

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT STUDY REPORT

THE CONSTRUCTION OF A 40,000M³, MKURU
WATER DAM IN KISHUSHE SUB LOCATION,
WUMINGU/KISHUSHE WARD IN TAITA SUB
COUNTY OF TAITA TAVETA COUNTY.



December 2019

CLIENT

Kenya Climate Smart Agriculture Project
P.O. Box 1035 – 80304
WUNDANYI
TAITA TAVETA

ESIA LEAD EXPERT

Quentin A. M. Ngati
Registration Number 1587
TEL: 0722-797326
WUNDANYI

DECLARATION

DECLARATION

On behalf of the Proponent, the ESIA/EA Expert submits this Environment Impact Assessment and Audit study report for the proposed construction of Mkuru Dam (Designs attached) on a community land in Kishushe Sub Location, Wumingu/Kishushe Ward in Taita Sub County of Taita Taveta County. The Environment and Social Impact Assessment study has been carried out in accordance with the Environmental Management and Co-ordination Act, 1999 (Revised in 2015) and Environmental (Impact Assessment and Audit) Regulations, 2003.

Lead Expert:

Andrew Quentin Mwakilanga Ngati

Registration Number: 1587

E.mail: qngati@gmail.com

Mobile: 0722797326/ 0735764943

P.O. Box 1035 – 80304

Wundanyi

Sign..........Date: 6th DECEMBER 2019.....

Proponent:



Sign For: Kenya Infrastructure and Agriculture Project

P.O. Box 1035 – 80304

Wundanyi

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ACRONYMS AND ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
CDE	County Director of Environment
CIDP	County Integrated Development Plan
dBA	Decibels
EHS	Environment Health and Safety
EMCA	Environmental Management and Coordination Act
ESIA	Environment and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESSO	Environment Social Safeguard Officer
GAP	Good Agricultural Practices
HIV	Human Immunodeficiency Syndrome
IFM	Integrated Fertilizer Management
IPM	Integrated Pest Management
KCSAP	Kenya Climate Smart Agriculture Project
NEMA	National Environment Management Authority
NGO	Non-Governmental Organization
OSHA	Occupation Safety and Health Administration
SHG	Self Help Group
TOR	Terms of Reference

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There were many community respondents who assisted us get pertinent information about the benefits and negative social and environmental impacts of this project, to them, I am grateful too. I also wish to thank the diverse people who provided very important reference material used in the assessment without which the report would not have been complete.

I cannot list all the people and organizations that have helped us in one way or another to realize this detailed report; I can only say thank you to all who have made it a success.

EXECUTIVE SUMMARY

This Environment Impact Assessment project report has been prepared in accordance with the National Environmental Management Authority (NEMA) requirements for the proposed construction of a dam by the Kenya Climate Smart Agriculture Project at Kishushe Sub Location, Wumingu/Kishushe Ward in Taita Sub County of Taita Taveta County. It describes the project including project inputs, activities and possible environmental impacts likely to arise from the construction and operation of the dam. In addition, the report proposes appropriate mitigation measures where negative impacts are likely to occur and ways to enhance the positive impacts if any. A detailed environmental management plan has also been developed to help the proponent take care of any impacts that may arise. There are inherent positive impacts in the project that include among which:- reliable source of livestock water for the community, local business boost, employment opportunities, job-skills acquisition, surface water destruction control by erosion, catchment protection and conservation of environment, nutritional status improvement, water borne diseases i.e. typhoid and diarrhea reduction, household incomes increased, communal leaving and cross cultural relations, water related conflicts reduction, vulnerable groups inclusion, micro climate modification and aquatic and non-aquatic biodiversity expansion. The study findings also show that the potential negative environmental impacts are minimal both in magnitude and scope. These impacts include: dust emission, vibration and noise pollution, vegetation cover and biodiversity loss, natural water course deviation, accidents during construction, soil and water contamination by waste/chemicals/oils, water borne disease- malaria and amoebiosis occurrence, danger of drowning, livestock/crop conflict and rural morality decay. This calls for putting up mitigation measures to adequately and promptly address the risk and dangers that these impacts pose to the community and the environment. The proponent has integrated the measures within the project components and hence there will be minimal added cost to the implementation of the environmental and social management plan outlined in this report. In general the potential negative impacts of the project are low and easy to mitigate, therefore they should not prevent the project from proceeding. Moreover the KCSAP project has a strong environmental protection and resilience component that is expected to actively implement the proposed mitigation measures. The positive impacts and the benefits to the community are immense and welcomed. It is recommended therefore that the project proceed with the outlined mitigation measures put in place.

CHAPTER ONE

1.0 BACKGROUND INFORMATION

Mkuru Dam is found in Kishushe Sub Location, Wumingu/Kishushe Ward in Taita Sub County of Taita Taveta County. It is located on community land at coordinates S - 3.02 6819, E 38.0250 28. The dam is situated at the boundary of Kanyaga and Wanjala villages of Kishushesub-location. The main road to the project area is the Maktau-Kishushe-Ndii road classified as E686. Accessing the project site from the Mombasa- Nairobi highway is by branching off South at Ndii along the Maktau-Kishushe-Ndii road for approximately 34km and then branch off to the west for another 4km towards Wanjala mines. The distance from Voi to project site via Ndii is approximately 55km while from Wundanyi to project site is approximately 38km. The site is about 4Km away from Kishushe trading centre.

The idea to construct the dam was mooted by the local community with a view to providing water in the area. The dam sources water from a catchment area of approximately 250Km² stretching from as far as Mgange and Mwandasub-locations. The dam has a potential of collecting massive water which can be used both for livestock, domestic and small scale irrigation purposes. On two previous occasions, the dam was constructed and retained water for a short while before it collapsed due to inadequate dam design- piping in the foundation. Community members reported that in the past, one herds boy aged 18 years drowned in the dam thus prompts the need to fence the dam once is fully constructed. Uniquely important is the fact that the dam is located away from the Kishushe community settlement area. It is located within Kishushe co-operative ranching land and most of the community members living in the area are members of Kishushe Co-operative Ranching Limited and therefore resistance to construct the dam is not anticipated.

The main livelihood activity by the community is small scale farming and livestock keeping. Among the many challenges encountered in their livelihood activities are:- drought, human wildlife conflict, and post-harvest pest i.e. cereal borers. The main source of domestic water is piped water from Kishenyi Dam. However, in many occasions the water becomes inadequate due taps often becoming dry thus prompting the County Government to supply water to the community through water boozers. Some of the main social issues which adversely affect the community include and not limited to;- Gender based violence, rampant illicit liquor brewing, HIV, malaria, typhoid, diarrhea, rape cases, teenage pregnancies, and marriage instability. Community members admit that, occurrence of most of these social issues are either directly or indirectly results of water inadequacy.

The main objective of the dam therefore is to enhance the availability of water for livestock watering but can be a source of domestic water during dry seasons. The project was selected through public participation during the CIDP II meetings. The

dam was and will be managed by a committee and the contact person is Mr. Antony Njumwa of telephone 0714 344089.

According to the 2nd Schedule, 9 (1) of section 58 of Environmental Management and Co-ordination Act (EMCA) No. 8 of 1999, water dams such as Mkuru dam are among those specified as requiring Environmental and Social Impact Assessment (ESIA). Further, according to the Environmental (Impact Assessment and Audit) regulation, 2003, new projects must undergo environmental and social impact assessment. ESIA's are undertaken for proposed activities that are likely to have a significant adverse or positive impact on the environment and are subject to a decision of a competent national authority, in this case in Kenya, it is the National Environment Management Authority (NEMA).

1.1 TERMS OF REFERENCE FOR CONDUCTING THE ESIA STUDY

The ESIA study has been carried out as per the following categorized terms of reference listed below:

a) Project activities

The main activities that the ESIA study will be engaged in during the project preparation, construction and operation phase will be:

1. Dam construction
2. Wing walls construction
3. Fencing
4. Cattle trough construction

These activities therefore will generally involve;

- i. Site clearing,
- ii. Mechanical and partially manual land excavation,
- iii. Backfilling around the excavated area,
- iv. Delivery of building materials and machines/equipments to the site,
- v. Reinforced and non-reinforced concrete/cement works,
- vi. Building block works,
- vii. Form works.

b) Objective of the Environmental and Social Impact Assessment

The overall objective of the environmental and social impact assessment study is to:

- i. To provide a concise description of the project area and its activities by focusing on potential impacts to the surrounding environment and community socially.
- ii. To carry out a systematic ESIA for the project through following the required regulations.

- iii. To develop an ESIA report that identifies specific impacts and recommend appropriate mitigation measures.
- iv. To develop a detailed Environment and Social Management Plan(ESMP) for the project.
- v. To show the economic as well as social benefits of the project in the area.

c) Scope of ESIA Study

The lead ESIA expert will undertake an Environment and Social Impact Assessment study on the intended site for Mkuru dam and prepare an ESIA study report as per the guidelines provided under the Environmental (Impact Assessment and Audit) regulations, 2003. The ESIA study report shall therefore provide details on the following aspects:

- i. The proposed location of the project
- ii. The objectives of the project
- iii. The technology, procedures and processes to be used, in project implementation
- iv. The materials to be used in the construction and implementation of the project
- v. The products, by-products and waste generated by the project
- vi. A concise description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information. related to the project
- vii. The environmental effects of the project on the biological diversity, ecosystem maintenance, surface water quality, ground water quality, soil contamination, social consideration such as economic impacts, social cohesion or disruption, effects on human health including air and noise qualities, landscape entailing compatibility with the surrounding area including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated
- viii. Analysis of alternatives including project site, design and technologies and reasons for preferring the proposed site, design and technologies
- ix. An environmental management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment; including the cost, time frame and responsibility to implement the measures
- x. The measures to prevent health hazards and to ensure security in the working environment for employees and for the management of emergencies
- xi. An indication of whether the environment of any other state is likely to be affected and the available alternatives and mitigating measures and
- xii. Such other matters as the Authority may require including public consultation with various stakeholders through focus group meetings.

d) Issues of concern during the project cycle

The ESIA study shall address, but not be limited to the following issues which are considered significant during construction, operation and commissioning stages:

- i) Bush clearing- Involving clearing of bushes, removal of trees, stumps, roots hat may affect vegetative cover and generally plant and animal biodiversity.
- ii) Management of solid waste-Especially during construction and decommissioning that will generate unwanted waste materials, contaminated soil and debris.
- iii) Excavation of dam area – Soil will be moved by heavy machinery creating dust, noise, debris among other impacts.
- iv) Masonry works of dam wall across the end point of Mkuru water way and concrete wing walls on both ends of the dam wall- Interfering with natural water flow.
- v) Noise, vibration and dust emissions- As a result of machinery works
- vi) Installation of inlet to the cattle trough –piping system drawing water from the upstream to the downstream addressing contamination of dam water
- vii) Fencing – Establishment of a fence of barbed wire, chain link and posts so as to prevent accidents or even contamination of the water.
- viii) Health and safety of workmen on site
- ix) Handling, use and storage of hazardous materials during water use i.e. oils and chemicals
- x) Drainage of surface run-off and
- xi) Social issues associated with the construction of the dam

e) Expected Outputs

Outputs from thisstudy will be an ESIA study report

f) Responsibilities of the Client

The project proponent will be required to provide the following;

- i. Architectural drawings for the proposed dam
- ii. Land ownership documents
- iii. Site history.
- iv. Pay prescribed project fee
- v. Any other information or responsibilities deemed necessary for the sturdy

h) Proposed Work Plan and Time Frame for the ESIA Study

The ESIA sturdy is expected to be done as per the indicated timeline below:-

Table 1: Proposed Work Plan

S/No.	Activity	Period	Methodology
1.	Sign TOR	1 day	Meeting
2.	Technical committee constitution	2 days	Vetting and invitation of technical experts to a meeting
3.	Legal frame work review	5 days	Sturdy of the various related Acts of

			parliament/ County Assembly.
4.	Development of sturdy tools	3 days	Sturdy/review and vetting-out of appropriate sturdy tools.
5.	Field sturdy	21days	1) Observation 2) Interview 3) Questionnaire
6.	Literature review	7 days	Sturdy of the primary and any necessary information
7.	Questionnaire administration	7 days	One on one interviewing and administration of a questionnaire.
8.	Biophysical analysis	5 days	Observation Literature review
9.	Interview with farmers	7 days	Personal interview
10.	Interview with government and organization	7 days	Personal interview
11.	Data analysis	7 days	Descriptive
12.	Report writing	14 days	Contributive
13.	Final report preparation and presentation	3 days	Meeting

1.2 METHODOLOGY:

1.2.1 Approach and Methodology

The ESIA study process entailed the following steps:

- i. Desk top study of documents pertinent to the proposed project
- ii. Field survey including interviews, focus group discussions with all levels of stakeholders and administration of a questionnaire.
- iii. Experts' site/field environmental and social sturdy and analysis i.e. biodiversity analysis
- iv. Preparation of ESIA study report

1.2.2 Screening

The environmental law (EMCA, 1999) provides that all projects that fall under second schedule must be subjected to an ESIA. Thus screening was done to establish whether or not an Environment and Social Impact Assessment was necessary. Since the proposed project was of significant importance as an intervention to supplement water for both domestic and irrigation, it was deemed necessary to conduct a study report for the assessment of its likely impacts on the environment and the community socially. The screening took place on 15th February 2019. The screening team was composed of the Environmental and Social Safe-guards Officer (ESSO), County Director of Environment, Sub County Water officer-Taita, Ward Livestock Officer and the Frontline Extension Officer.

1.2.3 Scoping

This process was undertaken aiming at two main goals;

- a. To identifying significant issues allied with the project and
- b. To identify reasonable and feasible project alternatives.

The result of this process helped the assessors to intelligently focus resources on the assessment of those issues and alternatives. This involved identifying relevant stakeholders mainly government ministries relevant in giving an input or intervention in the project at any of its stage of development. It was followed with developing information on the resources to be affected. This led to identifying potential concerns about the project thus sorting for project alternatives.

3 methodologies were deployed in the scoping process:-

- Discussions with the proponent,
- Face-to-face interviews with the identified stakeholders and
- Survey of the site.

1.2.4 Assessment of the Biophysical Environment

The biophysical environment was assessed first by reviewing the already documented works on the environment within the project area. This included previous reports and other documentaries. Thereafter a field investigation and collection of baseline data on the current environmental conditions was targeted in the following sequential manner:

- Analytic assessment of the current state of the environment in the project area
- Identification, prediction and evaluation of positive and negative environmental impacts.

1.2.5 Field Survey Techniques

The field survey adopted various techniques of baseline collection on the existing environmental and social conditions, namely

- 1) An open public baraza to establish community feelings about the project
- 2) Field observations and recordings including photography.
- 3) Administering a questionnaire in focused group discussion.
- 4) Discussions with neighbors, i.e. other people working in the area.



A FGD conducted on the ground with the Area Chief(2nd left) at his office and Dam Management Committee Members(1st three right)



The Hydrology/ Geology expert doing a field study of rock and soil formation



The Sociology and Agriculture/ Livestock experts during the field



Grass/Pasture growing during the wet season in Kishushe sub-location

1.3 PROJECT GOAL,OBJECTIVES, AIMS AND JUSTIFICATIONS

1.3.1 Project Goal

To improve the livestock productivity by storing enough water to be used during dry seasons.

1.3.2 Project Objectives

1. To harvest enough surface run off for livestock watering
2. To reduce soil erosion
3. To reduce the distance covered by animals to water sources during the dry period

1.3.3 Project Aims

The project is aimed at achieving the following:-

- i. Constructing of a dam of capacity 40,000m³ of water.
- ii. Provision of cost effective water for livestock and possibly domestic and small scale agricultural irrigation to 1,230 households consisting of 950 male and 520 female. {Direct beneficiaries- 2,200, (Males-1,300 and Females-900); Indirect beneficiaries- 6,600 (Males- 4,800 and Females-1,800); The vulnerable

beneficiaries: the poor, widows/widowers, orphans, physically challenged, the elderly, the HIV/AIDS infected/ affected comprised of 80 male and 120 female}

1.3.4 Project Justification

Access to water for livestock and small scale irrigation remains a countywide problem in Taita Taveta County and in Kishushe location in particular. Climatic changes and variabilities experienced in Taita Taveta County in the last four decades have resulted to long term environmental changes which include drying of wells and rivers, drought, increased human wildlife conflicts due to competition for the natural resource base (water and pastures), deforestation among others (Taita Taveta Climate Risk Profile).

