and O&M Timely repair and maintenance of the conveyance system	Physical assessment	Field reports	Annually during the project life	Proponent Water management committee	300,000 (continuous)
Wildlife human conflict	Loss of human life Loss of vegetation	Community sensitization	Monitoring and reporting on movement of wildlife	Reports on human wildlife contact	Throughout the project life	Proponent, Community leaders KWS	N/A (continuous)
Lose of vegetation	Land degradation	Avoid overcrowding and overstay of livestock Create a watering trough Establish catchment committee that includes farm bot upstream and downstream	Water management committee meeting	Animal watering schedule and regulations	Throughout the operation phase	Proponent, Community Management committee	150,000

7.3 MONITORING GUIDELINES

There must be continuous monitoring and follow-up on the project activities to ensure that the environmental management plan (EMP) is implemented and that its objectives are achieved. The implementing staff and the community supervisor should ensure that the mitigation measures are put in place as outlined in the EMP. The monitoring guidelines may be based on the following parameters.

- Public safety
- Water borne diseases prevention and control
- Wildlife human conflict management
- Soil conservation
- Improved vegetation cover and catchment protection
- Safety of equipment and property
- Capacity building and skills improvement

7.4 INSTITUTIONAL ENVIRONMENTAL POLICY

7.4.1 Ministry of Agriculture Livestock and Fisheries

Environment protection and Conservation of the natural resource base for sustainable agricultural production is one of the pillars in the ministry of agriculture livestock development and fisheries. This is to be achieved through soil and water conservation, promotion of agro-forestry and water catchment protection, river banks protection and land rehabilitation for improved agricultural production. The ministry also strives to train the farmers on the best land use practices, and soil and water management. This broadly covers all the key areas to ensure that agricultural development is both environmentally friendly and sustainable.

7.4.2 AfDB Environmental Strategy

The Bank's Strategy for 2013-2022 emphasises the need to assist regional member countries in their efforts to achieve inclusive growth and transition to green growth. In addition, the Bank is committed to ensuring the social and environmental sustainability of the projects it supports. **AfDB** has put a policy addressed various social and environment issues in all Bank's lending operations. Based on the review of the major constraints and opportunities facing sustainable development in Africa, and taking into account key concepts and principles underlying sustainable development, a number of key environmental issues have

been identified. The traditional sector-by-sector approach in the management of natural resources has been replaced by cross-sectoral environmental policy actions based on an integrated approach. Such an approach will ensure optimum results that will simultaneously help to meet basic human needs and protect the environment. Given that results of sustainable development policies can be reaped only in the medium- and long-term, the creation of enabling environments in the RMCs is stressed in order to stimulate and engage a wide spectrum of stakeholders in protecting and managing the environment. The key issues include: reversing land degradation and desertification; protecting the coastal zone; protecting global public goods; enhancing disaster management capabilities; promoting sustainable industry; increasing awareness, institutional and capacity building; environmental governance; urban development and population growth; and civil society organisations.

To help implement the policy, the Bank will use a set of approaches: (i) mainstream environmental sustainability considerations in all Bank's operations (ii) strengthen existing environmental assessment procedures and develop new environmental management tools; (iii) clearly demarcate internal responsibility in implementation; (iv) assist RMCs to build adequate human and institutional capacity to deal with environmental management; (v) improve public consultation and information disclosure mechanisms; (vi) build partnerships to address environmental issues, harmonize policies, and disseminate environmental information; and (vii) improve monitoring and evaluation of operations. In particular, the Environmental and Social Assessment Procedures released in 2001 will be fully enforced for all lending operations of the Bank. As policy lending is becoming increasingly important, Strategic Impact Assessment (SIA) procedures will be developed to bring environmental assessment upstream by assessing the impacts of policies, programs and plans, rather than the project-level EIA.

