



NATIONAL IRRIGATION BOARD

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) FOR RWABURA IRRIGATION DEVELOPMENT PROJECT

KIAMBU COUNTY

ESIA STUDY REPORT

SEPTEMBER 2016

PROPONENT:

NATIONAL IRRIGATION BOARD
Unyunyizi House,
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FACT SHEET

Project Name	Rwabura Irrigation Development Project
Assignment Name	Environmental and Social Impact Assessment (ESIA)
Location	Rwabura Irrigation project is located in Gatundu South Constituency, Kiambu County.
Coverage	13.4 Km ² comprising of twenty six (26) Sub locations.
Main water source	Rwambura and Thiririka rivers
Proponent	National Irrigation Board
Address of the Proponent	Unyunyizi House, P.O. Box 30372-00100 Lenana Road, Hurlingham NAIROBI
Project cost	Kenya Shillings One billion, ninety three million, four hundred and two thousand, one hundred. (KES 1,093,402,100.00)
Funding Agency	Government of Kenya
Start Date	July, 2016
Completion Date	September, 2016
Target households	12,200
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SUBMISSION FORM

This ESIA study report was prepared by a team of experts in accordance with the Environmental Management and Coordination Act, 1999 and the Environmental (Impact Assessment and Audit) Regulations 2003. We the undersigned, do hereby certify that this report was prepared based on the information provided by the proponent as well as that collected from other primary and secondary sources and on the best understanding and interpretation of the facts by the environment experts.

We are pleased to herewith submit the Environmental and Social Impact Assessment (ESIA) Study Report for the Rwambura Irrigation Development Project.

LEAD EXPERT

NAME: Vitalis Too..... **NEMA Reg. No.:** 1871.....

Sign: **Date:**

PROPONENT

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Unyunyizi House,
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On behalf of the proponent

Name: **Title:**

.....

Signature

.....

Date

Disclaimer

This Environmental Impact Assessment Study Report is being submitted in accordance with the terms and conditions of contract in respect of provision of consultancy services. It has been carried out in full observance of the EIA regulations and in compliance with the Environmental Management and Coordination Act, 1999 and subject to terms and conditions of the National Environment Management Authority (NEMA).

ACKNOWLEDGEMENT

We wish to appreciate the effort of NIB's team for the timely response, clarification of issues and support during data collection and reporting phases. Also, we wish to register special thanks to all stakeholders and farmers for their cooperation and willingness to support the process.

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ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
AWSB	Athi Water Services Board
BP	Bank Procedure
DOSHS	Directorate of Occupational Safety and Health Services
EMCA	Environmental Management and Coordination Act
EMP	Environmental Monitoring Plan
ESIA	Environmental and Social Impact Assessment
HHs	Households
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome
IFC	International Finance Corporation
IPs	Indigenous Peoples
IWUA	Irrigation Water Users Association
KFS	Kenya Forest Service
M&E	Monitoring and Evaluation
MoU	Memorandum of Understanding
NEMA	National Environment Management Authority
NLC	National Land Commission
OP	(World Bank's) Operational Policy
OSHA	Occupational Health and Safety Act
RAP	Resettlement Action Plan
RLA	Registered Land Act
ToR	Terms of Reference
WB	World Bank
WRMA	Water Resources Management Authority

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EXECUTIVE SUMMARY

Purpose

NIB contracted the consultants to undertake the Environmental Impact assessment for the proposed Rwabura Irrigation development project.

Background

National irrigation Board (NIB) intends to implement Rwabura Irrigation Development Project (RIDP) in Kiambu County. The project entails pipelines as well as required water storage facilities in the two drainage systems covered by Rivers Rwabura and Thiririka. Rwabura Irrigation project is located in Gatundu South Constituency, Kiambu County. The Project area covers approximately 13.4 Km² comprising of twenty six (26) Sub locations.

The project covers part of the Gatundu South District and falls under three (3) divisions, namely: Ng'enda in the South, Kiganjo in the West and Ndarugu in the North. Two of the divisions (i.e. Kiganjo and Ndarugu) border the forest while Ng'enda border coffee estates. The project is expected to serve more than 12,200 households.

Project components

The proposed project will consist of two (2) conveyance lines and three (3) main lines proposed to supply water across the project area. The Thiririka conveyance line (conveyance 1) of about 8.27 km offtakes from Thiririka intake in the Kikuyu escarpment forest and follows Thiririka River South Eastwards up to the head of the scheme. Conveyance line 2 of about 8.82 km offtakes from the Rwabura intake and follows Rwabura River South Eastwards up to the head of the scheme. Mainline one (1) follows the Kenyatta Road, Mainline two (2) the Gacharage Road, while mainline three (3) follows the Karatu Road. Nine (9) locations of the project area will be supplied through sub mains. Some 4,000 ha of land would be irrigated from the reservoir from Rivers Rwabura and Thiririka, released down the farms and subsequently distributed by gravity fed sprinkler system. The traditional small-holder mixed farming system based on rain fed and flood recession cropping and livestock husbandry would be transformed into a commercially-oriented agricultural system, based on reorganized small-scale family farms.

Environmental Social Impact Assessment (ESIA)

In response to the legal requirements that demand that an Environmental and Social Impact Assessment (ESIA) be carried out on projects that are likely to have negative impacts on the environment, the consultant carried out ESIA study. The assessment was carried out to determine the likely environmental impacts anticipated from implementation

of the proposed project and the mitigation measures that can be implemented to address the anticipated negative impacts. The assessment was done in accordance with the Environmental Management and Coordination Act (EMCA) 1999 and Environmental (Impact Assessment and Audit) Regulations 2003, among other national legislations, standards and international protocols. This was done in order to comply with environmental and quality standards, and meet requirements as per the applicable laws and regulations in Kenya.

Objectives

The objective of the study was to carry out an Environmental and Social Impact Assessment (ESIA) of the proposed project in accordance with the Environmental Impact and Audit Regulations 2003 and the international guidelines for ESIA and submit report to NEMA for approval. On the social impact assessment, it included; to carry out a social-economic and social environmental status analysis through a base survey and prepare an Environmental and Social Management Plan (ESMP).

Approach and Methodology

To meet the objectives of the study, we adopted systematic, integrated, participatory and collaborative approaches. We gathered information through document reviews, field investigations, focus group discussions and key informant interviews. We consulted administrators (Chiefs and their Assistants), community leaders among others.

The EIA experts examined all legal and regulatory frameworks, socio-economic profiles in the project area, identified environmental impacts and proposed relevant mitigation measures. The report also provides environmental management framework, monitoring and evaluation mechanisms.

Some of the key components in the ESIA include:

- i) **Public Consultations:** Consultations was conducted with the affected persons/communities where issues that may arise during the project life cycle were discussed.
- ii) **Project Impacts:** The project traversed a long stretch of land with considerable levels of immitigable impacts to the flora and fauna. Some impacts were socio-economic in nature especially during the construction phase. This would be addressed by interventions suggested in the ESMP section.

iii) Monitoring and Evaluation: There will be need for continued monitoring and evaluation. This will ensure that issues that may arise before and after project implementation are properly addressed.

iv) Community expectations: All the community expectations and concerns as obtained during the public participation were documented and addressed.

Legal Framework of the ESIA

Relevant Kenya laws considered include:-

- EMCA 1999
- Water Act, 2012
- Wildlife (Conservation and Management) Cap 376
- Lake and Rivers Act Cap 409
- Occupational Safety and Health Act, 2007
- Irrigation Act 2012
- Land Act, 2012
- Valuers' Act
- The Constitution of Kenya
- Agriculture, fisheries and food Authority Act, No.13, 2013

Environmental and social impacts

The environmental and social impacts are discussed in three phases namely: construction, operational and decommissioning phases. The summary of the positive impacts of the proposed Rwabura Irrigation Project are as follows:

- Creation of direct and indirect employment opportunities during the construction and operation phases;
- Increased agricultural productivity, through the provision of capacity for intensive land use by irrigation;
- Increase in on-farm revenue;
- Improved food security;
- Increased women involvement in irrigation will provide impetus for sustainable development.

Table I: Summary of the negative impacts and mitigation measures

Negative Impact	Mitigation measures
Construction Phase	
Reduced water flow	<ul style="list-style-type: none"> • Adopt a watershed management approach for River Rwabura and Thiririka River during construction. This will enable works to be undertaken when demand for water is minimal for downstream users; • Develop compensation measures for affected downstream water users.
Change in soil properties	<ul style="list-style-type: none"> • During construction, earthworks should be controlled so that land that is not required for the works is not disturbed; • Where possible, excavation should be carried out during the dry spell to prevent soil from being washed away by the rain; • Excavated materials and excess earth should be kept at appropriate sites approved by the construction supervisor; • Areas that are cleared for excavation should be planted with grass once the pipeline is laid; • Compaction of soil by heavy vehicles will be mitigated through the use of wide tyres to spread the weight of vehicles. In addition, only few tracks should be used to bring materials to the work area.
Air pollution	<ul style="list-style-type: none"> • The Contractor should maintain construction machinery and vehicles in accordance with the manufacturers' specifications to keep noise and gas emissions to a minimum; • The Contractor should control dust emissions and odours by sprinkling water and by good housekeeping practice; • Construction works should be undertaken only during day time.
Construction waste	<ul style="list-style-type: none"> • Waste management should comply with EMCA (Waste Management) regulations; • Designated garbage storage areas should be provided during construction and the contractor should be responsible for handling and disposal of all construction and related waste;

	<ul style="list-style-type: none"> Waste disposal by burning should not be permitted and signage should be erected to ensure that workers are sensitised to waste disposal and handling issues on site; Recycling is the most desirable option for 'disposal' of any waste materials resulting from construction. The contractor should, as much as possible put to good and acceptable use any materials damaged or rejected for use on site; The construction supervisor and contractor will have the primary responsibility for the environmental due diligence. The construction supervisor will be required to include environmental considerations in monthly progress reports and indicate progress in the implementation of mitigation measures as outlined in the EMP;
Biodiversity loss	<ul style="list-style-type: none"> Except to the extent necessary for establishing the construction site and carrying out the construction works, vegetation should not be removed, damaged or disturbed; Existing cleared or disturbed areas should be used for construction of temporary structures and stockpiling of materials; Construction staff should be encouraged to trim trees rather than remove them; Planting of vegetation should be undertaken after the pipes are covered with soil; Re-vegetate using indigenous tree and grass species whenever possible; Avoid cutting down indigenous trees.
Occupational health and safety	<ul style="list-style-type: none"> In order to prevent work-related accidents, there should be strict compliance with labour laws and health and safety committee rules; Hazardous areas should be secured and all workers should be provided with personal protective equipment; All workers should be trained in fire response and basic first aid procedures.
Public Health Issues	<ul style="list-style-type: none"> The irrigation water management committee should put in place information, education and communication programmes about safe uses of and treatment of irrigation water at household level;

	<ul style="list-style-type: none"> • The irrigation water management committee should support implementation of HIV/AIDS prevention programmes within the project area in collaboration with other stakeholders; • Include HIV/AIDS awareness and control campaigns in the project targeting construction workers.
Operation phase	
Conflicts with downstream users	<ul style="list-style-type: none"> • The irrigation water committee should abstract only authorized quantity of water and abide by any other conditions set by WRMA; • The committee should participate in the activities of Rwabura River Users Association to ensure successful river water management, apportionment and environmental protection; • Water Users Association (WUA) should solve problems promptly; • Conduct training on water saving technology to ensure efficient water use; • Install master water meter at the intake; • Install water meters at household level; • Use irrigation to grow water efficient crops; • Strictly enforce the Water Act, 2002 for the benefit of all stakeholders.
Soil erosion	<ul style="list-style-type: none"> • It is necessary that slopes be stabilised with Napier grass planted along contours before irrigation is undertaken. • Avoid encroachment to clear vegetation along the Rivers • Minimise and plainly define land clearing areas; • Avoid steep slopes and level the land/terrace the slopes as much as possible; • Protect the soil against erosion by good farm management practices such as agroforestry and contour farming; • Public awareness programmes should be conducted during project implementation to ensure that members, WUA and scheme management understand and take up their role in catchment management; • Train farmers in soil and water management to avoid land degradation.
Increased demand for	<ul style="list-style-type: none"> • Integrated Pest Management Practices incorporating crop management control techniques, biological control and restricted

agricultural inputs	<p>use of biocides are recommended in order to lessen the adverse effects of biocide use;</p> <ul style="list-style-type: none"> • The scheme management in collaboration with stakeholders such as Ministry of Agriculture should train farmers on adequate amounts of fertilisers and biocides to be used for various crops and on safe use of these chemicals.
Health and safety	<ul style="list-style-type: none"> • Health and safety risks should be minimised by conducting farmers training on the safe and effective use and storage of chemicals and basic first aid procedures; • Maintain Material Safety Data Sheets (MSDS) from manufacturers of agro-chemicals; • Store chemicals as recommended in the MSDS.
Waste generation	<ul style="list-style-type: none"> • Waste disposal from the scheme should comply with existing waste management practice that is acceptable under EMCA; • The scheme management should conduct periodic training for members on safe disposal of wastes.
Public Health Issues	<ul style="list-style-type: none"> • The management committee should put in place information, education and communication programmes about safe uses of and treatment of irrigation water at household level; • The management committee should support implementation of HIV/AIDs prevention programmes within the project area in collaboration with other stakeholders; • Include HIV/AIDs awareness and control campaigns in the project.
De-commissioning phase	
Loss of livelihood due to closure of irrigation activities	<ul style="list-style-type: none"> • Develop alternative livelihood activities.
Soil erosion	<ul style="list-style-type: none"> • Plant grass and other native vegetation along soil filled trenches; • Maintain soil conservation works until the site stabilizes.
Visual impacts	<ul style="list-style-type: none"> • Carry out landscaping works to rehabilitate the open trenches;

Generation of waste material	<ul style="list-style-type: none"> Waste from decommissioning of the pipeline and concrete structures should be carted away and disposed off in a manner that is acceptable under EMCA;
Risk of accidents	<ul style="list-style-type: none"> Secure all unsafe and potentially dangerous areas

Costs of the Project: Kenya Shillings One billion, ninety three million, four hundred and two thousand, one hundred. (KES 1,093,402,100.00)

Chapter One

1.0: INTRODUCTION

1.1 Preface

The National Irrigation Board (NIB) engaged the services of the consultant to carry out an Environmental and Social Impact Assessment (ESIA) for Rwabura Irrigation Development Project, in Kiambu County.

1.2 Project Area

Rwabura Irrigation project is located in Gatundu South Constituency, Kiambu County. The Project area covers approximately 13.4 Km² comprising of twenty six (26) Sub locations.

The project covers part of the Gatundu South sub-county and falls under three (3) divisions, namely: Ng'enda in the South, Kiganjo in the West and Ndarugu in the North. Two of the divisions (i.e. Kiganjo and Ndarugu) border the forest while Ng'enda border coffee estates. The project is expected to serve more than 12,200 households.

1.3 Objectives of the Environmental and Social Impact Assessment (ESIA)

The objective of the study was to carry out an Environmental and Social Impact Assessment (ESIA) of the project areas in accordance with the Environmental Impact and Audit Regulations 2003 and the international guidelines for ESIA and submit report to NEMA for approval. On the social impact assessment, it includes; carrying out a socio-economic and environmental status analysis through a baseline survey and preparation of an Environmental and Social Management Plan (ESMP).



1.4 Scope of work

The environmental and social impact assessment included in particular:

- i. Analysis of the socio-economic and socio-environmental status of the areas during pre and post construction and thus justify the development of the proposed irrigation project.
- ii. Assess the Community's capacity to implement the proposed mitigation measures, and make appropriate recommendations, including potential capacity building and training needs and their costs.
- iii. Based on the Environmental baseline survey, the consultant prepared an Environmental and Social Management Plan (ESMP) that outlines:
 - Potential environmental and social impacts resulting from the activity;
 - Proposed mitigation measures;
 - Reviewing institutional arrangements, training requirement and responsibilities for monitoring implementation of the mitigation measures and monitoring indicators;
 - Proposed work program, budget estimates, schedules, staffing and other necessary support services to implement the mitigation measures;
 - The proposed concerned parties should agree on the time horizons and mitigation measures for implementing the recommendations in the ESMP

The consultant also evaluated the social impact and showed how the communities in the area will benefit or lose upon implementation of the project.

Based on the information collected from the socio-economic baseline survey, the consultant proposed mitigation measures.

The consultant consulted with stakeholders and the public on the environmental and social aspects of the proposed project. The consultant recorded all public consultations and the issues raised e.g. views of affected stakeholders; date and location of consultation meetings; a list of attendees, their affiliation, contact addresses and a summary.

1.5 Methodology of ESIA Study

1.5.1 The approach of ESIA study

This EIA study was based on the available baseline information and reports on the proposed irrigation project. Among the sectoral issues addressed by the study were: irrigation systems design, technologies and water management; Socio-economic, gender and socio-cultural issues; environmental conservation, bio-diversity, wildlife and resource use; and occupational health and safety. The latter aspect was considered as cross cutting and therefore was captured in pertinent sectoral issues. This ESIA study report was prepared in accordance with “*The Environmental (Impact Assessment and Audit) Regulations, 2003*” for submission to the National Environmental Management Authority (NEMA).

Preparatory meetings were held with key stakeholders at various stages of the assignment. The ESIA consultancy team reviewed existing relevant legislations and regulations in Kenya; and all documents on the proposed irrigation project. The review of literature was to compliment field survey data. During the site visits, some comprehensive field survey data on the irrigation project and its environs was collected. The field survey was based on pre-determined parameters and acceptable methodologies used in environmental and social impact assessment. Field surveys included observations, focus group discussions and interviews with key informants, and assessment of extent of environmental degradation and conservation in Gatundu. The data collected was processed to establish the existing and expected environmental impacts.

The socio-economic, gender and socio-cultural component of this study was designed to assess the impact of the proposed irrigation project on the socio-economic, gender and cultural environment of the people who will be affected by the project. The assessment involved an investigation of the existing living conditions in some of the households in order to determine the nature and extent of poverty.

The overall objective of the assessment was to get the views and hear the voices of members of the local community on the positive and negative impacts of the irrigation project and suggest possible mitigation measures. The key issues which have been

addressed during the assessment included changing social networks, economic opportunities, cultural beliefs and practices, irrigation infrastructural development, emerging scenarios with project and community consultation and participation.

The consultant was accompanied to the public meetings and interviews by the representatives from NIB.

1.5.2 Mobilization and Planning

The consultancy team was mobilized within a day of receiving instructions from the client. At the commencement of the study, the consultant met with personnel from NIB to discuss and agree on the scope of work, confirm the consultancy team's understanding on the ToR and agree on the proposed methodology. During this meeting, the consultancy team were briefed by the proponent on their policy and philosophical viewpoint of the project as a whole. The consultancy team presented their detailed program of work in order to agree on specific timing for various inputs, progress meetings and reporting dates. The consultancy team also discussed and finalized the modalities of the logistics and staff who the client provided to the team during the assignment period.

1.5.3 Desk Review

The consultancy team reviewed all the relevant available documents on project activities and components from the client. The team also reviewed all the available and relevant internal environmental guidelines, if any, put in place by the proposed project and recognized guidelines and standards on ESIA.

1.5.4 Field Data Collection

The consultancy team conducted field visits to the proposed project site to obtain further data and consult with the stakeholders. The consultancy team established the nature of the surroundings including: existing infrastructure, economic and social set up of the local communities whose normal daily activities will be and/or likely to be affected by the implementation of the proposed irrigation project.

During the field study, the consultancy team collected existing information and administered interviews with a view to predicting the potential environmental impacts on

day to day activities of the community due to the implementation of the proposed irrigation project.

1.5.5 Project Data Synthesis

The consultancy team thereafter interpreted and used the data collected to prepare a comprehensive environmental and social management plan (ESMP) encompassing the potential negative environmental impacts, mitigation measures and monitoring indicators. The ESMP is incorporated in the final ESIA study report.

1.5.6 Public Consultation

The consultancy team organized and convened public consultation meetings for all stakeholders. The consultancy team used the local administration leaders (e.g. local chiefs and their assistants) to convey the consultation theme and appropriate public consultation venues. During these forums, the consultancy team in close consultation with the client shared the project information in terms of its implementation and predicted impacts.

Chapter

Two

2.0: PROJECT DESCRIPTION

2.1 Project Location, area and beneficiaries

Rwabura Irrigation project is located in Gatundu South Constituency of Kiambu County in Central Kenya. The Project is about 50kms to the North along the national route A2 and C66 from Nairobi off Thika road and along Kenyatta road. The area extends approximately 2.8 Km East and 2.5 Km West of Gatundu town, and is bounded by Kikuyu escarpment to the North and Kiaora Estate to the South. The study area covers approximately 134 Km² comprising of twenty six (26) Sub locations

The project is intended to serve approximately 12,200 households each irrigating up to 0.2 hectares.



Figure 3.1: Project area

2.2 Administration

The project area covers Ng'enda in the South, Kiganjo in the West and Ndarugu Divisions in the North in Gatundu South District. Kiganjo and Ndarugu border the forest while Ng'enda border coffee estates.

Table 2.1: Provincial Administration

No	Division	Area (km ²)	No. locations	of No. of Sub-locations
1.	Ng'enda	59.9	3	10
2.	Ndarugu	52.5	3	10
3.	Kiganjo	21.6	3	6
4.	Total	134	9	26

2.3 Need for Project

The rationale for the project is that a transformation from subsistence, rain-fed traditional farming to an intensified, diversified and modernised agricultural system including irrigation is essential to improve the country's food security situation and create the conditions for sustainable development. This is in line with the government of Kenya's Poverty reduction strategy.

In spite of the area being endowed with various natural and human resources, and much effort having been directed towards development by the authorities concerned, the economy of the area remains relatively low in comparison with the national average. In order to close the regional disparity gap in per-capita income, agriculture, which is the leading growth sector in the region, should be intensively developed. Existing agricultural productivity remains low in the area due to various agricultural constraints which include: annual shortage and uneven seasonal distribution of rainfall, shortage of irrigation water resources, lack of perennial irrigation system for upland cultivation, inadequate knowledge in value addition of farm produce and poor market structures for the agricultural produce

Agriculture in the district is characterized by subsistence cropping systems and low quality management practices. There is often poor or inadequate use of inputs, limited use of available technologies, inadequate extension and credit services, and poor

marketing and infrastructure. Supply of inputs and services is limited due to the high cost of procurement in addition to the traditionally unattractive nature of the farm enterprises. Consumers usually procure only that which is surplus from what farmers produce and there is often minimal value addition. There is need to move from subsistence based to enterprise oriented production, or developed agriculture. Under a developed state of agriculture, one would expect to witness commercially viable cropping enterprises driven by high technology crop management strategies and backed by adequate input use, extension services and access to credit. The development of the irrigation system will guarantee intensified production and hence higher incomes to the area.

2.4 Project Design

2.4.1 General

Sprinkler irrigation is a method of applying irrigation water which is similar to natural rainfall. Water is distributed through a system of pipes usually by pumping. It is then sprayed into the air through sprinklers so that it breaks up into small water drops which fall to the ground. The pump supply system, sprinklers and operating conditions must be designed to enable a uniform application of water.

2.4.2 Suitability

Sprinkler irrigation is suited for most row, field and tree crops and water can be sprayed over or under the crop canopy. It is adaptable to any farmable slope, whether uniform or undulating. The lateral pipes supplying water to the sprinklers should always be laid out along the land contour whenever possible. This will minimize the pressure changes at the sprinklers and provide a uniform irrigation. A good clean supply of water, free of suspended sediments, is required to avoid problems of sprinkler nozzle blockage and spoiling the crop by coating it with sediment.

2.5 Components of the System

The proposed system will consist of the following key components

- (a) A pump unit
- (b) Tubing's- main/submains and laterals
- (c) Couplers

- (d) Sprinkler head
- (e) Other accessories such as valves, bends, plugs and risers.

2.5.1 Pumping Unit

Sprinkler irrigation systems distribute water by spraying it over the fields. The water is pumped under pressure to the fields. The pressure forces the water through sprinklers or through perforations or nozzles in pipelines and then forms a spray. A high speed centrifugal or turbine pump can be used for operating sprinkler irrigation for individual fields.

2.5.2 Tubing's: Mains/submains and laterals

The Tubing's consist of mainline, submains and laterals. Main line conveys water from the source and distributes it to the submains. The submains convey water to the laterals which in turn supply water to the sprinklers. Aluminum or PVC pipes are generally used for portable systems, while steel pipes are usually used for center-pivot laterals.

2.5.3 Couplers

Couplers are used for connecting two pipes and uncoupling quickly and easily. Essentially a coupler should provide

- (a) A reuse and flexible connection
- (b) Not leak at the joint
- (c) Be simple and easy to couple and uncouple
- (d) Be light, non-corrosive, and durable.

2.5.4 Sprinkler Head

Sprinkler head distribute water uniformly over the field without runoff or excessive loss due to deep percolation. Different types of sprinklers are available. They are either rotating or fixed type. The rotating type can be adapted for a wide range of application rates and spacing. Fixed head sprinklers are commonly used to irrigate small lawns and gardens.

2.5.5 Fittings and Accessories

The following are some of the important fittings and accessories forming components of sprinkler system to be used in this project.

- (a) Water meters which are used to measure the volume of water delivered. These are necessary to operate the system to give the required quantity of water.
- (b) Flange, couplings and nipple used for proper connection to the pump, suction and delivery.
- (c) Pressure gauge necessary to know whether the sprinkler system is working with desired pressure to ensure application uniformity.
- (d) Bend, tees, reducers, elbows, hydrants, butterfly valve and plugs.
- (e) Fertilizer applicator: Soluble chemical fertilizers can be injected into the sprinkler system and applied to the crop. The equipment for fertilizer application is relatively cheap and simple and can be fabricated locally. The fertilizer applicator consists of a sealed fertilizer tank with necessary tubings and connections. A venturi injector can be arranged in the main line, which creates the differential pressure suction and allows the fertilizer solution to flow in the main water line.

2.6 Operating the System

The main objective of the system is to apply water as uniformly as possible to fill the root zone of the crop with water.

2.6.1 Wetting Patterns

The wetting pattern from a single rotary sprinkler is not very uniform. Normally the area wetted is circular. The heaviest wetting is close to the sprinkler. For good uniformity several sprinklers will be operated close together so that their patterns overlap. The uniformity of sprinkler applications can be affected by wind and water pressure. Spray from sprinklers is easily blown about by even a gentle breeze and this can seriously reduce uniformity. To reduce the effects of wind the sprinklers will be positioned more closely together.

Sprinklers will only work well at the right operating pressure recommended by the manufacturer. If the pressure is above or below this then the distribution will be affected.

The most common problem is when the pressure is too low. This happens when pumps and pipes wear. Friction increases and so pressure at the sprinkler reduces. The result is that the water jet does not break up and all the water tends to fall in one area towards the outside of the wetted circle. If the pressure is too high then the distribution will also be poor. The pressure will therefore be maintained at that recommended by the manufacturer.

2.6.2 Application Rate

This is the average rate at which water is sprayed onto the crops and is measured in mm/hour. The application rate depends on the size of sprinkler nozzles, the operating pressure and the distance between sprinklers. The sprinkler system to be used is that which ensures that the average application rate is less than the basic infiltration rate of the soil. In this way all the water applied will be readily absorbed by the soil and there will be no runoff.

2.6.3 Sprinkler Drop Sizes

As water sprays from a sprinkler, it breaks up into small drops between 0.5 and 4.0 mm in size. The small drops fall close to the sprinkler whereas the larger ones fall close to the edge of the wetted circle. Large drops can damage delicate crops and soils and so in such conditions it is best to use the smaller sprinklers. Drop size is also controlled by pressure and nozzle size. When the pressure is low, drops tend to be much larger as the water jet does not break up easily. So to avoid crop and soil damage, small diameter nozzles operating at or above the normal recommended operating pressure have been recommended for use.

2.7 Crops Selected for Agricultural Development

The crops and cropping patterns for the project will be formulated based on the national food policy and national development plan. The basic principle for selection of the crops and layout of the cropping patterns include:

- (a) Creation of maximum benefits for both the farmer and the national economy
- (b) Effective use of the available water resources
- (c) Farmers familiarity with farming practices

(d) Conformity to existing socio-economic conditions

The following categories of crops have been selected for the agricultural development plan:

- (a) Cereals such as maize and others
- (b) Pulses such as beans, snow peas etc.
- (c) Fruits such as passion fruits, pineapples, strawberry, watermelon, mangoes, bananas and pawpaw's
- (d) Vegetables such as tomatoes, onion, cabbage, kale, French beans, capsicum, carrots, eggplants, butternut and spinach
- (e) Forage crops for dairy cattle such as Napier grass
- (f) Root crops such as sweet potatoes and Irish potatoes

2.8 Delineation of Irrigation Area under the Project

The optimization study has been made in order to clarify optimum project scale from viewpoints of land suitability, available water resources, economic viability and environmental conservation. The irrigation area is delineated on a topo-map taking into account the optimum scale for the project. The irrigation area extends North of Gatundu town and is approximately bounded by Ndarugu River to the east, Kikuyu escarpment to the North and Kiaora coffee estate to the south. The delineated area of 12,169 ha is divided into nine (9) blocks by the locations of the project area as shown in table 2.2.

Table 2.2: Project Sub Areas

S/No	Sub area (Location)	Hectarage (Ha)	Perimeter (Km)	Irrigable area (Ha)
1	Munyuini Location	1451	28.2	548.377271
2	Ndarugu Location	2140	54.9	598.067582
3	Rwabura Location	1459	24.9	660.220444
4	Mundoro Location	456	24.4	196.639646
5	Kiganjo Location	916	20.0	255.258094
6	Ngenda Location	1431	34.9	440.9709101
7	Kiamwangi Location	432	15.5	229.6105
8	Kimunyu Location	1297	20.7	663.5577564
9	Ituru Location	2586	32.7	768.3710188
Total		12169		4360.073222

2.9 Irrigation Water Requirement

Estimates of the irrigation requirement for the project area will be based on the following:

- (a) Crops and crop water requirements
- (b) Effective rainfall
- (c) Area under irrigation
- (d) Soil types
- (e) Irrigation efficiency

2.10 Water Balance

Water difference between available water from the Thiririka and Rwabura Rivers and the estimated diversion water requirements. Water for irrigation will be diverted from both Thiririka and Rwabura rivers. After deducting the volume of water required for human and livestock use, and other mandatory downstream requirements, the balance of the available water, if any, would be used to irrigate the delineated area of 4,360 ha. If the water available is not adequate, it would be complemented through construction of a reservoir.

2.11 Layout of Irrigation Pipeline.

Two (2) conveyance lines and three (3) main lines are proposed to supply water across the project area. The Thiririka conveyance line (conveyance 1) of about 8.27 Km originates from Thiririka intake in the Kikuyu escarpment forest and follows Thiririka River South Eastwards up to the head of the scheme. Conveyance line 2 of about 8.82 Km originates from the Rwabura intake and follows Rwabura River South Eastwards up to the head of the scheme. Mainline one (1) follows the Kenyatta Road, Mainline two (2) the Gacharage Road, while mainline three (3) follows the Karatu Road. Nine (9) locations of the project area will be supplied through sub mains.

Chapter



Three

3.0: POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

3.1 Policy Framework

The Kenya Government's environmental policy aims at integrating environmental aspects into national development plans. The broad objectives of the national environmental policy include:

- Optimal use of natural land and water resources in improving the quality of human environment;
- Sustainable use of natural resources to meet the needs of the present generations, while preserving their ability to meet the needs of future generations;
- Integration of environmental conservation and economic activities into the process of sustainable development;
- Meeting national goals and international obligations by conserving biodiversity, arresting desertification, mitigation effects of disasters, protecting the ozone layer and maintaining an ecological balance on earth.

3.2 Legal Framework

Applications of national statutes and regulations on environmental conservation suggest that the proposed project management institutions will have a legal duty and social responsibilities to ensure the proposed development is carried out without compromising the status of the natural resources in the area, public health and safety. The key national laws that have a direct relevance to the proposed project are briefly discussed below.

3.2.1 Environmental Management and Coordination Act (EMCA), 1999

The Environmental Management and Co-ordination Act (EMCA) 1999 is an Act of parliament to provide for the establishment of an appropriate legal and institutional framework for the management of the environment and for related matters.

The main objective of the Act is to:

- Provide guidelines for the establishment of an appropriate legal and institutional framework for the management of environment in Kenya;
- Provide a framework legislation for over 77 statutes in Kenya that contain environmental provisions;
- Provide guidelines for environmental impact assessment, environmental audit and monitoring, environmental quality standards and environmental protection orders.

The Act empowers the National Environment Management Authority (NEMA) to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of government in the implementation of all policies related to the environment.

The *Second Schedule* to the Act specifies the projects for which an EIA or environmental audit must be carried out. According to the Act, Section 58, all projects listed in the Second Schedule of the Act must submit a study report to NEMA. The proposed Irrigation Project is classified under Item 8 (e) Irrigation, in the Second Schedule of EMCA 1999.

EMCA and the other national laws that govern environmental, health and safety issues, in relation to agricultural and irrigation activities, are briefly discussed in the following sections. Wherever any of these laws contradict each other, the Act should prevail.

3.2.2 Agriculture, Fisheries and Food Authority Act, 2013

Agriculture, Fisheries and Food Authority Act (No.13, 2013) is an Act of Parliament to provide for the consolidation of the laws on the regulation and promotion of agriculture generally, to provide for the establishment of Agriculture, Fisheries and

Food Authority. The Act tend to protect Agriculture and fisheries excluding livestock for the purpose of food security in the country.

The Act addresses these activities:

- Administer the crops Act and the fisheries Act in accordance with provision of these Act.
- Promote best practices and regulate, the production, procesing and marketing of agricultural and acquatic products.
- Collect, collate data and maintain a database on agricultural and acquatic products.
- Deteremines the research priorities in agriculture and acquaculture.

3.2.3 Water Act, 2012

The Water Act, 2012 is of key importance to irrigation activities since it provides for the conservation, control, apportionment and use of available water resources. Key areas of the Act related to irrigation activities are:

- Obtaining water permits for irrigation (application and issuance procedures and attached conditions);
- Provision of sufficient drainage works for delivery of used or unused water to a water course or body from irrigated lands;
- Revision or variation and cancellation of water permits;
- Penalty for waste;
- Penalty for polluting water used for human consumption.

3.2.4 Public Health Act

This Act provides the impetus for a healthy environment and outlines regulations on waste management, pollution control and human health. By providing for guidelines of water quality, this Act provides a useful tool for regulating activities of groups (such as the Irrigation water users associations) or individuals with potential to pollute the water resource base. Whereas the contractor must comply with the Act during construction, the proposed project will be required to comply with the provisions of this Act during the operation phase.

3.2.5 Pest Control Products Act, 2012

This Act (Cap. 346, 2012) requires all chemicals used in any agricultural undertaking to be registered by the Pest Control Products Board (PCPB). All pest control products sold in Kenya must bear a label showing a PCPB registration number. Under this Act, there are a number of pesticides whose use is banned in Kenya while training in the use of pesticides must be carried out by PCPB accredited institutions and persons. All pesticide storage and handling arrangements must be inspected and licensed under this Act. The proposed Irrigation Project will procure various agricultural biocides for its members and also organize trainings on the use of the same. It will be prudent for the management to familiarize themselves with provisions of this Act.

3.2.6 Occupational Safety and Health Act, 2009

This is an Act of Parliament to provide for the safety, health and welfare of all workers and all persons lawfully present at workplaces, to provide for the establishment of the Directorate of Occupational Safety and Health Services and its purposes. It applies to all workplaces where any person is at work, whether temporarily or permanently. During the construction phase of the irrigation project, the works contractor must adhere to the requirements of this Act.

3.2.7 Irrigation Act, 2012

Irrigation Act (Cap 347) revised in 2012 is an Act of parliament to provide for the development, control and improvement of irrigation schemes and applies only to public irrigation schemes managed by the National Irrigation Board. It is widely recognized that lack of a comprehensive irrigation policy and legal framework has constrained irrigation development in Kenya. Under the proposed new irrigation policy, organizations such as Rwabura Irrigation Project will be required to operate under a legally recognized Irrigation Water User Associations whose duties will involve management of irrigation water, collection of operation and maintenance fees and conflict resolution.