Kishushe is one of the areas that have been hit hard by the rapid global changes. This calls for introduction of new technologies in protection and conservation of environment, through harvesting of surface runoff water in order to facilitate watering of livestock within close proximity of the Kishushe community and possibly small scale irrigation.

Kishushe has a livestock population of both large and small stock presently estimated at over 50,000 animals with a population growth rate of 3% p.a. The area mostly experiences below average rains that are poorly distributed making access to water for livestock a main challenge. Herders normally trek long distances of between 4 – 6Kms in search of water for livestock. With the main livelihood activity of the community in Kishushe being small scale farming and livestock keeping, the construction of Mkuru water dam will go a long way in providing access to water for livestock near to the grazing areas reducing the return distances to water sources from the grazing areas. Further, the harvested water can also facilitate small scale irrigation of food crops improving food and nutrition security. Moreover, construction of the dam will help overcome the perennial challenges experienced in the area such as drought and human wildlife conflicts experienced due to competition for the scarce water resource.

1.4 PROJECT ALTERNATIVES:

The process of deciding where the dam was to be constructed was analyzed during the screening stage against the list in Taita Taveta CIDP II of proposed dam in the Ward.

1.4.1 Alternative 1- Water Pan Adjacent to the Mkuru Dam

In the CIDP II, there was an option of constructing a water pan adjacent to the current Mkuru dam site. This option was analyzed during a public meeting against reconstruction of the dam. It was found that, the pan would serve very few people as compared to the large size of the dam. Further, the amount of water flowing into the pan would be challenging to the possible capacity of the pan since during wet season, Mkuru water way has a very large amount of water flowing in it. The required pan

would be un-feasibly too big to construct and unable to sufficiently harness and hold this amount of water as compared to a dam. The site formation was more suitable for a dam than a water pan especially considering the very hilly topograph/gradient while the basement rock is fairly shallow which may present a challenge in excavating a pan. As result, this option was not opted for in favor of Mkuru dam.

1.4.2 Alternative 2- Reconstruction of the Earthen Dam

According to the civil engineer and hydrology experts, the underlying bed rock does not produce a water tight interface with soil material. The same shallow bed rock limits expansion of spillway. Soils in the area are sandy thus reduce their compatibility the required tightness. It would require importing compactable soils to form beyond Kishushe area to form a wall across the channel. It will be an extra cost to the total project cost. Further, as a result of the high content of sand in the soils, the erodability of soil for dam construction is high. Previous efforts of construction of an earth dam had proven challenging that resulted to piping and the wall being swept away by hydrological forces from weir. This lowered the chance of reconstructing the earth dam against the new design that would bring on board stone and mortar works.

1.4.3 Alternative 3 - No Action Alternative

In this alternative, it opts for no implementation of the project. This will mean losing the positive impacts associated with the project i.e. demonstrate to the community how they can harness/harvest run-off water; provide to the community a source of livestockwater; sensitize the community to adopt water harvesting technologies in their farms; lack of contract to the development consultants, contractors and suppliers of materials and thus the economy of the of the area will be retarded. However, from an environmental management perspective, this alternative will be beneficial in the sense that any potential negative impacts associated with the project will be avoided. This alternative should not be adopted as agricultural development particularly the harnessing of water for livestock production in ASAL areas like Kishushe Sub-location is one of the most significant contributors in a community and Country's economy. The faster we encourage investment in this sector, the faster will the livelihood of the community in this village grow.

CHAPTER TWO

2.0 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 GENERAL OVERVIEW

ESIAs are carried out in order to identify potential positive and negative impacts associated with the proposed project with a view to taking advantage of the positive impacts and developing mitigation measures for the negative ones. The guidelines on ESIAs are contained in Sections 58 to 67 of the Act. According to Section 68 of the Environmental Management and Coordination Act (EMCA) 1999, the Authority shall be responsible for carrying out environmental audits on all activities that are likely to have a significant effect on the environment. The government has established regulations to facilitate the process on ESIAs and environmental audits. The regulations are contained in the Kenya Gazette Supplement No. 56, Legislative Supplement No. 31, and Legal Notice No. 101 of 13th June 2003. In the past, the government has established a number of National policies and legal statutes to enhance environmental conservation and sustainable development.

2.1.1 Policy Framework

It aims to integrate environmental issues into the country's development plans. Its main objectives include:

- a) Meeting of national and international goals through conservation of biodiversity, prevention of desertification, protection of ozone layer and mitigation of disaster.
- b) Sustainable use of natural resources as well as water resources to improve the quality of human environment.
- c) Integrating environmental conservation into economic activities to the process of sustainable development.
- d) Optimization of use of natural resources in improving the quality of human environment.

Some of the applicable policies in this case are;

- a. National Environmental Action Plan (NEAP- 1994)
- b. National Policy on Water Resources Management and Development (1999)
- c. Policy Paper on Environment and Development (Sessional Paper No. 6 of 1999):

2.1.2 The legal framework

The applicable laws relating to irrigation projects include those on:

- i. Soil erosion
- ii. Public health
- iii. Endangered species
- iv. Protected areas
- v. Water quality

- vi. Water rights
- vii. Cultural, historical, scientific and archeological sites.
- viii. Land use and resettlement
- ix. Air quality

Through the enactment of Environmental Management and Coordination Act (EMCA) of 1999, the legal and institutional framework for environmental management was strengthened. The Act provides for the establishment of a National Environment Management Authority (NEMA). It became operational in July of year 2002. The Authority is a statutory body mandated to coordinate all environmental related activities.

The Environmental Impact and Assessment guidelines and regulations of year 2003 provide the basis and procedures of carrying out ESIA's and EA's.

The proponent will need to observe the provisions of the various statutes that are aimed at maintaining a clean, healthy and sustainable environment.

Some of the policy and legal provisions are briefly presented in the following sub-Sections

2.2 POLICIES

2.2.1 National Environmental Action Plan (NEAP- 1994)

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

2.2.2 National Policy on Water Resources Management and Development (1999)

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

Industrial and business development activities, therefore, should be accompanied by corresponding waste management systems to handle the wastewater and other waste emanating there from. The same policy requires that such projects should also undergo comprehensive ESIA's that will provide suitable measures to be taken to ensure environmental resources and people's health in the immediate neighborhood

and further downstream are not negatively impacted by the emissions. As a follow-up to this, EMCA, 1999 requires annual environmental audits to be conducted in order to ensure that mitigation measures and other improvements identified during ESIA's are implemented.

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

2.2.3. Policy Paper on Environment and Development (Session PaperNo. 6 of 1999):

The key objectives of the Policy include: -

- To ensure that from the onset, all development policies, programs and projects take environmental considerations into account,
- To ensure that an independent environmental impact assessment (ESIA) report is prepared for any industrial venture or other development before implementation,
- To come up with effluent treatment standards that will conform to acceptable health guidelines.

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

2.3 LEGAL ASPECTS

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

2.3.1 Environmental Management and Coordination Act (1999)

The Act came into force in January, year 2000. It aims to among others:

- a. Provide a framework registration for other statutes that contain environmental provisions in the laws of Kenya.
- b. To provide guidelines for ESIA, EA and monitoring environmental quality standards as well as environmental protection orders.

- c. To provide guidelines for the establishment of an appropriate legal and institutional framework for management of environment in the country.

According to the EMCA Act, section 58, all the projects that are listed in the second schedule of the act must submit a project report to NEMA.

2.3.2 The Agriculture Act

Cap 318 of this Act provides a legislative control over soil conservation and land management. The clearing of vegetation for steep slopes or in areas next to water courses without authorization is strictly forbidden. The Ministry of Agriculture can impose land conservation orders to control cultivation, grazing and clearing of vegetation.

Basic land usage rules

The rules apply to plots and land used for cultivation. They cover areas such as protection of sloppy land, water courses and against soil erosion by run-off water. They states that:

- a. Protection of land with slope exceeding 12%
Any person who cultivates any land of which the slope exceeds 12% and does not exceed 35%, when the soil is not protected against erosion shall be guilty of offence.
- b. Protection
Any person who cultivates and destroys the soil or cuts down any vegetation or dispastures by livestock on any land lying within 2m of a watercourse or in the case of a watercourse more that 2m wide within a distance equal to the width of that watercourse to a maximum of 30m shall be guilty of offence.

2.3.3 Crop production and livestock Act CAP 321

The purpose of the crop production and Livestock Act is to regulate the quantity of land that can be utilized for food crops or livestock production; what type of crops to be grown in which areas, etc.

2.3.4 The Water Act

Cap 372 is pivotal for irrigation projects and activities. It provides for the conservation, control, apportionment and use of available water resources. It provides for:

- a) Provision of sufficient drainage works for the delivery of used and unused water to a water course or body from irrigated land.
- b) Obtaining of water permits for irrigation.
- c) Revision or variation and cancellation of water permits.
- d) Penalty for waste dumping
- e) Penalties for polluting water used for human consumption.

Draft Water Rules 2006

To operationalize the Water Act 2002, the Water Resources Management Authority is in the process of developing water rules and regulations. It has already come up with the draft water rules, which are due for gazettelement. The rules cover the following areas:

- a) The reserve, protected areas, swamps, wetlands and riparian areas. They have also incorporated the means through which we can protect these fragile water resources and related environment.

Other areas that these rules cover include:

- b) Threshold levels for water allocation.
- c) Harmonization of water permitting fees and water use charges for different permits.
- d) Provide the Water Resources Management Authority (WRMA) with powers to place control orders, to stop destruction and anti-social behavior which are detrimental to our water resources.
- e) Formulation of Catchments Management Strategies (CMS) including the zoning of catchments
- f) Re-enforce and separate functions between different water sector institutions.
- g) Promote decentralization of decision making
- h) Promote participation and offer channels through which civil rights issues can be addressed.

2.3.5 Land Act

Draft land policy 2006

This draft policy is currently undergoing review. The public has already been requested to read and contribute. The policy is a result of extensive consultation and deliberation between the Ministry of lands, other Government Departments and other Non-State stakeholders for over two years.

History

Kenya has not had a clearly defined or codified National Land Policy since independence. This, together with the existence of many land laws, some of which are incompatible, has resulted in a complex land management and administration system.

Community Interest and Benefit Sharing

To protect community interests over land based Natural Resources and facilitate benefit sharing:-

- A legal framework shall be established for recognizing community and private rights over natural resources and put in place procedures for use of and access to these resources by communities and private entities;
- Devise and implement participatory mechanisms for compensation for loss of lives and damage to property occasioned by wild animals;

- Establish mechanisms for the sharing of benefits emanating from natural resources by the people of Kenya and by use of participatory methods, define benefit sharing criteria for natural resources within the jurisdiction of local communities;
- Ensure that the management and utilization of land based natural resources by community entities take into account the need to share benefits with contiguous communities and that such communities are fully involved in the management and development of the resources;
- Encourage the development of wildlife sanctuaries and conservancies and involve local communities in the co-management of parks with communities living contiguous to the parks and protected areas. It shall also provide mechanism for resolving grievances of communities arising from human-wildlife conflict; and
- Recognize and protect the rights of forest dependent or other Natural Resources dependent communities and facilitate their access, co-management and derivation of benefits from the Resources.

2.3.6 The Registered Land Act CAP 300

Under the Registered Land Act, any person may acquire absolute ownership to any land once he has been registered as the absolute owner. On registration, such a person acquires freehold interests on the land. A subsequent buyer of the same land acquires the same rights as enjoyed by the previous owner.

2.3.7 Land Control Act, Cap 302

The Land Control Act was enacted to regulate the sale and sub-division of agricultural land. The Constitution gives powers to the officers of the land Control Board to refuse to grant consent for transfers or sub-divisions of agricultural land into uneconomic units.

2.3.8 The Land Acquisition Act, Cap 295

The Land Acquisition Act reinforces the provisions of the constitution on compulsory acquisition, and consequently gives powers to the government to acquire any persons land for public utilities such as roads, hospitals, schools, dispensaries, etc. The only requirement by both the constitution and this act is that once such is acquired, prompt and full compensation be paid to the owner. However, the Act does not provide for the involvement of the land owners in determining the level and the mode of compensation.

2.3.9 The Chiefs' Authority Act Cap 128

Section 10 parts (f), (g), (h), (i) and (o) of The Chiefs' Act Cap 128 states:

Any Chief may from time to time issue orders to be obeyed by the persons residing or being within the local limits of his jurisdiction for any of the following purposes;

- a) Preventing the pollution of the water in any stream, watercourse or water-hole, and preventing the obstruction of any stream or watercourse;

- b) Regulating the cutting of timber and prohibiting the wasteful destruction of trees;
- c) Preventing the spread of disease, whether of human beings or animals;
- d) Prohibiting any act or thing that may cause damage to any public road or to any work constructed or maintained for the benefit of the community; and
- e) Regulating the use of artificial water supplies constructed from public funds

2.3.10 Cooperative Societies Act

This is an Act of parliament Cap 490 of 1997 which relates to the constitution and regulation of cooperative societies which covers: interpretation of the Act, establishment of officers responsible for the growth and development of cooperative societies, procedures for registration, privileges of registered societies, rights and liabilities among members, duties of cooperative societies, rights and obligations, property, funds and settlement of disputes among others.

2.3.11 The Lakes and Rivers Act

Cap 409 makes the provision for the protection of birds and other wildlife in the lakes or rivers.

2.3.12 The Public Health Act

Cap 242, section 115 states that, no person or institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 requires local authorities take all lawful action, necessary and reasonably practicable measures to maintain in their jurisdiction, clean and sanitary conditions to prevent occurrence of a nuisance or conditions liable to be injurious to human health. Any noxious matter or waste water flowing or discharged from any premises into a public street or into the gutter or side channel, water course, irrigation channel or bed not approved for discharge is so deemed as a nuisance. Others include accumulation of materials or refuse, which in the opinion of the medical officer of health is likely to harbor rats or vermin.

Section 129 of the Act states that "it shall be the duty of every local authority to take all lawful, necessary and reasonably practicable measures for preventing any pollution dangerous to health of any water supply in which the public within the district has a right to use and does use for drinking or domestic purposes.

Section 136 states that all collections of water, sewage, rubbish, refuse and other fluids, which permit or facilitate the breeding or multiplication of pests, shall be deemed to be nuisances and are liable to be dealt with as provided in the Act.

2.3.13 The pest control Act

All the chemicals used in any agricultural undertaking must be registered by the Pest Control and Products Board (PCPB). All pest control products sold in Kenya must bear a label showing a PCPB registration number. Cap 346 of the Act provides banned in Kenya. All pesticide storage and handling arrangements must be inspected and licensed under this Act.

2.3.14 Other relevant registration

- Irrigation Act Cap 320
- Penal code Cap 63
- Food, drugs and other chemical substances Act Cap 254
- Seeds and plant varieties Act Cap 326
- Agriculture produce and marketing Act Cap 320
- Fertilizer and food stuffs Act Cap 345
- Use of poisonous substances Act Cap 247
- Malaria prevention Act Cap 246
- Local Government Act Cap 265

2.3.15 Administrative framework

a) The National Environmental Management Authority (NEMA)

It exercises general supervision and coordination over all matters relating to the environment and is the principal organ of government in implementation of all policies relating to the environment. The EMCA Act provides for the establishment of Standards and Enforcement Review Committee (SERC)

b) The National Environmental Council (NEC)

It's responsible for policy formulation and direction. The council also sets national goals and objectives and determines priorities for protection of the environment.

c) County and Sub-County Environment Committees

They are decentralized structures involved in environmental stewardship. They enable the local community participation. They have diverse membership.

d) Public Complaints Committee

The EMCA act provides for its establishment and the administrative mechanism for addressing environmental issues. It has a mandate of investigating complaints relating to environmental damage and degradation. It has diverse membership.

2.3.16 Regulatory framework

2.3.16.1 The Environmental Impact Assessment and Audit Regulations

They state in Regulation No. 3 that “the regulations shall apply to all policies, plans, programs, projects and activities specified in Part IV, V and the second schedule of the Act.

Regulation 4 subsection 1 states that no proponent shall implement a project where:

- It’s likely to have negative environmental impacts.
- And for which an ESIA is required under the Act or these regulations.

2.3.16.2 Standards and Enforcement

This is the duty of the SERC. It’s responsible for drawing up the standards on the following

- Chemicals
- Land use
- Biodiversity
- Water quality
- Waste quality
- Economic instruments

It’s important to note that some of these standards have been gazetted i.e. on water quality.

Standards

To operationalize the Water Act 2002, the rules being developed by the Water Resources Management Association (WRMA) have addressed the guidelines for developing water quality standards for domestic water sources and for irrigation waters.