7.5 DECOMMISSIONING PHASE

Decommissioning takes place during the final phase of a project life-cycle, but a degree of environmental planning is necessary before any decommissioning activities should be allowed to commence. The reason for this is that a project earmarked for decommissioning has in all likelihood been operational for some time, and as such, the environment within which it lies has stabilized in response to the presence of the associated infrastructure, activities and facilities. The decommissioning of one or all components of such a project would therefore have an effect on the environmental status quo, either in a positive or in a negative way. For a Reservoir that has been abandoned after 20 years lifespan the site may be reclaimed by nature

through siltation and regeneration of vegetation. The decommissioning of Kangura earth dam would entail back fill of the excavated area, demolition of the embankments, leveling of the inlet trenches and reestablishment of vegetation cover. The soil from the embankments shall be used to back fill the pan. This will be done using machinery. The decommissioning process will be designed by an engineer using available data and costs at the time. Cost estimates for Reservoir removal will be prepared based on the estimated quantities and types of materials to be removed, assumed demolition methods and rates, expected transportation methods and capacities, local labor rates and fuel costs, and waste disposal locations. Sufficient information must be provided by the designer to price all items of work, including those identified in the bid schedule as lump sum. Additional allowances will generally be included for equipment mobilization, construction access, environmental controls (such as water for dust abatement), water removal, site restoration, and any unlisted items. Hazardous materials should be identified for proper handling and disposal, with an associated cost.

CONCLUSIONS

The environmental impact from the implementation of this project are minimal and can be addressed by putting in place mitigation measures to ensure that they pose no threat to the environment or any danger to the community. The advantages of placing the structures are enormous and it will address a chronic problem that has affected the community for a long time. The wildlife human conflict will be mitigated by the fencing of the earth dam, surveillance and monitoring of the movements of the elephants, sensitizing the community and informing them when the elephants are in the vicinity to lessen the chances of contact. Water borne diseases that may occur include malaria as the pan may act as breeding site for mosquitoes, calls for creation of awareness to the public on prevention and control of the diseases.

In summary the potential negative impacts of the project are low and easy to mitigate, therefore they should not prevent the project from proceeding. Moreover the project has a strong environmental component in form of promotion of agro-forestry and catchment protection. The positive impacts and the benefits to the community are immense and welcome. From the foregoing, it is evident that the construction of the proposed irrigation project will be beneficial to the community of Kagongo Wendani and also to the economy of the county and country at large. The positive impacts will include among others increased household incomes, poverty alleviation, improved living conditions, improved tree cover and creation of employment opportunities. There are also negative environmental impacts anticipated during the

construction and operation phases but their significance is not major to warrant worry as they are well addressed in the EMP. The major environmental and health and safety concerns associated with the project have been adequately addressed in the Environmental Management Plan.

It is concluded therefore that the project proceed as planned with the mitigation measures integrated in the implementation.

RECOMMENDATIONS

From the assessment done and the EMP put in place, it is recommended that the project proceed as planned with the mitigation measures integrated in the implementation. Further the following recommendations are given:

- The other Approving Agencies should allow the proponent of this project to undertake the development of the proposed irrigation project whose benefits are highlighted in the report. They should also address areas that concern their agency to ensure success of the project
- The proponent ensures a participatory approach during construction and operation of the project to ensure social acceptability. The community should be involved in environmental and infrastructural developments.
- Much as the farmers in whose land the pipe networks will pass and are not directly benefitting from the project are not objected to it, there is need to have them enter into a written agreement allowing for the way leave.
- To further enhance acceptance, an elevated water tank system should be put in place accessing water from the community water supply. This water should be used to do mini drip irrigation projects of 0.1 acres each for the 15 farmers affected in this form.
- Thorough capacity building to be done to the farmers so as to formalize their management structures and enhance project understanding especially of issues of Irrigation water management.
- It was indicated that a peer review was carried out in terms of the technical soundness of the designs including the dam and sprinkler system. We however did not see the proceedings of this review. The proceedings and conclusions reached thereof should be availed failure to which a new peer review exercise should be carried out.
- The proponent and the contractor should strictly adhere to the recommendations provided in the EMP and ensure that they are implemented during all phases. The proposed project should be approved by NEMA and issued with a license so that the proponent can commence construction.
- The proposed project should be approved by NEMA and issued with a license so that the proponent can commence construction.