Summary of the national laws that are likely to be triggered by the proposed project include those indicated in table 3.1:

Table 3.1 Legislation Summary

Legislation	Description
The Constitution of Kenya, 2010	Article 32 of the Constitution of Kenya states that “Every person has the right to a clean and healthy environment”. Environmental obligations are stated in Article 69.
Environment Management and Co-ordination Act 1999	This Act governs EIA studies in Kenya and requires that EIAs for Irrigation and drainage projects are carried out as per the second schedule of the Act. The Act also set-ups the NEMA.
Environment Impact Assessment and Audit Regulations, 2003	Under this Act submission of environmental reports became mandatory, and no proponent shall implement a project likely to have a negative environmental impact or one for which an EIA has been concluded and approved in accordance with these regulations.
EMCA (Noise and Excessive Vibration Pollution Control), 2009	These regulations prohibit excessive noise and vibration.
Waste Management Regulations, 2006 (Legal Notice No.121)	These regulations are meant to streamline the handling, transportation and disposal of various types of waste in order to protect human health and the environment.
EMCA (Wetlands, River, Lake and Sea) Regulations, 2009	This Act provides for the conservation and sustainable use of all wetlands and their resources whether occurring in private or public land in Kenya. It ensures the conservation of water catchments and the control of floods and the sustainable use of wetlands for ecological and aesthetic purposes. Furthermore, the Act makes provision for the protection of wetlands as habitats for species of fauna and flora and provision of a framework for public participation in the management of wetlands.
EMCA (Biological Diversity and	The Act does not permit any person to engage in any activity that may have an adverse impact on any ecosystem; may lead to the introduction of any exotic species or to unsustainable use of

Legislation	Description
Resources, Access) Regulations, 2006	natural resources, without an Environmental Impact Assessment License issued by the Authority under the Act.
The Land Act, 2012	This law “gives effect to Article 68 of the Constitution, to revise, consolidate and rationalize land laws; to provide for the sustainable administration and management of land and land based resources, and for connected purposes”. Section 143 and 144 of the Act provides for the establishment of Right of Way for public projects. The Act also provides for the rights and responsibilities of persons occupying the land for which the right of way is sought or has been provided.
The Forest Act 2005	This Act provides for the establishment, development and sustainable management, including conservation and rational utilization of forest resources for the socio -economic development of the country.
The Water Act of 2012	This Act provides for the management, conservation, use and control of water resources and for the acquisition and regulation of rights to use water; to provide for the regulation and management of water supply and sewerage services; to repeal the Water Act (Chapter. 372 of the Laws of Kenya) and certain provisions of the Local Government Act; and for related purposes.
Occupational Safety and Health Act 2007(CAP 15)	This Act secures the safety, health and welfare of persons at work; and protects persons other than persons at work against risks to safety and health arising out of, or in connection with, the activities of persons at work.
The Public Health Act (Chapter 242 of the Laws of Kenya)	This Act of Parliament makes provisions for securing and maintaining health. There are provisions within the Act to deal, in a general way, with water, air and noise quality as they pertain to human health. An environmental nuisance is defined and includes the emission from premises of wastewaters, gases and smoke which could be regarded as injurious to health.

Legislation	Description
Agriculture, Fisheries And Food Authority Act (No. 13, 2013)	This Act seeks to provide for the consolidation of the laws on the regulation and promotion of agriculture generally, to provide for the establishment of the Agriculture, Fisheries and Food Authority.
Wildlife (Conservation and Management) Cap 376 Laws of Kenya	This Act provides that where it is desirable that the present powers relating to the management and conservation of wildlife in Kenya should be amalgamated and placed in a consolidated Service of the Government.
The Valuers Act Cap 532	The revised edition 1985 of the valuers act cap 532 makes provisions for the relevant charges and conducts of valuers in relation to valuation of assets. This act help protect those people affected by the proposed project by providing the relevant regulations and guidelines in the undertaking land valuation.
The Penal Code (Cap. 63)	The chapter on “Offences Against Health and Conveniences” contained in the Penal Code enacted in 1930 strictly prohibits the release of foul air into the environment, which affects the health of other persons.
The Employment Act, 2007	An Act of Parliament to repeal the Employment Act, declare and define the fundamental rights of employees, to provide basic conditions of employment of employees, to regulate employment of children, and to provide for matters connected with the foregoing.
The Lake and Rivers Act Cap 409	The Act makes provision for regulating the use of lake or river for the transport of floating timber; regulating the traffic on a lake or river; for protecting the bird or animal life on or in a lake or river.

3.3 Institutional Framework

3.3.1 Institutions under EMCA, 1999

The Government established the following institutions to implement the EMCA 1999.

a) National Environmental Council

The National Environmental Council (NEC) is responsible for policy formulation and directions for the purposes of the Act. The NEC also sets national goals and objectives and determines policies and priorities for the protection of the environment.

b) National Environmental Management Authority

The responsibility of the National Environmental Management Authority (NEMA) is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of government in the implementation of all policies relating to the environment.

In addition to NEMA, the Act provides for the establishment and enforcement of environmental quality standards to be set by a technical committee of NEMA known as the Standards and Enforcement Review Committee.

c) Provincial and District Environmental Committees

The Provincial and District Environmental Committees also contribute to decentralised environmental management and enable the participation of local communities. These environmental committees consist of the following:

- Representatives from all the ministries;
- Representatives from local authorities within the province/district;
- Two farmers / pastoral representatives;
- Two representatives from NGOs involved in environmental management in the province/district;
- A representative of each regional development authority in the province/district.

d) Public Complaints Committee

The Act also established a Public Complaints Committee, which provides the administrative mechanism for addressing environmental harm. The committee has the mandate to investigate complaints relating to environmental damage and degradation.

Its members include representatives from the Law Society of Kenya, NGOs and the business community.

e) Standards and enforcement Committee

Part VIII of the Act deals with environmental quality standards. It establishes a Standards and Enforcement Review Committee (SERC) whose functions include the establishment of standards for all environmental media.

Standards have been established as regulations to the Act as presented above.

Standards for the following are still scheduled for release:

- Air quality;
- Chemicals;
- Land use;
- Economic instruments.

3.3.2 Water Resources Management Authority

The Water Resources Management Authority (WRMA) is of particular relevance to the project. Its mandate covers some sectoral issues which are applicable to environmental management, such as use of water resources, human settlement and administration of activities in the scheme.

Part III of the Water Act 2012 defines the powers and functions of WRMA which include:

- Developing principles, guidelines and procedures for the allocation of water resources;
- Monitoring the national water resources management strategy;
- Receiving and determining applications for permits for water use;
- Monitoring and enforcing conditions attached to permits for water use;
- Regulating and protecting water resources quality from adverse impacts;
- Managing and protecting water catchments.

WRMA may prosecute any offences arising under the Water Act and also provides the basis for the following:

- Formulation of a National Water Resources Management Strategy;
- Classification of water resources and resource quality objectives;
- Determination of water reserves;
- Designation of catchment areas;

- Formulation of a catchment management strategy;
- Declaration of protected catchment areas national monitoring of and information on water resource management;
- Definition of state schemes and community projects.

3.3.3 National Irrigation Board (NIB)

The mission of the National Irrigation board mandate is to develop, promote and improve irrigated agriculture through sustainable exploitation of available irrigation and drainage potential in Kenya in order to ensure food security and create wealth and employment, therefore improving the living standards of Kenyans.

The core functions of the NIB are:

- Controlling and improving national irrigation schemes in the country;
- Conducting research and investigation into the establishment of national irrigation schemes;
- Designing, constructing, supervising and administering irrigation schemes;
- Coordinating and planning settlement on national irrigation schemes;
- Determining the number of settlers to be accommodated in national irrigation schemes;

3.4 Environmental Policies of international institutions

3.4.1 World Bank Safeguard Policies

The objective of the World Bank's environmental and social safeguard policies is to prevent and mitigate undue harm to people and their environment in the development process. These policies provide guidelines for the bank and borrowers in the identification, preparation, and implementation of programs and projects. Safeguard policies have often provided a platform for the participation of stakeholders in project design, and have been an important instrument for building ownership among local populations. Some of the relevant World Bank Safeguard Policies likely to be triggered by the project includes:

(a) OP/BP 4.01 Environmental Assessment (January 1999)

Ensures that appropriate levels of environmental and social assessments are carried out as part of project design. It also deals with the public consultation process, and ensures that the views of project-affected persons/groups and local NGOs are taken into account.

(b) OP/BP 4.04 Natural Habitats (June 2001)

This supports the conservation of natural habitats and the maintenance of ecological functions as a basis for sustainable development. The Bank does not support projects that involve the significant conversion or degradation of critical natural habitats

(c) OP 15.50 Disclosures

This Policy details the Banks requirements for making operational information available to the public. The Bank reaffirms its recognition and endorsement of the fundamental importance of transparency and accountability to the development process. In addition, timely dissemination of information to local groups affected by the projects and programs supported by the Bank, including nongovernmental organizations, is essential for the effective implementation and sustainability of projects.

3.4.2 EU Environmental Policy

The European Union has an elaborate policy statement on environmental management covering a wide range of issues. EU-supported projects and programmes worldwide are expected to observe the relevant policy issues. These policy statements also apply to projects/programmes supported by member states of the EU.

3.5 International Laws and Guidelines/ Multilateral Environmental Agreements

In addition, the following guidelines/international laws/multilateral environmental agreements were also reviewed:

3.5.1 Ramsar convention on wetlands

This is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The Ramsar Convention is the only global environmental treaty that deals

with a particular ecosystem. The treaty was adopted in the Iranian city of Ramsar in 1971 and the Convention's member countries cover all geographic regions of the planet.

Unlike the other global environmental conventions, Ramsar is not affiliated with the United Nations system of Multilateral Environmental Agreements (MEA), but it works very closely with the other MEAs and is a full partner among the "biodiversity-related cluster" of treaties and agreements.

3.5.2 Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC)

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change, which commits its Parties by setting internationally binding emission reduction targets.

Recognizing that developed countries are principally responsible for the current high levels of GHG emissions in the atmosphere as a result of more than 150 years of industrial activity, the Protocol places a heavier burden on developed nations under the principle of "common but differentiated responsibilities."

The Convention on Climate Change sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. The Convention enjoys near universal membership.

Under the Convention, governments:

- gather and share information on greenhouse gas emissions, national policies and best practices
- launch national strategies for addressing greenhouse gas emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries
- cooperate in preparing for adaptation to the impacts of climate change

The Convention entered into force on 21 March 1994.

3.5.3 Convention on biological diversity

In response to the growing threat posed by human activity to biodiversity and inspired by the world community's growing commitment to sustainable development, during the 1992 Earth Summit in Rio de Janeiro world leaders adopted the Convention on Biological Diversity (CBD). It is the most important Convention dealing with biodiversity conservation.

The Convention has three main objectives:

- To conserve biological diversity
- To use biological diversity in a sustainable way
- To share the benefits of biological diversity fairly and equitably.

IUCN has been involved in the CBD since its drafting and through its further development. Its policy work has helped to ensure that decisions taken by the Parties to the Convention are as effective as possible to achieve the CBD objectives.

Chapter

Four

4.0: BASELINE INFORMATION

4.1 Climate

The Rwabura and Thiririka River sub-catchments lie within the humid to semi-humid agro-climatic zones of Kenya. The upper sub-catchment which lies within the Kikuyu Escarpment Forest comprises the humid zone and is the source of Rwabura and Thiririka River and other tributaries discharging into Ndarugu River and other adjacent rivers. The middle sub-catchment comprising the sub-humid and semi-humid zones provides agricultural land where small-scale agricultural activities are undertaken.

The climatic data collected and analysed include the following:

1. Rainfall;
2. Temperature;
3. Evaporation;
4. Humidity;
5. Radiation and
6. Wind run.



Figure 4.1: Rwabura River

4.1.1 Rainfall

The area experiences an average annual rainfall ranging between 800 and 2000mm which varies along the agro-ecological. Rainfall data from Kieni forest station, Gatundu Agriculture office station and Eastern rift sawmills limited station was analysed to determine mean monthly rainfall across the sub-catchments. The catchment experiences a mean annual rainfall of 1160mm with two distinct peaks in March to May and October to December (bimodal pattern). The maximum and minimum rainfall received is 257mm and 33.4 mm in April and July respectively as shown in the table 4.1.

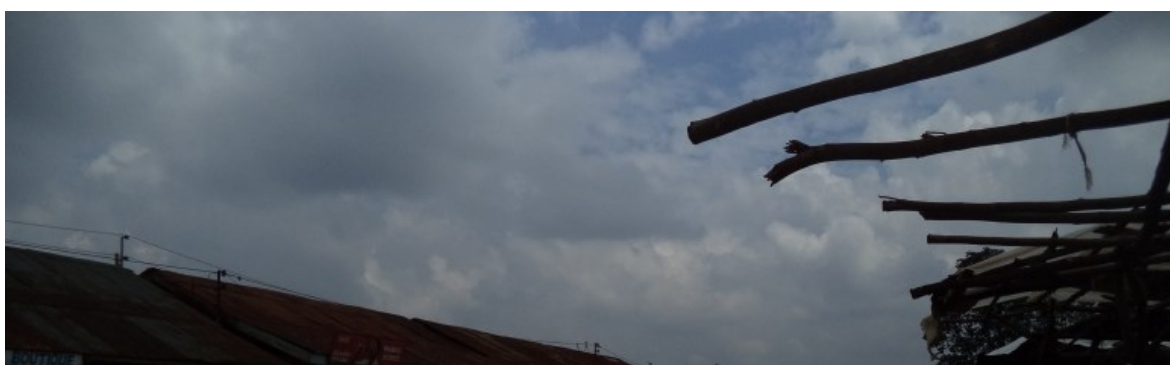


Figure 4.2: Formed clouds in the project area

Table 4.1: Annual Average rainfall

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
R/F (mm)	59.7	52.3	105.6	257	191.7	50	33.4	34.2	35.2	98.5	163.6	79	1160.2

Source: Kenya Meteorological Department

4.1.2 Evaporation

The area experiences a mean monthly evaporation ranging from 1.6mm to 6.6mm/day.

The average maximum evaporation rate is 166.6mm in months of July and March respectively as shown in Table 4.2 below.

Table 4.2: Mean Monthly Evaporation

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	155.	159.	166.	127.	107.	84.	75.	83.5	123.	138.	117.	134.
Evaporatio n (mm)	5	1	6	8	0	3	0		3	8	3	0

4.1.3 Temperature

The temperatures in the project area vary from humid to semi-humid characteristics. The maximum temperatures range from 25.2°C to 30.4°C in the months of August and March respectively while the minimum temperatures range from 9.8°C to 15.4°C in the months of February and April respectively

The mean annual temperature in the humid (upper) zone varies between 14°C and 18°C. In the sub-humid to semi-humid zones (lower zones), the mean annual temperatures vary between 18°C and 22°C.

Table 4.3: Mean Monthly Minimum and Maximum Temperatures

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Monthly Temp.	19.6	20.5	20.7	20.9	20.3	19.1	17.7	18.4	19.8	20.4	19.9	19.3
Maximum Monthly Temp.	28.6	29.2	30.4	28.2	26.6	28	25.4	25.2	28.6	28	26	26.3
Minimum Monthly Temp.	11.7	9.8	12.7	15.4	14.1	12.8	11.2	11.8	12.1	13.2	14	11.9

4.1.4 Sunshine Hours

The mean monthly sunshine hours ranges from 4.0 to 9.6 hours in the month of August and February respectively. (See Table 4.4). The graphical analysis of the sunshine data is presented in Annex 1.

Table 4.4: Mean Monthly Sunshine Hours

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
Mean(Hrs)	9.5	9.6	8.6	6.9	6.0	5.0	4.6	4.0	6.2	6.7	6.9	8.1	82.1

4.1.5 Solar Radiation

The mean monthly radiation ranges from 14.1 to 24.8 Langlays in the month of July and February respectively as shown below

Table 4.5: Mean Monthly Radiation Values (Langlays)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Monthly Radiation(Langl ays)	23.6	24.8	22.3	19.3	16.7	15.4	14.1	15.0	19.3	19.4	18.9	21.7

4.1.6 Wind

The wind speed in the project area ranges from 1.6 km/hr. to 3.2 km/hr. Maximum speed is recorded in March and September and the minimum speeds, in June. The mean monthly value is 2.5 km/hr.

Table 4.6: Wind Run (km/hr) for the Period 2008-2009

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean(Kph)
Wind run(km/hr)	2.8	2.5	3.2	2.9	2.2	1.8	2.3	2.4	3	2.9	2.6	1.6	2.5

4.1.7 Relative Humidity

Relative humidity in the project area varies between 52% in the dry seasons and 74.5% in the rainy seasons. Peak of the relative humidity is observed during April, August and November while low relative humidity is observed during February and March. The mean monthly relative humidity is 66.7.

Table 4.7: Mean Monthly Relative Humidity

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Mean
Mean Monthly Relative Humidity (%)	59	56.5	52	72.5	71.5	68	71.5	73.5	63.5	68.5	74.5	69.5	800.5	66.7

4.2 Hydrology

4.2.1 River Discharge

The mean flows for Thiririka river ranges from 0.318 m³/s in the month of March to 0.537 m³/s in May while the Rwabura river mean flows ranges from 0.237 m³/s in the months of September to 1.8m³/s in May as per the data for river Thiririka and Rwabura obtained from Water Resources Management Authority (WRMA) for RGS 3BD08 and 3CB07

Table 4.8: Mean Monthly Summaries of Discharge for Thiririka River at RGS 3BD08

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	0.378	0.324	0.318	0.464	0.537	0.461	0.39	0.342	0.332	0.348	0.432	0.415

Table 4.9: Mean monthly discharge for Rwabura River at RGS 3CB07

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	0.478	0.319	0.258	1.043	1.811	1.042	0.484	0.315	0.237	0.279	0.706	0.652

4.2.2 River Water Body

The two river water bodies under consideration is the Rwabura and Thiririka. They rise from the Southern slopes of the Aberdare Ranges in the Kikuyu Escarpment Forest and flows in a South by East direction to emerge from the forest near and to the East of Karatu Rural Market. The Rwabura River system lies in the Ndarugu Water Management Unit while Thiririka River system lies in the Ruiru Water Management Unit as delineated by the Water Resources Management Authority for management purposes.

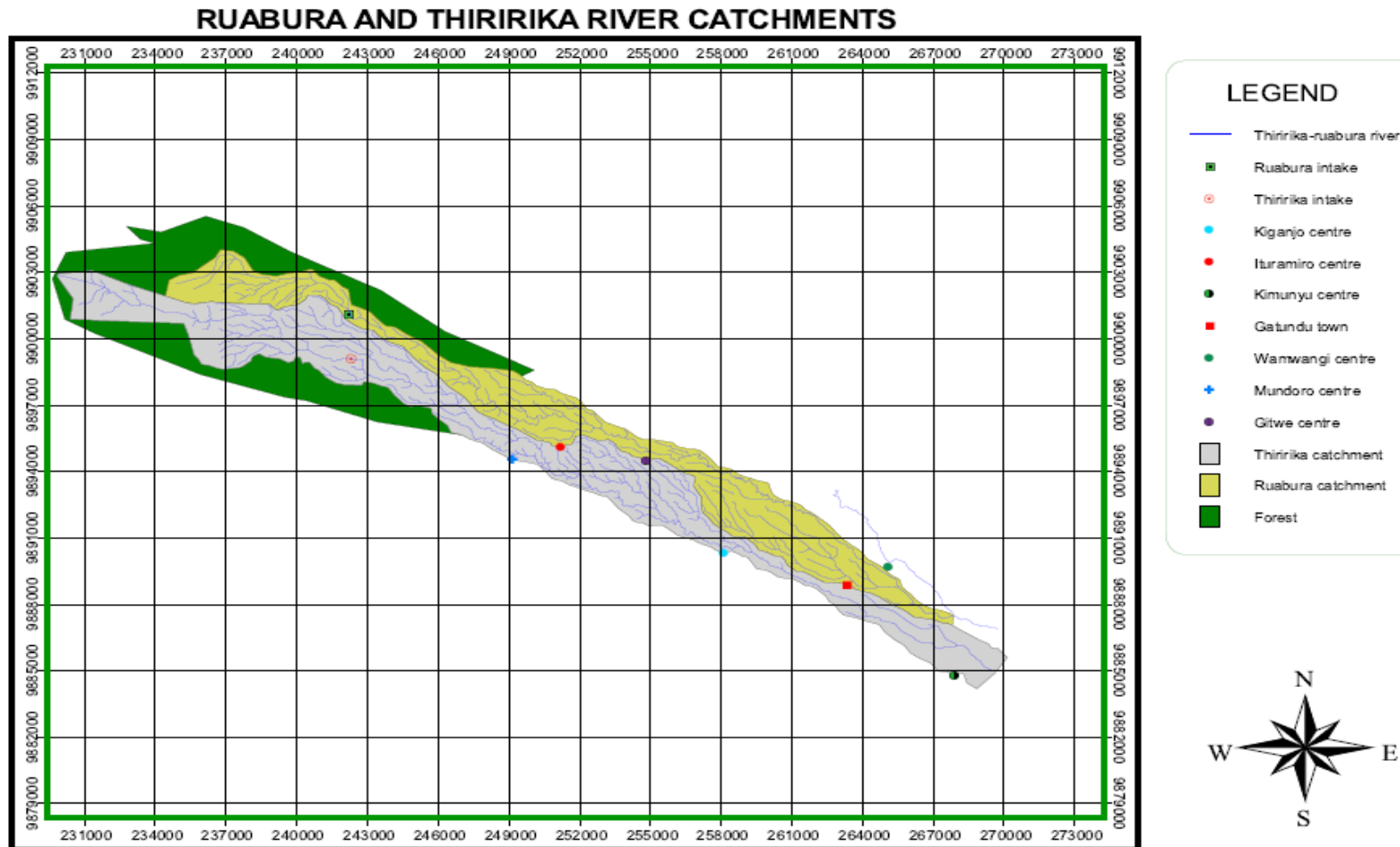


Figure 4.3: Rwabura and Thiririka River Catchments

4.2.3 Hydrological Analysis

4.2.3.1 Surface Water Data Availability

The upper Rwabura River was gauged at RGS 3CB07 located at coordinates 00.92844°S, 036.78088°E while Thiririka River was gauged at RGS 3BD08 located at coordinates 00.9243°S, 036.739°E and at RGS 3BD04 at coordinates 001.017°S, 036.8980E. However, these gauging stations are not operational currently. This gauging station operated from 1964 to January, 2005 but with data missing for 1994, 1999 to 2002. The station was rated and the discharge records from this station have been analysed and the long-term mean monthly flows calculated

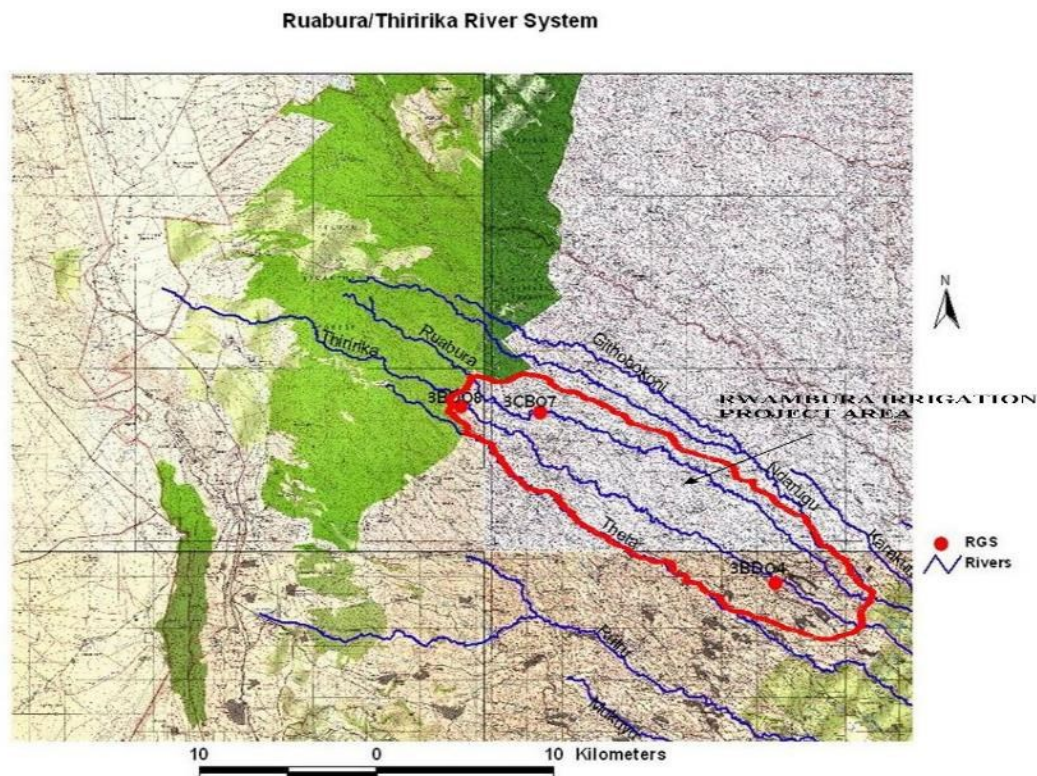


Figure 4.4: Rwabura and Thiririka River Gauging Stations

- Flow Duration Analysis

To assess the availability of water resources for the purposes of allocation, flow frequency analysis establishing frequency of occurrence of specific river flows are

undertaken. In this case, flow duration analysis using the discharge data available for RGS 3CB07 and RGS 3BD08 was undertaken.

In flow duration curve analysis, naturalized or present-day historical discharge records are analysed over specific durations to produce curves displaying the relationship between the range of discharges and the percentage of time each of them is equalled or exceeded. This analysis establishes the catchment yields at various percentage reliabilities upstream of the gauging station with particular emphasis on the 95%, 80% and 50% reliability yields.

The water resources management rules define flood flow as the flow that exceeds the Q80 flow value, i.e. the flow that is equalled or exceeded eighty percent of the time and, normal flow as that flow which is less than the Q80 flow value.

The Q95 flow value currently represents the Reserve, i.e. that quantity and quality of water required to satisfy basic human needs for all people who are or may be supplied from the water resource and, for the protection of aquatic ecosystems, in order to secure ecologically sustainable development.

Table 4.10: Rwabura Flow Duration Statistics at RGS 3CB07

Reserve (Q ₉₅)	0.058 m ³ /s equivalent to 5,011.2 m ³ /day;
Normal Flow (Q ₈₀)	0.140 m ³ /s equivalent to 12,096 m ³ /day;
Flood flow threshold (Q ₅₀)	0.290 m ³ /s equivalent to 25,056 m ³ /day.

Table 4.11: Thiririka Flow Duration Statistics at RGS 3BD08

Reserve (Q ₉₅)	0.110 m ³ /s equivalent to 9,504 m ³ /day;
Normal Flow (Q ₈₀)	0.20 m ³ /s equivalent to 17,280 m ³ /day;
Flood flow threshold (Q ₅₀)	0.33 m ³ /s equivalent to 28,512 m ³ /day.

4.2.4 Permitted Abstractions

According to the available abstraction data held by the Water Resources Management Authority at Kiambu Sub-regional Office, there are a total of 48 permitted and

authorisations from Rwabura River (10 Permits and 38 Authorisations) and a total of 145 permitted and authorisations from Thiririka River (40 Permits and 105 Authorisations).

The total abstraction authorisations from Rwabura River, from normal flow for domestic and industrial use amounts to 3,290.345 m³/day while the abstractions from flood flow amounts to 21,324.39 m³/day (15,584.676m³/day through permits and 5,739.714 m³/day through authorisations).

The total abstraction authorisations from normal flow on Thiririka River amounts to 9,264.581 m³/day while the abstractions from flood flow amounts to 49,599.931 m³/day (19,264.681 m³/day through permits and 30,335.250 m³/day through authorisations).

Perusal of permitting data from the sub-regional office indicates that most of the above abstractions might not be ongoing as the authorisations expired many years ago and there is no information on updating/renewal of the water permits nor the authorisations.

4.2.5 Water Balance

The available data on water allocation cover the whole reach of Rwabura and Thiririka Rivers. Consequently, basing the available water on analysis of discharge data at RGS 3CB07 and RGS 3BD08 are representative of the available water resources for allocation.

From the flow duration analysis, the total water available for allocation across Rwabura River from the flood flow is 25,228.8 m³/day out of which 21,324.39m³/day is already committed leaving a balance of 3,904.41m³/day.

The total water available for allocation across Thiririka River from the flood flow is 28,857.6 m³/day out of which 19,264.681m³/day is already allocated leaving a balance of 9,592.919m³/day. The available balance is much less than the volumes for which authorisations have been given indicating that Thiririka River is over-committed.

The analysis of water resources of Rwabura River indicates that most of the flood water resources of this river are already committed and consequently, further allocation of water from this river will require the construction of storage facilities appropriate for the water required.

4.2.6 Water Quality

The Water Quality results indicate that the water for both rivers sources is suitable for irrigation as presented in Table 4.12.

Table 4.12: Irrigation Water Chemical Analysis Results for Thiririka and Rwabura Rivers

Parameters	Thiririka River	Ruabura River	FAO 1976c	Remarks
• pH	7.38	7.4	Normal Range: (6.5–8.5)	Falls within normal range
• Conductivity, mS/cm	41.2	41.2	ok	ok
• TDS	25.5	22.6	0-200	ok
• Chlorides, me/litre	1	1	<4	Restriction on use: NONE
• Sulphates, me/litre	<0.3	<0.3	0-20	Negligible effects
• Sodium Absorption Ratio	0.3	0.3	<3	Restriction on use: NONE
• Salinity/Sodium Class	Low	Low		Salinity effects negligible
• Calcium, me/l	0.8	0.8	0-20	Salinity effects negligible
• Magnesium, me/l	1.46	1.46	0-5	Negligible effects
• Sodium ,me/l	5.6	5.6	0-40	Negligible effects
• Chloride ,me/l	1	1	0-30	Negligible effects
• Nitrate, mg/l	1.4	1.4	0-10	Negligible effects
• Ammonium ,mg/l	-	-	0-5	Negligible effects
• Potassium ,mg/l	0.2	0.2	0-2	Negligible effects

4.3 Topography

The area is generally hilly to the North, West, scattered hills in the central and southern parts, gentle plains to the East and South East, there are several valley bottoms scattered all over centripetal drainage system draining into the Athi Basin. The altitude ranges from 1,600 meters above sea level at the lower zones to about 2,200 meters above sea level in the West & North-Western parts. The map gives a general presentation of the ground topography of the project area. The average slope of the area varies across agro ecological zones in which the project area transects as described below;

- (e) Upper zones(UH and LH-1) the slopes are generally steep and beyond 35%
- (f) In middle zone(UM-1 and UM2) the slope range between 20-35%
- (g) While lower zone (UM3) the slope ranges between 5-15%.

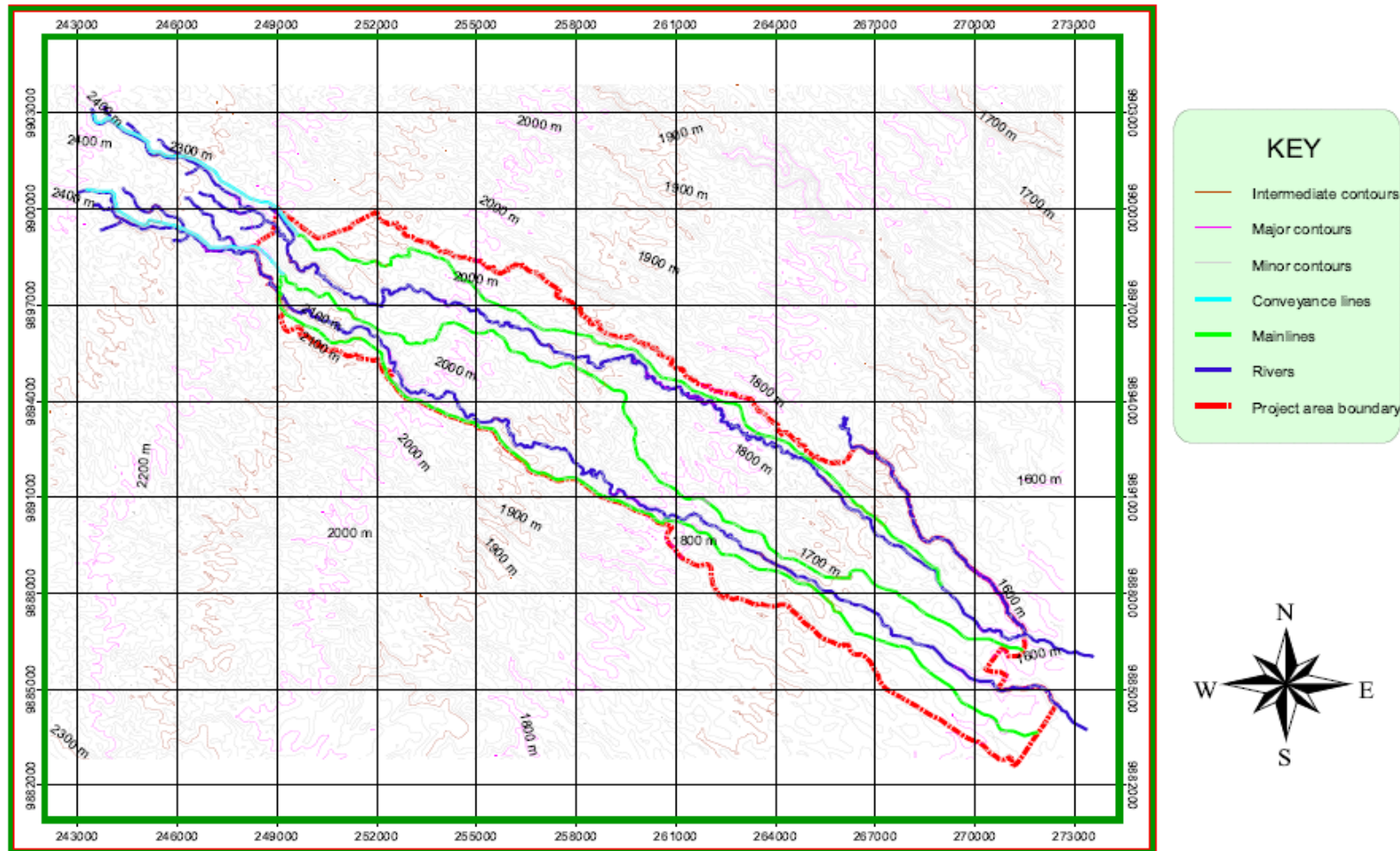


Figure 4.5: Contour map

4.4 Soils and Land suitability

4.4.1 Soils

The soils in the project area vary widely in both physical and chemical properties. The major limiting factors of soil for irrigation purposes include:-

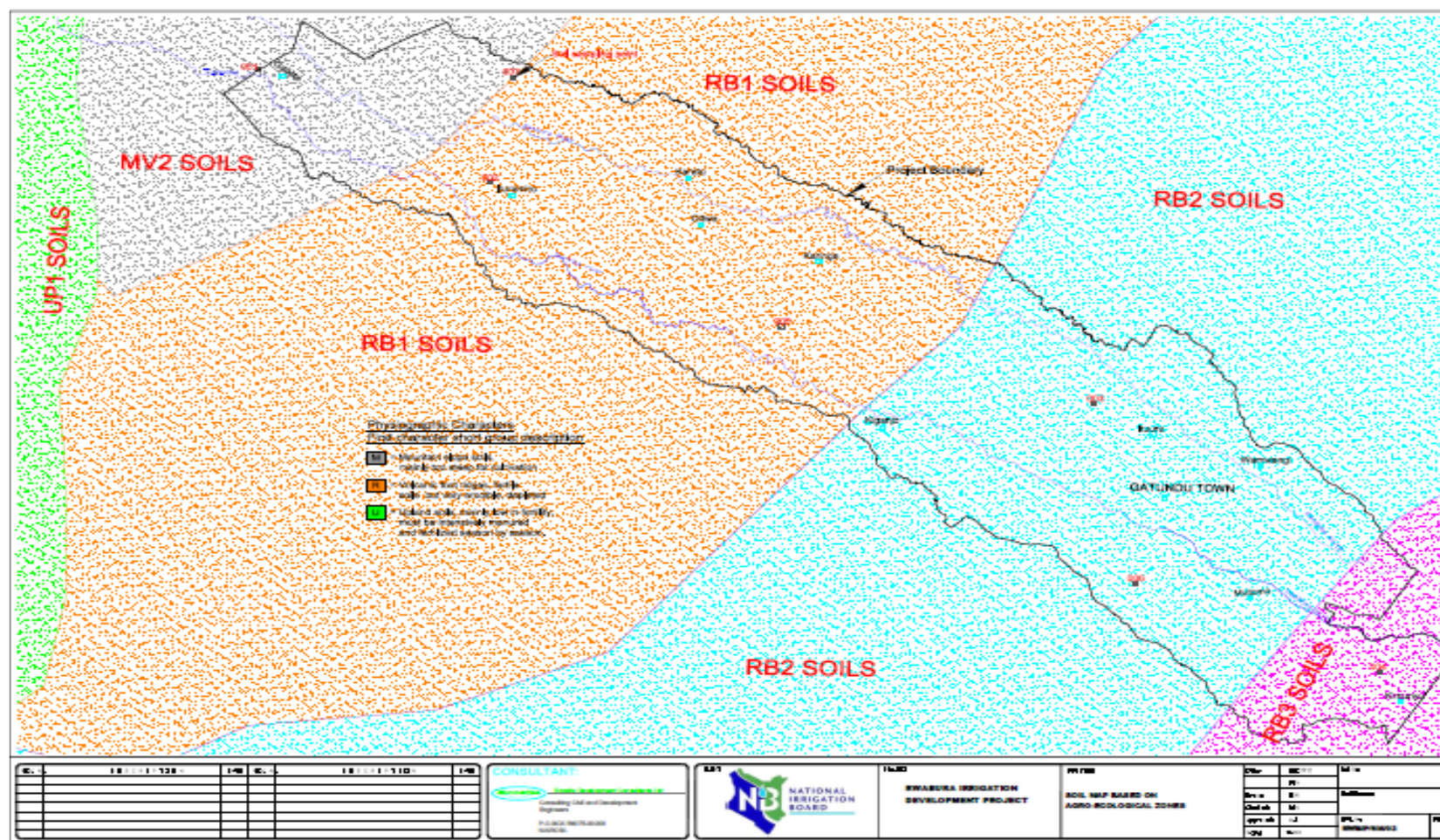
- (f) Salinity;
- (g) Sodicity;
- (h) Other physical properties related to soil structure and texture.