2.3.16.3 Euro Retailer Produce Good Agriculture Practice (EUREPGAP)

This is a private standard that is applicable to production of all kinds of agricultural products inclusive of livestock and flowers worldwide and Europe in particular. These are standards aimed at enhancing food and other products safely, though promotion of sound agricultural production methods by taking into consideration of hygiene, safety and quality.

These standards were to come into force in January, 2005 in Kenya, but the European Union extended it to 2007 to enable the local farmers enforce these standards. Producers receive their EUREPGAP approval through verification by an independent EUREP approved body i.e. AB cert, EUROCERT, ICM, Lloyds register QA, SGS Agro-control. The EUREPGAP protocol (2004) for the production of fruits and vegetables covers the following:

1. Traceability
2. Record keeping

3. Varieties and root stalks
4. Site history and site management
5. Soil and substrate management
6. Fertilizer usage
7. Irrigation
8. Crop protection
9. harvesting
10. Post-harvest treatment
11. Waste and pollution management, recycling and reuse
12. Worker health, safety and welfare
13. Environmental issues
14. Complaints procedures
15. Internal audits

For benefit of local farmers, they can participate in benchmarking schemes as equivalence with EUREPGAP requirements for development of regionally adjusted and integrated crop management systems.

2.3.16.4 ISO 14001 certification

International Standards Organization (ISO) is a worldwide federation of national bodies. It aims to contribute to making development, manufacturing and supply of products and services more efficient, safer and cleaner. It's good technical base for countries on health, safety and environmental legislation.

Its main aim is support in environmental protection and protection against pollution, balanced with socio-economic needs of countries. Its main goals include:

- Continuous improvement of environment management system and environmental performance of organizations.
- Compliance with legislation and demands set by the organization

ISO 14001 IS is a voluntary standard that provides guidance on the development and introduction of that system. Within the standards are the Environmental Management Systems (EMS), which is a part of an overall management system consisting of:

- a. Organizational structure
- b. Planning activities
- c. Responsibilities
- d. Practices
- e. Procedures
- f. Processes and resources for:
 - i. Developing
 - ii. Implementing
 - iii. Reviewing and
 - iv. Maintaining the environmental policy
 - v.

The EMS should therefore cover:

- a) Environmental policy
- b) Planning, implementation and operation corrective actions
- c) Management review

The EMS is supported by the following procedures and instructions:

Organizational responsibilities, communication, training, management manual, production of registers, non-compliance and corrective actions, complaints records and archiving and document control. Therefore, an organization wishing to have ISO 14001 provides written evidence showing that each of the above procedures is operational and established.

2.3.16.5 Civil Engineering Standards and Code of Practice

The design of the dam was done under guidance of the following reference code of practices and design;-

Table 2: Engineering Standards & Code of Proactic

S/No.	NAME OF LEGISLATION OR POLICY	RELEVANT PART
1.	Practice manual for small dams, pans and other water conservation structures in Kenya, 2 nd edition.	Chapter 13: Design of mass gravity dams
2.	British standards code of practice CP 114: Part 2: 1969 on reinforced concrete design	Section three: Design considerations
3.	Materials and structures 8 th impression of 1983 By R. Whitlow	Chapter 11: Retaining walls and gravity dams

2.3.16.6 International Treaties and Conventions

Kenya has ratified numerous international treaties and conventions. The relevant treaties include, but are not limited to:

- a) Convention on wetlands of international importance and water fowl habitat. This dictates wise use of wetlands and their resources
- b) Vienna convention for the protection of ozone layer. It encourages intergovernmental cooperation on research, systematic observation of the ozone layer, monitoring of CFC's production and exchange of information.
- c) Montreal protocol on substances that deplete the ozone layer. It gives guidelines on phase out of ozone depleting substances on the basis of periodic scientific and technological assessments.
- d) Kyoto protocol. In this protocol, the developed nations agreed to limit their greenhouse gas emissions, relative to 1990 levels and are pursuant to the United Nations Framework Convention on Climate Change of 1992.
- e) The International Trading Rules and Persistent Organic Pollution Convention (POP's). It identifies twelve groups of substances which have been either banned or whose use or production is severely restricted.

f) Convention on Biological Diversity. It aims at conservation of biological diversity and sustainable use of its components, fair and equitable sharing of benefits accruing from utilization of genetic resources.

g) African Convention on the Conservation of Nature and Natural Resources

Generally;

The convention established on African Convention on the Conservation of Nature and Natural resources.

Main requirements

- Improved soil conservation and introduce improved farming methods, which will ensure long term productivity of the land.
- Control erosion caused by various forms of land use which may lead to loss of vegetation cover.
- Prevent and control water pollution
- Protect flora and ensure best utilization and development and conserve threatened and or special scientific or aesthetic value, plant species or communities.

For protection of fauna resources, Kenya is required to manage wildlife populations inside designated areas and manage aquatic environment with a view of minimizing deleterious effects of any water.

CHAPTER THREE:

3.0 BASELINE INFORMATION.

3.1 PROJECT ENVIRONMENT

3.1.1 Conceptualization of the project.

Kishushe is a semi-arid zone and often the community in the area experience scarce rainfall, in adequate water for domestic and for livestock, crop failure, severe famine and lack of cash crop. To mitigate against these problems, the community collectively prioritized water inadequacy as the main common problem. The idea of constructing Mkuru dam in Kishushe sub location was conceived in September 2018 during the public participation meetings in Kishushe trading center in process of developing the Taita Taveta CIDP II.

The dam was constructed previously by the National Water Cooperation. In two occasions, it was constructed and retained water for a short while before it collapsed due to insufficient dam design. It was an earthen dam of height 7m. The dam was constructed by use of imported red soil and was built on the existing bed of the ravine which consists of deposited silt soil. The purpose then was to harvest flood waters of the Mkuru ravine for the uses in livestock, domestic and micro-irrigation use. After construction, it successfully harvested water to full capacity of about 40,000m³ and served about 5,000 persons both direct and indirectly. However, shortly after, it breached and the water escaped. On probing the residents around the dam, it emerged that piping in the foundation was the cause for the failure of the structure. The dam was constructed on the existing bed of the ravine which consists of deposited silt and which is porous and therefore the dammed water with a potential head of 7m developed piping under the dam structure which led to the weakening of the foundation and eventually the structure breached and the water escaped. The facility was managed by a dam management committee which was a sub group of the Mkuru Dam Self Help group. It was charged with the responsibility of managing the dam and coordinating any work related to sustainable use of the facility.

The idea to re-construct the dam was therefore conceived by the local community with a view to providing water in the area. The main livelihood activity by the community is small scale farming and livestock keeping. Among the many challenges encountered in their livelihood activities are:-drought, human wildlife conflict, and post-harvest pest i.e. cereal borers. The main source of domestic water is piped water from Kishenyi Dam. However, in many occasions the water becomes inadequate due taps often becoming dry thus prompting the County Government to supply water to the community through water boozers.

The dam has a potential of collecting 40,000m³ of water which can be used mainly for livestock and even domestic and small scale irrigation purposes. The catchment stretches from as far as Mgange and Mwanda markets. Important is also the fact that

the dam is located away from the Kishushe community settlement area. It is located in Kishushe co-operative ranching land and most of the community members living in the area are members of KishusheCo-operative Ranching Limited and therefore resistance to construct the dam is not anticipated. Some of the main social issues which adversely affect the community include and not limited to;- Gender based violence, rampant illicit liquor brewing, HIV, malaria, typhoid, diarrhea, rape cases, teenage pregnancies, and marriage instability. Community members admit that, occurrence of most of these social issues are as either directly or indirectly results of water inadequacy.

The dam is expected to provide cost effective water for livestock and possibly domestic and small scale agricultural irrigation to 1,230 households consisting of 950 male and 520 female. {Direct beneficiaries- 2,200, (Males-1,300 and Females-900); Indirect beneficiaries- 6,600 (Males- 4,800 and Females-1,800); The vulnerable beneficiaries: the poor, widows/widowers, orphans, physically challenged, the elderly, the HIV/AIDS infected/ affected comprised of 80 male and 120 female}.

This project will be implemented through funds from the Kenya Climate Smart Agriculture Project which is funded by the Government of Kenya and the World Bank with 20% of the total cost of the project contributed by the County Government of Taita Taveta.

3.1.2 Location

The Mkuru dam is found in Kishushe Sub Location, Wumingu/Kishushe Ward in Taita Sub County of Taita Taveta County. The area can be accessed from Mombasa-Nairobi highway by branching off South at Ndiu along the Maktau-Kishushe-Ndiu road for approximately 34km and then branch off to the west for another 4km towards Wanjala mines or from Wundanyi town about 30km away through Wundanyi-Werugha-Sangenyi- Kishushe road. The dam is situated at the boundary of Kanyaga and Wanjala villages in Kishushe location of Wumingu/ Kishushe ward.

Below is a sketch map of Kishushe micro catchment that was drawn by the community during preparation of the Kishushe Micro catchment Conservation Plan (MCCP) in the project Kenya Agricultural Productivity and Sustainable Land Management project(KAPSLM). It shows the proposed Mkuru dam within the group ranch which will be positioned at the furthest end of the Mkuru water way that will feed the proposed dam with water.



Figure 1: Sketch Map of Kishushe Micro-Catchment

3.1.3 Climate

The average annual rainfall is 500mm during a good season though most seasons are generally drier with average rainfalls of 150mm-400mm. The area has bi-modal rainfall ; - between March-April as short rains and between month of November-December as long rains. It is during the long rains that the area experience more surface runoff. However, rainfall patterns are currently unpredictable due to global climatic changes. Main rainfall season depended upon by the community is the short rains seasons which normally onsets in the months of October and ends in the months of December. It is during these rains that the area experiences more surface run-off.

The average annual temperature is about 25.1°C. The maximum outdoor temperature is 32.2°C while the minimum outdoor temperature is 17.7°C. The area experiences rapid evaporation as high 2,000mm per year. Below is a the temperature graph of Kishushe Sub-Location.

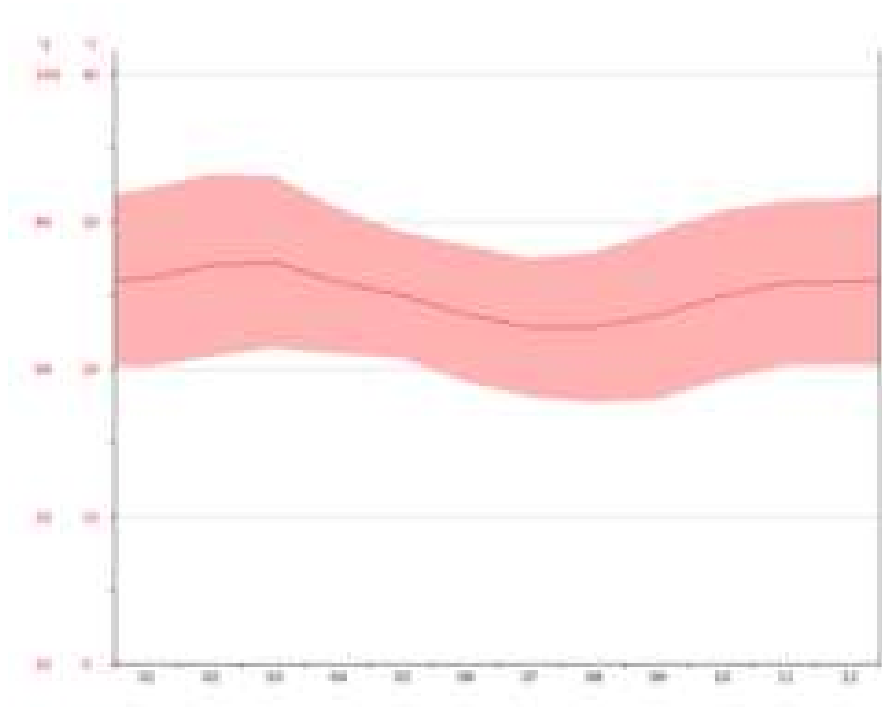


Figure 2: Temperature Graph of Kishushe Sub Location

3.1.4 Topography

The catchment area of the Mkuru water dam stretches to the Taita hills as far as Mghange and Mwanda locations which are part of the Taita Hills that are surrounded by the Tsavo plains and cover a total area of approximately 1000km². There is generally a gentle slope at an average of 1-2% around the dam area but steep towards Mwarangu hills on the South and Ngolia hills on the Northern side.

The notable problems identified in the area were environmental degradation, inadequate water, deforestation, land degradation, soil infertility and soil erosion. During the rainy season, Mkuru seasonal river flows resulting from surface runoff that are generally high carrying the water downwards to the adjacent Tsavo East National Park approximately 85kms away. Mkuru water way has undergone through soil erosion and land degradation along it. Mwarang`u hills are bare and cut with gullies during wet season. Other surrounding hills like Kambunde/ IriwaJaPunda are bare land with eroded soils and gullies. Daku slopes on the other hand have gullies and also bare land.

3.1.5 Flora and Fauna

3.1.5.1 Flora

Apart from extensive land under natural vegetation, the project area has some small pockets cleared for agricultural activity and charcoal burning which has left very little natural or planted vegetation. The general vegetation comprises of short trees shrubs and assorted grass species with sparse under cover on high grounds and dense cover in the Mkuru valley bottom.

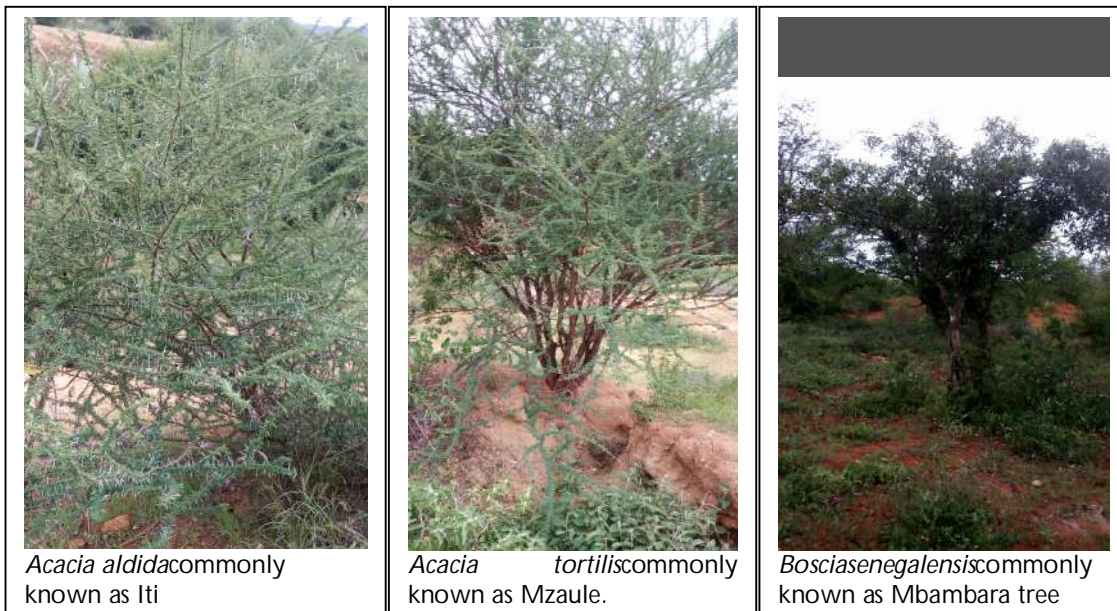
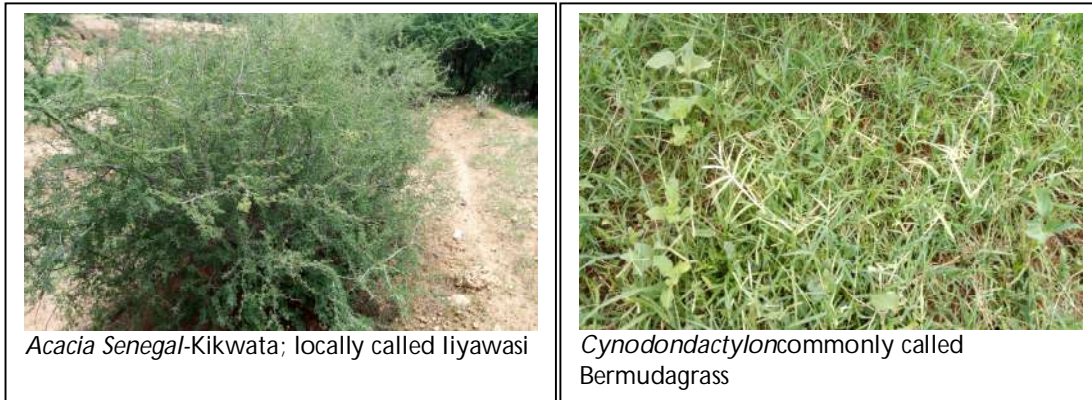
Common trees around the dam area include acacias; Mzwaule- *Acacia lahai*; Mwangari- *Commiphora Africana*, iti- *Acacia melifera/ Faidherbia albidia*, Chariso- *Boscia coriacea* and Ndomoko- *Grewia plagiophylla*. Other acacias include *Acacia senegal*, *Acacia aldida*, *Acacia tortilis* among others. Very little if not agro-forestry is being practiced in the area. Also found in the area are perennial woody plant species of *Boscia senegalensis* commonly known as Mbambaratree. Common low shrubs observed in the ecosystem include *Solanum incanum* shrubs commonly known as sodom apple.