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GOOGLE EARTH MAP SHOWING OF THE SITE



PHOTO GALLERY



Figure 38 The old wall of the ExJacob Dam. The wall is in bad shape and is leaking



Figure 39 The ex Jacob Reservoir



Figure 40 Stakeholders meeting held at SCAOs office Nyandarua West



Figure 41 Grup photo after the stakeholders meeting

PHOTO GALLERY



Figure 42 The leaking walls of the Exjacob dam



Figure 43 The ESIA team meet some of the beneficiaries of the project



Figure 44 The ESIA team meeting the downstream members of the community

LIST OF STAKE HOLDERS ATTENDING THE KAGONGO WENDANI IRRIGATION SCHEME CONSULTATIVE MEETING



Government of Kenya (GoK)

MINISTRY OF AGRICULTURE, LIVESTOCK AND FISHERIES



African Development Bank (AfDB)



LIST OF ATTENDANCE

ACTIVITY:

Review of Kagongo Wendani Irrigation Scheme EIA

DATE: 8/5/2019 JULY 2016

S/NO	NAME	GENDER	COUNTY	DESIGNATION	PHONE NO./ E-MAIL ADDRESS	SIGN
1.	Silvester M. Kariga	M	Nyandarua	D/Irrigation	KarigaSilvester@gmail.com	[Signature]
2.	Gloria Joyce Akinyi	F	Nyandarua	Assistant County Commissioner, Meru	gloriaakinyi87@gmail.com	Akinyi
3.	Lucy W. Churai	F	Nyandarua	C.A.A	Lucychurai@gmail.com	[Signature]
4.	Stephen Akoro Iumo	M	Nyandarua	Assistant County Commissioner, Meru	stephenakoro@yaho.com	[Signature]
5.	John M. Njitha	M	Nyandarua	Chief Executive Officer	0726 336666	[Signature]
6.	Mary Kamau	F	Nyandarua	Sub County Executive Officer	kamaumary@gmail.com	[Signature]
7.	Charles Githaiga	M	Nyandarua	Public Health Officer	0729887112 githaiga15@yahoo.com	Githaiga
8.	Simon G. Githaiga	M	Nyandarua	WASH Advisor	071436572 githaiga15@gmail.com	[Signature]
9.	Kamwesi P.G.	M	Nyandarua	SCED	dkpwest@yahoo.com	[Signature]
10.	Andrew K. Ndutho	M	Nyandarua	SCAO	0723041724 nduthoak@yahoo.com	[Signature]
11.	Paul Mbugua	M	TURKANA	ADA	0710911644	[Signature]
12.	CHARLES S. MACHARIA	M	BUZIA	CAO	0724967908	[Signature]
13.	Solomon Kamunika	M	NYANDARUA	CHARGED	0723430046	[Signature]
14.	ALLAN ABWOGA	M	NAIROBI	ADLR	0721812556 aabwoga@yahoo.com	[Signature]

SAMPLE COPIES OF QUESTIONNAIRES FOR KEY INFORMANTS

FIELD DATA GATHERING FOR THE ENVIRONMENTAL IMPACT STUDY FOR KAGONGO WENDANI IRRIGATION SCHEME AT OL JORO OROK SUB-COUNTY

CHECKLIST FOR KEY INFORMANTS/FGD

Name of informant GESION GITOGO GITHANJA

Institution Word Administrator Nyandarua County

Short description of the institution and relevance to the project

1 a) what are main livelihoods in this area?

- i. - livestock farming
- ii. - crop farming
- iii. -
- iv. -

b) What challenges are faced by this community in the above livelihoods?