The project area is characterized by one soil unit, Nitisols comprising of two soils types; Humic Nitisols and Rhodic Nitisols. Other soils types that are present in the project area but occupy a small area are Umbric Andosols, Haplic Nitisols and Rhodic Ferralsols. Humic Nitisols are found on the upper part while Rhodic Nitisols are found on lower parts of the project area.

Physical and chemical properties of the soil in the project area can be described as follows;

- **MV2** Well drained, shallow to moderately deep, dark reddish brown, friable, stony clay loam, with an acid humic top soil; in places very shallow and rocky:
- **RB1** Well drained, deep to extremely deep, dark reddish brown to dark brown, friable and slightly smeary clay, with an acid humic topsoil; in places shallow and rocky: ando-humic NITISOLS and humic ANDOSOLS, partly lithic phases; with Rock Outcrops
- **RB2** Well drained, extremely deep, dusky red to dark reddish brown, very friable clay, with an acid humic topsoil: humic NITISOLS

Figure 4.6: Soil Map



4.4.1.1 Physical Characteristics

- Geology

The project area lies in the tertiary volcanic rocks region of central Kenya. The geology of the region can further be classified as Kerichwa Valley Tuffs along the river valleys and the Middle and Upper Kerichwa Valley Tuffs found on the higher ground.

The soils comprise basically two types of soils, namely;

- Soils developed on ashes and other pyroclastic rocks of recent volcanoes. These soils are found in the upper catchment of the mountains (Aberdare Range including the Kikuyu Escarpment. These soils are well drained, very deep, dark reddish brown to brown, very friable, clay loam to clay, with a thick humic topsoil; in places shallow to moderately deep and rocky.
- Soils developed on volcanic footridges comprising dissected lower slopes of major older volcanics and mountains on undulating to hilly terrain. These soils are well drained, extremely deep, dark reddish brown to dark brown, friable with acidic humic topsoil.

Soils on the lower zones of Kimunyu can be classified as clay loam while loam soils are observed in the upper zones of Gacharage and Mundoro.

- Infiltration rate

The infiltration for the soil in the project area ranges between 5 and 10mm/hr. The average infiltration rate is estimated to be 8mm/hr. Permeability or saturated hydraulic conductivity (Ksat) of the soil in the project area is moderate with hydraulic conductivity of 100-300 mm/day. The soil bulk densities range from 1.15 to 1.55 g/cm³ while the average bulk density for loamy soils is 1.4g/cm³ and total porosity of 47 %. The water storage capacity for loam to clay loam soils ranges between 14 to 22 mm per 10 cm depth.

4.4.1.2 Chemical properties

- Soil -PH

PH values of the soils in the project area ranges from 4.3 to 6. In the lower zones, high PH of 6 is observed and hence suitable for wide variety of the crop enterprise, however deteriorating

soil structure is observed and use of organic manure is recommended. Humic Nitisols near the forest indicate low PH value of 4.3(Acidic soils) and use of liming fertilizers is recommended in crop production

- Salinity

The soil salinity was determined by measuring the total ion concentration. Most of the ions in the soil are adequate and within the range of good soil for crop growth, however, appropriate and right fertilizer use should be sort.

- Sodicity

The soils have adequate levels of the sodium ions, calcium and magnesium ions which are responsible for the sodicity problems when imbalance occurs. There no indication of sodicity problem however appropriate fertilizers applications should be enhanced to avoid the situation occurring in future.

4.4.2 Land Suitability

Land suitability evaluation is the process of appraising the land potential for its capacity for sustaining a particular type of use. This process takes into account environment factors and soil physical and chemical properties, which include:-

- Rooting conditions: Effective soil depth
- Oxygen availability: Drainage class
- Nutrient availability: Soil reaction and Cation Exchange Capacity (CEC)
- Excess of salt:-Sodicity (ESP) and Salinity (EC)
- Soil workability:- Texture, slope class and presence of stones on the surface

The land suitability analysis was carried out across agro-ecological zones in which the project cuts across.

The Agro Zones in which the project lies includes:

- i. Upper highland (UH1)
- ii. Lower highland I (LH – 1)
- iii. Upper middle I (UM –1 and upper midland 2(UM2))
- iv. Upper midland 3 (UM3)

- **Upper Highland (UH1)**

The soils are acidic for crops growth. An application of acidifying fertilizers such as DAP, urea or ASN should be avoided. The organic matter content is sufficient.

To raise the soil PH and magnesium content, liming with 800kg/acre of dolomite is very recommended at least 3 weeks before planting.

- **Lower Highland I (LH – 1)**

The soils are acidic for crops' growth .An application of acidifying fertilizers such as DAPS, urea or ASN should be avoided. The organic matter content is sufficient.

To raise the soil PH, calcium and magnesium soil content liming with 500kg /acre of dolmax or magmax is recommended at least 3 weeks before planting.

- **Upper Middle I (UM –1 and upper midland 2(UM2))**

The soil reaction (PH) is satisfactory for crops growth. Phosphorus and copper are deficient. Soil organic matter should be improved.

- **Upper Midland 3 (UM3)**

The soil (PH) is satisfactory for crops' growth. Phosphorus is deficient. Soil organic matter should be improved.

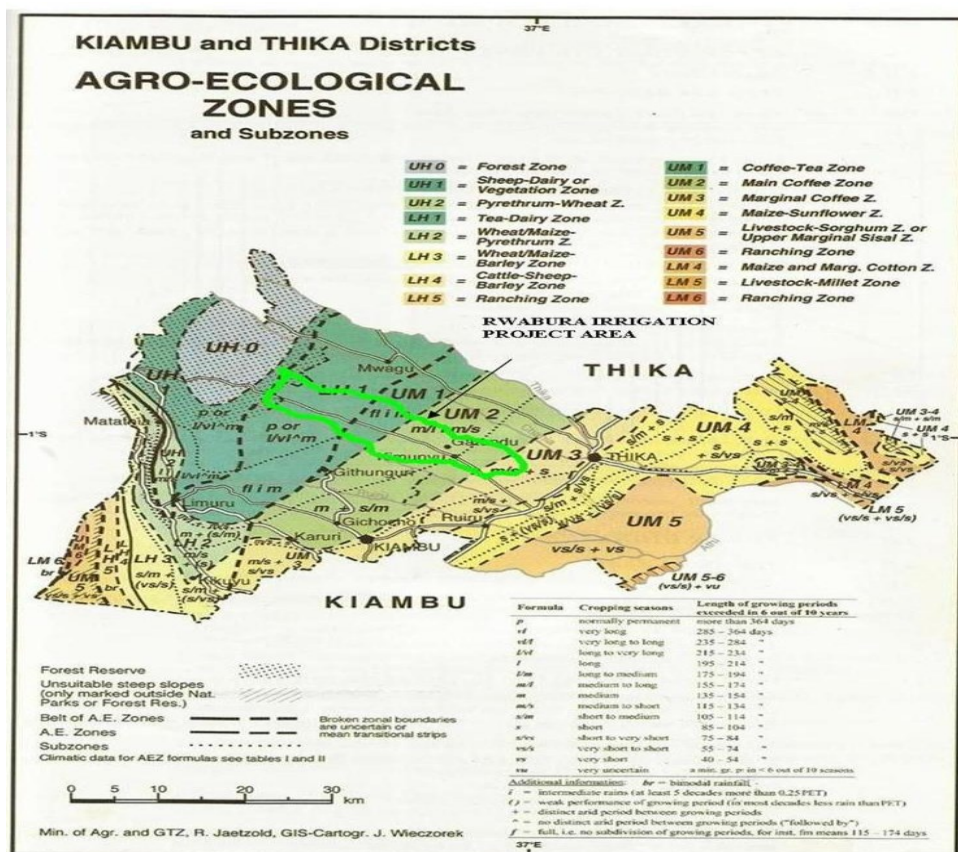


Figure 4.7: Agro Ecological Zones Map

Chapter

Five

5.0 SOCIAL AND ECONOMIC SETTING

5.1 Introduction

This Chapter presents the analysis and findings of the surveyed households as set out in the ESIA requirements by the National Environmental Management Authority of Kenya. The study findings are presented on the environmental and social impact assessment of Rwabura irrigation development project in Gatundu South, Kiambu County. The data was gathered exclusively from the questionnaires as the research instrument. The questionnaire was designed in line with the objectives of the study. The socio-economic attributes include household access to social amenities, household main source of income, and household land possession among others.

5.2 Socio-Economic Survey Findings.

During the study, socio-economic survey carried out targeted household heads. Random sampling was used to select the respondents from the project area.

5.2.1 Response Rate

A sample size of 160 questionnaires was administered. The response rate was 100%. This reasonable response rate was successful because the respondents were visited in their households.

5.2.2 Distribution of respondents in the project area

According to the findings shown in table 5.1, 28.8 % of the respondents were from Ndarugu division, 25.6% respondents from Kiganjo division, 23.8% of respondents from Gatundu division and 21.9% of the respondents were from Ng'enda division.

Table 5.1: Divisions and respective respondents

Divisions	Frequency	Percent (%)
Ndarugu	46	28.8
Ng'enda	35	21.9
Kiganjo	41	25.6
Gatundu	38	23.8
Total	160	100.0

Table 5.2 shows that, 25% of the respondents were from both Kiganjo and Ng'enda location giving a total of 50%, 20% of the respondents were from Kimunyu location, 13.8% of the respondents were from Rwabura location, 11.9% of the respondent were from Munyu-ini location while 4.4% of the respondents were from Kiamwangi location.

Table 5.2: Locations and respective respondents

Locations	Frequency	Percent (%)
Rwabura	22	13.8
Munyu-Ini	19	11.9
Kiganjo	40	25.0
Ng'enda	40	25.0
Kimunyu	32	20.0
Kiamwangi	7	4.4
Total	160	100.0

Table 5.3: Sub-locations with respective respondents

Sub locations	Frequency	Percent (%)
Kiganjo	30	18.8
Mutomo	5	3.1
Gacharage	1	0.6
Roi	1	0.6
Ritho	18	11.3
Githunguchu	10	6.3
Hangege	13	8.1
Kirangari	1	0.6
Karinga	1	0.6
Kimunyu	14	8.8
Karembu	6	3.8
Kahuguini	10	6.3
Gacharage	9	5.6
Gitwe	7	4.4
Karinga	12	7.5
Kibiru	2	1.3
Kiganjo	10	6.3
Munyu-Ini	2	1.3
Munyuini	4	2.5
Roi	4	2.5
Total	160	100.0

5.2.3 Age of the respondents

Age is a factor if any economic development should be realized. According to the findings, majority of the respondents (34.4%) were aged 46-60 years while the minority (4.4%) aged between 18-25 years. From the findings, it can be deduced that majority of the respondents fall in a fairly productive group.

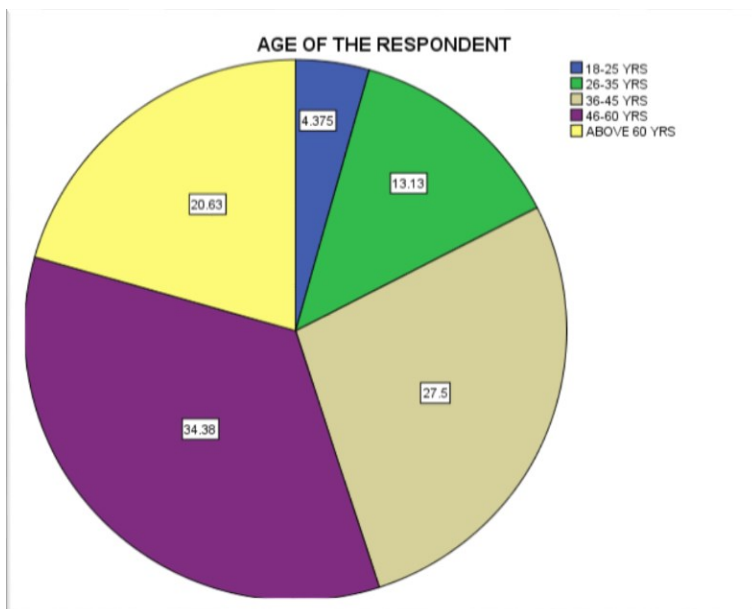


Figure 5.1: Age of the respondents

5.2.4 Marital status

The survey also sought to find out the marital status of the respondents so as to establish the vulnerable groups. Female-headed households and widows are vulnerable groups. According to the findings, majority (87.5%) of the respondents are married, 9.4% are never married, while the minority (3.1%) are widowed.

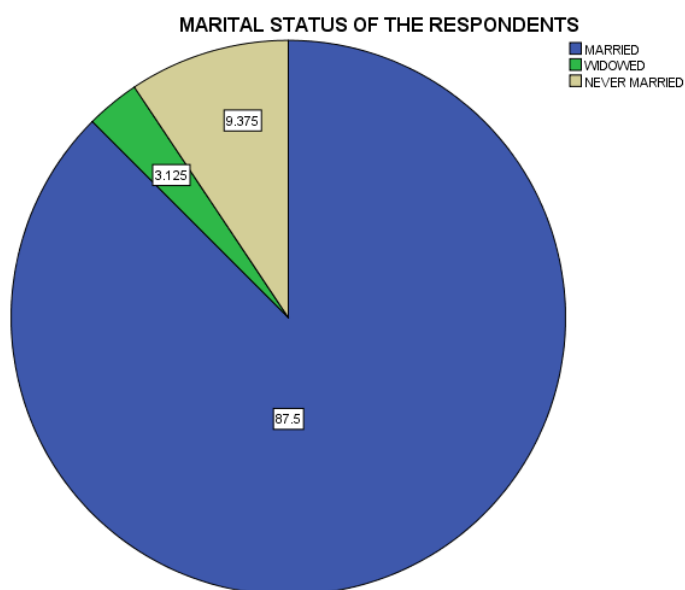


Figure 5.2: Marital Status of the Respondent

5.2.5 Household Size

The survey sought to find out the household size/dependants by asking respondents whether they have children under the age of 18 years. According to the findings, majority (60.6%) of the respondents have children under the age of 18 years, while the minority (39.4%) does not have children under the age of 18 years. Respondents who responded affirmative, majority (55%) of them have between 1-3 children. Therefore, average household size range between 5-6 people.

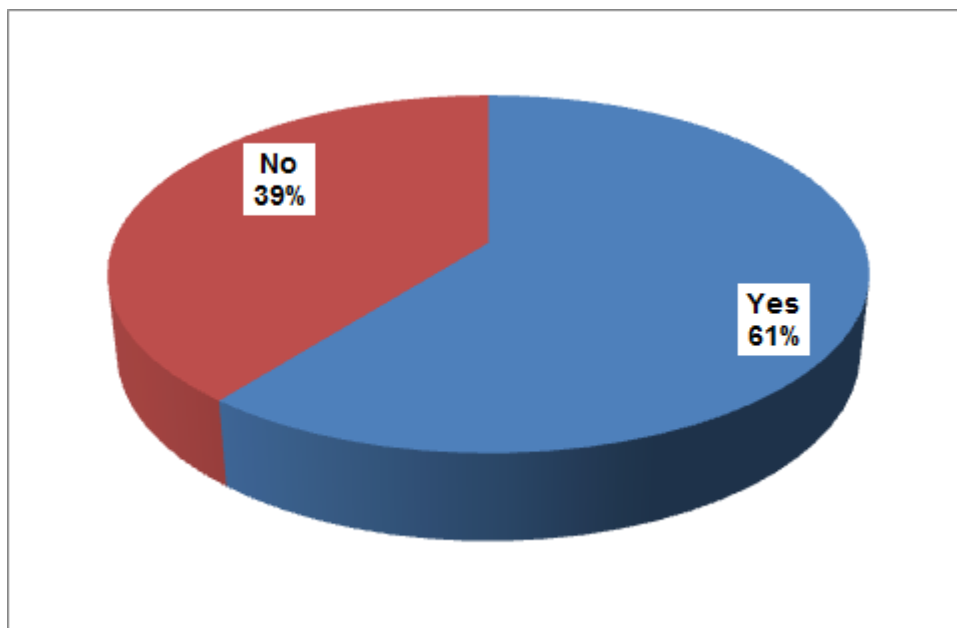


Figure 5.3: Children under the age of 18 years

5.3 Population

According to the 2009 housing and population census Gatundu South constituency has a total population of 114,118, with a density of 593 persons per square kilometre. The constituency has a dependency ratio of 0.791 implying that there are 8 dependants (under 15 and over 64 years) for every 10 economically productive persons in the household (Kenya National Bureau of Statistics and ICF Macro, 2010). The project area has a higher dependency ratio as compared to other constituencies and the overall County dependency ratio of 0.616 implying that households in the project area are experiencing increased pressure on resources and significant incomes are spent on subsistence i.e. food, health and

education compared to other households malaria (KNBS and Society for International Development, 2013). There is therefore a need to enhance income generation such through the irrigation scheme.

5.4 Settlement and Housing Conditions

The standard and quality of dwelling units are indicators of household resource endowments and have implications for provision of other social services. The settlement patterns in the area are influenced by natural resource endowments, rainfall patterns and economic opportunities. The conditions of houses within the project area are mixed. During our survey, we observed that the type and quality of construction materials varied from place to place. Housing in the area is a combination of permanent (made of stones or concrete and covered with tiles or corrugated iron sheet) and semi-permanent (made of wood and covered with corrugated iron sheet) houses.

5.5 Level of education of the respondent.

As of 2013, there were 1,225 primary and 303 secondary schools run on both the day and boarding system for boys and girls. The school enrolment level is generally high and attributed to Free Primary Education programme and infrastructure development through devolved funds. This contributes to very high literacy levels through basic education in the area. From the survey conducted, the findings revealed that majority of the target population (over 70%) know how to write and read. Moreover, 1.9 % of the population has no education. This implies that decision making can be done based on information disseminated to the community either through reading or orally in either Kiswahili or English.

Table 5.4: Level of education

Highest level of education	Percent (%)
Primary	38.8
Secondary	33.8
College	21.3
University	4.4
No Education	1.9

5.6 Land tenure

Land ownership is a necessity for any development project. As per the survey, majority (96.9%) of the respondents revealed to own land while the minority (3.1%) are leasing or using land given by their parents. Therefore, it is evident that most people of Gatundu south own land.

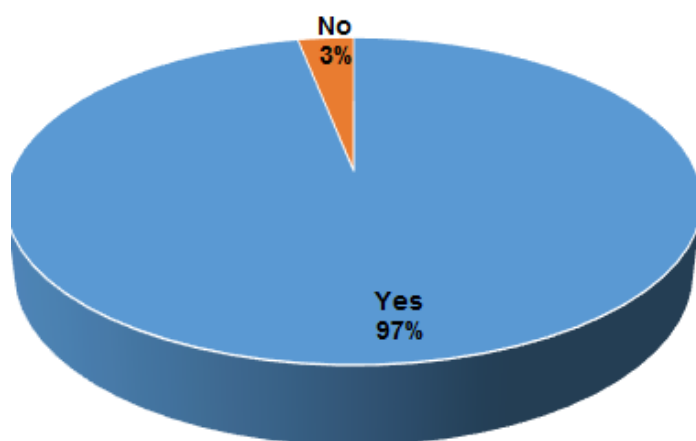


Figure 5.4: Respondent's land possession

Size of land

The survey sought to establish the size of land available for cultivation amongst the respondents. Majority (over 50%) of the respondents who own land indicated that they own more than 2 acres.

Table 5.5: Size of the land owned by the respondent

Size of land	Percent (%)
Less than 2 Acres	46.9
2.1-3.0	28.8
3.1-5.0	11.9
Above 5 Acres	9.4

5.7 Livelihood Activities

Regarding the main source of income of the respondent, the majority (78.1%) practice farming while (11.3%) are employed, followed by (10%) of traders and the minority of the respondents (0.6%) are livestock keepers.

Farming, business/investment, and non-farm activities are the most important livelihood strategies in the study area. Agriculture is the predominant economic activity in the County in

terms of employment, food security, income generation, and overall contribution to the socio-economic wellbeing of the people. The main food crops grown in the area include; maize, beans and Irish potatoes, horticultural production of fruits and vegetables and cash crops farming of tea, coffee, and tissue cultured bananas. Livestock production is also practiced with the common livestock reared being dairy cattle, sheep, goats, poultry, pigs, rabbits and donkeys. Dairy cattle comprise mainly of exotic breeds reared under zero grazing. The dairy products are sold locally and neighbouring towns. However, land fragmentation has resulted into production challenges hence the need to increase farm productivity. Non-farm livelihood activities common in the area include small-scale trade like selling of fruits and vegetables and are widely practiced by women in the project area. Other persons are engaged in formal employment, and business ventures. The youths have migrated to neighbouring towns such as Thika, Ruiru, Nairobi, Kiambu, and Juja in search of employment and others to Gatundu town to exploit business opportunities such *taxis*, *boda boda* in the market and other small enterprises.

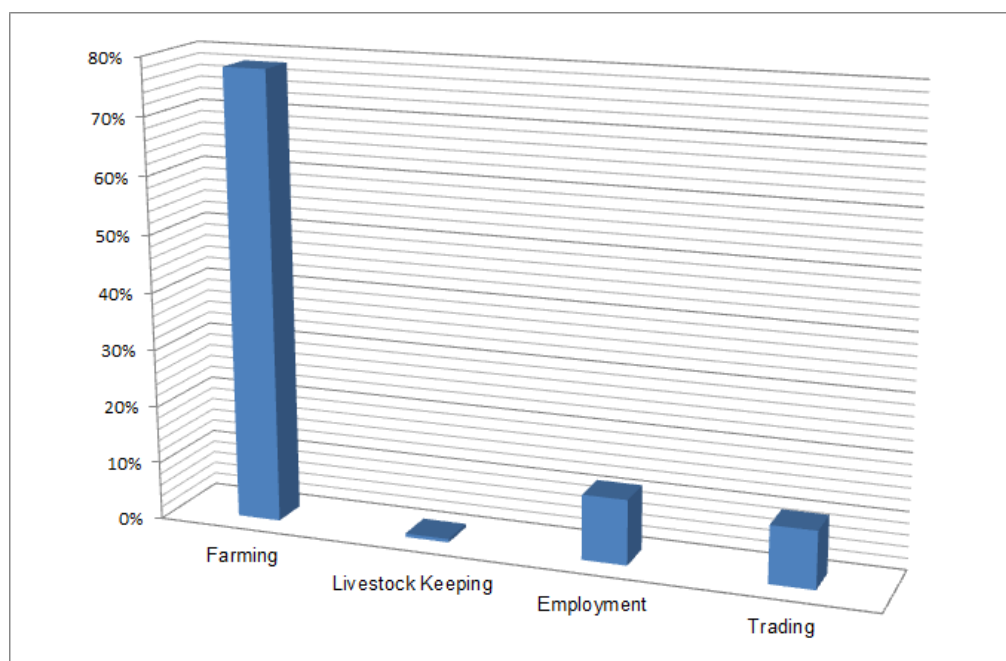


Figure 5.5: Main source of income

5.8 Health in Gatundu South sub- County

The County's health service network is comprised of District Hospitals, Sub-District Hospitals, Dispensaries, Health Centres, Medical Clinics and Nursing Homes. Gatundu District Hospital is the largest health facility in the project area located in Gatundu Town. There are also a number of private and public health centres and dispensaries within the project area such as Gatundu South level-4 hospital. As of 2013, there were 364 public and privately operated health facilities. Flu or cough and Malaria are the most prevalent diseases in the sub-county. Other common diseases include respiratory tract and ear, nose and throat infections.

Regarding respondent's member of the household ill within the last four months, the majority (70%) were not ill within that period of time while the minority (30%) had experienced illness in the past four months. This analysis implies that majority of the respondents had not experienced sickness over the last few months.

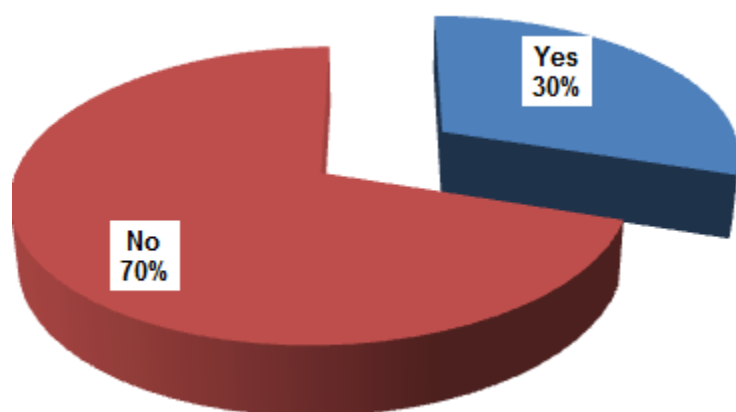


Figure 5.6: Members of the household ill within the last four months.

The survey sought to ascertain the prevalent illness in the project area. As shown in table 5.6, major diseases reported by the respondents are 22.5% had flu/cough, followed by 12% of malaria and stomach disorders, while chronic illness was found to be 5%.

Table 5.6: Causes of the illness

Diseases	Percent (%)
Malaria	6.0
Flu/Cough	22.5
Stomach Disorders	6.0
Headaches	1.5

Chronic Illness	5.0
N/A	59.0

Regarding the health service facility in the area, the majority of the surveyed households (64.38%) access their services from level IV hospital while the minority (35.63%) access health services from a dispensary.

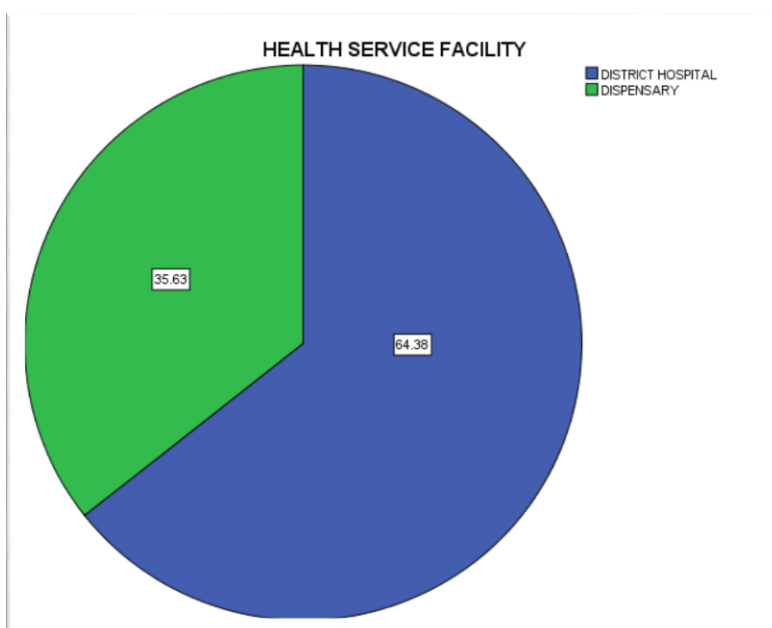


Figure 5.7: Health Service Facility

The research in addition sought to find out the respondent's distance to the nearest health centre. According to the findings, majority (40%) of the respondents reported the distance to be over 5.1km, followed by (35.6%) reporting distance to be 3.1-5km, then (23.8%) of respondents reporting the distance to be 1.1-3km while the minority (0.6%) of the respondent had a distance of below 1km to the nearest health centre.

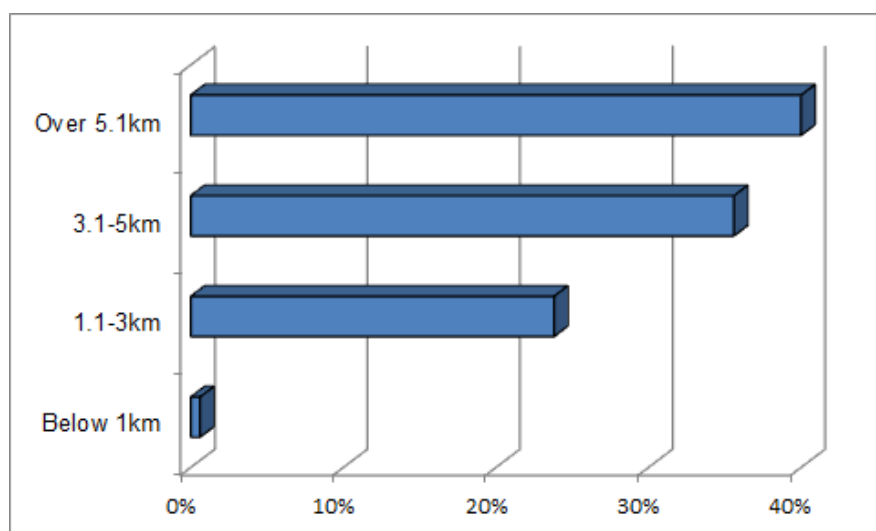


Figure 5.8: Distance to the nearest health centre.

5.9 Members of the household with disability

The research in addition sought to find out number of respondent's member of the household with disability. According to the findings, majority (96%) of the respondents did not have any member of the household with disability, while the minority (4%) of the respondents has at least one member of the household with disability.

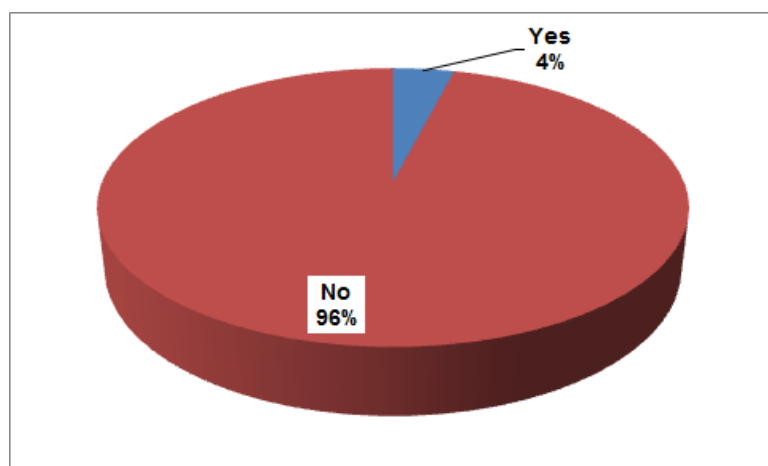


Figure 5.9: Members of the household with disability

The research in addition sought to find the nature of disability of the people found to living with disability. According to the findings, 1.2% of the respondents are either blind or dumb while the 2.6% of the respondents are either lame or crippled.

Table 5.7: Respondent's nature of disability

Nature of disability	Percent (%)
Lame	1.3
Blind	0.6
Dumb	0.6
Crippled	1.3

5.10 Water and sanitation

Water sources

The water resources comprise of both surface and ground water. Domestic water provision is either through improved sources such as springs, protected wells, boreholes and piped water and unimproved sources such as ponds, dams, stream/rivers, unprotected spring, and water vendors.

The source of drinking water within the County is derived from nine (9) licensed water services providers under Athi Water Services Board (AWSB). Household water in the area is provided by Gatundu South Water and Sanitation Company. However there still exist water infrastructural challenges thus limiting water and sanitation services. From the survey findings, all respondents (100%) agreed to have access to improved water sources (piped water, borehole and protected springs) for domestic purposes. The distance to these sources is less than 3km.

Sanitation

Regarding the sanitation facility and the distance, all the respondents indicated that sanitation facilities are less than 3km away. Most (97%) households use improved sanitation facility (VIP latrine) while unimproved sanitation facility makes 3% as presented below.

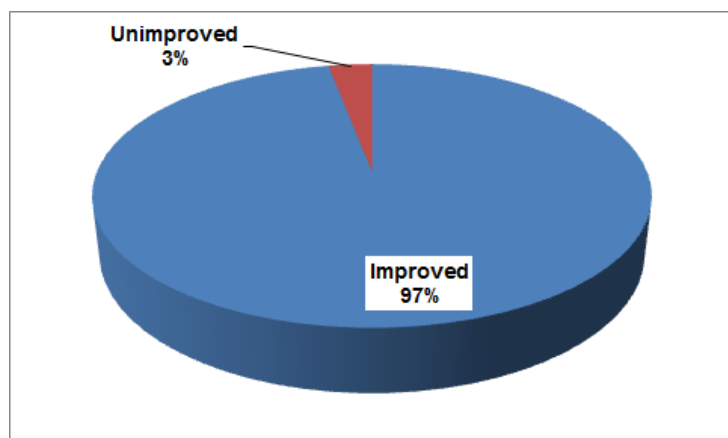


Figure 5.10: Type of sanitation facility

5.11 Infrastructure and Communication

The County has a road network comprising a total of 2,033 Km of roads under bitumen standard, 1,450 Km under gravel surface and 430 Km under earth surface. The main road users in the project area are 'matatus' (public transport vans), trucks, private cars and cyclists. The main market centres include Gatundu, Kiganjo, Ruiru, Juja, Thika, Kiambu and Nairobi towns. The existing roads network, railway lines, electric power service lines, telecommunication lines and Global System for Mobile (GSM) Communication coverage of the prospect area is adequate.

Chapter



Six

6.0: PUBLIC CONSULTATION AND PARTICIPATION

6.1 Introduction

The following section describes the consultations and public participation held to assess the opinions and attitude of the various stakeholders to the irrigation project. The goal and objective of public participation is to ensure adequate information is provided to all stakeholders in a clear and timely manner and to present sufficient opportunity to these groups to voice their concerns and opinion so that their views can be incorporated into the project design and development as well as augment overall benefits and avoiding potential conflicts.

The NIB is committed to pro-active and on-going communication with all parties interested in the development of the project. During our field inspections, we established that the project, stakeholders including individuals and groups had been actively engaged in the consultation process. Public consultations in relation to the ESIA occur at all stages, starting with inception and planning when the potential lands and alternative sites are being considered. A participatory approach was adopted as an on-going strategy throughout the entire project cycle. Public participation and consultations was done through individuals, groups, and community meetings. Selection of ways to consult, and expand participation by community and other stakeholders, took into consideration literacy levels prevalent in affected communities; ethnicity and cultural aspects; and practical conditions (like distance). The role of political and cultural leaders, including the community elders, in the participation strategy was important.

6.2 Stakeholders

During the public consultations, multiple groups of stakeholders were consulted. The stakeholders were those who have an interest in the project development, and who will be involved in the further consultative process. The main groups of stakeholders are:

6.2.1 Directly Affected People

These are the people who reside in the area or derive their livelihood from the affected land. These people will benefit from the irrigation project. Most of the directly affected people were informed and consulted on major issues concerning the proposed project, livelihood enhancement and income generation. They participated in the socio economic survey.

6.2.2 Indirectly Affected Persons

This group of stakeholders includes all those who reside in areas neighboring the project area or are reliant on resources in the project area and will have no change or the project may not adjust their livelihood e.g. groups such as those residing downstream of the river.

6.2.3 Government Agencies and other organizations

These included:

- KFS
- WRMA
- NEMA
- Ministry of Agriculture
- Ministry of Water and Irrigation
- County government of Kiambu

6.3 Key Issues Arising from Public Participation Meetings

The consultant held six (6) public consultative meetings (*barazas*) with the community in conjunction with the proponent and the administration as per the program and invitation made by county commissioner in appendix VI.

The lists of attendees and venues of the meetings are presented in the appendix I. The agenda for the meeting was to inform the community about the project and receive comments and suggestions from the participants. Table 6.1 show the place and date of the meetings.

Table 6.1: Public *barazas*

Date	Area	Day	Time
15/08/2016	Gitwe shopping centre	Monday	2.00pm
16/08/2016	Munyuinin shopping centre	Tuesday	2.00pm
17/08/2016	Gatundu chiefs office	Wednesday	2.00pm
18/08/2016	Kahuguini /Kimunyu	Thursday	10.00am
18/08/2016	Kiganjo polytechnic	Thursday	2.00pm
19/08/2016	Karinga shopping centre	Friday	2.00pm
29/05/2015	Ngenda Chief Office	Friday	9.00AM
29/05/2015	Kiganjo Shopping Center	Friday	11.30AM
29/05//2015	Itura Mero	Friday	2.00 PM

The following is a summary of issues raised by the members who attended the meetings:

6.3.1 Perceived Benefits

- (a) The proposed project will create significant economic and social benefits to the communities and contribute to the attainment of the national priority goals and ongoing national efforts to accelerate economic growth and alleviate poverty.
- (b) Irrigated agriculture will contribute to enhanced food security and improved nutrition at the household level. This will alleviate the negative impact of erratic and unreliable rainfall pattern on the community's productive resources.
- (c) Income diversification strategy; Investment in irrigation development is a strategy in reducing risks associated with rainfall variability and achieving food security.
- (d) Employment opportunities will be offered to the construction workers and any other person who will be hired to provide her/his services during the construction phase. In addition to direct employment, supplies of basic necessities to the workers will also

lead to more employment opportunities and acquisition of entrepreneurial skills. This will engrain a sense of project ownership within the community.

- (e) The irrigation scheme will also play a role in reduction of idleness particularly amongst the youth due to an increase in income generating activities both directly or indirectly.
- (f) The standard of living of the community especially vulnerable beneficiaries (elderly, female headed households and children) since there will be a reduction in distances traveled and time spent in search of water and time on agriculture. Therefore playing a significant role in income generation and increasing food and nutritional security amongst the vulnerable households.
- (g) The community will be assured an all year round access to irrigation water supply to their farms since, the current domestic water provided by the Gatundu water and sewerage company is not recommended for farming.
- (h) Upgrading of current road infrastructure will establish a transport and travel networks to rural and urban markets. This will have positive social and economic impacts in the area.
- (i) By providing direct and indirect local employment, the project will ease the direct resource dependency pressures on forest and forest resources.
- (j) Reduced poverty levels through increased incomes and improved livelihoods resulting from construction of the proposed project and maintenance employment and consumption from the local markets, emergence of other associated economic opportunities and activities.