Some parts of the area are covered with fodder grass- *Panicum maximum*, *Cynodoneragrostis* rhodes grass, star grass, red oat grass, lemon grass suitable for livestock keeping. The shrubs and bushes provide habitat for small wild animals such as Dikdiks, porcupines among others. The grasslands are periodically grazed and disturbance due to the activities of cattle and goats is evident.

There is rampant felling of trees for timber, firewood and charcoal burning that has contributed to environmental degradation. However, the project area is not within or near any environmentally sensitive area thus no adverse effects are expected or indigenous biodiversity be affected.

3.1.5.2 Fauna

While no direct evidence of large mammals such as elephants were noted at the site, the main types of large animals are domestic animals such as cattle, sheep, goats and donkeys. Observations were made for several indigenous birds, reptiles (lizards) and some insects in and around the site. Also noted was a variety of small wild animal species that periodically find their habitat in the shrub lands within the project area especially *Madoqua sp.*-Dikdiks, *Lepus microtis* - African savanna, hare and other rodents such as rats.



3.1.6 Drainage

The area has no permanent or seasonal rivers. Due to its topographical composition, there is a major water way called Mkuru water way that collects all the water within the catchment and directs it towards the group ranche area. Mkuru water collects water from as far away as Mghange and Mwanda hills that add to the surface run-off of the nearby Marang’u hills. It is at the tail end of this water way that the Mkuru dam is positioned to receive this water.

3.1.7 Soils and Geology

The underlying/ parent rock is metamorphic rocks of the basement/Parent rocks. Surface rocks are composed of undifferentiated gneisses and granites. There is a significant amount of minerals (iron ore) in the area that has prompted the establishment of an iron ore mining company called Wanjala Mining Company Ltd. The main erosion process is through abrasion that is corrosion using sand, gravel and large rock fragments as tools.

The main soils in the area include chromic luvisols, ferrallo-chromic and arenosols which have low natural fertility. Soils therefore need proper utilization and management for increased crop and livestock productivity. The need to maintain proper livestock stocking rate is also necessary to reduce pressure on grazing land. Thus the nature of soils is sandy-loam with pH at 7.5-slightly alkaline. Nitrogen, organic carbon, zinc and phosphorus are low. Calcium, potassium, magnesium, copper, manganese and sodium are adequate. Due to low permeability of the rocks and soils at the project area, the proposed dam will be able to hold water for a longer duration of time.

3.2 SOCIAL ECONOMICS

3.2.1 Land Tenure and Land Use

Kishushe being part of the lowland areas of Taita bordering Tsavo East National Park comprise of farms and ranches (Kishushe community ranch and Oza ranch). Being a semi-arid, the area finds its land use being characterized by agro-pastoralism. Some of the identified problems concerning land use in Kishushe include falling agricultural productivity due to erratic rains experienced, land degradation due to inappropriate soil conservation technologies and soil erosion; land use conflicts caused by mineral exploitations and prolonged unpredictable droughts. However, water availability and climate, especially rainfall, is the primary physical feature determining land use in Kishushe.

The paradox in land use is that soil in Kishushe is of good quality and fertile but it is under-utilized because of inadequate rainfall. Here, competition for water is severe especially, in dry seasons. In addition, the groundwater is extremely variable in chemical composition and quantities as well as its low water table. This has greatly limited the use of land and taking advantage of the fertile soils.

3.2.2 Agriculture

Kishushe falls in Agro-ecological zone (AEZ) L3 and L5 at altitudes below 790m. Majority of the Kishushe people are mainly mixed farmers. The main crops grown and common system in Kishushe sub-location include;-Cereals and pulses (maize, sorghum, cowpeas, green grams, beans, pigeon peas, and dolichos); horticultural vegetables (tomatoes, kales, spinach, black, night, shade, sweet, and paper.); and cash crops (moringa, castor, pawpaw, and mango). These are grown in a mixed cropping system of cereals, pulses and agro-forestry/cash crops. Farm activities are usually carried out equally by both men and women while there is idleness among the youth as most neglect taking up agricultural activities.

Livestock types kept include;- small East African goats, black headed sheep, local zebu cows, a few dairy cattle, local poultry, rabbits, donkey as well as pets such as local dogs. The total number of livestock herders or households in Kishushe location is

projected to be 5,330 (projected census 2009). Livestock population in the area stands at;- dairy cattle 142, local zebu 21,900, goats 18,000 and sheep 6,000. The old dam used to serve a total livestock population;- dairy cattle 120, local zebu 18,615, goats 15,300 and sheep 5,100. Provision of water for livestock has proved to be quite a challenge during dry seasons as the community is forced to depend on a borehole located in Wanjala Mining site which is over 10Kms from Kishushe trading center. Availability of pastures on vast lands is beneficial to those practicing commercial dairy production in the higher zones of Taita Sub County. Baling of hay is one of the activities done and sold at Ksh.60 a bale to dairy farmers in the hills. The pastures are only available during rainy seasons but dwindle drastically during dry spell hence the need to conserve.

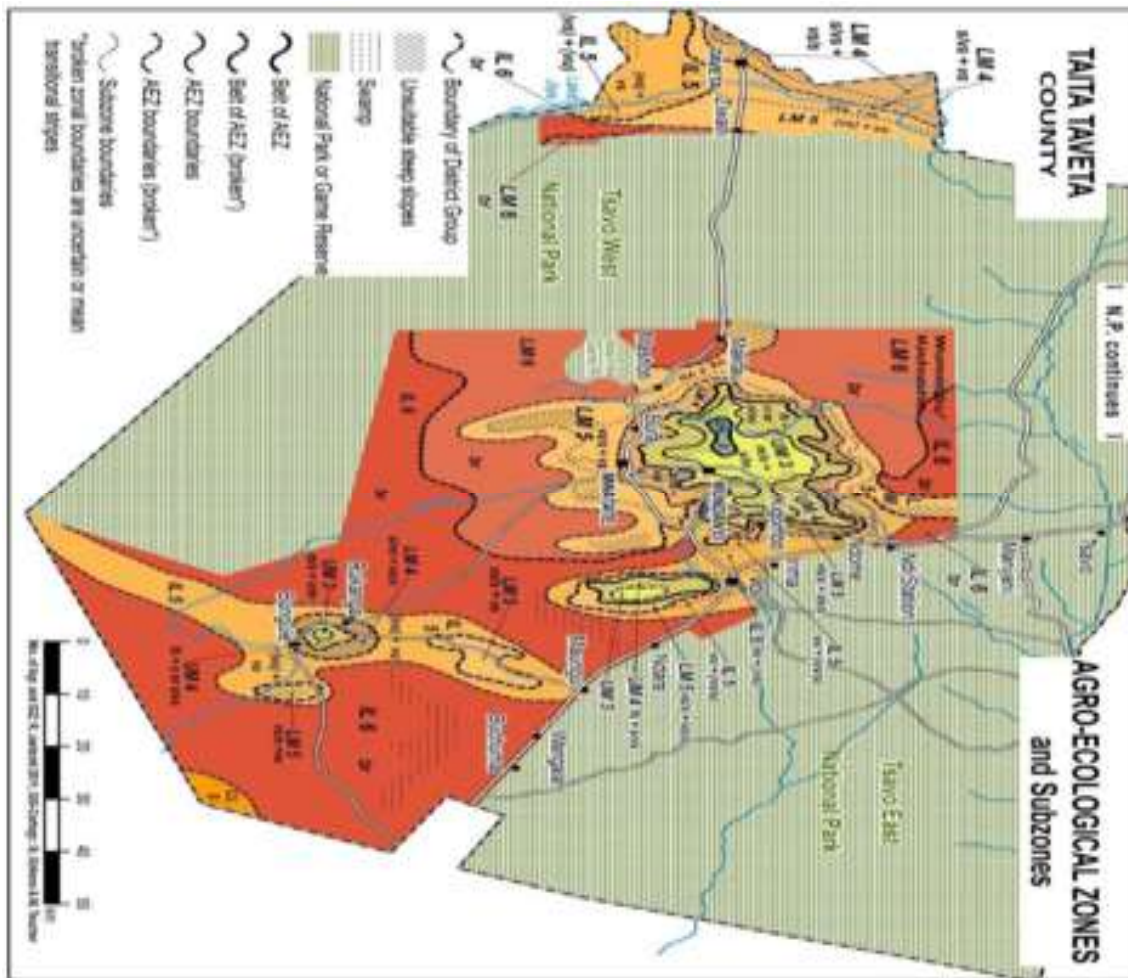


Figure 3: Agro Ecological Zones of Taita Taveta County

3.2.3 Transport and Communication

The project area is accessible by means of public and private vehicles and motorcycles that ply the dry all weather roads traversing the area. The project site can be accessed from three directions namely; a) Ndi-Kishushe- road, b) Wundanyi-Kishushe road and c) Maktau-Kishushe road. The main road to the project area is the Maktau-Kishushe-Ndii road classified as E686. The easiest access to project site is by branching South at Ndii off the Mombasa road, 34km on the Maktau-Kishushe-Ndii road and branch off to the West for another 4km towards Wanjala mines. Distance from Voi to the project site via Ndii is approximately 55km. Distance from Wundanyi to project site is approximately 38km. All the above mentioned roads are murramalla-weather roads.

The road network in the area is poor. The nearest tarmac road is the Mombasa-Nairobi highway which is about 20km away from the site. The project area can be accessible through 3 main road arteries; Ndii-Maktau, Kishushe-Sangenyi and Mlilo-

Nyache roads. There is no land line telephone service though communication in the area has been complimented by the fair network coverage of the mobile telephony.

3.2.4 Administration

The project area falls under the jurisdiction of Wumingu/Kishushe ward whose administration contact person is the area chief and ward administrator 4 kms away near Kishushe trading center. Kishushe Sub- Location has 24 Villages namely; Afiti, Daku, Mwasinenyi, Ngongodinyi, Mashashagho, MaghalemMlilo, Mbaramghondi, Paranga Central, Mwangoko, Kisima, Mazerenyi, Mwambingu, Shambisamu, Terenyi, Mfungunyi, kilulunyi, Mwangorua, Kanyagha, Wanjala, Itange, Mwakilemba, Mbula and Iriwajapunda. A police post is also located at this center. Paranga Assistant chief officer is located at Mbaramghondi shopping center. The Sub-County headquarters is in WundanyiTown, over 30km away. Human wildlife conflicts are common occurrence in the sub location.

3.2.5 Population

Based on 2019 population census Kishushe has a population of 4800 men and 1800 women. The total number of livestock herders or households in Kishushe location is projected to be 5330 (projected census 2009). Livestock population in the area stands at; dairy cattle 142, local zebu 21900, goats 18000 and sheep 6000. The old dam used to serve a total livestock population; dairy cattle 120, local zebu 18615, goats 15300 and sheep 5100.

3.2.6 Education

Within Kishushe and Paranga Sub-locations are Mbela secondary school, Kishushe Primary school, Daku primary school, Ngongodinyi primary school, Mlilo primary school, and Paranga primary school. There are no colleges or tertiary institutions in the two Sub-locations. Over 80% of the participants in the public participation could read and write, an indication of fairly high literacy levels.

3.2.7 Health Facilities

According to the ESIA study, the following are the most common diseases manifested in Kanyagavillage;-

Table 3: Common Diseases in Kishushe Sub- Location

Type	When common	Common/Remedy applied	Source of remedy
a. Malaria	Rainy season	Drugs, Herbs (Neem tree- <i>Azadirachta indica</i>)	Dispensaries, Neem tree
b. Typhoid	Wet and dry season	Drugs	Dispensaries
c. Diarrhea	Rainy season	Cleaning the environment Treat stagnant water	Dispensary
d. Amoeba	All year around	Boiled water	Hospital treatment

The health facilities that the villagers of Kanyaga access are;

Name of dispensary/hospital	Distance (Km)
a) Kishushe Dispensary	4
b) Sangeroko dispensary	4
c) Voi hospital	60

The most common diseases are malaria and typhoid in wet season. There are old sanitation blocks nearby constructed previously by the National Water Cooperation. The cooperation also constructed a water drawing point for both domestic and cattle watering point, as a GI pipe had been inserted through the dam wall. However, currently it doesn't exist as the dam breakage washed it out. The community is sensitized on health issues as they prefer to access modern medical attention from the health facilities indicated above. Parts of their medicine are bought across the counter from simple shops around. There exists a great challenge of drug and substance abuse like miraa (Khat) chewing and excessive drinking. These challenges would be addressed by involving the youth in micro catchment conservation activities.

3.2.8 Commerce and Industries

The Kenya Power Company (KPC) lines run along the Maktau-Kishushe-Ndii road which is about 4km away. There is a significant amount of minerals (iron ore) that is opening up the area for income gaining by the youth, though the mode of ownership of this resource is still wanting. This is through the iron ore extracting company called Wanjala Mining Company. Some of the few youth who have access to motorbike do use them to transport the locals in and outside the sub catchment. Commercial Charcoal burning is a common phenomenon in the area as a coping strategy leaving the land prone to degradation. This is to meet the cost of daily food and other essential requirements. Formal employment constitutes 1% and 29% on casual and waged labor.

There are no industries in the area except a posho mill that is located at Kishushemarket. Some community members are also involved in small cottage industries i.e. self-help groups in various agricultural related activities. Others have stalls in the market centers to sell farm produce and other fast moving consumer goods. However, from the field study and the questionnaire administered during the study, other destructive industrial activities like timber sales and charcoal burning feature in the location which are destructive to the environment. Other small scale industrial activities found in the area are brick making which involves quarrying clay in the area and thus leaving holes that are breeding ground for pest like snakes or mosquitoes during wet seasons. These activities need to be controlled so as to avoid further destruction of the environment.

Generally, there is the challenge of poor markets/marketing of their produce, lack of start-up capital, old agricultural technologies, poor road infrastructure that would make their produce reach the final destination among others.

3.2.9 Groups Formation

There are very few organized social groups in Kishushe Sub-location. In Kishushe Location there are over 60 registered social groups which include youth groups, self-help groups, water projects, welfare groups and women groups. The most active are women groups. Women groups perform merry go round and access credit through funding agencies to fund their activities. All the funds raised are used to pay school fees rather than investing. Groups are not growing economically due to lack of cash crops.

Around the dam is the Mkuru Dam Self Help Group. The facility was managed by the dam management committee which was a sub group of the Mkuru Dam Self Help group. It was charged with the responsibility of managing the dam and coordinating any work related to sustainable use of the facility. The project has already been registered with the Department of Social Development and has a certificate which gives the Projects Management Committee (PMC) power to operate the facility when it is complete. In the PMC constitution, the Committee has proposed friendly user fees which will enable the facility to be sustainable. It is expected that the group should address the sustainability issues concerned with the running of the project. There are also some other vulnerable groups like the old, widows and widowers and disabled.

3.2.10 Socialization and Gender Issues

There are several cases of early marriages probably associated with high poverty rates among the society members. There are several reported cases of domestic violence hence marriage instability that occur partly as a result of water inadequacy. Sautiya Wanawake- Kishushe Chapter are fighting against Gender Based Violence (GBV). Illicit brews are equally rampant in the area, but the area Chief is working round the clock to fight against the practice.

Gender roles are not properly defined. In the few groups that exist, it was observed that, leadership is a preserve for men. Women seem to be overloaded with almost all domestic chores. Illicit brews are rampant in the areas which the area chief is busy fighting against.

The presence of idle youths is worrying. There are no industries in Kishushe to employ the youth. The few in bodaboda industry waste away their income to illicit brews. The iron ore mining seems not to benefit the locals. The mineral is transported to Mombasa and exported. To create employment to the youth, iron ore processing plant can be constructed in Kishushe. There is Tsavoriver in the area. The river which is about 26kms away can be abstracted and water delivered to farmers for irrigation to create a cash crop for economic empowerment.