- i. - water shortage
- ii. - food shortage during dry seasons
- iii. - malnutrition
- iv. - few field extension officers
- v. - inadequate farm inputs

2. What are the benefits of having the KAGONGO WENDANI irrigation scheme projects?

- i. - Provision of water for domestic use and irrigation
- ii. - Increased food provision (quantity)
- iii. - Quality food to curb malnutrition
- iv. - conservation of immediate environment as the area will be secured
- v. -

4. What options exist for addressing the above challenges

- i. - Expansion of X-Jacob dam
- ii. - Introduction of irrigation downstream
- iii. - Introduction of other food crops in the area
- iv. - Provision of subsidized farm inputs by both the county and national governments

3

5. What are the major environmental concerns that may arise from proposed KAGONGO WENDANI Irrigation Scheme project?

- soil erosion

6. How can the above environmental concerns be address?

- Agriculture department to teach farmers on better farming methods

7. Who should address the environmental concerns?

- county government
- national government
- development partners
- NGOs

8. What are the main sources of water for the community?

- Rain water
- piped water

9. What are the main uses of water by the community?

- domestic use

10. Which are the main institutions/players and what interventions have they undertaken on agricultural development in the area?

- i. - County government - provision of extension officers & subsidised farm inputs
- ii. - National government - provision of farm inputs
- iii. - Development partners like GIZ - agricultural mechanisation
- iv. -
- v. -

FIELD DATA GATHERING FOR THE ENVIRONMENTAL IMPACT STUDY FOR KAGONGO WENDANI IRRIGATION SCHEME AT OL JORO OROK SUB-COUNTY

CHECKLIST FOR KEY INFORMANTS/FGD

Name of informant MARY KAWI

Institution Social Services

Short description of the institution and relevance to the project

1 a) what are main livelihoods in this area?

- i. - The community will uplift their living standard
- ii. - They will start in entrepreneurship
- iii. - they will start new methods of irrigation that
- iv. - will change their economic ~~standard~~ standard.

b) What challenges are faced by this community in the above livelihoods?

- i. - Community will be affected by the chemicals of not well used
- ii. -
- iii. -
- iv. -
- v. -

2. What are the benefits of having the KAGONGO WENDANI irrigation scheme projects?

- i. - they will acquire new technology of irrigation
- ii. - they will uplift their social-economy
- iii. -
- iv. -
- v. -

4. What options exist for addressing the above challenges

- i. - education
- ii. -
- iii. -
- iv. -

4

5. What are the major environmental concerns that may arise from proposed KAGONGO WENDANI Irrigation Scheme project?

- ~~Salt~~ Soil erosion
- lack of security

6. How can the above environmental concerns be address?

Through involving the surrounding community in the project

7. Who should address the environmental concerns?

The technical people from the ministry of Agriculture and the ministry of Internal government.

8. What are the main sources of water for the community?

- Domestic use Bore holes, dams
- Small home kitchen gardens

9. What are the main uses of water by the community?

- Domestic use
- Small home kitchen gardens

10. Which are the main institutions/players and what interventions have they undertaken on agricultural development in the area?

- Internal security - security purpose
- Water institution - water management
-
-
-

FIELD DATA GATHERING FOR THE ENVIRONMENTAL IMPACT STUDY FOR KAGONGO WENDANI IRRIGATION SCHEME AT OL JORO OROK SUB-COUNTY

CHECKLIST FOR KEY INFORMANTS/FGD

Name of informant CHARLES SUSA

Institution PUBLIC HEALTH OFFICE (Department)

Short description of the institution and relevance to the project

The department deal with health of the community and the project will improve nutrition and disease incidence.

1 a) what are main livelihoods in this area?

- i. - Agriculture (farming)
- ii. - Livestock
- iii. -
- iv. -

b) What challenges are faced by this community in the above livelihoods?

- i. - food shortage during dry season
- ii. - Inadequate domestic water during dry season
- iii. -
- iv. -
- v. -

2. What are the benefits of having the KAGONGO WENDANI irrigation scheme projects?

- i. - Improve health standard of the community
- ii. - Improve nutrition value
- iii. - lower disease incidence (water borne)
- iv. -
- v. -

4. What options exist for addressing the above challenges

- i. - provide treated water (safe) from the dam.
- ii. -
- iii. - Health education
- iv. -

5. What are the major environmental concerns that may arise from proposed KAGONGO WENDANI irrigation Scheme project?

1. Spiral off which can cause tragedy

6. How can the above environmental concerns be address?

Build strong embankment of the dam

7. Who should address the environmental concerns?

Hyandama county

8. What are the main sources of water for the community?

1. existing Jacobs dam.
2. Roof Catchment

9. What are the main uses of water by the community?

Domestic

10. Which are the main institutions/players and what interventions have they undertaken on agricultural development in the area?