6.3.2 Issues and Concerns

- a) Inadequate water for farmers at the downstream, the community expressed concern over water distribution and rationalization. The project management will put in place mechanisms to enable all to access water in compliance with regulations.
- b) Health risks associated with increased incidences of mosquito and malaria borne diseases due to increased breeding sites. This would be mitigated through capacity building of the community on mosquito preventive and control measures.

- c) Lack of marketing strategy and infrastructure for products; currently farmers do not have a crop storage and marketing plan. There is an urgent need for scheme beneficiary farmers to develop collaborative and effective marketing strategies to access larger and more sustainable markets.
- d) Lack of adequate knowledge in irrigation; the community in the project area have limited knowledge on irrigation crop development. This could be attributed to limited knowledge and lack of irrigation crop production skills, tillage services, fertilizer, seed, chemicals and operation of irrigation equipment and management.
- e) Damage of road infrastructure that is currently being developed during transportation and haulage of construction materials to project sites.
- f) Clearing of vegetation during construction phase, this would be addressed through reforestation programs and sparing of indigenous trees during the clearing process.
- g) The potential for pesticide and agro-chemical residues getting into the aquatic resources as the agricultural activities intensifies
- h) Lack of credit especially for irrigation purposes to enable farmers to grow high value crops and source inputs on time, and at competitive rates may hamper scheme productivity and adoption of climate smart agriculture techniques. The Project beneficiaries through collective action can enhance access to financial service providers.

During the survey findings, majority (81%) of the community members indicated that they had prior information about the project while the minority (19%) did not have any information. All the community members supported the implementation of the project.

Chapter

Seven

7.0 PROJECT ALTERNATIVES

7.1 Introduction

This chapter looks at the alternatives to the proposed project in terms of site, technology, design, scale and extent. The comparisons of these with the proposed project give rise to the best project option for adoption.

7.2 The proposed alternative.

This report has been prepared based on sound desktop and field studies made by the ESIA team. The findings and recommendations are based on the proposed site, materials and the proposed technologies to be used in implementation of the proposed project. Sprinkler irrigation is a method of applying irrigation water that is similar to natural rainfall. Water is distributed through a system of pipes usually by pumping. It is then sprayed into the air through sprinklers so that it breaks up into small water drops which fall to the ground. The pump supply system, sprinklers and operating conditions must be designed to enable a uniform application of water. This system is ideal to the extent that it conserves irrigation water.

7.3 Project Alternatives

7.3.1 Alternatives to Site

The proposed site has been selected by the National Irrigation Board based on selection criteria for irrigation development in the country. The consultant was therefore supposed to come up with the best irrigation system that suits this location. A feasibility study and ESIA was conducted in the area and the best irrigation technology for the area was identified.

7.3.2 Alternative to Technology

There are various alternative irrigation technologies that can be used in this area and they include the following:

1. Surface Irrigation

Surface irrigation is the application of water by gravity flow to the surface of the field. Either the entire field is flooded (basin irrigation) or the water is fed into small channels (furrows) or strips of land (borders).

i. Basin Irrigation

Basins are flat areas of land, surrounded by low bunds. The bunds prevent the water from flowing to the adjacent fields. Basin irrigation is commonly used for rice grown on flat lands or in terraces on hillsides. In general, the basin method is suitable for crops that are unaffected by standing in water for long periods (e.g. 12-24 hours). The crops proposed for irrigation in this system do not fall in this category. Environmental and public health impacts associated with this system are also numerous and it is on this account that it is not considered in this scheme

ii. Furrow Irrigation

Furrows are small channels, which carry water down the land slope between the crop rows. Water infiltrates into the soil as it moves along the slope. The crop is usually grown on the ridges between the furrows. This method is suitable for all row crops and for crops that cannot stand in water for long periods (e.g. 12-24 hours). Environmental impacts associated with this technology are also enormous and this informed the consultant's decision not to consider it for implementation.

iii. Border Irrigation

Borders are long, sloping strips of land separated by bunds. They are sometimes called border strips. Irrigation water can be fed to the border in several ways including opening up the channel bank, using small outlets or gates or by means of siphons or spiles. A sheet of water flows down the slope of the border, guided by the bunds on either side.

2. Drip Irrigation

With drip irrigation, water is conveyed under pressure through a pipe system to the fields, where it drips slowly onto the soil through emitters or drippers which are located close to the plants. Only the immediate root zone of each plant is wetted. Therefore this can be a very efficient method of irrigation. Drip irrigation is sometimes called trickle irrigation. This technology is too labour intensive and is expensive to operate. That notwithstanding, the consultant proposes for consideration and adoption of the technology.

7.4 No project Alternatives

As has been indicated elsewhere in this report, the project beneficiaries are ready for the project. The proposed project will therefore lead to the improvement in agricultural production, increased output and income levels, create employment opportunities, stem rural-urban migration, increase food security and livelihoods and lead to economic development and poverty reduction. These benefits will be lost if the status quo remains and the project is not implemented

Chapter

Eight

8.0: POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

This Chapter identifies and discusses both positive and negative impacts associated with the proposed Rwambura Irrigation Project. The anticipated impacts are discussed in three phases namely: construction, operational and decommissioning phases. Impacts associated with the construction are short term and of low magnitude. However the impacts associated with the operation are long term and in the event that the negative ones occur, then these are far reaching.

8.1 Impacts during Construction Phase

8.1.1 Positive Impacts

8.1.1.1 Creation of Employment

During the construction of the proposed Rwambura Irrigation Project, there will be employment opportunities for both professionals and unskilled workers. Several workers including casual labourers, plumbers and engineers are expected to work on during the construction period. Semi-skilled, unskilled labourers and formal employees are expected to obtain gainful employment during the period of construction. With labour intensive construction technologies, the project will provide employment for youths and provide support to the Government of Kenya initiatives on creation of jobs.

The creation of employment opportunities is beneficial both from the economic and social point of view. Economically, it means abundant unskilled labour will be used in digging of

trenches, laying of pipes, and transport of construction materials. Socially these people will be engaged in productive employment and minimize social ills like alcohol abuse which is rampant in the project area. This positive social change in the social behavior will be one of the anticipated transformational indicators in the project area.

8.1.1.2 Injection of money into the local economy

A large sum of the project money shall be released into the local economy due to the construction activities. This money will be in form of payments for skilled and unskilled labour; Purchases of construction materials; and payments for local provisions including fuel, foods and accommodation.

8.1.1.3 Creation of market for construction materials

The project will require materials, some of which will be sourced locally within the project area. Some of this include sand and hardcore for the construction of the intake weir. Local suppliers will be given first priority in supply of construction materials.

8.1.2 Negative impacts and their mitigations measures

8.1.2.1 Interference with the physical setting

Impact

The proposed project could result into the interruption of existing infrastructure such as access roads to farms, fences and farm structures. These services are critical and have implications with spillover effects on the social and economic performance.

Mitigation

1. Formal request for permission for a wayleave and laying the water pipeline should be sought from affected property owners;
2. Formal engagement of key land and other property owners in the project area;
3. Passing of relevant information to each of the affected parties; and
4. On completion of works, each affected farmer should be contacted again to give views and if complains arise the contractor should be in a position to address the same.

8.1.2.2 Noise Pollution and Vibrations

Impact

Construction of the proposed project will most likely result in noise emissions as a result of the machines that will be used (excavation equipment etc.) and construction vehicles delivering materials to site. Noise could impact negatively on the workers during the construction phase. Noise can also be a nuisance to the local community if construction works begin too early in the day and continues into the night.

Noise levels from construction activities exceeding 60 dB(A) at the construction camp site have a negative impacts to the environment.

Mitigation

The following noise-suppression techniques will be employed to minimize the impact of temporary construction noise at the Project site.

1. Best available work practices will be employed on-site to minimize occupational noise levels.
2. All construction equipment will be regularly inspected and maintained in good working condition.
3. Provision of ear muffs for those working with noise producing equipment.
4. Combine noisy operations so that they occur at the same time. The total noise level will not be significantly louder than the level produced if the operations were to be undertaken separately.

8.1.2.3 Dust Emissions

Impact

Dust will be emitted during excavation and related earthworks. Air borne particulate matter pollution is likely to occur during the route clearance, excavation and during the transport of construction materials. This is likely to affect site workers and the residents, in extreme situations leading to respiratory problems.

Mitigation

The following measures can help mitigate dust generation and damage likely to arise during the construction phase:

1. Strict measures are to be applied for the handling of construction materials in powder form such as cement, lime, concrete additives, etc. and for the disposal of the packaging
2. Excavation, handling and transport of erodible materials shall be avoided under high wind conditions or when a visible dust plume is present.
3. Minimizing the number of motorized vehicles on use;
4. Wet all active construction areas as and when necessary to lay dust;
5. Vehicle speeds be limited to a maximum of 30Km/h
6. Above all a monitoring and evaluation programme for air quality shall be implemented and reported on throughout the construction phase cycle.

8.1.2.4 Workers Accidents and Hazards during Construction

Impact

Construction workers are likely to have injuries and hazards at the construction works, unavoidably exposing them to occupational health and safety risks. The workers are also likely to be exposed to risk of accidents and injuries resulting from accidental falls, injuries from hand tools and construction equipment.

Mitigation

To reduce the workers accidents and hazards during construction the Proponent will develop and commit the contractors to Site Occupational Health and Safety rules and regulations as stipulated in the Occupational Safety and Health Act, 2007. In this regard, the Proponent is committed to provision of appropriate personal protective equipment, as well as ensuring a safe and healthy environment for construction workers.

Should an accident occur:

1. The injured person should be given first aid and immediately taken to the hospital
2. An investigation should be initiated immediately to ascertain the cause of the accident and preliminary findings released within 12 hours.

8.1.2.5 Extraction and use of Construction Materials

Impact

Construction materials that will be used in the construction such as: hard core, which will be obtained from quarries and sand, which will be harvested from natural resource banks such as rivers and land. The proposed development is being carried out at a level that can create considerable damage due to materials extraction.

Mitigation

1. The Contractors will source construction materials such as sand and hard core from registered and approved quarry and sand mining firms whose projects have undergone satisfactory environmental impact assessment/audit and received NEMA approval. Since such firms are expected to apply acceptable environmental performance standards, the negative impacts of their activities at the extraction sites are considerably well mitigated.
2. The Contractor will only order for what will be required through accurate budgeting and estimation of actual construction requirements.

8.1.2.6 Solid Waste Generation

Impact

Solid wastes generated during construction include papers used for packing, plastics, cuttings and trimmings off materials among others. Dumping around the site will interfere with the aesthetic status and has a direct effect on the surrounding community. Disposal of the same solid wastes off-site could also be a social inconvenience if done in the wrong places. The off-site effects could be pest breeding, pollution of physical environment including water resource, invasion of scavengers and informal recycling by communities.

Mitigation

1. It is recommended that construction waste be recycled or reused as much as possible to ensure that materials that would otherwise be disposed of as waste are diverted for productive uses. In this regard, the Contractor will ensure that construction materials

left over at the end of construction will be used in other projects rather than being disposed of.

2. The Proponent shall put in place measures to ensure that construction materials requirements are carefully budgeted and to ensure that the amount of construction materials left on site after construction is kept minimal.
3. Use of durable, long-lasting materials that will not need to be replaced often, thereby reducing the amount of construction waste generated over time.

8.1.2.7 Depletion of flora and fauna

Impact

The proposed project will involve clearing of vegetation cover especially where the water pipes will be laid. From the field visits, the areas selected have minimal sparse and shrubby vegetation cover. Large trees are very rear at the affected sites. Lower class animals and variety of insecta family are common and will inevitably be affected during the construction stage. The impacts will however be on short term and should not lead to a permanent change for the worst.

Mitigation

Clearance of part of the vegetation (mainly grass and trees) in the project area will be inevitable. However, the Proponent will ensure proper demarcation of the Project area to be affected by the construction works. This will be aimed at ensuring that any disturbance to flora is restricted to the actual Project area and route and avoid spillover effects on the neighbouring areas. In the same vein, there will be strict control of construction vehicles to ensure that they operate only within the area to be disturbed by access routes and other works.

Furthermore permission and easement shall be sort from the various owners and institutions concerned with each section of the route where vegetation has to be disturbed in order to allow for any development including the laying of pipes, construction and other temporary work.

Within the project areas and with the background that this area is arid, the conservation of mature tree species will be a big plus for the proponent. Conservation of old and indigenous trees should therefore be pursued and used as a measure of the successful implementation of the project.

Optimal use should be made of current road infrastructure during construction. Building of temporary access roads should be kept to a minimum to prevent unnecessary impact on the surrounding community and vegetation where relevant.

8.1.2.8 Occupational Safety and Health Impacts

Impact

Labour camps including workers' living and eating areas; grounds where equipment will be stored and serviced; and where construction materials will be stockpiled is likely to bring a temporary influx of migrant workers. This may stimulate business in the project area and also propagate the spread of STI's including the deadly HIV/AIDS. There could also be cases of unwanted pregnancies as the migrant workers interact and get into relationships with the local communities.

Local services such as medical, water supplies sanitation and waste disposal can be over stretched by the sudden increase in population. Improper sanitation arrangements at the camps can cause contamination of groundwater and pose a major health hazard, and outbreaks of diseases such as diarrhoea, cholera and typhoid.

Mitigation

Minimizing spread of the HIV/AIDS and other STI's due to the presence of migrant workers is meant to reduce the increase of HIV among the host community and among the project workers. The following measures should be put in place:

1. Sensitize the migrant workers on risky sexual behaviour.
2. Have VCT services on site and encourage workers to undergo the same.
3. Provision of protective devices such as condoms.

Provision shall be made for employee facilities including shelter, toilets and washing facilities.

1. Toilet facilities supplied by the contractor for the workers shall occur at a minimum ratio of 1 toilet per 30 workers (preferred 1:15).
2. The exact location of the toilets shall be approved by the Public Health Department prior to establishment.
3. Sanitation facilities shall be located within 100m from any point of work, but not closer than 50 m to any water body.
4. All temporary/portable toilets shall be secured to the ground to prevent them toppling due to wind or any other cause.
5. The contractor shall ensure that the entrances to toilets are adequately screened from public view.
6. Only approved portable toilets should be used.
7. These facilities shall be maintained in a hygienic state and serviced regularly.
8. Toilet paper shall be provided
9. The contractor shall ensure that no spillage occurs when the toilets are cleaned or emptied and that the contents are removed from site to an approved disposal site.
10. Discharge of waste from toilets into the environment and burying of waste is strictly prohibited.
11. Wash areas shall be placed and constructed in such a manner so as to ensure that the surrounding areas, which include groundwater, are not polluted.

Table 8.1: Summary of potential negative impacts and their mitigation measures during construction phase of the project

Potential negative impacts	Mitigation measures
Interference with the physical setting	<ul style="list-style-type: none"> • Formal request for permission to cross, break in and lay the water pipeline should be sought from affected farmers; • Formal engagement of key land and other property owners neighbouring the pipeline; • Passing of relevant information to each of the affected parties; • On completion of works, each property owner should be contacted again to give views and if complains arise the contractor asked to address the same.

Potential negative impacts	Mitigation measures
Noise pollution	<ul style="list-style-type: none"> • Employ best available work practices on-site to minimize occupational noise levels. • Regularly inspect all construction equipment and maintained in good working condition. • Provide ear muffs for those working with noise producing equipment. • Combine noisy operations so that they occur at the same time. The total noise level will not be significantly louder than the level produced if the operations were to be undertaken separately
Dust emissions	<ul style="list-style-type: none"> • Strict measures are to be applied for the handling of construction materials in powder form such as cement, lime, concrete additives, etc. and for the disposal of the packaging • Excavation, handling and transport of erodible materials shall be avoided under high wind conditions or when a visible dust plume is present. • Minimizing the number of motorized vehicles on use; • Wet all active construction areas as and when necessary to lay dust; • Vehicle speeds be limited to a maximum of 30km/h
Workers accidents and hazards during construction	<ol style="list-style-type: none"> 1. Provision of appropriate working tools such as safety shoes and helmets 2. Display at prominent places occupational health and safety rules. 3. Test and approve equipment before use. 4. Training workers on how to use various PPE and proper use of machinery.
Extraction and use of construction materials	<ul style="list-style-type: none"> • The Contractors to source construction materials from registered and approved quarry and sand mining firms whose projects have undergone satisfactory environmental impact assessment/audit and received NEMA approval. • The Contractor to only order for what will be required through accurate budgeting and estimation of actual construction requirements.

Potential negative impacts	Mitigation measures
Solid waste generation	<ul style="list-style-type: none"> • The proponent to carefully budget for construction materials in order to minimize leftovers on site after construction • Use of durable, long-lasting materials that will not need to be replaced often
Depletion of flora and fauna	<ul style="list-style-type: none"> • The contractor to ensure strict control of construction vehicles so that they operate only within the area to be disturbed by access routes and other works. • The proponent to ensure proper demarcation of the Project area to be affected by the construction works. • Minimize creation of new access routes as much as possible
Occupational safety and health impacts	<ul style="list-style-type: none"> • Sensitize the migrant workers on risky sexual behavior. • Have VCT services on site and encourage workers to undergo the same. • Provision of protective devices such as condoms.

8.2 Impacts during Operational Phase

8.2.1 Positive Impacts

8.2.1.1 Contribution to the flora, fauna and micro-climate

The supply of irrigation water to the farms in the project area will motivate the farmers to grow crops, fodder crops for the animals and trees. Through this, it is envisaged that the number of flora and fauna species will increase. This means that micro climate within the project area will be enhanced. This will immensely contributed to the property value, land value and aesthetic value of the area while ensuring that the environment remains healthy and productive.

8.2.1.2 Creation of Employment

During operational phase, there will be employment opportunities especially for those who will be employed to manage, maintain irrigation water supply system. A number of youths

within the project area will be employed in the farms to undertake such activities as cultivation, weeding, harvesting among others. This will improve their living standards and by engaging them will also change their social behavior.

8.2.1.3 Creation of Wealth

The proposed irrigation project will ultimately provide revenues to the beneficiaries and expand the wealth base for the nation as a whole. It will pump both liquefied and tied up wealth hence making the nation gain. It will also go a long way in uplifting Kiambu County and its neighbourhood as a whole. Once the people will be empowered in the project area, some will invest and develop the nearby towns.

8.2.1.4 Improved Food Security

Crop production through rain-fed agriculture has not been reliable due to the unreliable rainfall in the area. This has led to the rampant cases of food shortage in the households. The introduction of irrigated agriculture through the proposed project will increase crop production and thus alleviate the food shortage problem in the households. Surplus produce could be sold and earn households much needed incomes.

8.2.1.5 Improved Well-being of Women and Children

At the household level, women and children bear the burden of fetching water. Other than the time spent in getting water from long distances, these practices has far reaching consequences on their health and wellbeing.

Irrigation water accessibility at homesteads would translate to time saving by the women. Time saved thus would be invested in other engagements that could bring financial benefits to the family. Children also bear the brunt of water borne diseases while women are tied down to provide nursing care to the sick family members. With proximity of water all these negative impacts will be reversed in the project area.

8.2.2 Negative Impacts and their Mitigations Measures

8.2.2.1 Increase in Waterborne Diseases

Impact

Once the irrigation water is supplied to the farms, most households will use the same as drinking water and for domestic use without any treatment. This would increase the chances of contracting waterborne diseases such as typhoid and cholera. There will be increased chances of stagnating water in the farmers and thus attracting the breeding of mosquitoes which will be responsible for the spread of malaria. This will lead to ill health problems among the residents and even increase the chances of child mortality rates in severe cases.

Mitigation

1. Cases of waterborne diseases, water pollution and waste disposal should be adequately addressed.
2. Train farmers on household water treatment to guard against raw water use.
3. Train farmers on proper use and disposal of agro-chemicals

8.2.2.2 Water use Conflicts

Impact

Uneven distribution of irrigation water between the beneficiaries will result into water use conflicts. This scenario will arise when some farmers will in the upper section of the project will over abstract the water and minimize the water availability to the downstream users. This will result in conflicts and could even interfere with the sustainability of the project.

Secondly, too much abstraction of water from the River would result into conflicts between the upstream and downstream users. This will be a one of the worst case scenarios that could result to the withdrawal of the water abstraction permit from Rwambura Irrigation Project by WRMA.

Mitigation

1. The project should only abstract authorized quantity of water from the River and abide the requirements of the Water Resources Management Authority (WRMA);

2. There should be a registered WRUA that will solve water use conflicts promptly along the River;
3. An Irrigation Water Users Association (IWUA) should be formed and the existing ones strengthened. The committee will be required to form strict by-laws that will guide on water usage and conflict resolution in the irrigation scheme;
4. Conduct farmers training on best irrigation practices that aims at efficient water use;
5. Install a water meter at the intake and at household levels in order to control water usage and form a basis of rationing ;
6. Strictly enforce the Water Act 2000, in order to guide on water usage for the benefit of all stakeholders.

8.2.2.3 Pollution of Water

Impact

The key environmental issue during operation will be the increased use of agricultural biocides (insecticides, herbicides, fungicides etc.) and fertilizers due to expected intensification of agricultural activities in the project area. Production of horticultural crops will demand increased use of biocides many of which are toxic and can have a long term effect in soils. This might also find their way into the River and thus impact negatively the downstream ecosystems.

Mitigation

1. Promote Integrated Pest Management (IPM) Practices incorporating crop management control techniques, biological control and restricted use of biocides in order to lessen the adverse effects of biocide use;
2. The farmers should be trained on adequate amounts of fertilizers and biocides to be used for various crops and on safe use of these chemicals;
3. Sprinkler method of irrigation is efficient for application of water and should be used effectively to alleviate the effects of agricultural biocides.

8.2.2.4 Soil Erosion

Impact

Soil erosion from cultivation of steep slopes and stream banks in the project area will lead to silt deposition in the rivers. This will increase the turbidity levels in the rivers and could also affect the hydrology of the rivers and the downstream ecosystems.

Mitigation

1. Promote good farm management practices that aim at soil conservation
2. Training should be conducted during project implementation to ensure that members, IWUAs and scheme management understand and take up their role in catchment management;
3. Train farmers in soil and water management to avoid land degradation.

Table 8.2: Summary of potential negative impacts and their mitigation measures during operation phase of the project

Potential negative impacts	Mitigation measures
Increase in water borne diseases	<ol style="list-style-type: none"> 1. Cases of waterborne diseases, water pollution and waste disposal should be adequately addressed. 2. Train farmers on household water treatment to guard against raw water use. 3. Train farmers on proper use and disposal of agro-chemicals
Water use conflicts	<ol style="list-style-type: none"> 1. The project should only abstract authorized quantity of water from the River and abide by the requires of the Water Resources Management Authority(WRMA); 2. There should be a registered WRUA that will solve water use conflicts promptly along the Rwambura River; 3. An Irrigation Water Users Association (IWUA) should be formed. The committee will be required to form strict by-laws that will guide on water usage and conflict resolution in the irrigation scheme; 4. Conduct farmers training on best irrigation practices that aims at efficient water use; 5. Install a water meter at the intake and at household levels in order to control water usage and form a basis of rationing;

	6. Strictly enforce the Water Act 2000, in order to guide on water usage for the benefit of all stakeholders.
Pollution of water	<ol style="list-style-type: none"> 1. Promote Integrated Pest Management (IPM) Practices incorporating crop management control techniques, biological control and restricted use of biocides in order to lessen the adverse effects of biocide use; 2. The farmers should be trained on adequate amounts of fertilizers and biocides to be used for various crops and on safe use of these chemicals; 3. Sprinkler method of irrigation is efficient for application of water and should be used effectively to alleviate the effects of agricultural biocides.
Soil erosion	<ol style="list-style-type: none"> 1. Promote good farm management practices that aim at soil conservation 2. Training should be conducted during project implementation to ensure that members, IWUAs and scheme management understand and take up their role in catchment management; 3. Train farmers in soil and water management to avoid land degradation

8.3 Impacts during Decommissioning

8.3.1 Negative Impacts

When the scheme is put out of service, the under listed negative impacts are expected.

1. Loss of livelihood due to closure of irrigation activities is considered a significant impact;
2. Soil erosion will occur as a result of opening up previously firm ground to remove buried pipelines;
3. Visual impacts are anticipated as a result of removing previously buried pipelines and demolition of the intake weir, sedimentation tank and other concrete installations;

4. Generation of waste material comprising concrete rubble, steel and disused pipes and fittings;
5. Risk of accidents

Mitigation

1. Soil conservation works should be maintained until the site stabilizes;
2. Alternative uses of excess water should be sought;
3. Propose alternative livelihood activities;
4. Landscaping should be done to rehabilitate the open trenches;
5. Visual impact as a result of decommissioning the pipeline and concrete structures should be mitigated by planting grass and other native vegetation in the restored trenches;
6. Waste from decommissioning of the pipeline and concrete structures should be carted away and disposed off in a manner that is acceptable under EMCA;
7. Fence off all unsafe and potentially dangerous areas.

Chapter

Nine

9.0: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

9.1 Background

The purpose of the Environmental and Social Management Plan (ESMP) for the proposed Rwambura Irrigation Project is to provide mitigation measures for the significant negative environmental impacts. The objectives of the ESMP are:

1. To clearly show how the project will manage the negative impacts while enhancing the positive ones to ensure a project that is economically, socially and environmentally sustainable.
2. To provide evidence of practical and achievable plans for the management of the proposed project.
3. To provide the Proponent and the relevant Lead Agencies with a framework to confirm compliance with relevant laws and regulations.
4. To provide community with evidence of the management of the project in an environmentally and socially acceptable manner.

Environmental monitoring is an applied research and analysis activity to support cost-effective and timely assessment of the status and trends in environmental and social conditions in response to different project activities. Also, it is necessary to assess the project performance against the desired mitigation measures, and compliance with the regulations and standards in order to protect people's health and safety, and the environment health and performance. Monitoring activities should be applied to direct monitoring indicators whenever applicable.

Indirect indicators can be monitored instead of direct ones whenever it would provide acceptable indication of the occurrence of specific impacts and/or compliance with provisions of the ESMP.

Table 9.1: Environmental and Social Management Plan

Potential environmental/social Impacts	Proposed Mitigation Measures	Responsibility for Mitigation	Means for Monitoring	Frequency for Monitoring	Estimated Cost (KES)
During Construction					
Quarries/Extraction site impacts to ensure efficient use of raw materials during construction	<ul style="list-style-type: none"> Source building materials from local suppliers who use environmentally friendly processes in their operations. Ensure accurate budgeting and estimation of actual construction material requirements to ensure that the least amount of material necessary is ordered. Ensure that damage or loss of materials at the construction site is kept minimal through proper storage. 	<ul style="list-style-type: none"> NIB contractor Project Engineer 		Periodic and surprise checks	10,000 per month
Loss of vegetation cover	<ul style="list-style-type: none"> Ensure proper demarcation and delineation of the project area to be affected by construction works. Introduction of vegetation (trees, shrubs and grass) on open spaces and around the project site and their maintenance. Design and implement an appropriate landscaping programme to help in re-vegetation of parts of the project area after construction. 	<ul style="list-style-type: none"> NIB contractor Project Engineer 		Periodic and surprise checks during construction	50,000 per month

Potential environmental/social Impacts	Proposed Mitigation Measures	Responsibility for Mitigation	Means for Monitoring	Frequency for Monitoring	Estimated Cost (KES)
Air pollution by dust and VOCs generated during construction process.	<ul style="list-style-type: none"> All personnel working on the project will be trained prior to starting construction on methods for minimizing air quality impacts during construction. Construction heavy earth moving vehicle drivers will be under strict instructions to minimize unnecessary trips, refill petrol fuel tanks in the afternoon and minimize idling of engines. Careful screening of construction site to contain and arrest construction-related dust. Exposed stockpiles of e.g. dust and sand, will be enclosed, covered, and watered daily, or treated with non-toxic soil binders. All workers will be required to wear protective gear Ensure construction machinery and equipment are well maintained to reduce exhaust gas emission 	<ul style="list-style-type: none"> NIB Contractor Ministry of Health: provincial public health officer NEMA inspectors Ministry of Labour/DOSHS 	Periodic Activities	Periodic and surprise checks	100 000 per month over the construction period
Pollution from Hazardous waste	<ul style="list-style-type: none"> Handling of the materials using the material safety data provided by the manufacturers 	<ul style="list-style-type: none"> NIB Contractor 	Periodic inspection	Periodic and surprise checks	100 000 per month

Potential environmental/social Impacts	Proposed Mitigation Measures	Responsibility for Mitigation	Means for Monitoring	Frequency for Monitoring	Estimated Cost (KES)
	<ul style="list-style-type: none"> Appoint a safety officer to ensure that proper disposal guideline are observed Ensuring that maintenance and/or piece of work carried out on any piece of equipment or construction work is undertaken by qualified personnel In case of spillage emergency spillage control measures to be instituted Containerization of any wastes and disposal through a licensed waste handler. 	Ministry of Health: public health officer NEMA inspectors			
Noise and vibration by construction activities.	<ul style="list-style-type: none"> Use of equipment designed with noise control elements will be adopted where necessary. Trucks used at construction site shall be routed away from noise sensitive areas where feasible. Idling time for pick-up trucks and other small equipment will be minimized to limited time. All workers operating in noisy areas or operating noisy equipment will be provided with earpieces to protect against extreme noise. 	<ul style="list-style-type: none"> NIB Contractor Public Health Officer Ministry of Labour/DOSHS Workers NEMA inspectors 	Routine Activities	Periodic and surprise checks	10 000 per month over the construction period

Potential environmental/social Impacts	Proposed Mitigation Measures	Responsibility for Mitigation	Means for Monitoring	Frequency for Monitoring	Estimated Cost (KES)
	<ul style="list-style-type: none"> Comply with L.N. 25: Noise prevention and control rules, 2005 				
Traffic and Transport	<ul style="list-style-type: none"> Adequate maintenance to reduce emissions. Vehicle comply with axle load limits Well trained and experienced drivers 	Contractor	Routine Activities	Periodic and surprise checks	10,000 per month
Workers accidents during construction process.	<ul style="list-style-type: none"> All workers will be sensitized before construction begins, on how to control accidents related to construction. A comprehensive contingency plan will be prepared before construction begins, on accident response. Accordingly, adherence to safety procedures will be enforced. All workers to wear protective gear during construction, including helmets. Construction work should be limited to daytime only 	<ul style="list-style-type: none"> NIB Contractor Public Health Officer Ministry of Labour/DOSHS Workers NEMA inspectors 	Routine Activities	Periodic checks	10, 000 per month
Inadequate human waste disposal by workers during construction process	<ul style="list-style-type: none"> As provided for by the Building Code, a temporary latrine will be provided on site to be used by construction workers 	<ul style="list-style-type: none"> NIB Contractor Ministry of Health 	Periodic Activities	Periodic checks	50,000 one time

Potential environmental/social Impacts	Proposed Mitigation Measures	Responsibility for Mitigation	Means for Monitoring	Frequency for Monitoring	Estimated Cost (KES)
		<ul style="list-style-type: none"> Ministry of Labor NEMA inspectors 			
Increase in STI infections	<ul style="list-style-type: none"> Sensitization of local communities and staff working on the project on dangers of free lifestyle HIV/AIDS awareness training for all employees and subcontractors. 	<ul style="list-style-type: none"> Contractor NIB Ministry of Health Contractor 	Voluntary periodic random screening Secondary data from health institutions	Quarterly	Part of project budget
Soil Erosion	The contractor must implement erosion control measures to avoid erosion in areas that are prone to erosion, e.g. steep slopes and drainage lines. These measures must include the construction of cross drains and other appropriate measures	<ul style="list-style-type: none"> NIB Contractor 	Routine Activities	Periodic checks	20, 000 per month
Operation phase					
Change in Rwabura river flow regime and reduction in water flow downstream	Ensure sustainable abstraction of water from the River	<ul style="list-style-type: none"> NIB WRMA Farmers 	Periodic Activities	Periodic checks	50,000 per month

Potential environmental/social Impacts	Proposed Mitigation Measures	Responsibility for Mitigation	Means for Monitoring	Frequency for Monitoring	Estimated Cost (KES)
Rise of water table(Water logging)	<ul style="list-style-type: none"> • Use of good irrigation management, closely matching irrigation demands and supply • Installation and maintenance of adequate drainage system. 	<ul style="list-style-type: none"> • NIB • Farmers 	Periodic Activities	Periodic checks	50,000 per month
Soil erosion	<ul style="list-style-type: none"> • Use soil erosion control techniques which disperse erosive energy and avoid concentrating it e.g. providing good vegetative cover will disperse the energy of rain drops and contour drainage will slow down surface runoff • Proper maintenance of canal and the irrigation infrastructures. • Adopt conservation tillage systems and ripping to control hard pan formation and enhance infiltration and seepage. 	<ul style="list-style-type: none"> • NIB • Farmers 	Periodic activities	Periodic checks	20,000 per month
Increased storm water runoff and sedimentation	<ul style="list-style-type: none"> • Create diversion channels to ensure that no water flows across rehabilitated area until it is stable 	NIB Project Engineer	Periodic activities	Periodic and surprise checks	20,000 per month

Potential environmental/social Impacts	Proposed Mitigation Measures	Responsibility for Mitigation	Means for Monitoring	Frequency for Monitoring	Estimated Cost (KES)
	<ul style="list-style-type: none"> Minimize reduction of channel length and preserve some meanders of the River. Control surface runoff by Construction of sedimentation retention ponds (if necessary) Filters should be added to all storm water inlets, and silt fences established where erosion is predicted. Install sediment traps or screens to control runoff and sedimentation Design and management of canals to minimize sedimentation. Provision of access to canals for removal of weeds and sediments 				
Ecological change and imbalances	<ul style="list-style-type: none"> The use of herbicides should be limited as far as possible. Herbicides should only be used under strict control and only when other options are not available. Herbicides may not be used near sensitive environments especially wetland areas 	<ul style="list-style-type: none"> NIB Farmers 	Periodic activities	Periodic checks	10,000 per month

Potential environmental/social Impacts	Proposed Mitigation Measures	Responsibility for Mitigation	Means for Monitoring	Frequency for Monitoring	Estimated Cost (KES)
	<ul style="list-style-type: none"> Use “best practices” in handling/using agricultural chemicals To ensure that invasive alien plant species are not introduced to the area and if identified then should be immediately removed. 				
Human health (increase in water borne or water related diseases)	<ul style="list-style-type: none"> Investments in Disease Control measures Use of lined canals or pipes to discourage vectors. Avoid stagnant or slowly moving water Filling or draining of borrow pits along canals and roads. Disease prophylaxis Disease treatment 	<ul style="list-style-type: none"> NIB Ministry of Health 	Periodic Activities	Periodic checks	10,000 per month
Population Change	Population monitoring coordinated through the county office	<ul style="list-style-type: none"> NIB Kiambu county government 	Periodic Activities	Periodic checks	10,000 per month
Solid waste generation	<ul style="list-style-type: none"> Waste generation must be minimised as first priority. Unavoidable wastes should be separated at source, recycled or re- 	<ul style="list-style-type: none"> NIB Project management committee 	Periodic Activities	Periodic and surprise checks	Part of the operation and maintenance budget

Potential environmental/social Impacts	Proposed Mitigation Measures	Responsibility for Mitigation	Means for Monitoring	Frequency for Monitoring	Estimated Cost (KES)
	<p>used, combusted, and disposed in sanitary landfills</p> <ul style="list-style-type: none"> • Use of an integrated solid waste management system i.e. through several options including of Source reduction Recycling ,Composting and reuse and Incineration • Ensure that wastes generated at the scheme are efficiently managed through recycling, reuse and proper disposal procedures. 				
Air pollution	<p>NEMA/WHO environmental air emission standards should always prevail controlling suspended particles of matter, Sulphur Dioxide, Nitrogen Dioxide and other pollutants.</p>	<ul style="list-style-type: none"> • NIB • Ministry of Health: public health officer • NEMA inspectors • Ministry of Labour 	Periodic Activities	Periodic and surprise checks	10 000 per month
Proliferation of aquatic weeds	<ul style="list-style-type: none"> • Clearance of woody vegetation from inundation zone prior to irrigation (nutrient removal) • Use Best Practices in weed control 	<ul style="list-style-type: none"> • NIB • Project management committee 	Periodic Activities	Periodic and surprise checks	10,000 per month

Potential environmental/social Impacts	Proposed Mitigation Measures	Responsibility for Mitigation	Means for Monitoring	Frequency for Monitoring	Estimated Cost (KES)
	<ul style="list-style-type: none"> Harvest of weeds for compost, fodder or biogas Regulation of water discharge and manipulation of water levels to discourage weed growth 				
Algal blooms and weed proliferation	<ul style="list-style-type: none"> Reduction of input to and release of nutrients (nitrogen and phosphorous) from cane fields. Use of organic instead of chemical fertilizers 	<ul style="list-style-type: none"> NIB KARI 	Periodic Activities		10,000 per month
Pollution from Hazardous Chemicals (Waste)	<ul style="list-style-type: none"> Appoint a safety officer to ensure that proper disposal guideline are observed Ensuring that maintenance and/or piece of work carried out on any piece of equipment or construction work is undertaken by qualified personnel In case of spillage emergency spillage control measures to be instituted Containerization of any wastes and disposal through a licensed waste handler. Adhere to L.N. 121: Waste Management Regulations 	<ul style="list-style-type: none"> NIB Ministry of Health: public health officer NEMA inspectors 	Periodic inspection	Periodic and surprise checks	20 000 per month

Potential environmental/social Impacts	Proposed Mitigation Measures	Responsibility for Mitigation	Means for Monitoring	Frequency for Monitoring	Estimated Cost (KES)
Workers (or farmers) accidents	<ul style="list-style-type: none"> All workers will be sensitized and trained on occupational safety and health issues and on how to control accidents related to construction. A comprehensive contingency plan will be prepared on accident response. Accordingly, adherence to safety procedures will be enforced. 	<ul style="list-style-type: none"> NIB Public Health Officer DOSHS NEMA inspectors 	Routine Activities	Periodic checks and Accident audits	40 000 per quarter
Conflict over water supply and inequalities in water distribution	Develop means to ensure equitable distribution among users and monitor to assure adherence.	<ul style="list-style-type: none"> NIB WARMA 	Periodic activities	Periodic checks and Accident audits	10,000 per month
Decommissioning					
Noise pollution by disassembly activities	<ul style="list-style-type: none"> Portable barriers will be installed to shield compressors Use of equipment designed with noise control elements will be adopted where necessary. Trucks used during demolition exercise on site shall be routed away from noise sensitive areas in the neighborhood, where feasible. 	<ul style="list-style-type: none"> NIB NEMA inspector Contractor 			100,000

Potential environmental/social Impacts	Proposed Mitigation Measures	Responsibility for Mitigation	Means for Monitoring	Frequency for Monitoring	Estimated Cost (KES)
	<ul style="list-style-type: none"> • Idling time for pickup trucks and other small equipment will be minimized to limited time. • Use of very noisy equipment will be limited to daytime only. • All workers operating in noisy areas or operating noisy equipment will be provided with earpieces to protect against extreme noise. • The demolition exercise will be limited to day time 				
Demolition debris and related wastes	<ul style="list-style-type: none"> • Private contractor will be engaged to collect demolition debris/wastes • All debris/wastes to be collected regularly to control air pollution and injury etc. • A licensed operator to avoid illegal final dumping at unauthorized sites will collect demolition debris. • All persons involved in refuse collection shall be in full protective attire. 	<ul style="list-style-type: none"> • NIB • Ministry of Labour • NEMA inspectors • Contractor 			20,000

Potential environmental/social Impacts	Proposed Mitigation Measures	Responsibility for Mitigation	Means for Monitoring	Frequency for Monitoring	Estimated Cost (KES)
Workers accidents during demolition process.	<ul style="list-style-type: none"> All workers will be sensitized before the exercise begins, on how to control accidents related to the demolition exercise A comprehensive contingency plan will be prepared before demolition begins, on accident response. Adherence to safety procedures will be enforced at all stages of the exercise All workers, pursuant to labour laws, shall be accordingly insured against accidents. All workers will be provided and instructed to wear protective attire during demolition, including helmets. Demolition work will be limited to daytime only to avoid workers accidents due to poor visibility Provision of mobile clinics 	<ul style="list-style-type: none"> NIB Public Health Officer Ministry of Labour NEMA inspectors Contractor 			20,000

NB: Cost is only indicative and will be subject to prevailing market price at the time of implementation

Chapter



Ten

10.0: MONITORING AND TRAINING

10.1 Monitoring

The overall objective of environmental monitoring is to ensure that mitigation measures are implemented and that they are effective. Environmental and social monitoring will also enable response to new and developing issues of concern. The activities and indicators that have been recommended for monitoring are presented in the EMP.