3.2.11 Social Protection

Social protection has been implemented in Kenya for many years in various forms that include both non-contributory and contributory schemes. The schemes were given impetus in the year 2006 during the African Union Meeting held in Livingstone Zambia and this culminated in the Kenyan Government to formulate a National Social Protection framework. The Kenyan Government started implementing cash transfer program in 2004 targeting orphans and vulnerable children by giving out a stipend of Kshs 1,500, with the sole purpose of poverty reduction and hence improve livelihood of its citizens.

In 2007, the Government of Kenya introduced cash transfer program for older persons in 5 Districts namely; Busia, Nyando, Thika, Murang'a and Kilifi. The program proved successful and in 2009 it was rolled out in 47 Districts. Taita Taveta District targeted four Locations namely; Marungu, Mwanda, Maktau, Kimorigoin Voi, Taita, Mwatate and Taveta Divisions respectively where a total of 750 vulnerable people were reached. Currently the State Department of Social Protection is implementing four cash transfer program namely; Older Persons Cash Transfer (OPCT); Orphans and Vulnerable Children Transfer (OV-CT); People With WevereDisability (PWSD) and People Living With Albinism. All these are geared towards empowering the vulnerable people to cope with economic, social and natural risks. Kishushe Sub-location has beneficiaries of cash transfer program who are composed of older persons, orphans and people with severe disabilities.

The social risks the Mukuru Dam may cause to the Kishushe community are; water borne diseases, human wildlife conflicts, human conflicts and drowning of people into the dam. To fore stall the social risks the proponent must come up with risk management guidelines which will serve as a shield against all social risks.

3.3 HYDROLOGY

3.3.1 Surface Water

Generally there is very poor surface water formation in the area. There are no rivers in Kishushe sub-location. People depend on the piped water from Kisheni Dam piped water and Daku seasonal stream which is often are unreliable. The catchment area for the Mkuru gulley is estimated at 250 km². Water from as far as Mwanda and Mghange hills, flow into Mukuru water way. It is this water that is used mainly for livestock watering.

3.3.2 Ground Water Sources

The area has poor down ward percolation of rainfall or river water into aquifer. The infiltration rate is low due to the presence of aquiclude (such as clay) making recharge into aquifer low. Existing bore holes have low yield less than 5m³/h at a minimum depth of 200m. The water quality from the existing boreholes is not fit for both

domestic, livestock and crop watering as the level of mineral contents don't meet the required WHO standards.

There have been some efforts by some international development agencies, government ministries, and Non Governmental Organizations who have tried exploiting ground water sources. These include Danish International Development Agency (DANIDA), Plan Internal, National Water Cooperation, Member of Parliament Constituency Development Fund (CDF). They constructed two boreholes Kisima and Paranga bore holes. The former is not operational. There are two water springs in Daku and Mwasinenyi. They are both seasonal.

3.3.3 Other Sources

Other sources of water are from rainwater harvested from roof catchments and diverted into storage tanks. There is a regular supply of domestic water by the County Government of Taita Taveta through water boozers. The cost of providing all households with tanks of reasonable capacity is too high for the residents, considering that most of them live below the poverty line.



The dam construction site is on the top right side of this photo which is within the Mkuru water way as shown by the bushes that run along



The main type of acacia trees that dominate the landscape of the proposed site. Below are also the common grass and herbs at the site

3.4 WATER DEMAND AND APPLICATION

3.4.1 Consumer Projections

- The project target population is 2,000 persons within an area of 5 kms².
- Dam capacity is 40,000m³.

Water Demand

- ❖ Dam Capacity is estimated by the formula $V = \frac{1}{2} \times (H \times L \times W) = \frac{1}{2} \times 5 \times 90 \times 180 = 40,000\text{M}^3$.
- Indigenous cows = 3,000
- Shoats = 1,000
 - ✓ Total water demand for livestock unit;
 - ✓ Indigenous cows- $3,000 \times (50/3) = 50,000\text{litres/day}$.
 - ✓ Shouts- $1000 \times (50/15) = 3,340 \text{ litres/day}$.
 - ✓ Human population- $2000 \times (50) = 100,000\text{litres/ day}$
 - ✓ Hence total water demand per livestock unit is; $50,000 + 3,340 = 53,340$ litres/day
 - ✓ Total water demand per month, = $53,340 \text{ litre/day} \times 30 \text{ days}$
= $1,600,200 \text{ litres per month}$
= $1,600\text{M}^3/ \text{month}$
- Total water demand for human per month = $3000 \text{ M}^3/ \text{month}$
 - ✓ Total: $1600 + 3000 = 4600 \text{ M}^3/ \text{month}$
 - ✓ Total dam volume = $40,000\text{m}^3$
 - ✓ To determine the number of months in which water will be stored in the dam;
 - ✓ $40,000\text{m}^3/4600\text{m}^3/\text{month} = 8.7 \text{ months}$
 - ✓ Approximately 8 months due to evaporation losses

3.4.2 Design Period.

The design period is 25yrs with regular maintenance.

CHAPTER FOUR

4.0 PROJECT DESCRIPTION

4.1 NATURE, DESIGN AND DESCRIPTION OF THE PROJECT

The Dam is designed in accordance with the 2015 second edition of the "Practice Manual for Small Dams, Pans and other Water Conservation Structures In Kenya". The project will involve construction of a concrete 50m long, 5m high, 5.5m wide base and 1m wide crest dam wall across the end point of Mkuru water way. On both ends of the dam wall will be wing walls. This generally will be improved reconstruction of a destroyed dam that had been washed away. The dam will be recharged by the water from Mkuru water way that collects water from Mwanda and Mghange hills with an approximately 250m² of catchment. A cattle trough will be constructed at an appropriate position outside the dam area. The dam will be fenced to avoid unwanted entry into the dam area and more importantly avoidance of accidents. The main use of the water harnessed will be for livestock watering.

The failure of the previous dam was caused by piping through the pervious foundation consisting of deposited silt soil. To overcome this failure, four aspects have been incorporated in the design as follows;

- 1) The construction material shall be of concrete instead of earth.
- 2) Cutoff walls shall be included in the foundation to the bed rock at the heel and at the toe to eliminate the piping under the dam.
- 3) Wing walls at the banks shall also be constructed to prevent erosion around the structure.
- 4) An apron at the toe to prevent erosion at the toe from turbulent overflow during floods which leads to undermining of the structure.

4.2 SAFETY FACTORS OF THE DAM

- a) The dam is safe against overturning by a factor of 4.3 higher than the allowable minimum of 1.5 (stabilizing moments against overturning moments)
- b) The dam is safe against sliding at a factor of 1.38 higher than the allowable minimum of 1.3 (stabilizing forces against sliding forces)
- c) The dam is safe against foundation failure. Stress in foundation is 77.195KN/M² against the allowable maximum of 500 KN/M²
- d) Maximum flow over the dam in times of peak flow will have an overflow height of 1.43m, therefore the minimum available overflow height should be 2.2m. The site allows 3m overflow.
- e) The dam also incorporates wing walls and an apron with a hydraulic jump on riprap to prevent damage to the banks and the bed by the storm flow.

4.3 DAM CLASSIFICATION

Table 4: Classification of Dams

Class	Max. Depth of Water at NWL (M)	Impoundment at NWL (M ³)	Catchment Area (Km ²)
A (low hazard)	0 – 4.99	< 100,000	< 100
B (medium hazard)	5 – 14.99	100,000 – 1,000,000	100 – 1,000
C (high hazard)	>15	>1,000,000	>1,000

NB: NWL means Normal Water Level

Mkuru dam falls in the category “B” i.e. a **MEDIUM HAZARD DAM** from the following criteria;

1. Maximum depth of water at NWL is 5m
2. Impoundment at NWL is 40,000m²
3. Catchment area of 250 km².

4.4 SITTING/POSITIONING OF THE DAM

The dam is located in Kishushe Sub Location, Wumingu/Kishushe Ward in Taita Sub County of Taita Taveta County. It will be a suitable site because it is in a depression where there already exists a broken dam contracted previously by National Water Cooperation. Harnessed water is from the Mkuru water way that harvest water from Mwanda and Mghange hills beyond Kishushe sub location. The site offers the following conducive parameters for dam construction;-

- a) A Ravine of width approx. 100m
- b) A bed rock for the foundation, at 3.3m below the Ravine bed
- c) A total height of 8m from the bed of the Ravine to the top of the banks
- d) A favorable height of dam of 5m with a possible overflow height of 3m.
- e) A storage area of 40,000m³ with a throw back of 180m. The storage can last for 8 months.
- f) A catchment area of approximately 250km².
- g) A peak flood flow of 150m³

4.5 MAJOR PROJECT PARTS

- 1) The possible dam capacity will be 40,000m³.
- 2) Mobilization- Mobilization to and from site of all necessary equipment and machinery
- 3) Excavation of 642m³, 2,198m³, 2,4m³ of soil for the foundation construction of the dam wall (Coltrane), wing walls, and cattle trough respectively.
- 4) A masonry works of a 50m long, 5m high, 5.5m wide base and 1m wide crest dam wall across the end point of Mkuru water way
- 5) Concrete wing walls on both ends of the dam wall

- 6) A cattle trough constructed on the lower side adjacent to the dam that livestock will access it through a cleared path into it.
- 7) A 400m longfence erected round the dam.

4.6 DESCRIPTION OF CONSTRUCTION WORKS/ACTIVITIES

Construction works will be done under the supervision of the Department of Water and Department Livestock who will ensure the following;-

4.6.1 Construction of Concrete Dam Wall

- 1) Mobilization- Mobilization to and from site of all necessary equipment and machinery
- 2) Excavation and earthworks-To include for all trimming to levels, backfilling with approved selected soil, compacting, disposal of surplus material and reinstatement. Excavation in gully foundation trenches
- 3) Concrete works
 - a) Placement of class 20/20 concrete [1:2:4] in foundation trenches to form 400mm cutoff walls reinforced in Y12 bars at 200mm c/c both directions (m.s.).
 - b) Placement of class 20/20 concrete [1:2:4] to form 400mm apron bedding reinforced in Y12 bars at 200mm c/c both directions (m.s.).
 - c) Placement of concrete [1:2:4] mix with rough stones (m.s.) from Taveta at the ratio of 6:4 (concrete: rough stones) to form weir body.
- 4) Rough stones- Placement of rough stones the type found in Taveta (Igneous rocks) and mixed with concrete (m.s.) at the ratio of 6:4 (concrete : rough stones) in the weir body
- 5) Formwork
 - a) Formwork to sides of footing (cutoff) walling.
 - b) Formwork to sides of weir body and apron.
- 6) Riprap- Provision of a riprap to the downstream of apron in minimum 500mm diameter boulders of the type found in Taveta
- 7) Pipework
 - a) Placement of 100mm diameter PVC class E pipe with sluice valve for draw off at 500mm above the bottom of weir
 - b) Placement of 150mm GI pipe fitted with sluice valve for washout
- 8) Reinforcement- With Y12 bars

4.6.2 Retaining Wall for Wing Walls -Total Length 108 M

- 1) Excavation and earthworks
 - a) To include for all trimming to levels, backfilling with approved selected soil, compacting, disposal of surplus material and reinstatement.
 - b) Excavation in river bed foundation trench to reduced levels not exceeding 1.5 m deep.
 - c) Infill with approved selected material in between wings and banks
- 2) Concrete works
 - a) Construction of 300mm grade 20/20 in walling
 - b) Construction of 450mm grade 20/20 concrete to base

- 3) Formwork- to receive walling concrete.
- 4) Reinforcement
 - a) With Y16 bars as per drawing
 - b) With Y12 bars as per drawing
 - c) With Y20 bars as per drawing

4.6.3 Construction of the Cattle Trough

- 1) Excavation and earthworks-
 - a) To include for all trimming to levels, backfilling with approved selected soil, compacting, disposal of surplus material and reinstatement. Excavation in gully foundation trenches
 - b) Excavation of 2.4 m³ of soil
- 2) Inlet system- Construction of an inlet system with a regulator
- 3) Riprap around trough- Construction of a 5m² cattle trough

4.6.4 Fencing

- 1) Treated posts- 400 post to be used
- 2) Excavation of holes- 400 holes for the post insertion firmed with concrete
- 3) Barbed wire- 4,000m to be fixed on the posts



Part of the Mkuru water way at the point of the dam construction site. The back ground leads the water downstream into ranch land and Tsavo National Park.



The Social Services Coordinator-Mr. Mbui, ESIA Lead Expert- Mr. Quentin and Irrigation Engineer Mr. Musyimi standing before the previous destroyed dam wall

4.7 INPUTS

a) Capital

It is assumed that the proponent has set aside adequate finances to enable timely implementation of the project. The estimated cost of the project is KSHS.35,558,355 with an addition 10% of the total cost to be contributed by the County Government of Taita Taveta.

Table 5: Project Budget

Item	Description	Cost
1.	Concrete Dam Wall	19,047,700
2.	Retaining Wall for Wing Walls	7,668,240
3.	Construction of the Cattle Trough	83,550
4.	Fencing	1,200,000
5.	SUB-TOTAL	27,999,490
	Add 10% contingencies	2,799,949
	Add 5% supervision costs	1,399,975
	TOTAL	32,199,41
Total for civil works		33,589,414
Capacity building of beneficiaries @ 5%, ESIA @ 5% of total costs, Community contribution:		1,968,941
Total KCSAP grant applied for:		35,558,355

b) Tools and Equipments

The proponent is expected to tender for construction from the public through an open tender. The contractor who will win the tender is thus expected to provide all the machines. The following equipments/machinery are expected to be used among others:-

Table 6: Equipments and Machinery to be Used

Equipment/Machinery	Function
Excavator	Borrow excavation and loading materials into tippers
Tippers	Movement of earth and other materials to various areas
Dam Scoops	Borrow excavation and placement
Rollers	Compaction
Grader	Leveling and trimming soil and construction materials
Water bowser	Water application to construction materials and dusty soil
Mixer	Mixing concrete materials
Tractor	Moving heavy and amorphous materials, containers with water, fuel etc
Vibrator	Releasing trapped air to consolidate wet concrete

c) Labor

All the technical labor (plant operators) is expected to be provided by the contractor. In case of a need for manual work like bush clearing, the contractor is expected to provide for through employment of casual laborers.

d) Construction Raw Materials

These include soil, cement, stones, sand, ballast, crushed rock (gravel), pitching stones, reinforcement steel bars, UPVC pipes, et al. all these materials will be obtained from authorized dealers(if not naturally available from the site) and in particular, those that

have complied with Environmental Management guidelines and practices. These materials will be used singly or in combination.

e) Water

Moderate volumes of water will be required in constructing the dam wall, wing walls, cattle trough and domestic water access point using concrete. It will be sourced from the nearby water source without constraining the supply.

F) By-Products and Waste Generated

During construction and operation of the dam, the following products or by-products will be generated;

- 1) Packaging materials like carton boxes, plastic bags, cement bags, styrofoam packaging materials, oil/water/chemicals Jeri cans, cans among others
- 2) Excess top soil from excavation that may also be contaminated
- 3) Excess material supplied i.e. steel bars, cement, sand, wood, stakes, nails etc

Such by-products and waste generated are an environmental concern thus can be directed to undergo either recycling, re-use or proper placement or disposal.

4.8 DESCRIPTION OF ACTIVITIES DURING OPERATION/USE

The main use activities during operation and use of the dam can be put into the following groups;

4.8.1 Access by Livestock to Drinking Trough

The main objective of the dam is to provide water to livestock. Animals from within Kishushe Sub-location and neighboring villages and locations will be herded into the dam area. They are expected to access this area through a designated animal route and drink from the constructed animal water trough beyond the fenced area of the dam. No animal is expected to access water directly from the dam reservoir.

4.8.2 Access by Community for Domestic Water

During dry season or drying of taps/boreholes/other domestic water sources, it is expected that the community may intend to collect water from the dam using water Jeri cans or other water containers. This is not part of the projects component, even from the fact that the dam is located away from the human settlement of the Kishushe community. However, this may occur during adverse conditions as stated above. This can be a social impact concern in terms of risks of accidents of drowning. The erected fence is expected to mitigate against this and a consideration of a domestic water drawing point is advised to be constructed to cater for this once in a while need.

4.8.3 Dam Operations and Maintenance

The dam management committee will be charged with operating and maintaining the dam to ensure safe and sustainable operations of the dam. They will be performing routine checks in liaison with the department of water and irrigation.