- i. - Community
- ii. - County government of Hyandama
- iii. -
- iv. -
- v. -

SAMPLE COPIES OF QUESTIONNAIRES FOR MEMEBERS OF THE COMMUNITY

(HOUSE HOLD QUESTIONNAIRE)

2

FIELD DATA GATHERING FOR THE ENVIRONMENTAL IMPACT STUDY FOR KAGONGO WENDANI IRRIGATION SCHEME IN OL JORO OROK NYANDARUA COUNTY

A. BACKGROUND DATA

Name of the interviewee	PRISCILLA WAMBU		
Gender	Female		
Age	33 yrs		
Sub-County	DIK		
Ward	KEDU		
Location	WERU		
Sub-Location	KIRIMANGAI	Village	KIRIMANGAI

B. SOCIAL ECONOMIC STATUS

What are the main sources of income?

- Casual Labour Sale of crop produce Sale of livestock produce
 Formal employment Business
 Others: specify -----

C. CROP PRODUCTION

1. What method do you use for crop production?

- Irrigation _____ (acres)
 Rain-fed 5 (acres)
 Home gardening _____ (acres)

2. What total land acreage of land do you use for farming? 5 (acres)

3. What crops did you grow in the last Two-year?

Crops grown	Annual yield (Kg)	Est. amount of food consumed/year	Est. Amount sold/yr	Est. Amount purchased/yr	Amount given out	To whom?
(a.) Foods Crops						
maize	5400kg	10bags	44bags	44bags		Middlemen
potatoes	6000kg	8bags	52bags	52bags		Middlemen
wheat	3600kg	3bags	37bags	37bags		Middlemen

4. Did you store any food after harvest in the last one-year? _____ Yes No

5. If yes, where and what was the main method of preservation?

Type of food stored	Amount stored (kgs/bags)	Where stored?	Main method of preservation
potatoes	8bags	store	dark store
maize	10bags	store	drying, dusting
wheat	3bags	store	drying

6. Do you always have enough food for all the members of your household? 2

Yes No

7. How long does the harvested food last? 12 (months)

8. What are the other sources of food for HH consumption apart from farming? _____

1=food gifts 2=borrow 3=none 4=others specify

D. Do you own livestock? ----- Yes No if yes what kind?

goats

E. What Water Sources Do You Rely On During;

1. Rainy season? - Tank - roof catchment

2. Dry season? - EX-JACOBS

F. Impacts of the project

1. Are you aware the proposed KAGONGO WENDANI Irrigation Scheme Project?

Yes No

2. Has the land on which the project is to be constructed been identified for another project?

Yes No

If yes what is the name of the project.

3. What will be the benefits of the project to the community?

-They will irrigate their land during the dry seasons

4. What negative environmental impacts do you think will be caused by the project?

-None.

5. How can the above problems be resolved and by whom?

(HOUSE HOLD QUESTIONNAIRE)

6

FIELD DATA GATHERING FOR THE ENVIRONMENTAL IMPACT STUDY FOR KAGONGO WENDANI IRRIGATION SCHEME IN OL JORO OROK NYANDARUA COUNTY

A. BACKGROUND DATA

Name of the interviewee	Jane Mwai		
Gender	Female		
Age	35 yrs		
Sub-County	OL-JORO-OROK		
Ward	WERU		
Location	WERU		
Sub-Location	KIRIMANGAI	Village	Kirimangai

B. SOCIAL ECONOMIC STATUS

What are the main sources of income?