Environmental monitoring will be carried out to ensure that all construction activities comply and adhere to environmental provisions and standard specifications, so that all mitigation measures are implemented. The contractor shall employ an officer responsible for implementation of social/environmental requirements. This person will maintain regular contact with proponent's Environmental Officer and the County Environmental Officers. The contractor and proponent have responsibility to ensure that the proposed mitigation measures are properly implemented during the construction phase.

Environmental monitoring program will operate through the preconstruction, construction, and operation phases. It will consist of a number of activities, each with a specific purpose with key indicators and criteria for significant assessment.

Monitoring should be undertaken at a number of levels. Firstly, it should be undertaken by the Contractor at work sites during construction, under the direction and guidance of the Supervision Consultant who is responsible for reporting the monitoring to proponent. It is recommended that the Contractor employ local full time qualified environmental inspectors for the duration of the Contract. The Supervision Consultant should include the services of

an international environmental and monitoring specialist on a part time basis as part of their team.

Environmental monitoring is also an essential component of project implementation. It facilitates and ensures follow-up of the implementation of the proposed mitigation measure, as they are required. It helps to anticipate possible environmental hazards and/or detect unpredicted impacts over time. Monitoring includes:

- Visual observations;
- Selection of environmental parameters;
- Sampling and regular testing of these parameters.

Periodic ongoing monitoring will be required during the life of the Project and the level can be determined once the Project is operational.

10.1.1 Internal Monitoring

It is the responsibility of the proponent to conduct regular internal monitoring of the project to verify the results of the Contractor and to audit direct implementation of environmental mitigation measures contained in the EMP and construction contract clauses for the Project. The monitoring should be a systematic evaluation of the activities of the operation in relation to the specified criteria of the condition of approval.

The objective of internal monitoring and audit will be:

- To find out any significant environmental hazards and their existing control systems in force.
- Meeting the legal requirements as stipulated in the Environmental Management & Coordination Act, EMCA-1999.

The responsibility for mitigation monitoring during the operation phase will lie with the Environmental Section of the proponent. Environmental monitoring of the following parameters is recommended as a minimum for the Project.

Noise Levels Monitoring

Although noise during construction is expected to be a problem, periodic sampling of Contractor equipment and at work sites should be undertaken to confirm that it is not an issue.

Noise level monitoring could be supplemented by consulting with Project Affected People in the first instance to identify the level of monitoring required.

Air Quality Protection

The contractor shall monitor wind velocity and site dust levels during earthmoving activities. The contractor shall also monitor emissions from vehicles. If excessive dust is generated, the contractor shall immediately water down areas generating dust or, if this is not effective, cease the activities generating dust. Stop all excavation work if wind threshold velocity has been exceeded.

Soil Erosion Monitoring

The excavation of earth will exacerbate soil erosion. It will, therefore, be the responsibility of the contractor's environmental inspectors to ensure the implementation and effectiveness of erosion control measures. Focus should be given to work sites where soil is disturbed and its immediate environ.

Monitoring of Accidents/Health

The Contractor's safety and health officer must make sure that appropriate signs are posted at appropriate locations/positions to minimise/eliminate risk. The proponent will have overall responsibility to oversee that all environmental measures are put in place and that regulations are enforced. The construction supervision consultant should assist the proponent in this process in order to make sure that contractors fulfill the environmental requirements.

The following parameters could be used as indicators:

- Presence of posted visible signs
- Level of awareness of communities pertaining to dangers/risks
- Accident reports. Records on actual accidents associated with the project could be compiled.

Waste Management Monitoring

The contractor shall regularly monitor the management of wastes to ensure that;

- All stored waste shall be contained within construction sites;

- *Solid waste:* all site waste is to be collected and disposed of in an approved site. Where possible segregation of waste (paper, glass, metal) should be undertaken and recycling opportunities identified.

Workforce Training

The contractor shall ensure that all workers have been inducted. The contractor shall regularly monitor that occupational health and safety requirements are implemented. The client representative shall audit that all requirements are met. Where occupational health and safety requirements are not being implemented, relevant workers shall immediately be trained and instructed to implement these requirements.

10.1.2 External Monitoring and Evaluation

The Consultant recommends that a consultant (Environmental Auditor) should be hired to carry out Annual Environmental Audits in line with NEMA requirements. NEMA has the overall responsibility for issuing approval for the Project and ensuring that their environmental guidelines are followed during Project implementation. Its role therefore is to review environmental monitoring and environmental compliance documentation submitted by the implementing authorities and they would not normally be directly involved in monitoring the Project unless some specific major environmental issue arises.

The proponent through the consultant will therefore provide NEMA with reports on environmental compliance during implementation as part of their annual progress reports and annual environmental auditing reports. Depending on the implementation status of environmentally sensitive project activities, NEMA will perform annual environmental reviews in which environmental concerns raised by the project will be reviewed alongside project implementation.

Table 10.1: Monitoring Plan

Environmental Component	Parameter	Standard	Location	Frequency	Duration	Supervision
Construction phase						
Noise levels	Noise levels on dB (A) scale	NEMA guidelines on Noise (LN 25) <75dB	Construction site and the surrounding	As directed by the supervision consultant	Readings to be taken at 15 second interval for 15 min every hr and then averaged	Supervision Consultant/ contractor
Soil Erosion	Turbidity in stormy water	NEMA guidelines	Construction site	During and after the rainy seasons		Supervision Consultant / contractor
Rehabilitation of work sites	Monitoring to ensure all work sites are progressively rehabilitated	EMP	Construction site	As required		Supervision Consultant/contractor
Accidents	Safety training for workers, accident reports,	EMP	Construction site	continuous		Contractor/NIB
Health and safety	Signs, posters displayed, health awareness lectures,	EMP	Construction site	continuous		Contractor/NIB
Operation phase						

Environmental Component	Parameter	Standard	Location	Frequency	Duration	Supervision
Noise levels	Noise levels on dB (A) scale	NEMA guidelines on Noise (LN 25) <75dB	Generators & Substation surrounding	quarterly		Contractor/NIB
Health and safety	Visual inspection	EMP	Construction site	continuous		NIB
Decommissioning phase						
Rehabilitation of project site	revegetation	EMP	site	End of project life		Contractor/NIB
Noise pollution	Noise levels on dB (A) scale	NEMA guidelines on Noise	Decommissioning site and the surrounding	End of project life	Readings to be taken at 15 second interval for 15 min every hr and then averaged	Contractor/NIB
Dust and exhaust emissions,	Visual inspection	EMP	Decommissioning site	End of project life		Contractor/NIB
Occupational health and safety hazards.	Visual inspection	EMP	Decommissioning site	End of project life		Contractor/NIB

Table 10.2: Budget Estimate for Monitoring

Component	Item	Unit cost (KSh)	Quantity	Total Cost (KSh.)
Noise levels	At site	1,500	20 samples	30,000
Contractor staff	Environmental Inspectors	12,000 per person once a month	1 full time equivalent staff for duration of project	144,000 p.a
proponent staff	Environmental monitoring staff	16,000/month	1 full time equivalent staff for duration of project	192,000 p.a
Training	As per training program		Transport, equipment etc	150,000

10.2 Training

The Table below outlines the proposed training for proponent staff as well as employees of the Contractor. The training is aimed at the practical aspects of environmental monitoring and management.

Table 10.3: Training and Monitoring

Training Recipients	Mode of Training	Environmental Aspects to be Covered	Training Conducting Agency
Proponent Staff IWUA	Lecture System Workshops Group Discussion Visit to Case Study	-Environmental overview -Environmental regulations and acts -Environmental management plans -Environmentally sound construction management	Environmental and social experts, Supervision Consultant
Proponent Operation/Maintenance Staff IWUA	Seminar Workshop Lectures	-Environmental Management Plan implementation -Environmental pollution associated with the project	Environmental and social experts, Supervision Consultant

		-Best environmental practices	Proponent's Environmental Department
Contractor's Staff	Seminar Workshop Lectures	-Environmental overview -Environmental Impact Assessment -Environmental regulations and acts -Environmental management plans -Environmental pollution associated with the project	Environmental and social experts, Supervision Consultant Proponent's Environmental Department

Chapter

Eleven

11.0 CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusion

Based on the findings, it is evident that construction and operation of the proposed irrigation project will result in overall economic growth and development as a result as improvement in the availability of water for agricultural use within the project area. As it is indicated in chapter five, the potential negative impacts can be easily mitigated without any major effect to the environment. However, some important resources may be affected negatively such as flora, fauna, and water resources within the project area. These impacts vary from temporary to short term impacts. These impacts can however be mitigated as indicated in the Environmental and Social Management plan discussed in chapter 9 of this report.

The water diversion and intake works will be constructed across a river valley with minimal destruction to the environment. Any destroyed vegetation and trees will be planted elsewhere through massive afforestation activities to protect the intake works catchment. Many people are also likely to benefit from the project and the agricultural improvement anticipated will lead to the food security not only within the area but across the region and nationally.

11.2 Recommendations

The following should be observed:

11.2.1 Minimal vegetation destruction

Ensure minimum destruction of vegetation especially at the water diversion and intake works for the scheme. If possible, all project –related activities should be done within the designated project alignment areas.

11.2.2 Rehabilitation of quarries and borrow pits

Rehabilitate quarries, borrow and gravel pits to avoid potential health hazards.

11.2.3 Afforestation within intake works area and along river valleys

Replant bare areas within the vicinity of the intake works with vegetation cover to prevent soil erosion. This should also be done along the river valleys to help in ensuring that siltation of water courses from the anticipated increased agricultural activities are mitigated.

11.2.4 Occupational Safety and Health (OSH) management

Ensure that both construction and agricultural worker's occupational health and safety standards are maintained through capacity building, proper training on protection, clothing and managing their residential camps up to the required health standards. The proponent, project beneficiaries and the contractor therefore need to ensure all the workers wear safety gears/clothinglike gas masks while in dusty working areas. Use of earmuffs must also be ensured by the contractor especially for the people working in areas where the noise level is high.

11.2.5 Environmental audits and monitoring

Annual environmental audits should be carried out on the project in order to ensure compliance of the project with the mitigation measures outlined in the Environmental and Social Management Plan (ESMP). To ensure that the impact on the environment can be completely minimized, a monitoring and training activity should be carried out as outlined in the report.

11.2.6 Good Housekeeping

The design and the quality of construction of the intake works need to be strictly controlled to ensure maximum life of the intake works in order to get value for money from the investment. All activities concerning construction and maintenance such as, work execution, site inspection and material testing, shall be strictly monitored by an engineer or a designated official. This is important to ensure the quality of maintenance works. Engineers and/or

designates official shall be trained and experienced enough to judge the appropriateness of the work executed in order to carry out the monitoring properly.

11.2.7 Community Participation

There is need for strengthening and promotion of the role of community groups, women and youth to fully participate in health, sanitation, water resources and environmental management and conservation.

11.2.8 Water Quality Tests

Strengthen various water testing laboratories within the project area through the provision of adequately trained personnel and necessary laboratory equipment. These would in turn strengthen field operations especially water quality monitoring. The laboratories should also research into suitable technologies to support standards on drinking water, effluent discharge and solid waste disposal and waste water management.

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APPENDICES

Appendix I: Minutes of the public *barazas*

Appendix II: List of people consulted

Appendix III: Plates for public consultation meetings

Appendix IV: Bill of Quantities (BoQ)

Appendix V: Rwabura irrigation system layout

Appendix VI: Invitation letter by the deputy county commissioner

Appendix VII: Sample questionnaire

Appendix I: Minutes of the public *Barazas***Minutes of Public Forum Meeting Held on 19th August 2016 at Karinga Shopping
Center**

PRESENT.

See the attached list.

AGENDA

1. Introduction
2. Purpose of the meeting
3. Presentation
4. Discussions, concerns, and address
5. Way forward
6. Closing.

Minute 01: Introduction.

The area local chief called the meeting to order at 2:00pm. After a word of prayer, there were brief self-introductions by the project team as well as the ESIA consultants.

Minute 02: Purpose of the meeting.

The area assistant county commissioner (Chrispas Mwazoya) explained that the purpose of the meeting was to inform the community about the project ESIA so that they could identify key issues and provide them with an opportunity to raise additional issues or concerns that had not been identified in the scoping report.

Minute 03: Presentation on project description.

The project chairman presented on the project layout (topographical map) to the community on the following thematic areas:

- i. Project area, location, and beneficiaries.
- ii. Administration of the project.
- iii. Need for the project.
- iv. Project design.
- v. Components of the system.
- vi. The layout of the irrigation pipeline.
- vii. Registration of local community to the project.
- viii. Water balance.

The chairman emphasized that the project is very friendly to the environment since it will promote food security, create employment and increase agricultural revenue. He also emphasized that education on cropping pattern would be done as part of the project to empower the local community in having the best production.

Minute 04: Presentation by the ESIA consultants.

The ESIA team emphasized that the need to conduct a study was to establish possible areas where the local community could benefit from during the project construction and operation while assessing possible positive and negative impacts. The ESIA team also emphasized the importance of public participation.

The following highlights were particularly reaffirmed:

- The local community would be fully involved in the study- a team of field assistant had been trained.
- Explore the possible areas of community involvement in the project.
- Study will explore all possible impacts of the project
- The report shall present all mitigation measures for the impacts.

The consultant also pointed out some of the positive impacts from the Irrigation development project which includes Employment opportunities for local community members, food security and economic gains from agricultural investments. He also pointed out to the community the negative impacts of the project that include loss of biodiversity, increased demand for agricultural inputs that may change soil properties and dust in the construction phase.

Minute 05: Comments, Community Concerns and Address.

Various members of the local community and stakeholders welcomed the intended project in that it would enhance the region economically. They as well identified the following project benefits:

- i. Increased food production.
- ii. Food security.
- iii. Creation of employment.
- iv. Increased fodder crops production leading to an increase in livestock products.
- v. Improved wellbeing of the communities with better standards of living.
- vi. The attraction of investments such as in factory and industry establishment.
- vii. An Increase in land value.
- viii. Sustainable agricultural production.
- ix. Social asset building through the formation of agricultural cooperatives.

The local community, however, raised the following issues that were clarified as below:

	Community Concerns	Address
1	Demolition of social amenities affected such as schools in laying of water pipeline on the ground.	The water pipelines should be diverted to avoid schools or any other social facilities
2	Plant loss(coffee, tea, and trees)	The local community was assured by the ESIA consultant that affected people will fully be compensated.
3	Registration fee and membership of project beneficiaries.	The chairman of the project stated that the registration fee is 100 KES and should be done through the community representative (Mr. Maina)
4	Employment for the local community	Local Communities were assured of employment where applicable throughout the project life- ESIA consultant.
5	Dust	The community members suggested that the contractor should minimize activities that generate dust and that the construction phase is done quickly to prevent dust related allergies.
6	Extent of use of the irrigation water and water charges	The project chairman insisted that there will be a limit to the use of irrigation water through rationing. He also emphasized water charges will be minimal for maintenance and sustainability of the project.
7	Use of water for domestic purposes	The water will not be treated thus cannot be used for drinking. Its main use is farming- ESIA consultant
8	Accidents associated with water pipeline trenches.	The members suggested that during the construction phase, there should be an integrated plan that will ensure digging the trenches, laying of the pipelines as well as covering those pipelines at once to avoid accidents.
10	Availability of irrigation water during rain seasons.	The irrigation water will not be available to the community during the rainy season- project chairman.
11	Types of pipes used for the project	The project chairman explained that main conveyor pipe will be metallic while the sub-lines will be plastic.
12	Road accidents by huge lorries used in the construction phase.	The local community insisted that traffic control should be enhanced for the safety of the community.
13	Flow of the river after dam construction in the forest.	The ESIA expert assured the community that Environmental flow of both Rwabura and Thiririka river will be monitored to ensure that the required water flows.
13	Project timelines.	The project chairman assured the community that the project will commence soon after the NEMA license is acquired on the project.

Minute 06: Way forward.

The assistant county commissioner emphasized the importance of women and youth participation in the community projects. He called upon the community to maintain peace and security for prosperity.

All community members in attendance agreed that the project is of benefit to them economically and socially as it creates sustainable livelihoods and thus a decision was made from the public consultation forum at Karinga shopping center to carry out the project.

Minute 07: Adjournment.

There being no other business, the meeting was adjourned at 5:00 pm with a word of prayer.

Minutes of The Public Forum Meeting Held on 18th August 2016 at Kiganjo Sub- Location (Chief's Office), Kiambu County.

PRESENT

See the attached list.

AGENDA

1. Introduction
2. Purpose of the meeting
3. Presentation
4. Discussion, concerns, and address
5. Way forward
6. Closing.

Minute 01: Introduction.

The area local chief called the meeting to order at 2:30 PM. After a word of prayer, there were brief self-introductions by the project team and the local administration present. The local chief reported that due to time constraints during planning for the public baraza, most community members in attendance were the village administration elders and the 'Nyumba kumi' elders from the villages across Kahuguini sub-location. It was easy reaching them and they were representative.

Minute 02: Purpose of the meeting.

The area assistant county commissioner Mr. Abdikarim Gordana explained that the purpose of the meeting was to inform the community about the project ESIA so that they could identify key issues and provide them with an opportunity to communicate concerns that had not been identified in the scoping report. He emphasized the importance of the meeting as it recognized consulting the community as a stakeholder as a fulfillment of the constitutional requirements from policy formulation, down to project implementation.

Minute 03: Presentation on project description.

The project chairman presented on the project layout to the community on the following items:

- i. Project area, location, and beneficiaries.
- ii. Administration of the project.
- iii. Need for the project.
- iv. Project design.
- v. Components of the system.
- vi. The layout of the irrigation pipeline.
- vii. Registration of Irrigation Water Users Association (IWUA).
- viii. Registration of community member for the project.

The chairman emphasized the friendly nature of the project to the environment since it impacts members' lives positively.

Minute 04: Presentation by the ESIA consultants.

The ESIA team emphasized that the need to conduct a study was to establish possible areas from where the local community could benefit from the project's construction and operation while assessing possible positive and negative impacts. The ESIA team also emphasized the importance of public participation in the study as it enhances representation of the local concerns and view on the project.

The following highlights were particularly reaffirmed:

- i. The local community would be completely involved in the study.
- ii. Explore the possible areas of community involvement in the project.
- iii. Explore all possible impacts by the project.
- iv. The report shall present all mitigation measures for the impacts.

The consultant also pointed out some of the positive impacts of the Irrigation development project. They include Employment opportunities for local community members, food security and economic gains from agricultural investments. He also pointed out to the community the negative impacts of the project among them being a loss of biodiversity, noise, dust and destruction of natural habitats. He then called upon the community to suggest more and how they can be mitigated.

The ESIA consultant also emphasized that the members should encourage community implementation of the project for both intergenerational and intra-generational equity.

Minute 05: Comments, Community Concerns and Address.

Various members of the local community and stakeholders welcomed the intended project. They observed that it would enhance the region economically. The representatives identified the following project benefits:

- i. Food security through optimal sustainable food production.
- ii. Creation of employment thus improved the wellbeing of the communities through a rise in standards of living.
- iii. Increased fodder crops production hence promoting an increase in livestock products.
- iv. The attraction of investments such as in factory and industry establishment.
- v. Diversification of local people economy.
- vi. Establishment of farmers association.
- vii. Promotion of a culture of hard work in the society through as water resource is assured.

NOTE: Increased arrowroots production, as well as other fast growing crops which are popular in the area, is expected.

The community, however, raised some issues that required clarification on the following:

	Community Concerns	Address
1	Demolition of assets such as built plots	The water pipelines should be diverted or anchored- community members. The ESIA consultant explained that those residents affected especially at the dam construction site will be compensated for relocation.
2	Loss of crops (coffee, tea, and trees) and destruction of the forest habitat which is home to elephants.	The members were assured of compensation for their crops- ESIA consultant. The ESIA consultant also stressed that minimal destruction of the habitat will be ensured.
3	Increase of the size of land allowed for irrigation from half an acre to 2 acres	The project chairman stated that it is not possible to increase the sizes of land parcels for irrigation due to water demands. He advised that one should register a number of plots to meet individual size targets.
4	Employment for the local community	The community was assured of employment where applicable throughout the project life- ESIA consultant.
5	Registration office for the irrigation water.	The chairman urged the members to register with their two community representatives as members of the project.
6	The extent of use of the irrigation water and water charges.	There will be a limit to the use of irrigation water through rationing as well as water charges. The project beneficiaries were advised to procure storage tanks for the irrigation water. - ESIA consultative.
7	Dust.	The locals requested the construction phase to be done as quickly as possible to avoid dust related allergies from affecting the locals.
8	Accidents associated with the water pipes trenches.	The locals advised that the contractor should dig trenches, lay the pipes then cover the trenches without unnecessary delay.
11	Road accidents.	The community members insisted that the traffic should be controlled.
13	Noise from the lorries in construction phase	The lorries should carry loads during the day but not at night.
15	Project timelines.	The project chairman assured the community that once NEMA license is acquired, the project will commence immediately.
16	Types of water pipes proposed for use.	The project chairman explained that the main water line will be metallic while the sub-lines be PVC pipes.
17	Cold weather and mosquitoes.	The community said that they will keep warm and buy mosquito nets since the project will bring more benefits that loss to them.

Minute 06: Way forward.

The assistant county commissioner advised the community to actively participate in the project once called upon since the project is aimed at helping them. He also directed that there be security and peace in the area for better living and county development.

All community members in attendance agreed that the project is more beneficial to them for both social and economic transformation through the creation of sustainable livelihoods. A decision was therefore made at the public consultation forum at Kiganjo (chief's office) to implement the project.

Minute 07: Adjournment.

There being no other business, the meeting was adjourned at 5.00 pm with a word of prayer.

Minutes of Public Meeting Held on 18th August 2016 At Kahuguini (Sub-Chief's Office), Kiambu County

Present

See the attached list.

Agenda

1. Introduction
2. Purpose of the meeting
3. Presentation
4. Discussion, concerns, and address
5. Way forward
6. Closing.

Minute 01: Introduction.

The area local chief called the meeting to order at 10.00am. After a word of prayer, there were brief introductions of the project team and the local administration present. The local chief reported that due to time constraint during planning for the public *baraza*, most community members in attendance were the village administration elders and the 'nyumba kumi' elders from all the 17 villages in Kahuguini sub-location since they could be easily reached and were representative.

Minute 02: Purpose of the meeting.

The area assistant county commissioner -Abdikarim Gordana- explained that the purpose of the meeting was to inform the community about the project ESIA so that they could identify key issues and provides them with an opportunity to raise concerns that had not been identified in the Scoping Report. He emphasized that the meeting was of important as it recognized the voices of the community in fulfillment of the constitutional requirements for public participation in policy, Programs and project plan as well as their implementation.

Minute 03: Presentation on project description.

The project chairman presented on the project layout to the community on the following items:

- i. Project area, location, and beneficiaries.
- ii. Administration of the project.
- iii. Need for the project.
- iv. Project design.
- v. Components of the system.
- vi. The layout of the irrigation pipeline.
- vii. Registration of Irrigation Water Users Association (IWUA).

viii. Registration of Project Beneficiaries

The chairman emphasized that the project is very friendly to the environment and will enhance the community members' lives positively.

Minute 04: Presentation by the ESIA consultants.

The ESIA team emphasized that the objective of the study was to establish possible areas from where the local community could benefit from the project during construction and at operation phases while assessing possible positive and negative impacts. The ESIA team also emphasized the importance of public participation in this study as it enhances representation of the local concerns and view about the project.

The following highlights were particularly reaffirmed:

- i. The local community would be completely involved in the study.
- ii. Explore the possible areas of community involvement in the project.
- iii. Explore all possible impacts of the project.
- iv. The report shall present all mitigation measures for the impacts.

The consultant also pointed out some of the positive impacts from the Irrigation development project which includes Employment opportunities for local community members, food security and economic gains from agricultural investments. He also pointed out to the community the negative impacts of the project among them being a loss of biodiversity, noise, dust and destruction of natural habitats and called upon the community to suggest more and how they can be mitigated.

The ESIA consultant also encouraged the community to manage the project for both intergenerational as well as the intra-generational equity.

Minute 05: Comments, Community Concerns and Address.

Various members of the local community and stakeholders welcomed the intended project. they pointed out that it would enhance the region economically and they as well identified the following project benefits:

- i. Food security through optimal sustainable food production.
- ii. Creation of employment thus improved the wellbeing of the communities through a rise in standards of living.
- iii. Increased fodder crops production hence promoting an increase in livestock products.
- iv. The attraction of investments such as in factory and industry establishment.
- v. The increase in land value.
- vi. Establishment of farmers association.

The local community however raised some issues that required clarification on the following:

No.	Community Concerns	Response
1	Demolition of assets such as built plots	The water pipelines should be diverted - community members.

No.	Community Concerns	Response
		The ESIA consultant explained that those residents affected especially at the intake site will be compensated for relocation.
2	Loss of crops (coffee and tea) and trees and destruction of the forest habitat which is the home for elephants.	The community was assured of compensation for their crops loss- ESIA consultant. The ESIA consultant also insisted that minimal destruction of the habitat will be recommended.
3	Increase of the size of land allowed for irrigation from ½ acre to 2 acres	The project chairman stated that it is not possible to increase the recommended piece of land for irrigation due to water demands.
4	Employment for the local community	The community members were assured of employment where applicable throughout the project life- ESIA consultant.
5	Registration office for the irrigation water.	The chairman urged the members to register with their two community representatives once registration commences. He insisted that registration of members in the sub location was planned to start soon.
6	The extent of use of the irrigation water and water charges as well as individual water metering.	There will be a limit to the use of irrigation water through rationing as well as water charges. The members were advised to procure storage tanks for the irrigation water. - ESIA consultant.
7	Dust. The community requested the construction phase to be done as quickly as possible to avoid dust related allergy reactions in the surrounding communities.	Dust will be mitigated accordingly as per the ESIA report.
8	Accidents associated with the water pipes trenches. The locals insisted that the contractor should ensure multitasking is done through digging of trenches, laying the pipes as well as covering the trenches.	The contractor will barricade all the open trenches and where possible station a guard to man.
9	Fish farming in ponds.	The project manager insisted that fish farming will be allowed since it is an agricultural activity.
10	Provision of soft loans to project beneficiaries in order to procure storage tanks by the National Irrigation Board.	The communities were advised to organize themselves into groups and seek microfinance services from microfinance institutions.
11	<i>Road accidents.</i> The community members insisted that the traffic should be controlled.	Traffic will be managed as per the management plan.
12	Community sensitization for project sustainability.	The project manager assured the communities that they will receive a lot of training and workshops that will promote their knowledge in water management through community irrigation water users.

No.	Community Concerns	Response
13	Noise from the lorries in construction phase	The lorries should carry loads during the day but not at night.
14	Availability of market for the crops.	The project manager advised members to organize themselves in groups or establish cooperatives since there is an adequate market for their crops but would work well in a group or cooperative production rather than an individual.
15	Project timelines.	The project chairman assured members that once NEMA license is acquired, the project will commence.
16	If the project has political connections.	The project manager insisted that the project is not politically connected since it was conceptualized in 2010. He also insisted that the National Irrigation Board carries out a five-year strategic plan for implementation and thus Rwabura irrigation development project was captured in their plan. In addition, the project chairman insisted that the people should not link the project with politics and called for active participation for its success and the benefit of the locals' livelihoods.
17	Community management team.	The project chairman assured the members that they will have a management team and board of water management from their villages.

Minute 06: Way forward.

The assistant county commissioner advised that the local community should plan their agriculture using the irrigation water.

All community members in attendance agreed that the project is more beneficial to them for social and economic transformation through the creation of sustainable livelihoods. A decision was made at the public consultation forum at Gatundu town (chief's office) to implement the project.

Minute 07: Adjournment.

There being no other business, the meeting was adjourned at 2.00 pm with a prayer.

Minutes of Public Forum Meeting Held on 17th August 2016 at Gatundu Town (Chief's Office), Kiambu County.

PRESENT

See the attached list.

AGENDA

1. Introduction
2. Purpose of the meeting
3. Presentation
4. Discussion, concerns, and address
5. Way forward
6. Closing.

Minute 01: Introduction.

The area local chief called the meeting to order at 3:00pm. After a word of prayer, there was a session of brief self-introductions by the project community representatives, National Irrigation Board team as well as the ESIA consultants.

Minute 02: Purpose of the meeting.

The area assistant county commissioner explained that the purpose of the meeting was to inform the community about the project ESIA so that they can identify key issues and provide them with an opportunity to raise additional issues or concerns that have not been identified in the scoping report. He added that the meeting was very important as it recognized the voices of the community as a fulfillment of the constitutional requirements for public participation in policy, Programs and project plan as well as their implementation.

Minute 03: Presentation on project description.

The project chairman presented on the project layout to the community members in attendance (although they admitted to knowing about the project) on the following items:

- i. Project area, location, and beneficiaries.
- ii. Administration of the project.
- iii. Need for the project.
- iv. Project design.
- v. Components of the system.
- vi. The layout of the irrigation pipeline.

The chairman emphasized that the project is very friendly to the environment and will enhance people's lives positively.

Minute 04: Presentation by the ESIA consultants.

The ESIA team emphasized that the need to conduct a study was to establish possible areas from where the local community could benefit from the project construction and operation phases while assessing possible positive and negative impacts. The ESIA team also emphasized the importance of public participation in this study as it enhances representation of the local concerns and views about the project.

The following highlights were particularly reaffirmed:

- i. The local community would be completely involved in the study.
- ii. Explore the possible areas of community involvement in the project.
- iii. Explore all possible impacts by the project.
- iv. The report shall present all mitigation measures for the impacts.

The consultant also pointed out some of the positive impacts from the Irrigation development project which includes Employment opportunities for local community members, food security and economic gains from agricultural investments. He also pointed out to the community the negative impacts of the project among them being loss of biodiversity, noise, road damage by heavy Lorries used in dam construction and air pollution

Minute 05: Comments, Community Concerns and Address.

Various members of the local community and stakeholders welcomed the intended project in that it would enhance the region economically and they as well identified the following project benefits:

- i. Food security through optimal sustainable food production.
- ii. Creation of employment thus improved the wellbeing of the communities through a rise in standards of living.
- iii. Increased fodder crops production hence increase in livestock products.
- iv. The attraction of investments such as in factory and industry establishment.
- v. The increase in land value.
- vi. Establishment of farmers association.

The local community members, however, raised some issues that required clarification on the following:

	Community Concerns	Address
1	Compensation for assets such as houses affected.	The people affected had been identified and will be fully compensated- Consultant.
2	Crops loss (coffee, tea) and trees affected.	The locals were assured of compensation- ESIA consultant.
3	Increase of the size of land allowed for irrigation from half an acre to 2 acres	The project chairman stated that it is not possible to increase the recommended piece of land for irrigation due to water demands. He advised that one should register as many plots as possible to meet their intended size.

4	Employment for the local community	Locals were assured of employment where applicable throughout the project life- ESIA consultant.
5	Registration office for the irrigation water user association	The chairman urged the locals to register with their two community representatives.
6	The extent of use of the irrigation water and water charges as well as individual water metering.	There will be a limit to the use of irrigation water through rationing as well as water charges. The project beneficiaries were advised to procure storage tanks for the irrigation water. - ESIA consultant. The project beneficiaries present insisted that they needed an individual household metering and that they were willing to install their own water meters.
7	Use of water for domestic purposes if the local community can treat water at household level.	The water will not be treated thus not suitable for drinking; its main use is farming. If the community wants to treat the water for the drinking then they need to consult relevant public institution, they should also ensure that the treated water is safe for human consumption - ESIA consultant
8	Irrigation of cash crops for those farmers who did not want to produce food in their farms to prioritize everyone's need.	This will be determined whether there will be coffee farmers cooperative ready for this endeavor. - Project chairman.
9	Fish farming in ponds.	The project manager agreed that fish farming will be allowed since it is an agricultural activity.
10	Availability of irrigation water during rainy seasons.	The irrigation water will not be available to the community during the rainy season- project chairman.
11	Road accidents.	The community members insisted that the traffic should be controlled.
12	Water pipe terraces accidents.	These terraces will be covered after the pipes are laid down. - ESIA consultant.
13	Noise from the lorries in construction phase	The lorries should carry loads during the day but not at night.
14	Community volunteerism	The ESIA consults welcomed all the willing community members to volunteer in this project activities.
15	Disturbance of drinking water supply pattern during the construction phase.	The project chairman insisted that only zero to minimal disturbances will be expected.
16	Sustainable pipeline layout along the road.	The project chairman explained that there is adequate surface allowance from the road to the pipeline and that the pipes will be underground.
17	How the interior households will access the water from the main road pipeline.	The project chairman assured the communities that proper design has been put in place to enhance equity in irrigation water supply.

Minute 06: Way forward.

The chief reiterated that individual household metering is the best in this area for project sustainability as each one will be responsible for their proper use of the irrigation water. He called upon the project team to consider that during project implementation.

The assistant county commissioner emphasized that the community should plan their agriculture using the irrigation water.

All community members in attendance agreed that the project is of benefit to them for social and economic transformation through the creation of sustainable livelihoods and thus a decision was made the public consultation forum at Gatundu town (chief's office) to implement the project.

Minute 07: Adjournment.

There being no other business, the meeting was adjourned at 5:50pm after a prayer.

Minutes of Public Forum Meeting Held on 16th August 2016 at Munyuini Dispensary; Gatundu, Kiambu County.

PRESENT

See the attached list.

AGENDA

1. Introduction
2. Purpose of the meeting
3. Presentation
4. Discussion, concerns, and address
5. Way forward
6. Closing.

Minute 01: Introduction.

The area local chief (Hannah Wanjiku) called the meeting to order at 3:00pm. After a word of prayer, there was a session of brief self-introductions by the project community representatives, National Irrigation Board team as well as the ESIA consultants.

Minute 02: Purpose of the meeting.