4.9 DESCRIPTION OF DECOMMISSIONING PLAN

The three decommissioning possible scenarios are as follows:-

4.9.1 Donation or Transfer of the Dam for a Different Use

At the end of the lifetime or even before completion of such time of the dam, it may be put to a different use other than the intended. An ESIA shall be conducted to assess its suitability for the new use. Important element of this study should be the water quality and site location of the dam such that, measures to make these two elements suitable for the new use should be at the fore front to enable approval of its use before implementation

4.9.2 Transfer of Management

When the dam was constructed in the two instances by the National Water Cooperation, it was managed by a dam management committee which was a sub group of the Mkuru Dam Self Help group. In the event the dam management is transferred to a new owner/committee/self-help group or any entity, the new management entity shall assume all responsibilities associated with dam management and operation. The new entity shall be expected to adhere to the Environment and Social Management Plan (ESMP) and any issues arose in the ESIA report.

4.9.3 Abandonment of the Dam

Abandonment of the dam may arise due to among other factors such as structure failure, group/committee/community disagreements, dam over-siltation, safety issues, low water volumes due to drought, etc. An abandonment case shall comply with Section 41 of the Water Act. 2002. The Water Resource Authority (WRA) may direct the permit holder of the dam to remove, within such time as it may specify, all or any works erected in connection with the permit failure to which the WRA will do so but at the cost paid by the permit holder.

CHAPTER 5

5.0 SCOPING OF POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

5.1 SCOPING MATRIX

The ESIA team held 5 public Barazas, Focused Group Discussions (FGD) and Key Informant Interview (KII) among other data collection tools used to seek views of the beneficiaries on the construction of the Dam. Several field study visits were also conducted by the team.

Table 7: Scoping Matrix for Potential Environmental Impacts

Parameters	Components	Construction & Decommissioning Phases		Operation Phase	
		Positive	Negative	Positive	Negative
Atmosphere	Dust and atmospheric status		X		
Land	Vegetation cover/Biodiversity		X		X
	Soil status		X		X
	Catchment			X	
	Human and animal road traffic and infrastructure				X
Water	Water course		X		
	Source of water for the community			X	
	Surface flood water destruction control			X	
Aesthetic environment	Aesthetic/visual intrusion			X	
Public health and dangers	Water borne diseases				X
	Drowning				X
	Waste disposal and contamination by animal waste				X
	Water borne diseases i.e. typhoid and diarrhea			X	
	Water borne disease- malaria and amoebiosis				X
	Noise pollution		X		
Social-Economic	Livestock-crop conflict				X
	Development of animal production			X	
	Asset/land ownership conflict				X
	Employment status, Household incomes			X	
	Literacy levels			X	
	Communal leaving and cross cultural relations,			X	
	Water related conflicts			X	
	Vulnerable groups,			X	
	Local trade and industry.			X	
	Rural morality				X
	Social diseases i.e. HIV/AIDs				X
Outsiders/strangers accessing the dam				X	

5.2 SCOPING RESULTS

The following are summary of identified environment and social aspects of which the project could have significant impacts.

5.2.1 Potential Positive Impacts

A. During Construction

- 1) Local business boost
- 2) Employment opportunities,
- 3) Job-skills acquisition

B. During Operations

- 1) Surface water destruction control- erosion
- 2) Reliable source of livestock water for the community,
- 3) Catchment protection and conservation of environment,
- 4) Nutritional status improvement,
- 5) Water borne diseases i.e. typhoid and diarrhea reduction,
- 6) Employment opportunities,
- 7) Household incomes increased,
- 8) Literacy levels improvement,
- 9) Communal leaving and cross cultural relations,
- 10) Water related conflicts reduction,
- 11) Vulnerable groups inclusion,
- 12) Local trade and industry boost.
- 13) Micro climate modification
- 14) Aquatic and non-aquatic biodiversity expansion

C. During Decommissioning

- 1) Donation or transfer of the dam for a different use- No construction of a new dam
- 2) Transfer of management- Sustained management of the dam
- 3) Abandonment and demolition of the dam;-
 - a) Job creation
 - b) Improved run-off down stream

5.2.2 Potential Negative Impacts

A. During Construction

- 1) Dust emission
- 2) Vibration and noise pollution
- 3) Vegetation cover and biodiversity loss
- 4) Natural water course deviation
- 5) Accidents during construction
- 6) Ownership conflict
- 7) Soil and water contamination by waste/chemicals/oils

B. During Operations

- 1) Water borne disease- malaria and amoebiosis
- 2) Soil and water contamination by waste/chemical
- 3) Danger of drowning
- 4) Livestock/ crop conflict
- 5) Rural morality decay
- 6) Social diseases i.e. HIV/AIDs increase
- 7) Outsiders/strangers accessing the dam
- 8) Increase on human and animal road traffic
- 9) Structural failure

C. During Decommissioning

- 1) Donation or transfer of the dam for a different use- Incompatibility of the intended new use with the dam structure and frame work.
- 2) Transfer of management
 - a) Inexperienced new management resulting to miss-management
 - b) Different intentions of the dam other than conserving it
- 3) Abandonment and demolition of the dam;-
 - a) Generation of wastes
 - b) Loss all positive impacts associated with existence of the dam i.e. source of livestock water, micro-catchment improvement etc.
 - c) Land use change

5.2.3 Mitigation Measures

A. During Construction

- 1) Acquiring/signing all necessary legal documents with the community and the relevant authorities.
- 2) Community awareness of the project
- 3) Establishment of project management committee
- 4) Occupational Safety and Health Administration (OSHA)
- 5) Establishment of a materials storage to avoid accidental spills and littering
- 6) Minimal destruction of vegetation (especially indigenous) and habitats for fauna.
- 7) Solid waste management i.e. stones and debris
- 8) Waste water management i.e. discharge of construction water
- 9) Erosion control
- 10) Control of noise and air pollution
- 11) Sanitation- construction abolition blocks at safe distance from the dam
- 12) Site restoration
- 13) Environmental emergency procedures
- 14) Spillway/dam overflow mechanism to ensure that water flows back to its original course
- 15) Demobilization after construction

B. During Operations

- 1) Establishment of a tree nursery
- 2) Planting of trees
- 3) Erosion control
- 4) Community sensitization and awareness creation.
- 5) Installation of environmental friendly technologies
- 6) Establish adam management committee.
- 7) Sanitation sensitization and use of the constructed abolition blocks
- 8) Fencing off the dam
- 9) Monitoring and maintenance plan

C. During Decommissioning

- 1) Donation or transfer of the dam for a different use:- ESIA sturdy for the intended new use.
- 2) Transfer of management:-
 - a) Copies of ESIA and all relevant environmental project reports and correspondence made available to the new management
 - b) Adherence to ESMP and NEMA correspondence recommendation.
- 3) Abandonment and demolition of the dam;-
 - a) Proper disposal of waste
 - b) Evaluation of best land use option through ESIA

CHAPTER 6

6.0 ANALYSIS OF ANTICIPATED IMPACTS

6.1 ANALYSIS OF POSITIVE ENVIRONMENTAL IMPACTS

6.1.1 Reliable Source of Livestock Water

Water is one of the most limiting resources in the area. The dam will provide a readily available and convenient source of water for livestock production and even domestic use especially during dry season. The proposed water trough for livestock will give an alternative watering point and hence the animals will not be trekking for long distances to other seasonal water sources.

6.1.2 Catchment Protection and Conservation of Environment

To reduce siltation of the dam the proponent is expected to introduce a water catchment protection around the dam. This is an environmental conservation component. The proponent should mobilize the farmers to plant trees raised in the nursery on their farms and around the water dam to increase vegetation cover and reduce soil erosion. The trees in the nursery should include indigenous varieties that can withstand the climatic conditions of the project area. The catchment will improve the scenery and the natural beauty of the project area.

6.1.3 Aquatic and Non-aquatic Biodiversity Expansion

Presence of large water body like the dam in the area will offer opportunity to introduction of new aquatic species like fish that are of economic value. Introduction of mosquito larvae eating fish like the *common carp* to control malaria and *tilapia* can create a new fishing economy apart from improving the nutritional diversity and levels in the area. Crops and animal species requiring higher amounts of water intake i.e. tissue culture bananas, horticultural vegetables and zero grazing animals i.e. dairy cows can now be reared with the existence of the dam.

6.1.4 Surface Flood Water Destruction Control

By harnessing water along the Mkuru natural water way, the project will have reduced the amount of water in the waterway hence reduced the destructive hydro energy building downstream and the catchment at large. As a result, less destruction from this water in terms of erosion, plucking or felling trees and creation of gullies.

6.1.5 Food Security and Nutritional Improvement

The main goal of constructing the dam is harnessing water for livestock production. Kishushe sub location and particularly Kanyaga village is in a semi-arid region whose crop production is rain fed. The annual rainfall is very low- less than 500mm hence beef livestock keeping is a major economic activity. Clearly water is a major constraint in livestock production. The water harnessed will supplement the low amounts of

rainfall. It is expected to impact positively on livestock production hence food security.

6.1.6 Water Borne Diseases i.e. Typhoid, Cholera and Diarrhea Reduction

Some water diseases like typhoid, amoboeasis, cholera and diarrhea are related to low availability of amounts of water in the community i.e. low sanitation levels. This is may be due to things like utensils, raw consumed foods like fruits and salads that are not cleaned well before utilization. The project will make available enough water to improve sanitation levels in the village.

6.1.7 Employment Opportunities

During construction phase of the project, there will be required skilled and unskilled workers who are expected to be sourced locally. Further, the dam is expected to expand economic activities in the area such as increase in the stock size and land under cultivation, creation of middlemen to trade the livestock and agricultural produce, transporters of produce to the markets etc. Important is the creation of self-employment through enhanced livestock and agricultural activities around the dam. Employment during construction should consider the youth, women and the vulnerable groups

6.1.8 On-Job Skills Acquisition

First priority of sourcing for artisans and workers will be given to local population. Some will have already undergone training while others will be trained on-job. The latter group will acquire skills and remain back in the local population. It will be a positive boost to the community as the same can now attend to small projects and even offer a higher employment chance beyond Kishushesub-location.

6.1.9 Local Business Boost

During construction of the dam, the engineers will seek for materials from the nearest outlets which are located around Kishusheand Parangaat large. This will boost business in the area. New business outlets/opportunities may emerge i.e. supply of formwork materials like support trappers, timber works, water etc. The dam is expected to boost livestock business. Excess products from these industries are expected to feature in both the local and regional markets. As a result, trading in the area is expected to be boosted.

6.1.10 Household Incomes Increased

With the increase of trade and commerce around the dam as indicated above, profits emanating from the business created will go a long way in increasing the incomes of the household of KishusheSub-Location. New types of business are expected to be created along value chains of livestock production.

6.1.11 Literacy Levels Improvement

One of the challenges in the area is low levels of literacy. The social impact survey done during ESIA scoping exercise reveal that low incomes from their economic livelihood activities i.e. subsistence farming and free range livestock keeping has contributed to inability to send their children to school. Dynamically, some of the children do not go to school just to attend to house hold chores on the part of the girl child while tending to animals on the part of the boy child. With the expected increase in house hold incomes from improved livestock keeping activities, parents will be able afford school uniform, shoes, transport means, lunch etc to send their children to school. One of the activities expected to be part of the project is the sensitization aspects on different topics and areas i.e. public health, agriculture and commerce. This is also part of upgrading the community education on social economic matters.

6.1.12 Communal Leaving and Cross Cultural Relations,

Sharing of a big, essential and common resource like a dam by over 4,000 residents will improve their social bound. Business men and general public from Paranga, Mulilo and other areas like Werugha, Mwanda, and Wundanyi are bound to come knocking doors in the business created in Kishushe as result of the dam construction. KishusheSub location is a livestock zone whose animals are raised in a free range. Thus there will be a cross cultural relation of people in the village and will automatically live communally for these commerce to thrive.

6.1.13 Water Related Conflicts Reduction

There have been very few reported serious cases of water related conflicts in the village. However, it is reported during the community participation stage that there has been growing tension over the few livestock drinking sources of water may develop into water related conflict. During dry season, the Kishushe community goes sourcing water for their livestock from villages from gullies located over 5kms away or from the two water springs in Daku and Mwasinenyi. Some herders bring into these small water sources, large numbers of livestock that compete with the human water/domestic water demand and further dirtying the water with animal droppings. Even though the community get their domestic water from taps that source their water from Kishenyi dam in Werugha Ward, during dry seasons, taps run dry hence are to source from two boreholes;- Kisima and Paranga bole holes. The former is not operational. This competition between humans and animals for the scarce water may develop into conflict between farmers against livestock herders. The dam is expected to improve quantities of water in the village and atleast ease such tension.

6.1.14 Vulnerable Groups Inclusion

The MkuruSHG and the community can resort in allocating some resources or running of small projects like tree nursery to vulnerable groups like the old and disable. Improved livelihood in the community will allow it leave in harmony with such vulnerable. Further, sensitization on gender equity by proponents and other change argents will be a clarion to inclusion of the vulnerable groups into the social day to day activities in the community.

6.1.15 Micro-climate Modification

From the existence of a large water body in the area, amount of water evaporated into the atmosphere will increase the relative humidity especially considering the high average temperatures (32°C) of the area. Part of the dam impacts is promoting increase in vegetation cover through tree planting. Therefore the area around the dam will become humid with average temperatures slightly lower than areas far from the dam to the advantage of the surrounding vegetation.

6.1.16 Positive Impacts During Decommissioning

During decommissioning of the dam, if it will be a case of donating or transfer of the dam for a different use it will offer an opportunity of not constructing a new dam. Thus resources for the same will have been saved. If it will involve transfer of management, it will offer a continuous and sustained management of the dam such that the dam won't be left unattended at any time. On the other hand, decommissioning involving abandonment and demolition of the dam will offer job opportunities to the local. In the same vein, after the dam has been demolished, it will improve run-off downstream and also improve the aesthetic value of the local scenario through rehabilitation of the dam site.

6.2 ANALYSIS OF POTENTIAL NEGATIVE IMPACTS

6.2.1 Dust Pollution

During excavation activities around the damsite and the subsequent spreading and compaction of the soil, a lot of dust will be raised. Dust created will be a hazardous to workers in construction site. Dust masks to workers at the dam should be provided. They should also sprinkle water on the soil during the spreading and compaction to reduce the amount of dust generated. Dust screens can be put up around the dam area.

6.2.2 Vibration and Noise Pollution

Noise is a major negative impact during any construction activity due to its nuisance and difficulty in mitigating. However, this will be at a minimal impact level as the dam project is located off from human settlement. In this project noise will emanate from use of machinery and vehicles that will be shipping materials in and out of the

project area. The National Environmental Management Authority (NEMA) standard for noise emissions from construction equipment prohibits vibration exceeding 0.5cm/sec beyond and source property boundary or 30m from any moving source. The maximum noise level permitted (Leq) as measured from within the construction facility is 75dBA for day and 65dBA for night. The accepted range of noise that a normal human being can withstand is gauged at 80dBA. This impact is moderately high during construction. The contractor can mitigate this through ensuring regular and continuous use of well maintained equipment and machinery that produces noise of accepted range. Workers should practice Occupational Safety and Health Administration (OSHA) by wearing ear plugs in cases of operating machines producing sound beyond the Leq limits i.e. hard rock drilling. The contractor should also restrict noisy construction activities within 8am-5pm. He/she should also inform the community of this impact and request of their tolerance well before working hours. Engines should be shut off when not in operational and avoid unnecessary hooting.

6.2.3 Vegetative Cover and Biodiversity Loss

During the construction of the dam, an area equivalent to 200m² will be cleared off vegetation to pave way for site store and office, equipment routes and storage of other materials like stones blocks. This however will have minimal negative impact on biodiversity as there are no established endangered plant species in the project area that are unique to the site. In general the cleared trees, bushes and grasses will contribute to loss in vegetation cover. There could be some species of fauna such as minute insects or fauna i.e. grasses or small plants that contribute to the total biodiversity mix. The contractor should avoid as much as possible cutting down trees and clearing bushes unnecessarily to preserve habitats to fauna and vegetation cover. The cleared trees and bushes can be recycled into construction of a tree nursery structures such as nursery beds and shades. In the same vein, the project should contribute to improvement of vegetation cover in the adjacent areas and farms by establishing a tree nursery and promoting agro-forestry. The project should endeavor to establish trees that are tolerant to the local conditions and other indigenous species. The dam management committee in this case Mkuru dam SHG should be trained on tree establishment and management on the farm the catchment to ensure their survival after transplanting. There is also a community training component within the project that will improve farmers' skills. A buffer zone can be established around the dam planted with grasses and trees.