- Casual Labour Sale of crop produce Sale of livestock produce
 Formal employment Business
 Others: specify -----

C. CROP PRODUCTION

1. What method do you use for crop production?

Irrigation _____ (acres)

Rain-fed _____ (acres)

Home gardening _____ (acres)

2. What total land acreage of land do you use for farming? 1 (acres)

3. What crops did you grow in the last Two-year?

Crops grown	Annual yield (Kg)	Est. amount of food consumed/year	Est. Amount sold/yr	Est. Amount purchased/yr	Amount given out	To whom?
(a.) Foods Crops						
Potatoes	1500kg	2bags	10bags	10bags		Middlemen
Maize	1800kg	3bags	17bags	17bags		Middlemen

4. Did you store any food after harvest in the last one-year? _____ Yes No

5. If yes, where and what was the main method of preservation?

Type of food stored	Amount stored (kgs/bags)	Where stored?	Main method of preservation
Maize	3bags	store	drying
Potatoes	2bags	store	dark room

6. Do you always have enough food for all the members of your household?
Yes No

6

7. How long does the harvested food last? 12 (months)

8. What are the other sources of food for HH consumption apart from farming? _____
1=food gifts 2=borrow 3=none 4= others specify

D. Do you own livestock? ----- Yes No if yes what kind? cattles

E. What Water Sources Do You Rely On During;

1. Rainy season?

TANK - roof catchment

2. Dry season?

EX-JACOB

F. Impacts of the project

1. Are you aware the proposed KAGONGO WENDANI Irrigation Scheme Project?

Yes No

2. Has the land on which the project is to be constructed been identified for another project?

Yes No

If yes what is the name of the project.

3. What will be the benefits of the project to the community?

- Increase in income.
- Food security to the community.

4. What negative environmental impacts do you think will be caused by the project?

None.

5. How can the above problems be resolved and by whom?

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(HOUSE HOLD QUESTIONNAIRE)

FIELD DATA GATHERING FOR THE ENVIRONMENTAL IMPACT STUDY FOR KAGONGO WENDANI IRRIGATION SCHEME IN OL JORO OROK NYANDARUA COUNTY

A. BACKGROUND DATA

Name of the interviewee	JOYCE WANJIAU NIMUNGU		
Gender	FEMALE		
Age	65		
Sub-County	OL JORO OROK		
Ward	WERU		
Location	WERU		
Sub-Location	KIRIMANGU	Village	KIRIMANGAI

B. SOCIAL ECONOMIC STATUS

What are the main sources of income?

- Casual Labour Sale of crop produce Sale of livestock produce
- Formal employment Business
- Others: specify -----

C. CROP PRODUCTION

1. What method do you use for crop production?

- Irrigation 1 (acres)
- Rain-fed 1 (acres)
- Home gardening (acres)

2. What total land acreage of land do you use for farming? 1 (acres)

3. What crops did you grow in the last Two-year?

Crops grown	Annual yield (Kg)	Est. amount of food consumed/year	Est. Amount sold/yr	Est. Amount purchased/yr	Amount given out	To whom?
(a.) Foods Crops						
POTATO	25	3 Bags	22	22	30,000	Buokers

4. Did you store any food after harvest in the last one-year? Yes No
5. If yes, where and what was the main method of preservation?

Type of food stored	Amount stored (kgs/bags)	Where stored?	Main method of preservation
Potatoes	3 bags	store	dark store

6. Do you always have enough food for all the members of your household?
Yes No

7. How long does the harvested food last? 1 year (months)

8. What are the other sources of food for HH consumption apart from farming? _____
1=food gifts 2=borrow 3=none 4=others specify

D. Do you own livestock? ----- Yes No if yes what kind? Cattles

E. What Water Sources Do You Rely On During;

1. Rainy season? Tank-roof catchment

2. Dry season? * Jach

F. Impacts of the project

1. Are you aware the proposed KAGONGO WENDANI Irrigation Scheme Project?

Yes No

2. Has the land on which the project is to be constructed been identified for another project?

Yes No

If yes what is the name of the project.