The area acting deputy county commissioner (Alex Mukinda) explained that the purpose of the meeting was to inform the community about the project ESIA so that they could identify key issues and it provided them with an opportunity to raise additional issues or concerns that had not been identified in the scoping report. He added that the meeting was very important as it recognized the voices of the community as a fulfillment of the constitutional requirements of public participation in policy, Programs and project plan as well as their implementation.

Minute 03: Presentation on project description.

The project chairman presented on the project description to the community. The community stated that they knew much about the project having attended previous meetings since the conceptualization of the project idea.

The chairman emphasized that the project is very friendly to the environment and will enhance the locals' lives positively.

Minute 04: Presentation by the ESIA consultants.

The ESIA team emphasized that the need to conduct a study was to establish possible areas from where the local community could benefit from the project construction and operation phases while assessing possible positive and negative impacts. The ESIA team also

emphasized the importance of public participation in this study as it enhances representation of the local concerns and views about the project.

The following highlights were particularly reaffirmed:

- i. The local community would be completely involved in the study.
- ii. Explore the possible areas of community involvement in the project.
- iii. Explore all possible impacts by the project.
- iv. The report shall present all mitigation measures for the impacts.

The consultant also pointed out some of the positive impacts from the Irrigation development project which includes Employment opportunities for local community members, food security and economic gains from agricultural investments. He also pointed out to the community the negative impacts of the project that include loss of biodiversity, increase demand for agricultural inputs that may change soil properties and soil erosion.

Minute 05: Comments, Community Concerns and Address.

Various members of the local community and stakeholders welcomed the intended project in that it would enhance the region economically and they as well identified the following project benefits:

- i. Food security through optimal sustainable food production.
- ii. Creation of employment.
- iii. Increased fodder crops production hence promoting an increase in livestock products.
- iv. Improved wellbeing of the communities through a rise in standards of living.
- v. The attraction of investments such as in factory and industry establishment.
- vi. The increase in land value.
- vii. Promote social cohesion in the area.
- viii. Establishment of farmers association.

The community, however, raised some issues that required clarification on the following:

	Community Concerns	Address
1	Demolition of social amenities affected in laying of water pipeline on the ground.	The water pipelines should be diverted or anchored- community members.
2	Loss of crops (coffee, tea) and trees as well as resettlements.	The community members were assured of compensation- ESIA consultant.
3	Increase of the size of land allowed for irrigation from half an acre to 2 acres	The community representative of Munyuini stated that it is not possible to increase the recommended piece of land for irrigation due to water demands. He insisted that one should register as many plots as possible so if they wanted to meet their intended amount land size.
4	Employment for the local community	Residents were assured of employment where applicable throughout the project life- ESIA consultant.

5	Construction of greenhouse for the community by the National irrigation board.	The project manager insisted that the community should first organize themselves in self-help groups or cooperatives and write proposals to the National irrigation board requesting for the same.
6	The extent of use of the irrigation water and water charges as well as water metering.	There will be a limit to the use of irrigation water through rationing as well as water charges. The residents were advised to procure storage tanks for the irrigation water. - ESIA consultant. The residents' representative explained that there will be no household metering but a master metering. He also said that the water charges are minimal meant for project maintenance and sustainability.
7	Use of water for domestic purposes	The water will not be treated thus cannot be used for drinking. Its main use is farming- ESIA consultant
8	Irrigation of cash crops	This will be determined by the amount of water contained in the dam and will be discussed later after the project commences- project chairman.
9	Fish farming in ponds.	The project manager insisted that fish farming will be allowed since it is an agricultural activity.
10	Availability of irrigation water during rain seasons.	The irrigation water will not be available to the community during the rainy season- project chairman.
11	Mosquitoes and temperature fall for those near the dam.	The project manager emphasized that since the project will create employment hence increasing per head capita, the community members will be expected to buy mosquito nets for the household use. He also insisted that other institutions such as health sector will take part in fulfilling their respective duties. He promised the community members that all shall be well.
12	Electricity production from the dams for Theta and Ndarugo tea factory.	The ESIA consultant responded that feedback would be given later.

Minute 06: Way forward.

The assistant county commissioner added that they welcomed the project in the area since it will promote better livelihood and hence security being achieved. He called upon the locals to spread the news about the project to their neighbors who might not be aware of it. He also called upon the locals to form farmers' cooperatives as well as to register with the irrigation water users association. In addition, he urged more youth and women to participate in the project as they are the most vulnerable groups in the society.

All community members in attendance agreed that the project is more beneficial to them for social and economic transformation through the creation of sustainable livelihoods and thus a decision was made at the public consultation forum at Munyuini dispensary implement the project.

Further, the assistant county commissioner called upon the National Irrigation Board to introduce the appropriate crop varieties suitable for optimal production in the area. He concluded by thanking the project team for the effort made so far pertaining the project.

Minute 07: Adjournment.

There being no other business, the meeting was adjourned at 5:00pm with a word of prayer from John Kamau.

Minutes of Public Forum Meeting Held on 15th August 2016 at Gitwe Shopping Center Kiambu County.

PRESENT

See the attached list.

AGENDA

1. Introduction
2. Purpose of the meeting
3. Presentation
4. Discussion, concerns, and address
5. Way forward
6. Closing.

Minute 01: Introduction.

The area local chief called the meeting to order at 3:00pm. After a word of prayer, there were brief self-introductions by the project team as well as the ESIA consultants.

Minute 02: Purpose of the meeting.

The area District officer, Alex Mukinda explained that the purpose of the meeting was to inform the community about the project ESIA so that they can identify key issues. It also provided them with an opportunity to raise additional issues or concerns that had not been identified in the scoping report.

Minute 03: Presentation on project description.

The project chairman presented on the project layout using a topographical map to the community members in attendance on the following:

- i. Project area, location, and beneficiaries.
- ii. Administration of the project.
- iii. Need for the project.
- iv. Project design.
- v. Components of the system.
- vi. The layout of the irrigation pipeline.
- vii. Water balance.

The chairman emphasized that the project is very friendly to the environment and will promote food security, create employment and increase agricultural revenue.

Minute 04: Presentation by the ESIA consultants.

The ESIA team emphasized that the need to conduct a study was to establish possible areas from where the local community could benefit from the project construction and operation while assessing possible positive and negative impacts. The ESIA team also emphasized the importance of public participation.

The following highlights were particularly reaffirmed:

- i. The local community would be completely involved in the study- a team of field assistant has been trained.
- ii. Explore the possible areas of community involvement in the project.
- iii. The study will explore all possible impacts of the project
- iv. The report shall present all mitigation measures for the impacts.

The consultant also pointed out some of the positive impacts from the Irrigation development project which include Employment opportunities for local community members, food security and economic gains from agricultural investments. He also pointed out to the community the negative impacts of the project that include loss of biodiversity, increased demand for agricultural inputs that may change soil properties and soil erosion.

Minute 05: Comments, Community Concerns and Address.

Various members of the local community and stakeholders welcomed the intended project in that it would enhance the region economically and they as well identified the following project benefits:

- i. Increased food production.
- ii. Food security.
- iii. Creation of employment.
- iv. Increased hygiene.
- v. Increased fodder crops production hence promoting an increase in livestock products.
- vi. Improved wellbeing of the communities through a rise in standards of living.
- vii. The attraction of investments such as in factory and industry establishment.
- viii. The increase in land value.
- ix. Sustainable agricultural production.
- x. Community development through social and physical assets effective utilization.

The locals, however, raised some issues that required clarification on the following:

	Community Concerns	Address
1	Demolition of social amenities affected in laying of water pipeline on the ground.	The water pipelines should be diverted or anchored- community members.
2	Loss of crops (coffee, tea) and trees.	The locals were assured of compensation- ESIA consultant.
3	Registration fee and membership of locals in the project.	The chairman of the project stated that the registration fee is 100 KES but membership will be decided later- project chairman.

4	Employment for the local community	Locals were assured of employment where applicable throughout the project life- ESIA consultant.
5	Construction of latrines by the project personnel during their operations	The locals stated that they will offer their latrines for use by the project personnel so there will be no need to construct others along the road- community representative.
6	Extent of use of the irrigation water and water charges	There will be a limit to the use of irrigation water through rationing as well as water charges- ESIA consultative.
7	Use of water for domestic purposes	The water will not be treated thus cannot be used for drinking. Its main use is farming- ESIA consultant
8	Irrigation of cash crops	This will be determined by the amount of water contained in the dam and will be discussed later after the project commences- project chairman.
9	Community authority for investing in the dam for fish farming	This will be determined by the management that will run the project together with the community members later after the project commences- project chairman.
10	Availability of irrigation water during rain seasons.	The irrigation water will not be available to the community during the rainy season- project chairman.

Minute 06: Way forward.

All community members in attendance agreed that the project is more beneficial to them for social and economic transformation through the creation of sustainable livelihoods. A decision was therefore made at the public consultation forum at Gitwe shopping center to implement the project.

Minute 07: Adjournment.

There being no other business, the meeting was adjourned at 5:05pm with a word of prayer from Mr.Mwaura.

Appendix II: List of People Consulted

No.	Name	Mobile number	ID. Number	Division	Location	Sub-Location	Village
1.	Michael Mutunga	0720273350		Kiganjo	Kiganjo	Kiganjo	Ikuma
2.	Sam Kageni	0710808882	267323	Gatundu	Ng'enda	Githunguchu	Githungu
3.	Teresia W Karanja	0715250039	3171629	Ng'enda	Kimunyu	Kimunyu	Ithingo
4.	Jacob Mburu Chai	0724304637	25078290	Ndarugu	Munyu-Ini	Gacharage	Gaitete
5.	Mary Mugure Gathoni	0722844511	6240387	Kiganjo	Kiganjo	Kiganjo	Ikuma
6.	Andrew Ngenoh	0701176065	3090314	Gatundu	Ng'enda	Githunguchu	Mukinye
7.	Joseph Gachigi	0717741719	11055531	Ng'enda	Ng'enda	Kimunyu	Ithingo
8.	Edward Njihia Gakuru	0722314871		Ndarugu	Munyu-Ini	Gacharage	Gaitete
9.	John Karanja Njuguna	0727133130	1907249	Kiganjo	Kiganjo	Kiganjo	Ikuma
10.	Daniel Kamau	0705108132		Gatundu	Ng'enda	Githunguchu	Mukinye
11.	Simon N Chege	0728288369		Ng'enda	Kiamwangi	Karembu	Karembu
12.	Margaret Wangari Njoroge	0710552470	14401559	Ndarugu	Munyu-Ini	Gacharage	Muhiriga
13.	Margaret M Gitau	0724448925	10715692	Kiganjo	Kiganjo	Kiganjo	Ikuma
14.	George Gakonyo	0726431369	11709460	Gatundu	Ng'enda	Githunguchu	Mukinye
15.	Salome Wanjiru	0706703753	22278266	Ng'enda	Kiamwangi	Karembu	Karembu
16.	Timothy Mukono Mburu	0723320685	14569394	Ndarugu	Munyu-Ini	Gacharage	Kiamutanga
17.	James Maina Wachira	0708766132		Kiganjo	Kiganjo	Kiganjo	Ikuma

No.	Name	Mobile number	ID. Number	Division	Location	Sub-Location	Village
18.	David Kinyanjui	0708938758	25336868	Gatundu	Ng'enda	Githunguchu	Mukinye
19.	John Maina Gitau	0712631787		Ndarugu	Munyu-Ini	Gacharage	Gaitete
20.	Beatrice W Kimani	0718449207		Kiganjo	Kiganjo	Kiganjo	Ikuma
21.	Jemimah Njeri	0720552369	21186578	Gatundu	Ng'enda	Githunguchu	Muthige
22.	Franico Waweru	0727428141		Ng'enda	Kiamwangi	Karembu	Karembu
23.	John Kanyita	0725121862		Ndarugu	Munyu-Ini	Gitwe	Mumbuini
24.	Joseph Kamuti	0712884831		Kiganjo	Kiganjo	Kiganjo	Ikuma
25.	Lilian Wanjiku	0712178629	9531433	Gatundu	Ng'enda	Githunguchu	Githungu
26.	Michael Nderi Kamau	0725812001	4422612	Kiganjo	Kiamwangi	Karembu	Karembu
27.	Patrick Njoroge Mwangi		4300524	Ndarugu	Munyu-Ini	Munyu-Ini	Mina-Ini
28.	Dorcas Njeri Njuguna	0717102157		Kiganjo	Kiganjo	Kiganjo	Ikuma
29.	Catherine Muhugu	0714569965	28401261	Ng'enda	Ng'enda	Kirangari	Rurie
30.	Franico Mwangi	0724348707	11249538	Ng'enda	Kiamwangi	Karembu	Karembu
31.	Simon Gitau Kariuki	0724631444	23098838	Ndarugu	Munyu-Ini	Munyu-Ini	Irigu-Ini
32.	Jeanta Wangiru	0712432883	13462107	Kiganjo	Kiganjo	Kiganjo	Kiganjo
33.	Peter Kinyanjui	0713044630	291563024	Gatundu	Ng'enda	Ritho	Ritho
34.	Joseph Gitau	0724802323	1023639	Ng'enda	Kimunyu	Kahuguini	Wamuguthuko
35.	Joseph Kimani Njoroge	0729851443	1021971	Ndarugu	Munyu-Ini	Roi	Roi
36.	Patrick Gathera		3119270	Kiganjo	Kiganjo	Kiganjo	Kahuruko

No.	Name	Mobile number	ID. Number	Division	Location	Sub-Location	Village
37.	Peter Thini	0700406081	2570526	Gatundu	Ng'enda	Hangege	Handege
38.	John Kimbathi Kiongo	0727965270	3116882	Ng'enda	Kiamwangi	Karembu	Karembu
39.	Henry Macharia Kihurunjo	0795936568	23529173	Ndarugu	Munyu-Ini	Roi	Nyamuna
40.	Harris Wainaina			Kiganjo	Kiganjo	Kiganjo	Kahuruko
41.	George Mbogo	0736223228	24916844	Gatundu	Ng'enda	Hangege	Handege
42.	John Muiru	0720455753		Ng'enda	Kimunyu	Kahuguini	Kahugin
43.	Raphael Kiruku Njoroge	0725920509	24350813	Ndarugu	Rwabura	Roi	Roi
44.	Joenta Njeri Kimani	0712930555		Kiganjo	Kiganjo	Kiganjo	Chago
45.	Peter Mwangi	0735928991	29152127	Gatundu	Ng'enda	Hangege	Handege
46.	Peter Mungai Muiru	0710558941	9167514	Ng'enda	Kimunyu	Kahuguini	Gatukier
47.	Obadiah Kamonyo	0729276815	9860658	Ndarugu	Munyu-Ini	Kibiru	Wang'onde
48.	Samuel Kagut	0711906017		Kiganjo	Kiganjo	Kiganjo	Kivu
49.	Joseph Wainaina	0727071835	3114096	Gatundu	Ng'enda	Hangege	Handege
50.	Lucy Waithera Njoroge	0721605431	14401558	Ndarugu	Munyu-Ini	Roi	Wang'onde
51.	Ayub Ngugi	0728303632		Kiganjo	Kiganjo	Kiganjo	Centre
52.	Simon Njonjo	0727812568	8473599	Ng'enda	Kimunyu	Kimunyu	Thangari
53.	Peter Kinyanjui M.	0716612878	13413148	Ndarugu	Rwabura	Karinga	Gati-Iguru
54.	Isaac Ndung'u	0729472259		Kiganjo	Kiganjo	Kiganjo	Kahiga
55.	Stephen Njenga	0791306140	22994537	Gatundu	Ng'enda	Hangege	Gakindu

No.	Name	Mobile number	ID. Number	Division	Location	Sub-Location	Village
56.	Isaac Ndung'u	0716370925	4297147	Ng'enda	Kimunyu	Kimunyu	Kimunyu
57.	Onesmus Chege Makira	0715516364	14484720	Ndarugu	Rwabura	Karinga	Mbaru-Ini
58.	Samuel Wachira Maina	0732088735		Kiganjo	Kiganjo	Kiganjo	Ikuma
59.	Charles Karie	0723914541	291163073	Gatundu	Ng'enda	Hangege	Gakindu
60.	Peter K Kibe	0726806951	1022738	Ng'enda	Kimunyu	Kimunyu	Kimunyu
61.	Agnes Wandia Muiruri	0708649227		Ndarugu	Rwabura	Karinga	Ngomongo
62.	John Gaturu	0711286907		Kiganjo	Kiganjo	Kiganjo	Moboini
63.	Gaturu W Nyagia	0701751853	3116062	Gatundu	Ng'enda	Hangege	Ihura
64.	Kibe Kigara Ham	0729433936		Ng'enda	Kimunyu	Kimunyu	Thirika
65.	John Murii Kigathi	0724215749	1020103	Ndarugu	Rwabura	Gitwe	Kamutua
66.	Hannah N Karanja			Kiganjo	Kiganjo	Kiganjo	Mutungu
67.	Lucia Muthoni	0717880766	5179460	Gatundu	Ng'enda	Hangege	Ihura
68.	Peter Mbugua	0712161283	1851267	Ng'enda	Kimunyu	Kimunyu	Thangari
69.	Grace Wanjiku Njenga	0721949863		Ndarugu	Munyu-Ini	Gacharage	Gaitete
70.	Anthony K Mwangi	0720772028	3114832	Kiganjo	Kiganjo	Kiganjo	Mutungu
71.	Jane Wanjiku	0725232422	22024216	Gatundu	Ng'enda	Hangege	Handege
72.	Paul K Karangi	0720583788	10229592	Ng'enda	Kimunyu	Kimunyu	Thangari
73.	James K.Mwangi	0723811731	3055556	Ndarugu	Rwabura	Gitwe	Gitwe
74.	George Kihui	0722539535		Kiganjo	Kiganjo	Kiganjo	Ikuma

No.	Name	Mobile number	ID. Number	Division	Location	Sub-Location	Village
75.	Peter Njoroge	0727067378	4918335	Gatundu	Ng'enda	Hangege	Gikure
76.	Rose Wanjiru	0729389870	1026129	Ng'enda	Kimunyu	Mutomo	Mutomo
77.	Joseph Njuguna Mbugua	0721332055	681963	Ndarugu	Munyu-Ini	Gacharage	Gacharage
78.	Paul Nduati Njeri	0712521944	10999383	Kiganjo	Kiganjo	Kiganjo	Matungiu
79.	George Mwangi	0724547607	22995610	Gatundu	Ng'enda	Hangege	Gikure
80.	Andrew Kamau	0727448260	11223170	Ng'enda	Kimunyu	Mutomo	Mutomo
81.	Peter Kamau Gathagu	0720984193	22304333	Ndarugu	Munyu-Ini	Munyuini	Gatungu-Ini
82.	Patrick Kajui	0722353598		Kiganjo	Kiganjo	Kiganjo	Gatukier
83.	Joseph Ndung'u	0727069341	3054843	Gatundu	Ng'enda	Karinga	Karinga
84.	Josep Kamau Njuguna	0724531579	22833550	Ndarugu	Munyu-Ini	Munyuini	Giathenge
85.	John Njoroge	0726063536		Kiganjo	Kiganjo	Kiganjo	Thamu
86.	Peter Muichi	0710752392	24701907	Gatundu	Ng'enda	Ritho	Ritho
87.	Elijah Mwangi Njoroge	0765118072	6595968	Ndarugu	Rwabura	Karinga	Karinga
88.	Anthony Muthua	0727158011		Kiganjo	Kiganjo	Kiganjo	Kiganjo
89.	Joeeph Mburu	0715154174	24775457	Gatundu	Ng'enda	Ritho	Mutaraho
90.	Lucy Wanjiru	0726595562	20626214	Ndarugu	Rwabura	Karinga	Kimaruri
91.	Margaret Nyambura	0704679811		Kiganjo	Kiganjo	Kiganjo	Cura
92.	Moses Waithaka	0716225216	11770718	Gatundu	Ng'enda	Ritho	Ritho
93.	Jane W Njoroge	0720400767	1019484	Ng'enda	Kimunyu	Mutomo	Mutomo

No.	Name	Mobile number	ID. Number	Division	Location	Sub-Location	Village
94.	Elizabeth Wanjira Muchir	0720967283	24336779	Ndarugu	Rwabura	Kibiru	Kimaruri
95.	Gabriel Gitau	0714653057		Kiganjo	Kiganjo	Kiganjo	Cura
96.	Veronicah Wambui	0720463852	7385624	Gatundu	Ng'enda	Ritho	Mutaraho
97.	Peter Macharia K	0724351149		Ng'enda	Kimunyu	Mutomo	Mudaini
98.	Samuel Gitau Ndiragu	0729272812	12944729	Ndarugu	Rwabura	Gitwe	Icanjwa
99.	Gorge Ngugi Wainaina	0713523463		Kiganjo	Kiganjo	Kiganjo	Kivu
100.	Margaret Wanjiru	0714329162	6451889	Gatundu	Ng'enda	Ritho	Mutaraho
101.	Jane W Njoroge	0713442947	21895342	Ng'enda	Kimunyu	Mutomo	Mutomo
102.	Joseph Kariuki Gitahi	0724328941	2294812	Ndarugu	Rwabura	Karinga	Karinga
103.	Stephen Karanja	0714146269	31552887	Kiganjo	Kiganjo	Kiganjo	Kivu
104.	Eunice Wacheke	0704240860	28894524	Gatundu	Ng'enda	Ritho	Mutaraho
105.	Stephen N Mungai	0722730568	855467	Ng'enda	Kimunyu	Kimunyu	Thanyari
106.	Mary Mugure Njoroge	0717587387	28441835	Ndarugu	Rwabura	Karinga	Mission
107.	Francis Gathera	0726361267	20229670	Kiganjo	Kiganjo	Kiganjo	Kivu
108.	Dominic Karanja	0717722802	2571677	Gatundu	Ng'enda	Ritho	Mutaraho
109.	Samuel Ndungu	0724733556	4926558	Ng'enda	Kimunyu	Kimunyu	Thirika
110.	Henel Kihara Njoroge	0723460726	3054916	Ndarugu	Rwabura	Karinga	Mbaruini
111.	Simon Mwangi Kamau	0721886944		Kiganjo	Kiganjo	Kiganjo	Kivu
112.	Susan Nduta	0705298522	14513704	Gatundu	Ng'enda	Ritho	Mutaraho

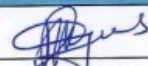
No.	Name	Mobile number	ID. Number	Division	Location	Sub-Location	Village
113	Mary W Kimani	0711812206	6239143	Ng'enda	Kimunyu	Kimunyu	Kimunyu
114	Ruth Wambui Muturi	0792425112		Ndarugu	Rwabura	Karinga	Mission
115	Susan Njoki	0716736566		Kiganjo	Kiganjo	Kiganjo	Munyabo
116	Peter Wainaina	0711978788	12529425	Gatundu	Ng'enda	Ritho	Mutaharo
117	Joseph Thuku	0721538424	8614246	Ng'enda	Kimunyu	Kimunyu	Thirika
118	Peter Njoroge Wairegi	0723685476	22468746	Ndarugu	Munyu-Ini	Munyuini	Magomano
119	Joseph Mburu	0723625026		Kiganjo	Kiganjo	Kiganjo	Gatahi
120	Virginic Njoki	0729866610	4436876	Gatundu	Ng'enda	Ritho	Mbariti
121	Julius Kiruka N	0720561166		Ng'enda	Kimunyu	Kimunyu	Thirika
122	Francis Wainaina Kariuki	0721847218		Ndarugu	Rwabura	Karinga	Gikure
123	Hanna Njoki Kabunga	0704289987	10671820	Kiganjo	Kiganjo	Kiganjo	Gatahi
124	Peter Karagu	0717895913	22772417	Gatundu	Ng'enda	Ritho	Gituamba
125	Mary Njori	0717889663	4243001	Ng'enda	Kimunyu	Kahuguini	Kahuguini
126	Peter Thuku Muigai	0729896045	9860710	Ndarugu	Rwabura	Karinga	Gati-Iguru
127	George Muiruri	0712467016	10425197	Kiganjo	Kiganjo	Kiganjo	Gatahi
128	Patric Gichichi	0729592004	1315369	Gatundu	Ng'enda	Ritho	Gituamba
129	Felister Ngina	072762839	5110335	Ng'enda	Kimunyu	Kahuguini	Kahuguini
130	Peter Thairu Ngugi	0763866257		Ndarugu	Rwabura	Gacharage	Wakiani
131	Teresia Kera	0722762409	10228316	Kiganjo	Kiganjo	Kiganjo	Kihara

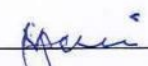


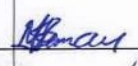


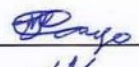



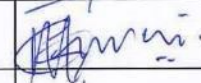
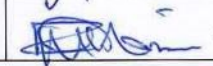
No.	Name	Mobile number	ID. Number	Division	Location	Sub-Location	Village
132	Hannah Wanjiku	0723410188	11055442	Gatundu	Ng'enda	Ritho	Gituamba
133	Peter Kanyanja M	0712570430	33308453	Ng'enda	Kimunyu	Kahuguini	Mjothorei
134	John Kamau Njenga	0721472930	9194494	Ndarugu	Rwabura	Gitwe	Ngaragaca
135	Francis Muiruri Thuo	0710441686	7985350	Kiganjo	Kiganjo	Kiganjo	Gatahi
136	Jacinta Wanjiku	0729418699	28632339	Gatundu	Ng'enda	Ritho	Gituamba
137	Joyce W Kamau	0717312797	4131099	Ng'enda	Kimunyu	Kahuguini	Kiamuche
138	William Kabubi Ndung'u	0721476554	20812137	Ndarugu	Munyu-Ini	Gacharage	Muhiriga
139	Franci Mbugua Kirobi	0717509744	1021951	Kiganjo	Kiganjo	Kiganjo	Gatahi
140	Francis Thairu	0711507779	23959157	Gatundu	Ng'enda	Ritho	Gituamba
141	John Kimemia M	0704299678	1022082	Ng'enda	Kimunyu	Kahuguini	Wamukuta
142	Gichuhi Njoroge			Ndarugu	Rwabura	Karinga	Kimaruri
143	John Macharia W	0710327302	4839706	Kiganjo	Kiganjo	Kiganjo	Kihara
144	James Kuria	0735928614	2671677	Gatundu	Ng'enda	Hangege	Handege
145	Francis Kariuki G	0729003211	9722065	Ng'enda	Kimunyu	Kahuguini	Wamtaa
146	Michael Macharia Maina	0720485782		Ndarugu	Rwabura	Gacharage	Cununiki
147	Samuel Dirangu Gutu	0723322921	618633	Kiganjo	Kiganjo	Kiganjo	Kahata
148	Peter Muragu	0702146037	416020413	Gatundu	Ng'enda	Ritho	Gituamba
149	Samuel Gaturu	0725416406		Ng'enda	Kimunyu	Kimunyu	Wamtaa
150	John Gicheru Kamau	0720353494	7485807	Ndarugu	Munyu-Ini	Munyuini	Cununuki

No.	Name	Mobile number	ID. Number	Division	Location	Sub-Location	Village
151	Samwel Thuo	0723046271	3114093	Kiganjo	Kiganjo	Kiganjo	Kahate
152	George Ndung'u	0728605337	31685125	Gatundu	Ng'enda	Hangege	Githara
153	Peter Kimunga	0720733636		Ng'enda	Kimunyu	Kahuguini	Wamtaa
154	Daniel Kamau Thuku	0714115677		Ndarugu	Rwabura	Gitwe	Gitwe
155	Erosom Kamande	0722300899		Ndarugu	Kimunyu	Ritho	Kahuguini
156	Salome Wambui Maina	0711627285		Ndarugu	Kimunyu	Githunguchu	Mutome
157	Francis Thuo G	0728052068	1018560	Ndarugu	Kimunyu	Githunguchu	Mutomo
158	Michael Ngugi Ng'ang'a	0732447524		Ndarugu	Kimunyu	Githunguchu	Mutomo
159	Kiragu Njuguna	0723322512	3341166	Ndarugu	Kiamwangi	Roi	Karembu
160	Daniel Kariuki Mathenge	0714115687		Ndarugu	Rwabura	Gitwe	Gitwe

Public Participation Attendance list

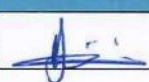

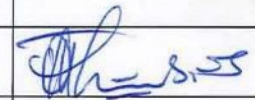


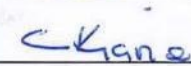
Date: 28/05/2015. Venue: CHIEF'S OFFICE NGENDA (GATUNDU TOWN). Time: 9.00 a.m.








NO	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	Peter Muthoni	NGENDA			
2.	Peter Kaguthi K.	NGENDA			Phaputhi Kaguthi
3.	Margaret Wambui	NGENDA			M.W
4.	David GAGAY	NGENDA			David
5.	ESTHER MUTHONI	NGENDA			Esther
6.	JANE GATHUJA	NGENDA			J. G
7.	MARY MUTHONI G.	NGENDA			Mary
8.	PETER NJORGE	RWABURA			P.N. Wambui
9.	JOSEPH KARIKI KOMUNDA	NGENDA			Joseph
10.	KARIKI ^{WA} NGERA	NGENDA			ca
11.	TERESIA WAIHIRA	NGENDA			Ter
12.	JOHN WANERU	NGENDA			John
13.	CATHERINE WAIHIRA	NGENDA			Cather
14.	PETER KAMAU M.	RWABURA			Peter

15.	NGONI NJOROGE	RUABURA				
16.	DABAN KINYANGU	NGENDA				
17.	RADHAEL NDUATI	NGENDA				NDUATI
18.	PAUL NGUMBA M.	NGENDA				
19.	JOSEPH WANGA	NGENDA				
20.	ANGELICA N'WAMATI	NGENDA				ANGELICA
21.	SAMUEL NJOKA	NGENDA				
22.	NJOROGE NGANGA	NGENDA				NJOROGE
23.	JOHNSON KARIUKI	NGENDA				
24.	JOSEPH MUTURI	NGENDA	0726266647			
25.	JOSEPH KIRAGU K.	NGENDA				
26.	MARY MURINGI K.	NGENDA				
27.	GABRIEL KAMAU GITAU	ITURU	0720261986	058524		
28.	GIDEON M. MURAI	NGENDA	0720458014			
29.	PAUL MUNYAGA	NGENDA	0711904753			MUNYAGA
30.	FRANCIS M. KABIRU	NGENDA	0721286234			

Public Participation Attendance list

Date: 28/05/15 Venue: CHIEF'S OFFICE Time: 9.00 a.m
NGENDO (GATUNDU LOCATION)

NO	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	DAVID MISOBOGE	ITURU	13028499	0700201484	
2.	MARGARET WAMBUI	ITURU			
3.	MONICA WANJIKU	ITURU			
4.	RUTH WANJIKU	ITURU			
5.	MARGARET WAMBUI	ITURU	0712265366		
6.	KIMARI KIMANI	ITURU	1872530 0717269097	0717269097	
7.	MARGARET WANJIKU	ITURU			
8.	BECHOLT WAMBUI	ITURU			
9.	TERESIA NJERI KARI	ITURU			
10.	Thambi Oliver K.	Kirangusi	24249587 0712631967	0712631967	
11.	DAVID MISOBOGE	ITURU			
12.	GEORGE NDICHU	NGENDA		0711675690	
13.	Pius Njokuna	ITURU	102117	0721328950	
14.	Charles Kiano	NGENDA			

15.	Peter Kimuthi	Ngenda			
16.	JOSEPH KARIUKI	NGENDA			
17.	TITUS KIMANI	TURU			
18.	PETER HINDU	TURU	9400758	0720356186	
19.	PATRICK KARIUKI	NGENIA	9400758	0720356186	
20.	STEPHEN MURARI	WAMWANGI	7260472	0725726295	
21.	PATRICK KARIUKI	Wamwangi	7260471	0712265366	
22.	JOSEPH NANGI				
23.	PETER NANGI				
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Date 28/05/2015 Venue CHIEF'S OFFICE Time 9:00 a.m

NO	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	MUNYAGA NGORGE	NGENDA		0705098673	Munyaga
2.	BENSON KURURIE KIAWERA	ITURU		0732868185	BK
3.	Edward Gicheri Gitau	Kigarijo		0720767641	Gitau
4.	DORCAS WANJIRO	ITURU		0712004503	Dk.
5.	Rosemary Muthoni N.	RWABURA		0729929970	Rosemary
6.	JOHN S. GATUNGU				
7.	John M. Kamuti	Kigarijo		0710327302	Kamuti J.M.
8.	PETER RIMUI	Kigarijo		0705935582	Peter Rimi
9.	PETER CHAKORE KAMUTI	ITURU		0723749331	Pem.
10.	KINYANSUI KARANSO	NGENDA		0723347658	Kin
11.	Pius NSUGUNA	ITURU	1023117	0721328950 0213	Pius
12.	Benson KIMANI	NGENDA			Baringi
13.					
14.					

Venue: KIGANJO MARKET

Date: 28/05/15

Time: 11.00 a.m

NO	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	IRENE muthoni	Kiganjo	21133507	0720838882	muthoni
2.	Joseph Mwangi	11	0951758	0711420823	Joseph
3.	Wanyoike Gichuki	MUNDORO	3069496	0722855002	Gichuki
4.	FREDRICK WAWERU	Kiganjo	21244659	0705929014	Waweru
5.	FRANCIS KIMANI	CHURRA	10767921	0801989066	Kimani
6.	John Njoroge	Kiganjo	12520214	0710654176	Njoroge
7.	Martin Kinyanjui	Kiganjo	21865586	0711750258	Kinyanjui
8.	Paul Mwangi	Kiganjo	5179936	,	Mwangi
9.	Bernard Kinyanjui	Muhaho	5178074	0704990734	Kinyanjui
10.	Scarugo Peter	Nyaka			Peter

Public Participation List

Venue: KIGANJO MARKET.

Date: 28/05/15

Time: 11.00 am

NO	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	PATRICK GACHOKA	KIGANJO	3114406	0711822925	Patrick
2.	PETER G. NGARUIYA	KIGANJO	11769336	0728461642	Peter
3.	PHYLIS WAMATHA	KIGANJO	07083474	0708347475	Phylis
4.	JAMES MBURU	KIGANJO		070834775	Mburu
5.	REGINA MUTHONI K.	KIGANJO	3115066	0710485590	Regina
6.	MARY WAMBUI K.	KIGANJO	5178737	0726987854	Mary
7.	ROSE MARY WARIINGA	KAREBU	11292591	0721434458	Rose
8.	TERESIA GATHONI	KIAMWANGI	4302895	0715028598	
9.	PETER SAMANI GATHONI	KI GATHONI	11249455	0722552813	
10.	Samuel Gitau	KIGANJO	10523649	0714963009	

Public Participation List

Venue: KIGANJO MARKET.

Date: 28/05/15 Time: 11.00 a.m


NO	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	PETER MWANGI	KIGANJO	3119320	0735330647	[Signature]
2.	MWANGI NJESIA	KIGANJO	4307362	0723851822	[Signature]
3.	STEPHEN NJUGUNA	KIGANJO	11292591	0725481601	[Signature]
4.	George Mochiri	KIGANJO	14484662	0728073918	[Signature]
5.	Henry Kang'ia	KIGANJO	10182403	0724869751	[Signature]
6.	JOSEPH M. MATHIAS	MUTIMUNYU	1886639	0721484061	[Signature]
7.	George M. Lohu	HAAZA	2570132	0722427648	[Signature]
8.	Joseph Wanyoike	MUTIMUNYU	4918275	0718470980	[Signature]
9.	Paul Njiru	KIGANJO	5188805	076082057	[Signature]
10.	Simon Mbugua	MUTIMUNYU	20174495	0706914443	[Signature]

Public Participation List

Venue: _____

Date: _____

Time: _____

NO	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	PAUL KIBWE	KIGAMBO	9722139	0737597480	
2.					
3.					
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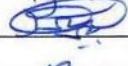



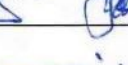


Public Participation List

Venue: MUNYUINI DISPENSARY (MUNYUINI LOCATION)

M. KARUGA
CHIEF
LOCATION
01030 GATUNDU
Sign: 

28/05/15

Time: 3.00 pm.