6.2.4 Habitat Loss

Trees, bushes, grass, soil structure are home to flora and fauna of different species. Clearing of bushes and excavation of soil during construction may expose fauna such as termites and earth worms that build their homes in the soil. The contractor should therefore avoid unnecessary clearing of trees and bushes and excavation of areas that

construction won't take place. He should strive to restore the site after construction to give room for animals to re-establish their habitats.

6.2.5 Water Borne Disease

The water body created will act as a breeding ground for mosquitoes which are the vectors of malaria. For any household near the dam i.e. at radius of 2km, it is prudent to make sure that they do not get infected by the disease. This is by putting up mitigation measures such as creating awareness and campaigns on malaria prevention and provision of mosquito nets. The Public Health Department through the Kishushe dispensary should take measures of enhanced provision of free mosquito nets to the community and other measures towards control of malaria. The other potential disease is amoebiasis as there is a likelihood of the community using the water for domestic and drinking purposes. The community should be sensitized on water treatments e.g. boiling it to reduce risk of infection. The proponent should also consider Introduction of mosquito larvae eating fish species like the *common carp*.

6.2.6 Natural Water Course Deviation

The project entails harnessing water from the Mkuru water from a catchment of size 250m² during the rainy season. This will capture a very large percentage of the total surface run-off and hence will have impact for the community down slope. In fact, during the field study, farmers in the vicinity of the dam site which is on a lower point than the rest of the surrounding farms, attested to experiencing large volumes of water flowing in the water way during wet season. It is therefore obligatory to have in place a proper outflow mechanism (spillway or topping/overflow) whose discharge does not cause soil erosion in the adjacent areas, to ensure the overflow water is returned to the original course to serve ranching community downstream. A proposal can also be put forth to the adjacent farms along the Mkuru water way to construct soil and water conservation structures such as retention ditches so as avoid soil fertility loss and siltation of the dam.

6.2.7 Soil and Water Contamination by Waste/Chemical/Fertilizer

At construction stage, machinery and plant may have leakages which result to oil and fuel spills either accidentally or even out of maintenance negligence. Soil contamination may also emanate from poorly disposed chemical containers and unmanaged waste receptacles. Contaminated soil cannot be used for crop production. Manure and chemical residues from the increased livestock activities within the feed lots around the dam are also point and non-point sources of pollution to land and water. During wet season rain water may leach down into ground water while on the other hand surface flow may carry these contaminants into bodies of water. Eutrophication and contaminated water related diseases like lead poisoning and blue babies may occur. The contractor will mitigate by proper disposal of chemical containers and proper maintenance of machinery and plant. The site engineer should

identify the specific location for disposing the contaminated soil, prompt site clearance, avoid stock piling at the site, and monitor areas of exposed soil especially during wet season. Soil from the excavation can be used to construct the embankment and the rest used for landscaping. On the other hand, livestock farmers through livestock and agricultural extension officers should be trained on safe use of chemicals and pesticides, animal nutrition, Integrated Pest Management (IPM), and soil and water conservation. The Department of Physical planning can consider securing a managed damp site.

6.2.8 Accidents During Construction

During the construction phase, due to workers use and operation of machinery/plant and interaction between workers and materials and normal movement of the staff and materials etc, accidents are bound to happen. The site Engineer should design and practice Occupational Safety and Health Administration (OSHA). All workers should adhere to this plan to the later. All workers on site should wear protective gear like safety helmet, gloves, safety boots, reflector jackets etc. In case of any accident any accidents, proper procedure for each case i.e. first aid procedures, should be followed to save lives and avoid further recurrence of such accidents.

6.2.9 Danger of Drowning

This is a real hazard associated with the Dam. Children are the most vulnerable to drowning if they resort to drawing water directly from the dam. The proponent has to undertake fencing of the dam to mitigate this hazard. A strategic gate should be located and kept under lock and key by the dam management committee for access into the dam during maintenance. Water should be piped out from the draw-off tower to a watering point where the community can access the water instead of drawing it directly from the dam. This also applies to livestock who are expected to consume water from a constructed water trough. Before construction of the dam, animals used to go into the dam from any side and destruct the dam walls through trampling and soil erosion and further endangering them to drown. The same case applies to community members in accessing domestic water from the dam. A fence will mitigate this impact.

6.2.10 Livestock Crop Conflict

The Kishushe community has fairly diverse types of livestock ranging from cows, sheeps, goats and donkeys. Construction of the dam will increase the size of animal traffic into the dam area. It is therefore possible for animals left un-attended to stray into farmer's plots and damage or graze on the crops. This may generate conflicts between livestock herders and crop farmers. To avoid this conflict, proper animal routes into the dam area and correct placement of the livestock water trough beside the dam is crucial. Grazing/browsing of livestock around the dam area should be avoided. The livestock department should promote environmental technologies i.e.

zero grazing. The area chief assistance should be sought in enforcing and solving these conflicts.

6.2.11 Asset Ownership Conflict

Due to the land being public one, while the community at large will be expected to access and use the dam, a conflict may arise on the use of this resource. The proponent should spearhead a signing of a memorandum of understanding between Mkuru dam management committee and the community where the local leaders can declare the project as a communal project run by the appointed committee. A project management committee should be established to oversee the development of the project during construction phase on behalf of the community. The committee will cease to exist after the dam has been handed to the dam operations management committee to manage it. The committee is expected to charge a very small agreed fee for the dam maintenance. The memorandum should be witnessed by the local administration.

6.2.12 Increase on Human & Animal Road Traffic- Pressure on Local Infrastructure

The construction of the dam will attract people coming from outside the community to utilize the water, especially during the dry season. More people will come from a larger radius beyond Kishushesub location and Wumingu/Kishushe ward to access water for livestock drinking domestic use during dry season. As a result more people will be accessing infrastructure facilities like roads, toilets, dispensaries, etc than the designed capacity putting pressure on such infrastructure facilities. In particular roads will undergo a faster degradation than before the implementation of the project due to the increase in the number of animals using it. This can be mitigated by the proponent in collaboration with the Chiefs and local leaders to informing and educate the community towards embracing these new members of the community. Departments of infrastructure especially the Roads Department should expand narrow roads and paths linked to the dam site. Further, a shorter time for routine maintenance of roads should be put in place.

6.2.13 Rural Morality Decay and Social Diseases

It is expected that the project will stir-up the local economy and thus attract people from different communities or tribes to come do business, trade or even settle in Kishushe village. This may be exacerbated by the iron ore mining commerce associated with trucks and personnel coming in and out of the area. The village may very fast upgrade to a trading center. Along with this will come different cultures and other trades like prostitution that may degrade the social morality of the community. Social diseases like HIV/AIDs, gonorrhoea and syphilis are expected to be on the rise. Public Health department should consider stepping up comprehensive health awareness campaigns. Health facilities should be equipped with drugs and measures against these diseases i.e. distribution of condoms and stocking of ARVs and antibiotics.

6.2.14 Structural Failure

The dam should be surveyed and designed correctly by the irrigation engineer to the required standards. The contractor is expected to construct the dam according to the engineering designs and specifications and follow this to the later without compromising on materials used or structural design. There should be a monitoring and maintenance plan to be implemented during the lifetime of the dam. The dam management committee should be briefed about it and should include an engineer or a technical person as part of the routine monitoring and maintenance activity

6.2.15 Negative Impacts During Decommissioning

- 1) In the case of donation or transfer of the dam for a different use there may be incompatibility of the intended new use with the dam structure and frame work. The dam may not have been designed to be utilized for the new use hence creates a challenge to the user or the dam structure itself. An ESIA study should be conducted to ascertain the impacts of the new use hence propose placement of mitigation measures. Detailed review of the engineering designs should be undertaken.
- 2) Transfer of management option of decommissioning may present challenges of the new owners or managers not having the experience to manage the dam or even have a different intention of utilization of the dam apart from conserving it. The proponent should consider availing to the new management all copies of ESIA and all relevant environmental project reports and correspondence. The new management should strictly adhere to ESMP and NEMA correspondence recommendations.
- 3) When an abandonment and demolition of the dam will be the option for decommissioning, a lot of waste will be generated. A significant number of positive impacts associated with existence of the dam i.e. source of livestock water, micro-catchment improvement etc. will be lost. The dam site will probably be put to a different land use hence disrupting the normal livelihood routine of the community. The proponent is expected to do a proper waste disposal plan and implement it. Through an ESIA study, a proper land use option can be suggested and the ESMP implemented to the later.

6.2.16 Demobilization after Construction

On conclusion of the dam construction phase, the contractor should ensure that unnecessary materials and structures will not be left on the project site. This shall involve demolition of all site offices, site camps, signage, pegs, and any other temporary structures that were erected to facilitate the construction. All wastes in form of metals, plastics and UPVC, stones, etc that will have accumulated during the construction period will also require to be properly disposed off in accordance

toNEMA guidelines. Remains of the excess construction material, tools and machines shall be stored in an environmentally friendly manner for future use.

CHAPTER 7

7.0 RELATING IMPACT TO MITIGATION MEASURES

Table 8: Relating Impacts to Mitigation Measures

Project Phase	Positive Impacts	Activities	Negative impacts	Mitigating measures of negative impacts
Preparation Phase	1) Local business boost 2) Employment opportunities, 3) Job-skills acquisition	Mobilization of equipments and machinery	1) Ownership conflict	1) Acquiring and signing all the necessary legal documents with the community and the relevant authorities. 2) Community awareness of the project 3) Project management committee to oversee construction on behalf of the community
			2) Vibration and noise pollution	1) Community awareness of the project 2) Occupational Health and Safety Administration (OSHA) 3) Control of noise and air pollution i.e. avoid unnecessary hooting 4) Workers operating machines or plants for than 8hrs that produce over 80dBA of sound to wear ear muffs 5) Regular inspection of machines and plant 6) Restrict noisy construction activities within 8am-5pm 7) Inform community request of their tolerance
			3) Dust emission	1) Provision of dust masks to workers 2) Sprinkling of water and compaction dusty spots 3) Dust screen around the dam
			4) Soil and water contamination by waste/chemicals/ oil	1) Maintenance of machinery and plant. 2) Identification of appropriate location for disposing chemicals, their containers and contaminated soil & water. 3) Prompt site clearance, avoiding on-site stock piling, 4) Monitor exposed soil especially during wet season. 5) Establishment of a materials storage to avoid accidental spills and littering 6) Building of abolition blocks

Construction Phase		Site clearing	<ol style="list-style-type: none"> 1) Vegetation cover and biodiversity loss 2) Habitat loss 3) Dust emission 4) Accidents during construction 	<ol style="list-style-type: none"> 1) Minimal destruction of vegetation (especially indigenous) and habitats for fauna 2) Cut trees set for tree nursery construction 3) Establishment of a tree nursery 4) Provision of dust masks to workers 5) Sprinkling of water and compaction dusty spots 6) Dust screen around the dam 7) Community training on biodiversity conservation 8) Re-vegetate /Vegetative buffer zone around the dam 9) Community awareness the project 10) Occupational Health and Safety Administration (OSHA) i.e. signage, first aid kit, etc 11) Workers to wear protective gear i.e. safety boots, safety helmets, reflector jacket etc 12) Establishment of a materials storage to avoid accidental spills and littering 13) Solid waste management i.e. stones and debris 14) Erosion control 15) Site restoration 16) Environmental emergency procedures
			<ol style="list-style-type: none"> 5) Vibration and noise pollution 	<ol style="list-style-type: none"> 1) Community awareness of the project 2) Occupational Health and Safety Administration (OSHA) 3) Control of noise and air pollution i.e. avoid unnecessary hooting 4) Workers operating machines or plants for than 8hrs that produce over 80dBA of sound to wear ear muffs 5) Regular inspection of machines and plant 6) Restrict noisy construction activities within 8am-5pm 7) Inform community request of their tolerance
			Excavation of works	<ol style="list-style-type: none"> 1) Vibration and noise pollution	1) Control of noise and air pollution i.e. avoid unnecessary hooting 2) Workers operating machines or plants for than 8hrs that produce over 80dBA of sound to wear ear muffs 3) Regular inspection of machines and plant 4) Restrict noisy construction activities within 8am-5pm 5) Inform community request of their tolerance

			<ul style="list-style-type: none"> 2) Habitat loss 3) Natural water course deviation 4) Accidents during construction 5) Soil and water contamination by waste/chemicals /oil 	<ul style="list-style-type: none"> 1) Minimal destruction of vegetation (especially indigenous) and habitats for fauna 2) Cut trees set for tree nursery construction 3) Establishment of a tree nursery 4) Community training on biodiversity conservation 5) Re-vegetate /Vegetative buffer zone around the dam 6) Solid waste management i.e. stones and debris 7) Erosion control 8) Site restoration 9) Environmental emergency procedures 10) Occupational Health and Safety Administration (OSHA) i.e. erection of signs, first aid kit, etc 11) Workers to wear protective gear i.e. safety boots, safety helmets, reflector jacket etc 12) Maintenance of machinery and plant. 13) Identification of appropriate location for disposing chemicals, their containers and contaminated soil & water. 14) Prompt site clearance, avoiding on-site stock piling, 15) Monitor exposed soil especially during wet season. 16) Establishment of a materials storage to avoid accidental spills and littering
			6) Dust emission	<ul style="list-style-type: none"> 1) Provision of dust masks to workers 2) Sprinkling of water and compaction dusty spots 3) Dust screen around the dam
		Masonry and concrete works	1) Vibration and noise pollution	<ul style="list-style-type: none"> 1) Control of noise and air pollution i.e. avoid unnecessary hooting 2) Workers operating machines or plants for than 8hrs that produce over 80dBA of sound to wear ear muffs 3) Regular inspection of machines and plant 4) Restrict noisy construction activities within 8am-5pm 5) Inform community request of their tolerance
			2) Dust emission	<ul style="list-style-type: none"> 1) Provision of dust masks to workers 2) Sprinkling of water and compaction dusty spots 3) Dust screen around the dam
			3) Accidents during construction	<ul style="list-style-type: none"> 1) Environmental emergency procedures 2) Occupational Health and Safety Administration (OSHA) i.e. erection of signs, first aid kit, etc 3) Workers to wear protective gear i.e. safety boots, safety helmets, reflector jacket etc

			4) Soil and water contamination by waste/chemicals/ oil	7) Maintenance of machinery and plant. 8) Identification of appropriate location for disposing chemicals, their containers and contaminated soil & water. 9) Prompt site clearance, avoiding on-site stock piling, 10) Monitor exposed soil especially during wet season. 11) Establishment of a materials storage to avoid accidental spills and littering
		Fencing	1) Noise pollution	1) Control of noise and air pollution i.e. avoid unnecessary hooting 2) Workers operating machines or plants for than 8hrs that produce over 80dBA of sound to wear ear muffs 3) Regular inspection of machines and plant 4) Restrict noisy construction activities within 8am-5pm 5) Inform community request of their tolerance
			2) Habitat loss 3) Accidents during construction	1) Minimal destruction of vegetation (especially indigenous) and habitats for fauna i.e. termite mounds. 2) Cut trees for tree nursery construction 3) Establishment of a tree nursery 4) Community training on biodiversity conservation 5) Re-vegetate /Vegetative buffer zone around the dam 6) Solid waste management i.e. stones and debris 7) Waste water management i.e. discharge of construction water 8) Erosion control 9) Site restoration 10) Environmental emergency procedures 11) Occupational Health and Safety Administration (OSHA) i.e. erection of signs, first aid kit, etc. 12) Workers to wear protective gear i.e. safety boots, safety helmets, reflector jacket etc
		Cattle trough and domestic water draw off	1) Dust emission 2) Noise 3) Accidents during construction	1) Provision of dust masks to workers 2) Sprinkling of water and compaction dusty spots 3) Dust screen around the dam 4) Solid waste management i.e. stones and debris 5) Waste water management i.e. discharge of construction water 6) Occupational Health and Safety Administration (OSHA) i.e. erection of signs, first aid kit, etc 7) Workers to wear protective gear i.e. safety boots, safety helmets, reflector jacket etc