3. What will be the benefits of the project to the community?

Project will ensure Food Security to the Community.
Increase in yield

4. What negative environmental impacts do you think will be caused by the project?

None

5. How can the above problems be resolved and by whom?

12

(HOUSE HOLD QUESTIONNAIRE)

FIELD DATA GATHERING FOR THE ENVIRONMENTAL IMPACT STUDY FOR KAGONGO WENDANI IRRIGATION SCHEME IN OL JORO OROK NYANDARUA COUNTY

A. BACKGROUND DATA

Name of the interviewee	John Maina Nyunguoi		
Gender	Male		
Age	52 yrs		
Sub-County	OL-JORO-OROK		
Ward	WERU		
Location	WERU		
Sub-Location	KIRIMANGAI	Village	KIRIMANGAI

B. SOCIAL ECONOMIC STATUS

What are the main sources of income?

- Casual Labour Sale of crop produce Sale of livestock produce
- Formal employment Business
- Others: specify -----

C. CROP PRODUCTION

1. What method do you use for crop production?

- Irrigation _____ (acres)
- Rain-fed 1 (acres)
- Home gardening _____ (acres)

2. What total land acreage of land do you use for farming? 1 (acres)

3. What crops did you grow in the last Two-year?

Crops grown	Annual yield (Kg)	Est. amount of food consumed/year	Est. Amount sold/yr	Est. Amount purchased/yr	Amount given out	To whom?
(a.) Foods Crops						
Potatoes	1500kg	3bags	7bag	7bags	14000F	Middlemen.
Maize	720kg	8bags	NO sale	none	none	none

4. Did you store any food after harvest in the last one-year? _____ Yes No

5. If yes, where and what was the main method of preservation?

Type of food stored	Amount stored (kgs/bags)	Where stored?	Main method of preservation
Potatoes	3bags	store	dark room.
Maize	8bags	store	drying

6. Do you always have enough food for all the members of your household?
Yes No

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7. How long does the harvested food last? 12 (months)

8. What are the other sources of food for HH consumption apart from farming? _____

1=food gifts 2=borrow 3=none 4=others specify

D. Do you own livestock? ----- Yes No if yes what kind? ,cattles.

E. What Water Sources Do You Rely On During;

1. Rainy season?

Tank - roof catchment

2. Dry season?

Ex-jacob

F. Impacts of the project

1. Are you aware the proposed KAGONGO WENDANI Irrigation Scheme Project?

Yes No

2. Has the land on which the project is to be constructed been identified for another project?

Yes No

If yes what is the name of the project.

3. What will be the benefits of the project to the community?

Food Security to the Community.
Development of the infrastructure.
Increase in production.

4. What negative environmental impacts do you think will be caused by the project?

None.

5. How can the above problems be resolved and by whom?

07/16/12 7324

CHIEFS LETTER ON LAND OWNERSHIP

THE PRESIDENCY



MINISTRY OF INTERIOR AND CO-ORDINATION OF NATIONAL GOVERNMENT

ASST.CHIEF'S OFFICE
KIRIMANGAI SUB LOCATION
P.O. BOX 66-20302
OL-JORO-OROK.
4th June 2019

To whom it may concern.

RE : EX JACOB DAM/HYANDANIA/LESIRKO/21.

The above named dam is located in my area of administration Kirimangai Sub location of Nyandarua west sub county.

This is a confirmation that the above named dam lies on a public land, it is from the same that the intended SWAP Project Kagongo Wendani irrigation Project will get its water and there is no objection concerning the same.

Thank you.



LEAD EXPERT PRACTICING LICENCE

FORM 7

(r.15(2))



**NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)
THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT
ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE**

License No : NEMA/EIA/ERPL/9159

Application Reference No: NEMA/EIA/EL/12745

M/S **Njuguna Paul Kariuki**
(individual or firm) of address

P O Box 27 Lodwar


is licensed to practice in the


capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Lead Expert**
registration number **1571**

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

Issued Date: **1/24/2019**

Expiry Date: **12/31/2019**

Signature..... 

 (Seal)
Director General

**The National Environment Management
Authority**