NO	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	HANNAH KIMATA	Munyuni	10425691	0727673414	
2.	FRANCIS G. KANYINGI	Munyuni	11182130	0718463613	
3.	Joseph K. Kanyingi	Munyuni	3054579	0722731605	
4.	JOAKIM K. KIMATA	NDARUGU	9181081	0727592463	
5.	JOSEPH M. KARUGA	Munyuni	8554406	0721345359	
6.	Benson Kimenju	Ndarugu	11878869	0700272217	
7.	Joseph Shagi	Munyuni	5179504	026833866	
8.	Patrick M. MUKU-M	Munyuni	9531599	0713081162	
9.	PETER K. MUNGA	Munyuni	3066047	0713081162	
10.	JOSEPH M. KUNGA	Munyuni	0436252	0710702539	


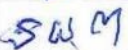








Public Participation List

Venue: MUNDUNI DISPENSARY (MUNDUNI LOCATION)

Date: 28/01/15

Time: 3.00 p.m

29/1/15
KARUGA
CHIEF
SUB-LOCATION
Box 61-01030 GATUNDU

NO	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	SAMUEL K. GITAU	MUNDUNI	1906224	0720081547	
2.	SAROME WAGITHIRA MBUKU	MUNDUNI	5179943	N/A	
3.	RAPHAEL MWANGI N.	MUNDUNI	3088675	0722555-691	
4.	DAVID K. NJIRIA	MUNDUNI	9267226	0724-102333	
5.	JOSEPH N. KARIUKI	MUNDUNI	2570582	0724577016	
6.	Sabine Warimu	MUNDUNI	3066293	0723169452	
7.	JOSEPH M. KAMAU	MUNDUNI	3060528	0712310737	
8.	JACINTA WANDIRU THIGA	MUNDUNI	22011519	0723639295	
9.	John Kimani Giku	MUNDUNI	5702385	0722306391	
10.	Michael Kamau	MUNDUNI	1339393 13039	0721757273	

JOSEPH N. KARIUKI
CHIEF
SUB-LOCATION
Box 61-01030 GATUNDU

Public Participation List

Venue: MUNYUINI DISPENSARY (MUNYUINI LOCATION)

Date: JOSEPH M. KARUCA
ASS. CHIEF
ROI SUB-LOCATION
P. O. Box 61 - 01030 GATUNDU

Time: 3:50 p.m

NO	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	JOSEPH NGANGA KAMBU	MUNYUINI	50	0729758290	<i>[Signature]</i>
2.	Francis Muthandikwa	MUNYUINI	2918130	0727695471	<i>[Signature]</i>
3.	FRANCIS G. KUNGA	MUNYUINI	12943374	0727053371	<i>[Signature]</i>
4.	ALBERT N. KANYINGI	MUNYUINI	7985238	0721569987	<i>[Signature]</i>
5.	DAVID M. NGUNJIRE	MUNYUINI	11309139	0727150051	<i>[Signature]</i>
6.	JOHN G. KARANGA	MUNYUINI	5702426	0727592799	<i>[Signature]</i>
7.	ALBERT M. Mdirangu	MUNYUINI	11028338	0712649642	<i>[Signature]</i>
8.	Thomas Wama	MUNYUINI	8615730	0713028551	<i>[Signature]</i>
9.	JOHN MICHAEL Mwangi	MUNYUINI	7334944	0728709711	<i>[Signature]</i>
10.	Peter Ngang'ani	MUNYUINI	303055836	0721266574	<i>[Signature]</i>

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) FOR RWABURA IRRIGATION DEVELOPMENT

PROJECT, KIAMBU COUNTY

JEFF M. KARUGA
ASS. CHIEF
SUB-LOCATION
Box 61 - 01030 GATUNDU
29/5 Sign: [Signature]


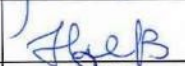

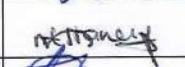


Public Participation List

Venue: MUNYUINI DISPENSARY (MUNYU-INI LOCATION)

Date: 28/06/15 Time: 3.00 P.m

NO	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	JAMES M KARUGA	MUNYU-INI	14401573	0729998485	[Signature]
2.	JOHN KARIKI	KARIKI	11482013	0711551600	[Signature]
3.	DAVID GACHIHU	Munyuni	22729016	0701382402	[Signature]
4.	Patrick Thigoi	Munyuni	22467816		[Signature]
5.	John Wanyake	Munyuni	11481356	0715398208	[Signature]
6.					
7.					
8.					
9.					
10.					




List Key Informants Consulted

NO	NAME	ORGANIZATION	DESIGNATION	ID NO	CONTACTS	SIGNATURE
1.	Phileas M. Nguni	WRMA	SWO	8556761	070-2626072 0723 709 781	
2.	Ju -	-	-	-	Box 1864-0090 KIAMBURU	
3.	Juliano Cheptoo	WRMA	CDO	0722987758	1197 THKA	
4.	Anthony K. Kinyoni	KFS	ZFM	09 3109980	0722990548	
5.	Mohican Kigori	ENVIRONMENT	County Env off	11613050	072582988	
6.	Eng. Kinyi Samuel	Ki.				
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Key Informants Consultation List

Venue: _____

Date: _____

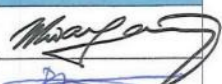

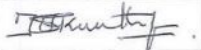
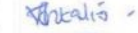


NO	NAME	ORGANIZATION	DESIGNATION	ID NO	CONTACTS	SIGNATURE
1.	HANNAH W. KIMATA	D.P.	CHIEF	10425691	0727673414	
2.	JOSEPH M. KARUGA	D.P.	A/CHIEF	8554406	0721305389	
3.	DAVID K. NJHIA	O.P.	A/CHIEF	9267226	0724-102533	
4.						
5.						
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9.						
10.						

JOSEPH M. KARUGA
ASS. CHIEF
ROI SUB-LOCATION
P. O. Box 61 - 01030 GATUNDU
29/5/2019

Key Informants Consultation List

Venue: Kiambu County government office.



Date: 12/08/2016

NO	NAME	ORGANIZATION	DESIGNATION	ID NO	CONTACTS	SIGNATURE
1.	Hon (Dr) Monica Wangari	KIAMBUR COUNTY	CEC	6420092	0733595182	
2.	Boniface Njenga	KIAMBUR COUNTY GOVT	irrigation Engineer	23560115	0723235490	
3.	Stephen K. Thathi	KIAMBUR COUNTY GOVT	C.I.O	8510008	0722642383	
4.	VITALIS Too	Envrag Co. Ltd	EIA LEAD EXPERT	2221852	0720283773	
5.	Peter Kimani	Envrag Co. Ltd	Consultant	24243651	0722260693	
6.	Matthew Kamau	chair RIDP	Chair	22453291	0721686344	
7.						
8.						
9.						
10.						

Key Informants Consultation List

Venue: DCC Office - Gatundu South

Date: 12/08/2016

NO	NAME	ORGANIZATION	DESIGNATION	ID NO	CONTACTS	SIGNATURE
1.	Alex Mwangi	INTERIOR AG ACC 1	AG ACC 1	1375721	0720291611	
2.	CECILIA MUNGA	INTERIOR	Secretary	748532	0716612822	Cwani
3.	JOSEPH M. KAMAU	INTERIOR	CHIEF RWABURA	3085787	0729214772	
4.						
5.						
6.						
7.						
8.						
9.						
10.						

Venue: Karinga Market

Date: 19/08/2016

Time: 6:00 pm

1.	James Njorog	Karinga		0726724853	James
2.	FRANCIS KAMAMI	KARINGA	12942645	0724355323	Francis
3.	FRANCIS KAHARUKA	KARINGA	13427281	0725894531	Francis
4.	Joseph Ngetho	KARINGA			Joseph
5.	Robert Njorog	Karinga	3055633	0729273992	Robert
6.	FRANCIS Kariuki Njorog	Karinga	3368480	0720138779	Francis
7.	James Njorog Wanjiku	Karinga	21501460	0710992415	James
8.	John Sakoo Mwangi	Karinga	4811819	0712934418	John
9.	Peter Kimani Komau	KARINGA	14400283	0727057423	Peter
10.	Paul Njoroge Wanyui	Karinga	30717877	0706908079	Paul

JOSEPH M. KAMAU
CHIEF
RWABURA LOCATION
P.O. Box 61 - 01030, GATUNDU
DATE: 19-08-2016 SIGN: [Signature]

Venue: Karinga Market

Date: 19/08/2016

Time: 3:00 pm

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.	Patrick Kinyansui	Karinga	10671991	0723625322	<i>[Signature]</i>				
2.	Maina Mwaniri	Karinga		0727856725	<i>[Signature]</i>				
3.	Mburu Kimani	Karinga	0960281	07295113619	<i>[Signature]</i>				
4.	Sephia Mudeke	Karinga	32205625	0702888874	<i>[Signature]</i>				
5.	TERESIA NJERI GAKUHO	Karinga		0706402300	<i>[Signature]</i>				
6.	ESTHER WAIKARA		30668088	0706032986	<i>[Signature]</i>				
7.	Jamwa Mwikim	Karinga	9253516	0718640193	<i>[Signature]</i>				
8.	H.K. Kamani	Karinga	3115215	0721416563	<i>[Signature]</i>				
9.	PETER NJIRGE WANDERU	KARINGA	3367660	-	<i>[Signature]</i>				
10.	JAMES CHEGE MWANGI	KARINGA	24354873	0711150818	<i>[Signature]</i>				

JOSEPH M. KAMAU
CHIEF
RWABURA LOCATION
P.O. Box 61-01030, GATUN
DATE: 19-8-2016 SIGN: *[Signature]*

Venue: Karinga Market

Date: 19/08/2016 Time: 3:00 pm

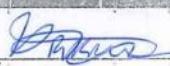





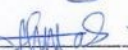



		LOCATION	ID NO	PHONE NO	SIGNATURE
1.	Karanja Ndungu	Rwabura Karinga	20316277	0720643830	KAT
2.	FREDECK KIMANI	KARINGA	23191434	0712844663	Frede
3.	Paul Njoroge	KIRIKIRI	20561618	0712562602	B
4.	P. Mwangi	KARINGA	384054	0721663880	RR
5.	Elijah Mwangi Njoroge	KARINGA	6595968	0765118072	Chip
6.	James Njoroge	KARINGA	4510764	0701845759	D
7.	Najia Njoroge	Karinga	700873		Ngugi
8.	Alice W. Njoroge	Karinga	3055021	0712862870	Am
9.	John Gitau	Karinga	9325195	0755901354	JB
10.	Barbra Mwangi	KARINGA	11298252	0728378102	m/usi

JOSEPH M. KAMAU
CHIEF
RWABURA LOCATION
P.O. BOX 51 - 01030, GATUNDU
DATE: 19/08/16 SIGNATURE: *[Signature]*

Venue: Karinga Market

Date: 19/08/2016



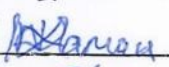

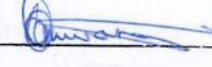



Time: 3:00 PM

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.	RAPHAEL KINYANSUI	KARINGA	28330614	0712 088 210					
2.	PAUL KIRU	KARINGA	20688725	241926061					
3.	Joseph Kimani Mungu	Karinga	071056 0353247	0710560660					
4.	Peter K. Mungu	Karinga	1015569	0725635374					
5.	STANLEY QITHO QITHO	KARINGA	1019878	0723-925-774					
6.	Patrick Mwanja Mungu	Karinga		070287862					
7.	JAMES MUIGAI	KARINGA	3067674	0720221636					
8.	Wanance Matema	Karinga	4302825	0725264995					
9.	Kamisa njoroge	Karinga	4302809	0715274705					
10.	PETER THUKU	KARINGA	9860710	0729896045					

JOSEPH M. KAMAU
CHIEF
RWABURA LOCATION
P.O. Box 61-01036, UNDU
DATE: 19-8-2016 SIGNATURE: 

Venue: KARINGA SHOPPING CENTRE

Date: 19/08/2016

NO	NAME	ORGANIZATION	DESIGNATION	ID NO	CONTACTS	SIGNATURE
1.	Alex K. Muthinda	Gatundu	As Acc 1	13757121	0720291611	
2.	CRISPUS M. CHISHAMBO	Gatundu	Acc Ndaraga	22556691	0729569231	
3.	JOSEPH M. KAMAU	Gatundu	CHIEF RWABURA	3088787	0729214772	
4.	PATRICK K. CHEGE	Gatundu	KARINGA As Chief	8173537	0714761169	
5.	NELSON W. MWANGI	GATUNDU	As Chief Gatundu	12442008	0721291045	
6.	MARGARET KARIUKI	ENWAG	EIA CONSULTANT	29872468	0706189770	
7.	MATHEN. N. KAMAU	RIDP	Chairman	20453291	0721686344	
8.	MUSYOKI MUSA	Gatundu	DRIVER	8536902	0703485896	
9.						
10.						

JOSEPH M. KAMAU
CHIEF
RWABURA LOC. TION
P.O. Box 61-01030, GATUNDU
DATE: 19-8-2016 SIGN: 

Venue: Karinga market

Date: 19/05/2016

Time: 3:00 pm

Sl. No.	Name	Location	Phone No.	Phone No.	Signature
1.	Peter Kinyani	Karinga Rwabura	9860634	0729564782	<u>R.</u>
2.	PATRICK GACEMA	Karinga Rwabura	3115216	0708452074	<u>P.</u>
3.	PETER NGUGI	Karinga Rwabura	1018363	078816397	<u>P.</u>
4.	CHARLES K. Ndarwa	" "		0711678020	<u>C.</u>
5.	Samuel Kamau	Karinga Rwabura	24805843	0726145386	<u>S.</u>
6.	Francis wanjiri	Karinga Rwabura	11445922	0725574435	<u>F.</u>
7.	James Mbari	Karinga Rwabura	26979744	0725405374	<u>J.</u>
8.	Mason Ngaiga	Karinga Rwabura	14572854	0710563287	<u>M.</u>
9.	JOHN GAKUHI	Karinga	23152819	0717514817	<u>J.</u>
10.	JOSEPH MAINA	Karinga Rwabura	11099582	0725945086	<u>J.</u>

JOSEPH M. KAMAU
CHIEF
RWABURA LOCATION
P.O. Box 61-01030, GATUNDI
DATE: 19-5-2016 SIGN: [Signature]

Venue:

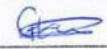
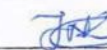

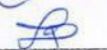



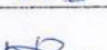
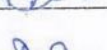
Karinga Market

Date:

19/08/2016

Time:

3:00 pm



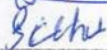
1.	Geoffrey Kung'u	KARINGA	33608801	0790759552	
2.	John Njathi K	KARINGA	21165127	0725647790	
3.	Joseph Ngariga	KARINGA	1815855	0728515740	
4.	Joseph Kimani	KARINGA	9619700	0711885768	
5.	Peter Ngugi	KARINGA	32270369	0727262910	
6.	P K Ruben	KARINGA	3493885	0726819340	
7.	Salome Njeri K	KARINGA	14401011	0415412783	
8.	M. Wamui M	Karinga	24859581	0701719349	
9.	Margaret Wairimu N.	Karinga	25057146	0728136249	
10.	Mburu Kavugu	Karinga			

JOSEPH M. KAMAU
CHIEF
RWABURA LOCATION
P.O. Box 61 - 01030, GATUNDU
DATE 19-8-2016 SIGN 

Venue: Kigango ~~market~~ Karunga market

Date: 19/08/2016

Time: 3:00 pm





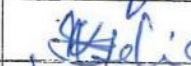
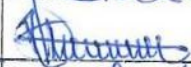



	Name	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	Dominic W. Gakani	RWABURA	1337456	0726999817	
2.	John M. Kamukwa	KARUNGA	10086413	074908103	
3.	Kichoi Njunge	Karunga	—	—	
4.					
5.					
6.					
7.					
8.					
9.					
10.					

JOSEPH M. KAMAU
CHIEF
RWABURA LOCATION
P.O. Box 61-01030, GATUNDU
DATE: 19-8-2016 SIGN: 

HANNAH W. KIMATA
CHIEF
MUNYU-INI LOCATION
P. O. Box 51-01030 GATUNDU
Date: 16/08/2016

Venue: Munyuni dispensary

Date: 16/08/2016



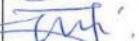




NO	NAME	ORGANIZATION	DESIGNATION	ID NO	CONTACTS	SIGNATURE
1.	Musyoki Musau		DRIVER	8536902		
2.	Crispus M. Chishamba	National Govt.	ACC.	22556691	0729569231	
3.	HANNAH KIMATA	National Govt	CHIEF	10425691	0727673414	
4.	Joseph M. Kamya	NATIONAL GOVT	ASST/CHIEF	8554406	0721345389	
5.	DAVID K. NJIHA	NATIONAL GOVT	ALCHIEF	9267226	0724102352	
6.	JANE NJERI MUCHIRI	NATIONAL GOVT	ALCHIEF	11769384	0729142162	
7.	Chris Muriungi	NIB	Environ	2135576	0707565598	
8.	Joeta Ndwiiga	NIB	Social	30537453	0711719463	
9.	Eric Ruki	NIB	Environment	31649224	0716361165	
10.						

HANNAH W. KIMATA
CHIEF
MUNYUINI LOCATION
P. O. Box 61-01030 GATINDU
Date: 16/05/2016 Sign: 

Venue: Wangari Location Munyu-ini dispensary

Date: 16/05/2016

Time: 3:00 pm

NO	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	JACINTA WAMBURA	Munyu-ini	22011519	0723639295	
2.	TABITHA MUGURE	Munyu-ini	22380754	0715472772	T.M.
3.	FRANCIS NGECHU	Munyu-ini	4510251	0729713291	
4.	JOSEPH N-CHAP	MUNYU-INI	7466880	0721394855	
5.	CHARLES M. KARU	MUNYU-INI	23309872	0723921003	
6.	SUSAN WAMBURA	MUNYU-INI	22236464	0729357761	SUB
7.	JACINTA NTAMBURA	MUNYU-INI	20688335	0729855928	JNTA
8.	ALBERT N. KANYINGI	Munyu-ini	7985238	0721569987	
9.	Peter Ngere Karimu	Munyu-ini	21848789	0722387125	
10.	Mary Wambui Ihuita	Munyu-ini	5179405	0701321327	

HANNAH W. KIMATA
CHIEF
MUNYU-INI LOCATION
P. O. Box 61-01030 GATUNDU
Date: 16/08/2016 Sign: [Signature]

Venue: Munyuni Dispensary

Date: 16/08/2016 Time: 3:00pm

NO	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	Gabriel Mburu Kamau		184498	0710361569	[Signature]
2.	Joseph K. Nanyingi		3054579	0723731605	[Signature]
3.	PETER ITUO CHOCIE		220799063	0721990925	[Signature]
4.	NICHOLAS MBUCHA		4243148	0724586527	[Signature]
5.	Joseph Mwachia		20586887		[Signature]
6.	ISAAC NGUGIA WAWERU		32298188	0720497276	[Signature]
7.	John Mburu Ndirangu			37572535	[Signature]
8.	Antony W. Kigotho		29123701	0700517051	[Signature]
9.	CHARLES MURUGU GACHERU		29886326	0712745827	[Signature]
10.	HENRY NGECI KIMANI		11669710	0706096971	[Signature]

HANNAH W. KIMATA
CHIEF
MUNYU-INI LOCATION
P. O. Box 61-01030 GATUNDU
Date: 16/08/2016 Sign: [Signature]

Venue: Munyuni Dispensary

Date: 16/08/2016

Time: 3:00 pm

NO.	NAME	LOCATION	ID NO.	MOBILE NO.	SIGNATURE
1.	PETER M. KAMATA	Munyuni	2917841	070085854	[Signature]
2.	DAVID NGANGA MWANGI	Munyuni	0969459	N/A	[Signature]
3.	JOH N. KARARI	Munyuni	1018437	0716495554	[Signature]
4.	MA Michael Thuma K.	Munyuni	7485488	0726131182	[Signature]
5.	Patrick Gachui Chani	Munyuni	5332039	0722926709	[Signature]
6.	GABRIEL MWANGI	Munyuni	24639982	0729711491	[Signature]
7.	ALICE H. KIMANI	Munyuni	9237240	0721120270	[Signature]
8.	Paul Mwangi	"	3368758	079003332	[Signature]
9.	Harbor Mburu	"	29850429	0723136369	[Signature]
10.	JOSEPH MBURU	MUNYU-INI	23439119	0723559568	[Signature]

HANNAH W. KIMATA
CHIEF
MUNYUINI LOCATION
P. O. Box 61-01039 GATUNDU
Date: 16-08-2016 Sign: [Signature]

Venue: MUNYUINI LOCATION (Dispensary)

Date: 16-08-2016

Time: 3:00 pm

NO	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	Alex MUKANDIA	Munyuni	13757121	0720291611	[Signature]
2.	DAN ADIALE	Munyuni	22735521	0724585376	[Signature]
3.	Matthew Kamau	Munyuni	22453291	0721686344	[Signature]
4.	CRISPUS M. CHISHAMBO	Munyuni	22556691	0729569231	[Signature]
5.	HANNAH KIMATA	Munyuni	10425691	0727673414	[Signature]
6.	JADE N. MUCHIRI	Munyuni	11769384	0729142162	[Signature]
7.	JOSEPH M. KARUGA	Munyuni	8554406	0721345389	[Signature]
8.	DAVID K. NDIHA	Munyuni	9267226	0724102333	[Signature]
9.	JOHN K. NDIUNGU	Munyuni	7545714	0712056102	[Signature]
10.	FIDELIS W. NDIUNGU	Munyuni	7980041	0722726045	[Signature]

HANNAH W. KIMATA
CHIEF
MUNYU-1 LOCATION
P. O. Box 601030 GATUNDU,
Date: 16/08/2016

Venue: Munyu-1 Dispensary

Date: 16/08/2016 Time: 3:00 pm

	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	WILSON KARIUKI BURUCH	FARMER	10255054	0726916675	WK. Bur
2.	Mwaura KINU	FARMER	5715770	0723643070	MD
3.	PETER KANGETHE	FARMER	23434110	X	KE
4.	Samuel K. Waweru	FARMER	22065054	0727323367	SW
5.	Simon Kihara	Catechist	27721754	0719346691 0722946449	SK
6.	Hannah Wangari	FARMER		0722946449	HW Wangari
7.	Stephen Kariuki	FARMER	1033475	0716283330	SK
8.	Joseph maina	FARMER	3060529	0712310737	JM
9.	Julius NJOROGE	Shop Markor	13840366	0721294728	JN
10.	Joseph Kibe	FARMER	4086077	0725074510	JK

HANNAH W. KIMATA
CHIEF
MUNYU-INI LOCATION
P. O. Box 61-01030 GATUNDU
Date: 16/08/2016 Sign: [Signature]

ie: Munyu-ini Dispensary

16/08/2016

Time: 3:00 pm

	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	Lucy KIAMBU KANGARI	MUNYU-INI	25594297	0713845298	[Signature]
2.	Solome Wanjiku Kariba	MUNYU-INI	12944836	0700101172	[Signature]
3.	Peter Nganga Njoroge		3055836	0721466594	[Signature]
4.	Eric Wamari Ruri	MUNYU-INI	31649226	0716361168	[Signature]
5.	Joana Ndwiiga		30537453	0736438906	[Signature]
6.					
7.					
8.					
9.					
10.					

Venue: Giftwe Shopping Centre

Date: 15/08/2016 Time: 3:00 pm

NO	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	Christopher Wamaga	Rwabura	11050535		Christop
2.	Joseph Munira	Rwabura	10424232	0708255026	J.
3.	David Ieshui	Rwabura			
4.	Joseph Ngugi Mwangi	Rwabura	3116052	—	J.N. Mwangi
5.	Peter Maina Karega	Rwabura	4242682	0728238035	P.
6.	John Mwinimi	Rwabura	3117830	0723575974	
7.	Paul Migai	Rwabura	4716308	0719410883	
8.	Peter Kamau	Rwabura			P. Kamau
9.	Peter Karuri	Rwabura	6241907	0716717474	P.
10.	John Mwangi	Rwabura	3117088	0715318059	

JOSEPH M. KAMAU
CHIEF
RWABURA LOCATION
P.O. Box 61 - 01030, GATUNDU
DATE: 15/8/2016 SIGN: [Signature]

Venue:



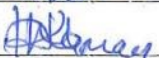


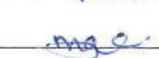

GITWE Shopping Center

Date:

15/08/2016

Time:

3.00 PM

NO	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	Alex Mukindia	Acc office	13757121	0720291611	
2.	Musyoki Musen	Driver	8526902	0703485296	
3.	JOSEPH M. KAMAU	CHIEF RWABURA	3088707	0729214772	
4.	NELSON W MWANGI	ASS. CHIEF GITWE	12942068	0721891045	
5.	PETER M. NGICHU	ASS. CHIEF KIBIKU	9925978	0720593820	
6.	MARGARET NOUTA	Rwabura	11391404	0718944841	
7.	MARIA Wanjiku	"	29477481		MWN
8.	HANNAH Wanjiku	"	7985268		
9.	ACEALES Wanjiku	"			AWK
10.	ALICE Wanjiku	"			A.WJ.

JOSEPH M. KAMAU
CHIEF
RWABURA LOCATION
P.O. Box 61 - 01030, NATUNDU

DATE: 15-8-2016 SIGN: 

Venue: Gitur Shopping center

Date: 15/08/2016

Time: 3:00pm

NO	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	Abraham Mwangi W	Rwabura	ID/3119020	0706440326	<i>[Signature]</i>
2.	Nyugia Kimuthia				<i>[Signature]</i>
3.	JOHN MURGU	Rwabura	11054608		<i>[Signature]</i>
4.	Stephen Main Kibunga	Rwabura	10182273	0721699804	<i>[Signature]</i>
5.	PHILIP Njeng'a Njoroge	Rwabura	3054321	0716272124	<i>[Signature]</i>
6.	HENRY KIMANI MATHIA	Rwabura	0794932	0722603847	<i>[Signature]</i>
7.	Peter Kimuthia Njeng'a	Rwabura	10140036	0733523358	<i>[Signature]</i>
8.	Patrick Mucheru Ngao		4923481	0720547199	<i>[Signature]</i>
9.	Daniel Mwangi	Rwabura	3119638	-	<i>[Signature]</i>
10.	PETER N. GICHURU	KIGARA	3053124	0729724715	<i>[Signature]</i>

JOSEPH M. KAMAU
CHIEF
RWABURA LOCATION
P.O. Box 61 - 01030, GATUNDU
DATE: 15-8-2016 SIGN: *[Signature]*

Venue: GIWE STOPPING CENTER

Date: 15/08/2016

Time: 3:00 pm

NO	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	John Kimani	Rwabura	3055180		John Kimani
2.	HEBRY Nduahi	Rwabura	21278430	0715268752	HEBRY
3.	JACKSON Mwangi K	"	3053193	0701756152	JACKSON
4.	Francis mungu muna	Rwabura	4312879	0727950566	Francis
5.	GEORGE Mwangi	Rwabura	27697408	0702151528	GEORGE
6.	MARTIN Mwangi	"	22604417	0726873052	MARTIN
7.	MICHAEL Mwangi	Rwabura	11536606	0725822403	MICHAEL
8.	CARMEL Mwangi	Rwabura	20273420	092752605	CARMEL
9.	PAUL MUMBIRI	Rwabura	7817103		PAUL
10.	Nelson Wamukui	Rwabura	20632571	0718194673	Nelson

JOSEPH M. KAMAU
CHIEF
RWABURA LOCATION
P.O. Box 61-01030 GATUNDU
DATE:.....SIGN:.....

Venue: Githu Shopping Center

Date: 15/08/2016

Time: 3.00 pm

NO	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	GEORGE MWABURA	RWABURA	4301212		<i>cm</i>
2.	Paul Makira	RWABURA	3472852		<i>PM</i>
3.	Samuel Njunge	RWABURA	1735077	0711651867	<i>SN</i>
4.	Samuel Mwangi	RWABURA	3118644	0712028252	<i>SM</i>
5.	Wendy Kihara	RWABURA	3331026	0716300671	<i>WJ</i>
6.	John Gakuma	RWABURA	3117941	0708645517	<i>JG</i>
7.	Margaret Sathoni		7467221	0721646896	<i>MS</i>
8.	Salome Mwangi		305509	0716586129	<i>SM</i>
9.	Peter Kiarie Gitai	RWABURA	3119305	0714672384	<i>PK</i>
10.	Joseph M. Njuguna	RWABURA	4300913	0728268387	<i>JMN</i>

JOSEPH M. KAMAU
CHIEF
RWABURA LC
P.O. BOX 01-01030 GATUKU
DATE: 15/08/2016 SIGN: *[Signature]*

Venue: Gitwe Shopping Center

Date: 15/08/2016 Time: 2:00 pm

NO	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	PETER HAMAU	RWABURA	0094398	0710776014	PK
2.	MOSES NJABE	RWABURA	7545154	0725986191	MN
3.	GODFREY NJUGIA	Rwabura	7985348	0705303736	Gigist
4.	STEPHEN MBUGUA	Rwabura	13028486	0702333381	Stephen Mbugua
5.	SHADRACK KINYANTUI	RWABURA	0769701	0720682068	Shadrack
6.	JOSEPH KARUGU	RWABURA	3119115	0713073441	JK
7.	Frederick King'ori	Rwabura	5703679	0716912699	King'ori
8.	DANIEL KAMAU	RWABURA	0716912699	073548302	Dan
9.	JOSEPH MURCHORI	RWABURA	4918446	0735395911	JP
10.					

JOSEPH M. KAMAU
CHIEF
RWABURA LOCATION
P.O. Box 61 - 01033 KARIAKO


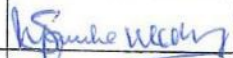


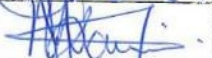
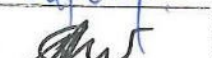
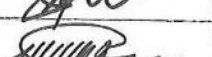
DATE: 15/8/2016 SIGNATURE: *[Signature]*

JOSEPH M. KAMAU
F

DATE: SIGNATURE:

Venue: Kahuguini sub-chiefs office
Agenda location (chiefs office)

Date: 18/08/2016


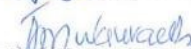





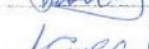


NO	NAME	ORGANIZATION	DESIGNATION	ID NO	CONTACTS	SIGNATURE
1.	Alex Muliachi	Gatundu	AP ACC 1	1375714	0720291611	
2.	Lilian W. Kimani	Gatundu	Asst-Chief	11669772	0720027887	Konkukelion
3.	SALOME N' WAKHITA	GATUNDU	ASST. CHIEF	11028576	0727 987 643	
4.	PETER K. GACHUKA	GATUNDU	ASST. CHIEF	10027576	0720733636	
5.	JOHN M. MUIRY	GATUNDU	CHIEF	13535332	0720 455753	
6.	Matthew Kamau	RISP	Chairman	20483291	0721 686344	
7.	ABDIKADIR S. GODANA	Gatundu	ACC Ngenda	26249813	0726000955	
8.	MUSYOKI NUSCA	Gatundu	DRIVER	8536902	0703485296	
9.						
10.						

JOHN M. MUIRY
CHIEF
KIMURA IRRIGATION
P.O. BOX 61 - 01030 GATUNDU
DATE..... SIGN.....

Venue: KAHUGUINI SUBLOCATION (Sub-chiefs office)

Date: 18/08/2016

Time: 10:00am

	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	WALTER MBUGUA MURU	KAHUGUINI SUB	1022408	0720577086	
2.	JOHN KIMU MWAURA	KAHUGUINI SUB	14401485	0729676065	
3.	JAMES CHEGE MBUGUA	KAHUGUINI	13219897	0720911785	
4.	WALTER DANIEL MUCHARA	KAHUGUINI	33068561	0718652408	
5.	SIMON GATHORO GITAU	KAHUGUINI	3076006	0711333361	
6.	WILLIAM KARIKU MUCHAU	KAHUGUINI	21408232	0725846790	
7.	MWANGI WANGI	KAHUGUINI	1838114	0703874591	
8.	LAVIS MUNGAI MURU	KIMUNYU MUGANDA	1183055	0728702909	
9.	JOSEPH MWAURA	KIMUNYU	3506066	0727883689	
10.	PETER MURU	KIMUNYU	5422337	0720521320	

JOHN M. MURU
CHIEF
KIMUNYU
P.O. BOX 61 - 01030
DATE: 18/08/2016

Venue: KATHUNGI SUBLOCATION (Sub-chief's office)

Date: 18/08/2016

Time: 10:00am

	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	WANTU RUSAMUKE	KIMUNYU		0704337835	Ste
2.	EMILY NJAMBURA	KIMUNYU	14400023	0723710003	Emily
3.	MARY WANJA	KIMUNYU	2571340	0723799524	Mary
4.	JAMES K. NGWIRI	KIMUNYU	0562679	0725417533	James
5.	CHRISTOPHER M. WARIU	KIMUNYU	8169549	0725416413	Chris
6.	PETER K. KIMANI	KIMUNYU	20136431	0725316748	Peter
7.	SAMUEL MURURI	KIMUNYU	04927778	0720713563	Samuel
8.	JOHN KIMANI GIDA	KIMUNYU	0512378	0734718734	John
9.	NICHOLAS NJUNGA NJUNGA	KIMUNYU	4296860	0722313829	Nicholas
10.	FRANCIS KAMAU KABOGA	KIMUNYU	1018541	0720146609	Francis

JOHN M. MURURI
CHIEF
KIMUNYU LOCATION
P.O. BOX 61 - 01030 GATUNDU
DATE..... SIGN.....

Venue: KATHUGUINI (Sub-chief's office)

Date: 18/08/2016

Time: 10:00 am




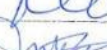



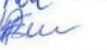


	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	John chege	Kimunya			
2.	Veronica Wangari chege	Kimunya	4306392	0710326712	Veronica Wangari chege
3.	MARY M. KIMUNYU	KIMUNYU	6259011	0726556882	MARY MUTHONI
4.	ELIUD MBIYI GACHAU	Kimunya	1882207	—	Elud Mbiyi
5.	Samuel B. Gacheru	Kimunya	4918181	0725416606	Samuel B. Gacheru
6.	Benjamine Kamau Q	Kimunya	10671284	0707400460	Benjamine Kamau Q
7.	ISAAC GACHERU WANJA	KIMUNYU	21016881	0714-260643	Isaac Gacheru Wanza
8.	MARY GATHONI NDUNGU	KATHUGUINI		0728813995	Mary Gathoni Ndungu
9.	MARY NJERI KAMAU	KATHUGUINI	1023063	0725723532	Mary Njeri Kamau
10.	Kithiji Wilson	KATHUGUINI	30886078	0701467045	Kithiji Wilson

JOHN M. MURUGU
CHIEF
KIMUNYU LOCATION
P.O. BOX 61 - 01030 GATUNDU
80CM

Venue: KATHUNINI SUBLOCATION (Subchiefs office)

Date: 18/08/2016

Time: 10:00 am

	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	FRANCIS W. GAKUWISHA	KIMUNYU	5711031	0735595273	
2.	Stephen K. Muriu	KIMUNYU	9167909	0725992727	
3.	Stanley W. Kibitshi	"	1019357	0724912744	
4.	Joseph H. GORU Kimani	KIMUNYU	1191970	0723884044	
5.	Lucia Murekia	KIMUNYU	7985393	072788721	
6.	BENSON NOUNGO KUNGATI	KIMUNYU	0372539	0712727151	
7.	Francis Kabia Kariuki	KIMUNYU	9722065	0729003211	
8.	Leonard Mwangi Muriuki	KIMUNYU	0435388	0720311841	
9.	Peter Mbugua Kahura	KIMUNYU	1851267	0712161283	
10.	Peter Ngo Kumu Ngenda	KIMUNYU	0727560776	1021678	

JOHN M. MURU
KIMUNYU LOCATION
P.O. BOX 61 - 01030
SIGNED
18/08/2016

Venue: KATHU GUINI SUBLOCATION (Sub-chiefs office)

Date: 18/06/2016

Time: 10:00 am







	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	Joseph Kabue Willy	Kimunya	1020637	0722618364	<i>[Signature]</i>
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					

[Signature]
JOHN M. M...
TON
URDU
SIGN

Venue: NG'ENDA LOCATION & CHIEF'S OFFICE

Date: 17/08/2016

Time: 2:00pm

Sl. No.	Name	Location	ID No.	Mobile No.	Signature
1.	Mary Wanjira	NG'ENDA	14484682	0716803572	MWJ
2.	JACKSON NJOROGE	"	1452004	0722600258	
3.	SUSAN W. KIBOGORO	"	7240717	0714833976	Kibogoro
4.	GEORGE KURIA	"	29152127	0782042973	
5.	Kimani Alex Mwendwa	"	33963455	0791746999	
6.	Mary W. Lucy	Kigongo	32605725	0718605016	
7.	Joseph Gakuru Mbugua	NDarugu	9237368	0725052690	
8.	JOHNATH H. SORGE WAMAGE	NG'ENDA	0517707	0722451594	
9.					
10.					

* SENIOR CHIEF *
JOSEPH NJIRAINI N.
NG'ENDA LOCATION
P.O. Box 66003 KIAMBU
DATE: 17/08/2016

Venue: NGENDA LOCATION {CHIEF'S OFFICE}

Date: 17/08/2016

Time: 2:00 pm

	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	George K/Obu Thonko	Ngenda	7385605	0700406363	X
2.	Ruth Njamboi Kwaru	NGENDA	9057404	0739811309	Ruth
3.	Samuel Kaman Kianu	NGENDA	3366800	0713854404	Samuel
4.	Paul N Gumba Munga	Ngenda	1021848	0714792040	Paul
5.	JOHN MURUGI	NGENDA	9441844	0727045088	John
6.	Joseph Muchogo Kaman/Kikwato	Ngenda	8921648	0726632255	Joseph
7.	Ann Kasochi	NGENDA	1019452	0727758086	Ann
8.	Susan N. Kamau	Ngenda	11770786	0723334434	Susan
9.	Elizabeth Muhugi	Ngenda	11536571	0716270802	Elizabeth
10.	Rebecca Njeri	Ngenda	14712411	0703416189	Rebecca

* SENIOR CHIEF *
JOSEPH NJIRAINI N.
NG'ENDA LOCATION
P.O. Box 61-1000 GARISSA
DATE: 17/08/2016

Venue: NGENDA LOCATION {CHIEF'S OFFICE}

Date: 17TH, August, 2016

Time: 2:00 pm

		LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	Peter Nganga Mwangi	NGENDA	1198472	0722733240	Mwangi
2.	Francis Kamuki	NGENDA	3116209	0711333382	J.
3.	Bhn Maria Kamuki	Rwabura	10086413	0718109545	Francis
4.	Patrick Gtaci	Handege	5179124	0426595703	Rui
5.	Joseph K. Kamoni	Handege	1018109	0411253582	Handege
6.	MICHAEL M'IMBOSO	HANDEGE	1876395	0773742616	Buboso
7.	FRANCIS KAMPANJA	NGENDU	11669201	072555572	Ho
8.	PATRICK MAHA	NGENDU	10974146	0729442389	PA
9.	JAMES KINJUA	NGENDA	11148611	0724243303	Thingis
10.	KIARIE KARIUKI	HANDEGE	3334157		Kari

* SENIOR CHIEF *
 JOSEPH NJIRAINI
 NG'ENDA LOCATION
 P.O. BOX 10080 KARIAKU
 17/8/2016

Venue: NGENDA LOCATION { CHIEF'S OFFICE }

Date: 17/08/2016

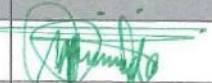



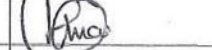



Time: 2:00pm

NO	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	GEORGE KAMITA	Ngenda	1021218	0700830444	<i>George</i>
2.	Jane waithu	Ngenda	4242841	0727975631	<i>Jane</i>
3.	MICHAEL M. GATUNE	GITURU	4919932	0715611162	<i>Michael</i>
4.	Wairimbo Chege	Gituri	3055110	0731384556	<i>Wairimbo</i>
5.	JOSEPH NDUACHI	NGENDA	1018066	0716237844	<i>Joseph</i>
6.	PETER M. KACUMBE	NGENDA	1932297	0735928991	<i>Peter</i>
7.	HANAH MUTHOWI KIMANI	NGENDA		0705093692	<i>Hanah</i>
8.	Agnesica N. Wamati	NGENDA	4850136	0715050067	<i>Agnesica</i>
9.	Mary Gichuega	NGENDA	3116091	0725799375	<i>Mary</i>
10.	Peter Njiri Kenju	NGENPA	1020281	0728119238	<i>Peter</i>

* SENIOR CHIEF *
JOSEPH NJIRAINI N.
NG'ENDA LOCATION
P. O. Box 10300, KENYA
DATE: 17/08/2016

Venue: NGENDA LOCATION of CHIEF'S OFFICE

Date: 17TH, AUGUST, 2016

NO	NAME	ORGANIZATION	DESIGNATION	ID NO	CONTACTS	SIGNATURE
1.	Alex MUKINDI	Gatundu	Ag. Au 1	B75721	0720 291611	
2.	Musyoki Musca	Gatundu	DRIVER	8536402	0703485296	
3.	ABDIKADIR S. GADAMA	Gatundu	ACC Ngenda	26249953	0726000955	
4.	JOSEPH NJIRAINI N.	Gatundu	SNN. Chief	1020926	0723596587	
5.	PETER NI HAWA	GATUNDU	SHR. ASST. CHIEF	11054513	0724293185	
6.	FRANCIS M GICHIA	GATUNDU	ASST. CHIEF	9924846	0724566306	
7.	JOETA NDWIGA	NIB	SOCIAL OFFICER	30537453	0711719463	
8.	ERIC RUHI	NIB	Environmentalist	31649226	07116361168	
9.						
10.						

★ SENIOR CHIEF ★
JOSEPH NJIRAINI N.
NG'ENDA LOCATION
P. O. Box 61 01030 Kiambu
DATE: 17/8/2016

Venue: Kiganjo Market

Date: 18/08/2016

FRANCIS K. KABUNGA
ASST. CHIEF
KIGANJO SUB-LOCATION
Date: 18/08/2016 Sign: [Signature]

NO	NAME	ORGANIZATION	DESIGNATION	ID NO	CONTACTS	SIGNATURE
1.	AGNES W. HAUNGU	NATIONAL GOVERNMENT	ASST. CHIEF	11770506	0721689094	[Signature]
2.	Timothy K. Thabingo	COUNTY GOVT	WARD ADM	24588426	0703981485	[Signature]
3.	JOSEPH N. NJORGE	NATIONAL GOVERNMENT	ASS. CHIEF	8845384	0720428736	[Signature]
4.	PAUL K. NOUNGU	NATIONAL GOVERNMENT	SRV ASST CHIEF	6037880	0720927731	[Signature]
5.	JOETA N. NOUNGU	NIB	SOCIAL OFFICER	30532453	0711719463	[Signature]
6.	ERIC RUIHI	NIB	Environmentalist	31649226	0716361168	[Signature]
7.	Margaret Karuki	ENWAGI	ENVIRONMENTALIST	29872468	0706189770	[Signature]
8.	ABDIKABIR S. GADANKI	Gatundu	Acc Ngenda	26249853	0726000955	[Signature]
9.	MATHEW N. KAMAU	RIDP	Chairman	2453291	0721686344	[Signature]
10.	Murungu Chas	NIB - HO	Enviro	21835836	0707065898	[Signature]

Venue: Kiganjo Market

Date: 18/08/2016

FRANCIS K. KABUNGA
ASST. CHIEF

KIGANJO SUB-LOCATION

Date: 18/08/2016 Sign: [Signature]

NO	NAME	ORGANIZATION	DESIGNATION	ID NO	CONTACTS	SIGNATURE
1.	JOSEPH KAMAU IKWYU	SNR CHIEF KIGANJO	NATIONAL GOVERNMENT	1843615	0722658114	[Signature]
2.	FRANCIS K KABUNGA	ASST. CHIEF KIGANJO	NATIONAL GOVERNMENT	0439021	0727826577	[Signature]
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						


FRANCIS K. KABUNGA
ASST. CHIEF
KIGANJO SUB-LOCATION
Date: 18/05/2016 Sign: *Francis*

Venue: Kiganjo market

Date: 18/05/2016

Time: 3:00 pm

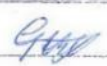


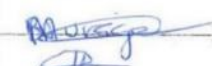



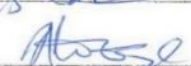
	NAME	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	Henry Mungu	Ngenda	22289177	0703423781	<i>[Signature]</i>
2.	Joseph Mwanja Mungu	Ngenda	3114547		<i>[Signature]</i>
3.	Anthony Karanja	Kiganjo	0724364	070131766	<i>[Signature]</i>
4.	Peter Kimani	Kiganjo	27574987	0701855036	KIMANI
5.	Patrick Kariuki	Kiganjo	3118119	0724212414	<i>[Signature]</i>
6.	Njeri Wamuyu	Kiganjo			
7.	Kipoo Thiongo	Kiganjo			Kipoo
8.	Daniel K. Gichaka	Kiganjo	4300034	0735632893	<i>[Signature]</i>
9.	JAMES NJENGA NJOU	KIGANJO	8499869	0712442250	<i>[Signature]</i>
10.	PETER N. NGOTHO	KIGANJO	3114917	0726228154	<i>[Signature]</i>

FRANCIS K. KABUNGA
ASST. CHIEF
KIGANJO SUB-LOCATION
Date: 18/08/2016 Sign: 

Venue: Kiganjo market

Date: 18/08/2016

Time: 3:00 pm

	Name	Location	ID No	MOBILE NO	Signature
1.	Samuel Gitau	Kiganjo	10573649	0714963009	
2.	MARY WANJA	Kiganjo	125 27822 0707611036	0202671036	MARY
3.	George Njau	Kiganjo	10044906	0726753347	
4.	Benson K Njeroge	Kiganjo	5703906	0726320630	
5.	Beatrice N. Muriu	Kiganjo	13320319	0714013154	
6.	Simon AKUA	Kiganjo	8024999		
7.	Joseph Kimani	Kiganjo	9925809	0724785976	
8.	JOHN NGUGI	Kiganjo	3114193	072898845	
9.	James W. Njeroge	Kiganjo	3114068	0725628483	
10.	Henry G. Kariuki	Kiganjo			GITU

FRANCIS K. KABUNGA
ASST. CHIEF
KIGANJO SUB-LOCATION
Date: 18/08/2016 Sign: [Signature]

Venue: Kiganjo Market

Date: 18/08/2016

Time: 3:00 pm

	Name	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	Charles Mwangi Mwangi	KIGANJO	8749741	0712591177	[Signature]
2.	Gachoka Patrick N.	Kiganjo	3114406	07115032925	Phuge
3.	David Karambi	Kiganjo	3114231	0726528493	@
4.	Patrick Gachoka	Ikuma	—	—	Gachoka
5.	David Kinyanjui	Kiganjo	3114038	0713237634	JK
6.	Peter Chege	Kiganjo	—	0726930245	PD
7.	Joseph Gikari	KIGANJO	3114527	0722625335	[Signature]
8.	Joseph Chege	KIGANJO	3114305	—	[Signature]
9.	George Gichia	(Ikuma) Kiganjo	7466740	0728004014	[Signature]
10.	Kimani Muchiri	Muhoho	—	—	Tim

FRANCIS K. KABUNGA
ASST. CHIEF
KIGANJO SUB-LOCATION
Date: 18/08/2016

Venue: Kiganjo Market

Date: 18/08/2016

Time: 3:00 pm

	Name	LOCATION	ID NO	MOBILE NO	SIGNATURE
1.	Peter Katariso Waduna	Kiganjo	1804840	0722562835	Kabunga
2.	DAVID N. NYOTA	MUNDORO	3159714	0722423619	Chacha
3.	Peter Mwangi	KIGANJO	31141321	0714839590	Prize
4.	Hannah Kanyi	Kiganjo	11242193	0726948291	Agri
5.	MARY MAGARI NJAU	Kiganjo	9925755	0722134581	Agri
6.	Joseph Kahuga	Kiganjo	4676884	0711348049	Agri
7.					
8.					
9.					
10.					

Appendix III: Plates for Public Consultation Meetings



Wednesday, 17th August 2016 from 2pm-4pm. Public consultation in Gatundu Town, Chiefs Office



Thursday, 18th August 2016 from 10am-1pm. public consultation meeting in Kahuguini sub-chief's office



Thursday, 18th August 2016 from 3pm-5pm. Public consultation meeting in Kiganjo Market



Friday, 19th August 2016 from 3pm-5pm. Public consultation meeting in Karinga shopping Market



Monday 15th August 2016 from 3pm-5pm. public consultation meeting in Gitwe Market



Tuesday, 16th August 2016 from 3pm-5pm. Public consultation meeting in Munyuini Dispensary



Public consultation in Ngenda Chief's Office, Friday, 29th May 2015



Public consultation in Kiganjo Shopping Center



Public consultation in Itura Mero, 29th May 2016

Appendix IV: Bill of Quantities (BoQ)

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR RWABURA IRRIGATION DEVELOPMENT PROJECT (CONTRACT REF. NO.: NIB/T/028/2014-2015)

SUMMARY OF BILL OF QUANTITIES

Bill No.	Description	Amount (KSh.)
1	Intake Works	29,906,300.00
2	Sedimentation Tanks	37,309,600.00
3	River & Gully Crossings	35,942,300.00
4	Conveyance Pipelines	142,975,200.00
5	Main lines	288,311,100.00
6	Sub-mains	211,009,900.00
7	Distributions	347,354,200.00
8	Day works	593,500.00
	GRAND TOTAL	1,093,402,100.00

Appendix V: Rwabura irrigation system layout



Appendix VI: Invitation letter by the deputy county commissioner

OFFICE OF THE PRESIDENT

MINISTRY OF INTERIOR AND COORDINATION OF NATIONAL GOVERNMENT

Telegrams: "DISTRICTER", Gatundu
Fax: 0202344220
E-mail: dkgatundu@gmail.com

When replying please quote

Ref. GTD/AGR.11/12/VOL11

12th August, 2016

Chiefs:

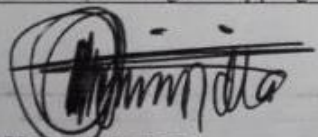
- Rwabura
- Munyuini
- Ngenda
- Kimunyu

RE: PUBLIC CONSULTATION ON ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) PROGRAMME – RWABURA IRRIGATION DEVELOPMENT PROJECT

You are kindly requested to convene public barazas on the dated indicated below for public participation on the above subject.

All pertinent organizations, religious, youth and community leaders should be encouraged to attend. National Irrigation Board and ENWAG will attend among other stakeholders

Date	Area	Day	Time
15/08/2016	Gitwe Shopping Centre	Monday	2.00pm
16/8/2016	Munyuini Shopping Centre	Tuesday	2.00pm
17/8/2016	Gatundu (Chief's Office)	Wednesday	2.00pm
18/8/2016	Kahuguini/Kimunyu	Thursday	10.00am
18/8/2016	Kiganjo Polytechnic	Thursday	2.00pm
19/8/2016	Karinga Shopping Centre	Friday	2.00pm



ALEX. K. MUKINDIA
FOR: DEPUTY COUNTY COMMISSIONER
GATUNDU

CC:

ACCs: Ngenda, Kiganjo and Ndarugu (kindly attend)

Appendix VII: Sample Filled Household Questionnaires



National Irrigation Board

Ref No.	0	0	6
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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) FOR RWABURA IRRIGATION DEVELOPMENT PROJECT, KIAMBU COUNTY

Household Socio-Economic Questionnaire

SECTION A: INTRODUCTION

Hello. My name is [Alex M]. We have been contracted by The National Irrigation Board (the proponent) to conduct an **Environmental and Social Impact Assessment Study for Rwabura Irrigation Development Project**. This study will help us obtain information that will be used to identify potential socioeconomic impacts of the proposed project and hence propose adequate mitigation measures to be adhered to during project implementation.

Name of Respondent:	<u>Francis Mwangi</u>	Division:	<u>Mgarara</u>
Respondent Contact:	<u>07 27 428 141</u>	District / Sub-County:	<u>Kitale</u>
Respondent ID No.:		Location:	<u>Kimwangi</u>
Date of Interview:	<u>16/08/2016</u>	Sub Location:	<u>Karombu</u>
Name of Interviewer:	<u>Alex Mwangi</u>	Village:	<u>Karombu</u>

(NOTE: This questionnaire shall be administered only to the household head or any other responsible adult person at the time of the survey)



Enwag Company Limited

Page 1 of 3

SECTION B: DEMOGRAPHIC DATA

B1	B2	B3	B4	B5	B6
Gender of respondent 1. Male 2. Female	How old are you (yrs)? 1. < 18 yrs 2. 18 – 25 yrs 3. 26 – 35 yrs 4. 36 – 45 yrs 5. 46 – 60yrs 6. Above 60 yrs	What is your marital status? 1. Married 2. Widowed 3. Divorced 4. Separated 5. Never Married (99) Others(Specify)	Do you have any children under the age of 18 yrs? 1. Yes 2. No >>B6	If yes, how many? 2	What is the highest level of education you attained? 1. Pre-primary 2. Primary 3. Secondary 4. College 5. University 6. Never Attended (99)Others (Specify)

SECTION C: HEALTH AND VULNERABILITY

C1	C2	C3	C4	C5
What is the distance to the nearest health centre? 1. < 1 km 2. 1.1 – 3 km 3. 3.1 – 5 km 4. Over 5.1km	Do you have any member of your household who is disabled or orphaned? 1. Yes 2. No	What is the nature of disability? 1. Lame 2. Blind 3. Deaf 4. Dumb 5. Crippled 6. Crossed eyes 99. Others	Has any member of your household been ill within the last for months? 1. Yes 2. No	If yes, what was the cause of illness? 1. Malaria 2. Flu/Cough 3. Stomach disorders 4. Diarrhoea 5. Cholera 6. Headaches 7. Chronic Illness 8. Other (Specify)

NB:-Chronic illnesses include Ulcers, Sickle Cells, Cancer, Diabetes, Asthma, High Blood Pressure, Tuberculosis, and HIV/AIDS.

SECTION D INCOME & LIVELIHOOD

D1	D2	D3	D4
Do you own any land? 1. Yes >>D2 2. No	If Yes, how many acres? 1. Less than 2 acres 2. 2.1 – 3.0 3. 3.1 – 5.0 4. Above 5 acres	What is your main source of income? 1. Farming >>D4 2. Livestock keeping >>D6 3. Employment 4. Trading/Businessman >> D7	If 1 in D3, which crops do you cultivate? 1 Maize 2 Beans 8 Vegetables 99 Others (Specify)

SECTION E: PROPOSED IRRIGATION PROJECT

E1	E2
Has the proposed Irrigation project been mentioned to you before? 1. Yes 2. No	Do you support the proposed project? 1. Yes 2. No

E3: In your view, what are the likely environmental impacts (benefits or negative impacts) of the proposed project in the area?

enable us in growing new crops and will raise yields.

SECTION F: ACCESS TO SOCIAL SERVICES/AMENITIES

	Type of Social Service/Amenity	Source	Distance
E.1	Access to Water	Piped	compound
E.2	Sanitation Facilities	compound	compound N/A
E.3	Cooking Fuel	gas	5km N/A
E.4	Access to Health Services	Garundu	5km

Sources of Water: (1=Improved Sources (Protected Springs, Protected Wells, Boreholes, Piped into Dwelling; Water Harvesting); 2=Unimproved Sources (ponds, dams, lake, stream/river, unprotected springs, and unprotected wells))
Distance (1=Less than 3km; 2=3km-5km; 3=above 5km)
Sanitation Facilities (1=Improved sanitation facilities (main sewer, septic tank, cess-pool, VIP latrine and covered pit latrine); 2=Unimproved sanitation facilities (bucket, bush, digging and buying))
Cooking Fuel (1=Fuelwood; 2=Charcoal; 3=Other (specify))
Health Services (1=District Hospital; 2=Mission Hospital; 3=Dispensary; 4=Health Clinics; 5=VCT; 6=Nursing Homes; 99=Other (Specify))



Ref No.	CK	0	3	9
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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) FOR RWABURA IRRIGATION DEVELOPMENT PROJECT, KIAMBU COUNTY

Household Socio-Economic Questionnaire

SECTION A: INTRODUCTION

Hello. My name is [George]. We have been contracted by The National Irrigation Board (the proponent) to conduct an **Environmental and Social Impact Assessment Study for Rwabura Irrigation Development Project**. This study will help us obtain information that will be used to identify potential socioeconomic impacts of the proposed project and hence propose adequate mitigation measures to be adhered to during project implementation.

Name of Respondent:	<u>PETER MURAGU</u>	Division:	<u>GATUNDU</u>
Respondent Contact:	<u>0702 14 60 37</u>	District / Sub County:	<u>GATUNDU</u>
Respondent ID No.:	<u>41 6020 413</u>	Location:	<u>NG'ENDA</u>
Date of Interview:	<u>17/08/16</u>	Sub Location:	<u>RITHO</u>
Name of Interviewer:	<u>George</u>	Village:	<u>SITUAMBO</u>

(NOTE: This questionnaire shall be administered only to the household head or any other responsible adult person at the time of the survey)



SECTION B: DEMOGRAPHIC DATA

B1	B2	B3	B4	B5	B6
Gender of respondent 1. <input checked="" type="checkbox"/> Male 2. Female	How old are you (yrs)? 1. < 18 yrs 2. 18 – 25 yrs 3. 26 – 35 yrs 4. 36 – 45 yrs 5. 46 – 60yrs 6. <input checked="" type="checkbox"/> Above 60 yrs	What is your marital status? 1. <input checked="" type="checkbox"/> Married 2. Widowed 3. Divorced 4. Separated 5. Never Married (99) Others(Specify)	Do you have any children under the age of 18 yrs? 1. Yes 2. <input checked="" type="checkbox"/> No >>B6	If yes, how many? .	What is the highest level of education you attained? 1. Pre-primary 2. Primary 3. <input checked="" type="checkbox"/> Secondary 4. College 5. University 6. Never Attended (99)Others (Specify)

SECTION C: HEALTH AND VULNERABILITY

C1	C2	C3	C4	C5
What is the distance to the nearest health centre? 1. < 1 km 2. 1.1 – 3 km 3. 3.1 – 5 km 4. <input checked="" type="checkbox"/> Over 5.1km	Do you have any member of your household who is disabled or orphaned? 1. Yes 2. <input checked="" type="checkbox"/> No	What is the nature of disability? 1. Lame 2. Blind 3. Deaf 4. Dumb 5. Crippled 6. Crossed eyes 99. Others	Has any member of your household been ill within the last for months? 1. <input checked="" type="checkbox"/> Yes 2. No	If yes, what was the cause of illness? 1. Malaria 2. <input checked="" type="checkbox"/> Flu/Cough 3. Stomach disorders 4. Diarrhoea 5. Cholera 6. <input checked="" type="checkbox"/> Headaches 7. Chronic Illness 8. Other (Specify)

NB:-Chronic illnesses include Ulcers, Sickie Cells, Cancer, Diabetes, Asthma, High Blood Pressure, Tuberculosis, and HIV/AIDS.



SECTION D INCOME & LIVELIHOOD

D1	D2	D3	D4
Do you own any land? 1. <input checked="" type="checkbox"/> Yes >> D2 2. No	If Yes, how many acres? 1. <input checked="" type="checkbox"/> Less than 2 acres 2. <input checked="" type="checkbox"/> 2.1 – 3.0 3. 3.1 – 5.0 4. Above 5 acres	What is your main source of income? 1. <input checked="" type="checkbox"/> Farming >> D4 2. Livestock keeping >> D6 3. Employment 4. Trading/Businessman >> D7	If 1 in D3, which crops do you cultivate? 1. <input checked="" type="checkbox"/> Maize 2. <input checked="" type="checkbox"/> Beans 8. Vegetables 99. Others (Specify) (Potatoes)

SECTION E: PROPOSED IRRIGATION PROJECT

E1	E2
Has the proposed Irrigation project been mentioned to you before? 1. <input checked="" type="checkbox"/> Yes 2. No	Do you support the proposed project? 1. <input checked="" type="checkbox"/> Yes 2. No

E3: In your view, what are the likely environmental impacts (benefits or negative impacts) of the proposed project in the area?

It will help to do fish farming.

SECTION F: ACCESS TO SOCIAL SERVICES/AMENITIES

	Type of Social Service/Amenity	Source	Distance
E.1	Access to Water	borehole	compound
E.2	Sanitation Facilities	compound	compound
E.3	Cooking Fuel	gas/firewood	3-4 km
E.4	Access to Health Services	Hospital	3-4 km

Sources of Water (1=Improved Sources (Protected Springs, Protected Wells, Boreholes, Piped into Dwelling; Water Harvesting); 2=Unimproved Sources (ponds, dams, lake, stream/river, unprotected springs, and unprotected wells))
 Distance (1=Less than 3km; 2=3km-5km; 3=above 5km)
 Sanitation Facilities (1=Improved sanitation facilities (main sewer, septic tank, cess-pool, VIP latrine and covered pit latrine); 2=Unimproved sanitation facilities (bucket, bush, digging and buying)).
 Cooking Fuel (1=Fuelwood; 2=Charcoal; 3=Other (specify))
 Health Services (1=District Hospital; 2=Mission Hospital; 3=Dispensary; 4=Health Clinics; 5=VCT; 6=Nursing Homes; 99=Other (Specify))





Ref No.	J	0	3
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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) FOR RWABURA IRRIGATION DEVELOPMENT PROJECT, KIAMBU COUNTY

Household Socio-Economic Questionnaire

SECTION A: INTRODUCTION

Hello. My name is [JMK]. We have been contracted by The National Irrigation Board (the proponent) to conduct an **Environmental and Social Impact Assessment Study** for **Rwabura Irrigation Development Project**. This study will help us obtain information that will be used to identify potential socioeconomic impacts of the proposed project and hence propose adequate mitigation measures to be adhered to during project implementation.

Name of Respondent:	<u>MARGARET WANGARI NYORGE</u>	Division:	<u>NDARUGU</u>
Respondent Contact:	<u>0710552470</u>	District / Sub-County:	<u>GATUNDO</u>
Respondent ID No.:	<u>14401559</u>	Location:	<u>MUNYU-INI</u>
Date of Interview:	<u>17/08/2016</u>	Sub Location:	<u>GACHARAGE</u>
Name of Interviewer:	<u>JMK</u>	Village:	<u>MUTHIRIGA</u>

(NOTE: This questionnaire shall be administered only to the household head or any other responsible adult person at the time of the survey)



SECTION B: DEMOGRAPHIC DATA

B1	B2	B3	B4	B5	B6
Gender of respondent 1. Male 2. Female <input checked="" type="checkbox"/>	How old are you (yrs)? 1. < 18 yrs 2. 18 – 25 yrs 3. 26 – 35 yrs 4. 36 – 45 yrs <input checked="" type="checkbox"/> 5. 46 – 60yrs 6. Above 60 yrs	What is your marital status? 1. Married <input checked="" type="checkbox"/> 2. Widowed 3. Divorced 4. Separated 5. Never Married (99) Others(Specify)	Do you have any children under the age of 18 yrs? 1. Yes <input checked="" type="checkbox"/> 2. No >>B6	If yes, how many? 4	What is the highest level of education you attained? 1. Pre-primary 2. Primary <input checked="" type="checkbox"/> 3. Secondary 4. College 5. University 6. Never Attended (99)Others (Specify)

SECTION C: HEALTH AND VULNERABILITY

C1	C2	C3	C4	C5
What is the distance to the nearest health centre? 1. < 1 km 2. 1.1 – 3 km 3. 3.1 – 5 km <input checked="" type="checkbox"/> 4. Over 5.1km	Do you have any member of your household who is disabled or orphaned? 1. Yes 2. No <input checked="" type="checkbox"/>	What is the nature of disability? 1. Lame 2. Blind 3. Deaf 4. Dumb 5. Crippled 6. Crossed eyes 99. Others	Has any member of your household been ill within the last for months? 1. Yes 2. No <input checked="" type="checkbox"/>	If yes, what was the cause of illness? 1. Malaria 2. Flu/Cough 3. Stomach disorders 4. Diarrhoea 5. Cholera 6. Headaches 7. Chronic Illness 8. Other (Specify)

NB:-Chronic illnesses include Ulcers, Sickle Cells, Cancer, Diabetes, Asthma, High Blood Pressure, Tuberculosis, and HIV/AIDS.

SECTION D: INCOME & LIVELIHOOD

D1.	D2	D3	D4
Do you own any land? 1. Yes >>D2 ✓ 2. No	If Yes, how many acres? ✓ 1. Less than 2 acres 2. 2.1 – 3.0 3. 3.1 – 5.0 4. Above 5 acres	What is your main source of income? ✓ 1. Farming >>D4 2. Livestock keeping >>D6 3. Employment 4. Trading/Businessman >> D7	If 1 in D3, which crops do you cultivate? 1 Maize ✓ 2 Beans ✓ 8 Vegetables ✓ 99 Others (Specify) Tea

SECTION E: PROPOSED IRRIGATION PROJECT

E1	E2
Has the proposed Irrigation project been mentioned to you before? 1. Yes ✓ 2. No	Do you support the proposed project? 1. Yes ✓ 2. No

E3: In your view, what are the likely environmental impacts (benefits or negative impacts) of the proposed project in the area?

Job creation (more farming); Weather (cold effects)

SECTION F: ACCESS TO SOCIAL SERVICES/AMENITIES

	Type of Social Service/Amenity	Source	Distance
E.1	Access to Water	Piped	close 1
E.2	Sanitation Facilities		
E.3	Cooking Fuel		
E.4	Access to Health Services		

Sources of Water (1=Improved Sources (Protected Springs, Protected Wells, Boreholes, Piped into Dwelling; Water Harvesting); 2=Unimproved Sources (ponds, dams, lake, stream/river, unprotected springs, and unprotected wells))
Distance (1=Less than 3km; 2=3km-5km; 3=above 5km)
Sanitation Facilities (1=Improved sanitation facilities (main sewer, septic tank, cess-pool, VIP latrine and covered pit latrine); 2=Unimproved sanitation facilities (bucket, bush, digging and buying))
Cooking Fuel (1=Fuelwood; 2=Charcoal; 3=Other (specify))
Health Services (1=District Hospital; 2=Mission Hospital; 3=Dispensary; 4=Health Clinics; 5=VCT; 6=Nursing Homes; 99=Other (Specify))



Ref No.			
AM	0	0	8

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) FOR RWABURA IRRIGATION DEVELOPMENT PROJECT, KIAMBU COUNTY

Household Socio-Economic Questionnaire

SECTION A: INTRODUCTION

Hello. My name is [Alex m]. We have been contracted by The National Irrigation Board (the proponent) to conduct an **Environmental and Social Impact Assessment Study for Rwabura Irrigation Development Project**. This study will help us obtain information that will be used to identify potential socioeconomic impacts of the proposed project and hence propose adequate mitigation measures to be adhered to during project implementation.

Name of Respondent:	<u>Francis Mwangi</u>	Division:	<u>Ngonda</u>
Respondent Contact:	<u>0724 348 707</u>	District / Sub-County:	<u>Barotunga</u>
Respondent ID No.:	<u>11249538</u>	Location:	<u>Kimwangi</u>
Date of Interview:	<u>16/08/2016</u>	Sub Location:	<u>Karumbu</u>
Name of Interviewer:	<u>KIMANI ALEX</u>	Village:	<u>Karumbu</u>

(NOTE: This questionnaire shall be administered only to the household head or any other responsible adult person at the time of the survey)



SECTION B: DEMOGRAPHIC DATA

B1	B2	B3	B4	B5	B6
Gender of respondent 1. <input checked="" type="checkbox"/> Male 2. Female	How old are you (yrs)? 1. < 18 yrs 2. 18 – 25 yrs 3. 26 – 35 yrs 4. <input checked="" type="checkbox"/> 36 – 45 yrs 5. 46 – 60yrs 6. Above 60 yrs	What is your marital status? 1. <input checked="" type="checkbox"/> Married 2. Widowed 3. Divorced 4. Separated 5. Never Married (99) Others(Specify)	Do you have any children under the age of 18 yrs? 1. <input checked="" type="checkbox"/> Yes 2. No >>B6	If yes, how many? 2	What is the highest level of education you attained? 1. Pre-primary 2. <input checked="" type="checkbox"/> Primary 3. Secondary 4. College 5. University 6. Never Attended (99)Others (Specify)

SECTION C: HEALTH AND VULNERABILITY

C1	C2	C3	C4	C5
What is the distance to the nearest health centre? 1. < 1 km 2. <input checked="" type="checkbox"/> 1.1 – 3 km 3. 3.1 – 5 km 4. Over 5.1km	Do you have any member of your household who is disabled or orphaned? 1. Yes 2. <input checked="" type="checkbox"/> No	What is the nature of disability? 1. Lame 2. Blind 3. Deaf 4. Dumb 5. Crippled 6. Crossed eyes 99. Others	Has any member of your household been ill within the last for months? 1. Yes 2. <input checked="" type="checkbox"/> No	If yes, what was the cause of illness? 1. Malaria 2. Flu/Cough 3. Stomach disorders 4. Diarrhoea 5. Cholera 6. Headaches 7. Chronic illness 8. Other (Specify)

NB:-Chronic illnesses include Ulcers, Sickie Cells, Cancer, Diabetes, Asthma, High Blood Pressure, Tuberculosis, and HIV/AIDS.

SECTION D INCOME & LIVELIHOOD

D1	D2	D3	D4
Do you own any land? 1. Yes >>D2 2. No	If Yes, how many acres? 1. Less than 2 acres 2. 2.1 – 3.0 3. 3.1 – 5.0 4. Above 5 acres	What is your main source of income? 1. Farming >>D4 2. Livestock keeping>>D6 3. Employment 4. Trading/Businessman >> D7	If 1 in D3, which crops do you cultivate? 1 Maize ✓ 2 Beans ✓ 8 Vegetables 99 Others (Specify)

SECTION E: PROPOSED IRRIGATION PROJECT

E1	E2
Has the proposed Irrigation project been mentioned to you before? 1. Yes 2. No	Do you support the proposed project? 1. Yes 2. No

E3: In your view, what are the likely environmental impacts (benefits or negative impacts) of the proposed project in the area?

will enable to do farming

SECTION F: ACCESS TO SOCIAL SERVICES/AMENITIES

	Type of Social Service/Amenity	Source	Distance
E.1	Access to Water	Piped	centrally
E.2	Sanitation Facilities	cess-pool	centrally
E.3	Cooking Fuel	Acacia	within
E.4	Access to Health Services	Ngunda	2km

Sources of Water (1=Improved Sources (Protected Springs, Protected Wells, Boreholes, Piped into Dwelling; Water Harvesting); 2=Unimproved Sources (ponds, dams, lake, stream/river, unprotected springs, and unprotected wells))
Distance (1=Less than 3km; 2=3km-5km; 3=above 5km)
Sanitation Facilities (1=Improved sanitation facilities (main sewer, septic tank, cess-pool, VIP latrine and covered pit latrine); 2=Unimproved sanitation facilities (bucket, bush, digging and buying)).
Cooking Fuel (1=Fuelwood; 2=Charcoal; 3=Other (specify))
Health Services (1=District Hospital; 2=Mission Hospital; 3=Dispensary; 4=Health Clinics; 5=VCT; 6=Nursing Homes; 99=Other (Specify))



Ref No.			
M.W	0	0	30

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) FOR RWABURA IRRIGATION DEVELOPMENT PROJECT, KIAMBU COUNTY

Household Socio-Economic Questionnaire

SECTION A: INTRODUCTION

Hello. My name is [Mary W.]. We have been contracted by The National Irrigation Board (the proponent) to conduct an **Environmental and Social Impact Assessment Study for Rwabura Irrigation Development Project**. This study will help us obtain information that will be used to identify potential socioeconomic impacts of the proposed project and hence propose adequate mitigation measures to be adhered to during project implementation.

Name of Respondent: <u>Susan Ngaki</u>	Division: <u>Kigango</u>
Respondent Contact: <u>0716 73 6566</u>	District / Sub County: <u>Gakundu</u>
Respondent ID No.: <u>N/A</u>	Location: <u>Kigango</u>
Date of Interview: <u>17/08/2016</u>	Sub Location: <u>Kigango</u>
Name of Interviewer: <u>Mary Wambui</u>	Village: <u>Ki Mungu</u>

(NOTE: This questionnaire shall be administered only to the household head or any other responsible adult person at the time of the survey)



SECTION B: DEMOGRAPHIC DATA

B1	B2	B3	B4	B5	B6
Gender of respondent 1. Male <u>2. Female</u>	How old are you (yrs)? 1. < 18 yrs 2. 18 – 25 yrs 3. 26 – 35 yrs 4. 36 – 45 yrs <u>5. 46 – 60yrs</u> 6. Above 60 yrs	What is your marital status? <u>1. Married</u> 2. Widowed 3. Divorced 4. Separated 5. Never Married (99) Others(Specify)	Do you have any children under the age of 18 yrs? <u>1. Yes</u> 2. No >>B6	If yes, how many? <u>2</u>	What is the highest level of education you attained? 1. Pre-primary 2. Primary 3. Secondary <u>4. College</u> 5. University 6. Never Attended (99)Others (Specify)

SECTION C: HEALTH AND VULNERABILITY

C1	C2	C3	C4	C5
What is the distance to the nearest health centre? 1. < 1 km <u>2. 1.1 – 3 km</u> 3. 3.1 – 5 km 4. Over 5.1km	Do you have any member of your household who is disabled or orphaned? 1. Yes <u>2. No</u>	What is the nature of disability? 1. Lame 2. Blind 3. Deaf 4. Dumb 5. Crippled 6. Crossed eyes 99. Others	Has any member of your household been ill within the last for months? 1. Yes <u>2. No</u>	If yes, what was the cause of illness? 1. Malaria 2. Flu/Cough 3. Stomach disorders 4. Diarrhoea 5. Cholera 6. Headaches 7. Chronic Illness 8. Other (Specify)

NB:-Chronic illnesses include Ulcers, Sickle Cells, Cancer, Diabetes, Asthma, High Blood Pressure, Tuberculosis, and HIV/AIDS.

SECTION D INCOME & LIVELIHOOD

D1	D2	D3	D4
Do you own any land? 1. Yes >>D2 2. No	If Yes, how many acres? 1. Less than 2 acres 2. 2.1 – 3.0 3. 3.1 – 5.0 4. Above 5 acres	What is your main source of income? 1. Farming >>D4 2. Livestock keeping>>D6 3. Employment 4. Trading/Businessman >> D7	If 1 in D3, which crops do you cultivate? 1 Maize 2 Beans 8 Vegetables 99 Others (Specify)
			Coffee

SECTION E: PROPOSED IRRIGATION PROJECT

E1	E2
Has the proposed Irrigation project been mentioned to you before? 1. Yes 2. No	Do you support the proposed project? 1. Yes 2. No

E3: In your view, what are the likely environmental impacts (benefits or negative impacts) of the proposed project in the area?

It will make farming easy and reliable.

SECTION F: ACCESS TO SOCIAL SERVICES/AMENITIES

	Type of Social Service/Amenity	Source	Distance
E.1	Access to Water	River	2km
E.2	Sanitation Facilities	Compound	compound
E.3	Cooking Fuel	firewood	1km
E.4	Access to Health Services	Dispensary	3km

Sources of Water (1=Improved Sources (Protected Springs, Protected Wells, Boreholes, Piped into Dwelling; Water Harvesting); 2=Unimproved Sources (ponds, dams, lake, stream/river, unprotected springs, and unprotected wells))
Distance (1=Less than 3km; 2=3km-5km; 3=above 5km)
Sanitation Facilities (1=Improved sanitation facilities (main sewer, septic tank, cess-pool, VIP latrine and covered pit latrine); 2=Unimproved sanitation facilities (bucket, bush, digging and buying)).
Cooking Fuel (1=Fuelwood; 2=Charcoal; 3=Other (specify)
Health Services (1=District Hospital; 2=Mission Hospital; 3=Dispensary; 4=Health Clinics; 5=VCT; 6=Nursing Homes; 99=Other (Specify)