		Demobilization	1) Vibration and noise pollution	<ol style="list-style-type: none"> 1) Community awareness of the project 2) Occupational Health and Safety Administration (OSHA) 3) Control of noise and air pollution i.e. avoid unnecessary hooting 4) Workers operating machines or plants for than 8hrs that produce over 80dBA of sound to wear ear muffs 5) Regular inspection of machines and plant 6) Restrict noisy construction activities within 8am-5pm 7) Inform community request of their tolerance
			2) Dust emission	<ol style="list-style-type: none"> 1) Provision of dust masks to workers 2) Sprinkling of water and compaction dusty spots 3) Dust screen around the dam
			3) Soil and water contamination by waste/chemicals/ oil	<ol style="list-style-type: none"> 1) Maintenance of machinery and plant. 2) Identification of appropriate location for disposing chemicals, their containers and contaminated soil & water. 3) Prompt site clearance, avoiding on-site stock piling, 4) Monitor exposed soil especially during wet season. 5) Establishment of a materials storage to avoid accidental spills and littering
Operational phase	1) Surface water destruction control-erosion	Dam in operation	1) Water borne disease- malaria and amoebiosis	<ol style="list-style-type: none"> 1) Community sensitization and awareness creation i.e. water treatment, clearing of bushes around homesteads 2) Sanitation during construction and building of the abolition blocks at safe distance from the dam 3) Provision of free Insect treated Nets(ITNs) 4) Health education 5) Introduction of mosquito larvae eating fish species
	2) Reliable source of livestock water for the community,		2) Soil and water contamination by waste/chemical	<ol style="list-style-type: none"> 1) Community sensitization and awareness creation. 2) Management of the irrigation water 3) Establishment of a tree nursery 4) Planting of trees 5) Erosion control 6) Installation of environmental friendly technologies i.e. zero grazing 7) Train on safe use of pesticides and chemicals, Integrated Pest Management (IPM), and Soil & Water Conservation(S&WC)
	3) Catchment protection and conservation of environment,		3) Danger of drowning	<ol style="list-style-type: none"> 1) Community sensitization and awareness creation. 2) Fencing off the dam 3) Establish a dam management committee. 4) Employ a guard 5) Construction of domestic water drawing point and a cattle trough.
	4) Nutritional status improvement,			
	5) Water borne			

<p>diseases i.e. typhoid and diarrhea reduction,</p> <p>6) Employment opportunities,</p> <p>7) Household incomes increased,</p> <p>8) Literacy levels improvement,</p> <p>9) Communal leaving and cross cultural relations,</p> <p>10) Water related conflicts reduction,</p> <p>11) Vulnerable groups inclusion,</p> <p>12) Local trade and industry boost.</p> <p>13) Micro climate modification</p> <p>14) Aquatic and non-aquatic biodiversity expansion</p>	4) Livestock/ crop conflict	<p>1) Community sensitization and awareness creation.</p> <p>2) Animal water trough construction</p> <p>3) Installation of environmental friendly technologies i.e. zero grazing</p> <p>4) Establish a dam management committee.</p> <p>5) Committee to ensure equitable water distribution</p> <p>6) Operational rules</p> <p>7) Proper animal routes and holding grounds</p> <p>8) Avoid grazing animals around the dam</p> <p>9) Chief, local administration and dam committee enforce rules</p>	
	5) Rural morality decay and Social diseases i.e. HIV/AIDs increase	<p>1) Community sensitization and awareness creation on comprehensive health care</p> <p>2) Formal education enrolment campaigns</p> <p>3) Gender mainstreaming campaigns</p> <p>4) Equip local dispensaries with drugs</p> <p>5) Measurers against social diseases i.e. free condoms and ARVs</p>	
	6) Outsiders/strangers accessing the dam	<p>1) Community sensitization and awareness creation towards embracing new members of the community</p> <p>2) Establish a dam management committee.</p>	
	7) Increase on human and animal road traffic and Pressure on local infrastructure	<p>1) Community sensitization and awareness creation.</p> <p>2) Establish a dam management committee.</p> <p>3) Expand new roads and infrastructure capacity</p> <p>4) Routine maintenance of infrastructure</p>	
	8) Structural failure	<p>1) Review of dam design by independent panel of experts</p> <p>2) Emergency preparedness plan</p> <p>3) Community sensitization and awareness creation.</p> <p>4) Establish a dam management committee.</p> <p>5) Proper engineering design</p> <p>6) Contractor to abide to engineering design provide quality works</p> <p>7) Proper supervision of the works</p> <p>8) Monitoring and maintenance plan</p> <p>9) Implementation of monitoring and maintenance plan</p> <p>10) Planting of trees</p> <p>11) Erosion control</p>	

			9) Deviated natural water flow	1) Spill way designed to return water to its natural flow 2) Construction of retention ditches by farms on the lower side of the dam
Decommissioning stage	1) Donation or transfer of the dam for a different use- No construction of a new dam	Dam decommissioned	Donation or transfer of the dam for a different use- Incompatibility of the intended new use with the dam structure and frame work	ESIA study for the intended new use.
	2) Transfer of management- Sustained management of the dam 3) Abandonment and demolition of		Transfer of management a) Inexperienced new management b) Different intentions of use	1) Copies of ESIA and all relevant environmental project reports and correspondence made available to the new management 2) Adherence to ESMP and NEMA correspondence recommendation.

	<p>the dam;-Job creation and Improved run-off down stream</p>		<p>Abandonment and demolition of the dam;-</p> <ul style="list-style-type: none"> a) Generation of wastes b) Loss all positive impacts associated with existence of the dam c) Land use change d) Vibration, noise, and dust pollution 	<p>Abandonment and demolition of the dam;-</p> <ol style="list-style-type: none"> 1) Proper disposal of waste 2) Evaluation of best land use option through ESIA 3) Community awareness of the project 4) Occupational Health and Safety Administration (OSHA) 5) Control of noise and air pollution i.e. avoid unnecessary hooting 6) Workers operating machines or plants for than 8hrs that produce over 80dBA of sound to wear ear muffs 7) Regular inspection of machines and plant 8) Restrict noisy construction activities within 8am-5pm 9) Inform community request of their tolerance 10) Provision of dust masks to workers 11) Sprinkling of water and compaction dusty spots 12) Dust screen around the dam
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CHAPTER 8

8.0 PROPOSED ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN(ESMP)

8.1 Objectives of ESMP

The narrative in the Environmental and Social Management Plan (ESMP) is to describe all the possible environmental and social issues that can be associated with the project. It broadly outlines management strategies that will be employed to mitigate potential adverse environmental impacts. Further, it highlights the project's environmental and social constraints. As such, the main objectives of the ESMP are;

1. To outline the mitigating, monitoring, consultative and institutional measures required to prevent, minimize, mitigate or compensate for adverse environmental and social impacts, or enhance the projects beneficial impacts,
2. To make the project comply with the applicable national environmental, social and legal requirements,
3. To address capacity building requirements of the implementing parties to achieve sustainable compliance.

Table 9: Environmental and Social Management Plan

Potential impact	Activities	Mitigation measure	Responsibility	Action time frame	Targets to achieve	Monitorable indicator	Estimated Cost
1) Vegetation cover and biodiversity loss 2) Habitat loss	Site Clearing	1) Minimal destruction of vegetation (especially indigenous) and habitats for fauna i.e. termite mounds. 2) Cut trees for tree nursery construction 3) Establishment of a tree nursery 4) Community training on biodiversity conservation 5) Re-vegetate /Vegetative buffer zone around the dam 6) Community awareness of the project 7) Establishment of a materials storage to avoid accidental spills and littering 8) Solid waste management i.e. stones and debris 9) Erosion control 10) Site restoration 11) Environmental emergency procedures	Proponent & farmers representatives	During construction	<ul style="list-style-type: none"> ▪ 1 fruit/forest tree nursery ▪ 5,000 tree seedlings in the nursery ▪ 2,000 seedlings planted quarterly at least for 5 years. ▪ 500 member sensitized ▪ 1 material store ▪ Environmental emergency plan 	<ul style="list-style-type: none"> ▪ No. fruit/forest tree nursery ▪ No.r of seedlings raised ▪ No. of seedlings transplanted ▪ No. of farmers sensitized ▪ No. of materials store ▪ No. of environmental emergency plan 	In the budget

Dust emission	Mobilization , Site clearing, Excavation, Concrete works, Cattle trough, Fencing, Demobilization and Decommissioning	<ol style="list-style-type: none"> 1) Provision of dust masks to workers 2) Sprinkling of water and compaction dusty spots 3) Dust screen around the dam 	Proponent & farmers	During construction	<ul style="list-style-type: none"> ▪ 300 dust masks ▪ Damp soil during construction phase ▪ Erect dust screens 	<ul style="list-style-type: none"> ▪ No of masks distributed ▪ Damp soil 	15,000
Accidents during construction	Excavation, Concrete works, Cattle trough, Fencing and Decommissioning	<ol style="list-style-type: none"> 1) Occupational Health and Safety Administration (OSHA) i.e. erection of signs, first aid kit, etc 2) Workers to wear protective gear i.e. safety boots, safety helmets, reflector jacket etc 	Workers and supervising staff	During construction	<ul style="list-style-type: none"> ▪ Accidents put to a minimal as possible ▪ Implement OSHA 	<ul style="list-style-type: none"> ▪ No. of accidents and nature ▪ Workers wearing protective gear. ▪ Work time table. ▪ Erected guard rails and warning signs ▪ Emergency response plan in place 	20,000

Ownership conflict	Preparation stage	<ol style="list-style-type: none"> 1) Acquiring and signing all the necessary legal documents with the community and the relevant authorities. 2) Community awareness of the project. 3) Establish project management committee to oversee construction on behalf of the community 	Proponent and Dam management committee	Implementation & transitioning phase	<ul style="list-style-type: none"> ▪ Acquisition of all relevant ownership documents ▪ No public complaint/conflict ▪ Public sensitized on ownership 	<ul style="list-style-type: none"> ▪ All relevant ownership documents ▪ No. of complaints from the public ▪ No. of community members sensitized 	In the budget
Vibration and noise pollution	Mobilization, Site clearing, Excavation, Concrete works, Cattle trough, Fencing, Demobilization and Decommissioning	<ol style="list-style-type: none"> 1) Community awareness of the project 2) Occupational Health and Safety Administration (OSHA) 3) Control of noise and air pollution i.e. avoid unnecessary hooting 4) Workers operating machines or plants for than 8hrs that produce over 80dBA of sound to wear ear muffs 5) Regular inspection of machines and plant 6) Restrict noisy construction activities within 8am-5pm 7) Inform community request of their tolerance 	Workers and supervising staff	During construction	<ul style="list-style-type: none"> ▪ Controlled noise and vibration ▪ Implementation of OSHA ▪ Community awareness of the project 	<ul style="list-style-type: none"> ▪ Work time table ▪ Idle engines switched off ▪ No. of public complaints ▪ Use of ear muffs ▪ Machine inspection reports 	10,000

Soil and water contamination by waste/chemicals/oils	Mobilization, Site clearing, Excavation, Concrete works, Cattle trough, Demobilization and Decommissioning	<ol style="list-style-type: none"> 1) Maintenance of machinery and plant. 2) Identification of appropriate location for disposing chemicals, their containers and contaminated soil & water. 3) Prompt site clearance, avoiding on-site stock piling, 4) Monitor exposed soil especially during wet season. 	Workers and supervising staff	During construction	<ul style="list-style-type: none"> ▪ Reduced soil and water contamination ▪ Proper disposal of contaminated soil and water 	<ul style="list-style-type: none"> ▪ Report on no., amount/size/area and serverity of contamination ▪ Disposal sites 	15,000
Water borne disease-malaria and amoebiosis	Dam operation	<ol style="list-style-type: none"> 1) Community sensitization and awareness creation i.e. water treatment, clearing of bushes around homesteads 2) Sanitation during construction and building of the abolition blocks at safe distance from the dam 3) Provision of free Insecticide Treated Nets(ITNs) 4) Health education 5) Introduction of mosquito larvae eating fish species 	Proponent and Public Health department, Dam management committee	Within 1 st month of dam use	<ul style="list-style-type: none"> ▪ Reduced water borne diseases ▪ 500 community members sensitized ▪ Sanitation blocks constructed ▪ ITNs distributed ▪ Mosquito larvae eating fish introduced into the dam 	<ul style="list-style-type: none"> ▪ Disease prevalence reports ▪ No. of beneficiaries capacity built ▪ Sanitation blocks ▪ No. of ITNs distributed 	30,000

Soil and water contamination by waste/chemical	Dam operation	<ol style="list-style-type: none"> 1) Community sensitization and awareness creation. 2) Establishment of a tree nursery 3) Planting of trees 4) Erosion control 5) Installation of environmental friendly technologies i.e. zero grazing 6) Train on safe use of pesticides and chemicals, Integrated Pest Management (IPM), and Soil & Water Conservation(S&WC) 	Proponent and Department of livestock , Dam management committee	Throughout the dam operation	<ul style="list-style-type: none"> ▪ 200 farmers sensitized ▪ Farmers trained on Good Agricultural Practices ▪ Increased tree cover ▪ Herders trained and install environmental friendly technologies ▪ Reduced chemicals contaminating soil and water 	<ul style="list-style-type: none"> ➤ No. of farmers trained ➤ Adaptation of environmental friendly technologies ➤ Water and soil tests 	20,000
Danger of drowning	Dam operation	<ol style="list-style-type: none"> 1) Community sensitization and awareness creation. 2) Fencing off the dam 3) Establish a dam management committee. 4) Employ a guard 5) Construction of domestic water drawing point and a cattle trough. 	Proponent and Farmers	On completion of excavation	<ul style="list-style-type: none"> ▪ Protect the vulnerable(people/livestock) ▪ No deaths 	<ul style="list-style-type: none"> ▪ Fence in place ▪ Guard in place ▪ Water trough and domestic water drawing point constructed 	In the budget

Livestock/ crop conflict	Dam operation	<ol style="list-style-type: none"> 1) Community sensitization and awareness creation. 2) Animal water trough construction 3) Installation of environmental friendly technologies i.e. zero grazing 4) Establish a dam management committee. 5) Committee to ensure equitable water distribution 6) Operational rules 7) Proper animal routes and holding grounds 8) Avoid grazing animals around the dam 9) Chief, local administration and dam committee enforce rules 	Propone nt, Departm ent Livestoc k.	Through out Impleme ntation	<ul style="list-style-type: none"> ▪ Reduced herders/farmer conflict ▪ Reduction of crop damage cases 	<ul style="list-style-type: none"> ▪ Community sensitization reports ▪ Adaptation of environment friendly technologies ▪ Enforcement of dam use rules ▪ Fence in place 	15,000
Rural morality decay and Social diseases i.e. HIV/AIDs increase	Dam operation	<ol style="list-style-type: none"> 1) Community sensitization and awareness creation on comprehensive health care 2) Formal education enrolment campaigns 3) Gender mainstreaming campaigns 4) Equip local dispensaries with drugs 5) Measurers against social diseases i.e. free condoms and ARVs 	Propone nt and Social Services Departm ent , Public health departm ent	Through out Impleme ntation	<ul style="list-style-type: none"> ▪ Reduced social diseases ▪ Reduced immorality in the community 	<ul style="list-style-type: none"> ▪ Public Health reports ▪ Social services reports 	20,000

Outsiders/strangers accessing the dam	Dam operation	<ol style="list-style-type: none"> 1) Community sensitization and awareness creation towards embracing new members of the community 2) Establish a dam management committee. 	Proponent, Chiefs, Local Leaders, Dam Management Committee	Within 1 st month of dam operation	<ul style="list-style-type: none"> ▪ Reduced conflicts between locals and visitors 	<ul style="list-style-type: none"> ▪ Chiefs reports on conflict occurrence 	5,000
Increase on human and animal road traffic and Pressure on local infrastructure	Dam operation	<ol style="list-style-type: none"> 1) Community sensitization and awareness creation. 2) Establish a dam management committee. 3) Expand new roads and infrastructure capacity 4) Routine maintenance of infrastructure 	Dam management committee and Departments involved in infrastructure development i.e. roads department	Throughout the dam operation	<ul style="list-style-type: none"> ▪ Sustainable infrastructure facilities offering services to all plus the increase in population 	<ul style="list-style-type: none"> ▪ Infrastructure rehabilitation reports 	10,000

Structural failure	Dam operation	<ol style="list-style-type: none"> 1) Review of dam design by independent panel of experts 2) Emergency preparedness plan 3) Community sensitization and awareness creation. 4) Establish a dam management committee. 5) Proper engineering design 6) Contractor to abide to engineering design provide quality works 7) Proper supervision of the works 8) Monitoring and maintenance plan 9) Implementation of monitoring and maintenance plan 10) Planting of trees 11) Erosion control 	Workers and Dam management committee.	Throughout the dam operation	Dam structure monitored and in good condition	<ul style="list-style-type: none"> ▪ Structure constructed as per approved design. ▪ Monitoring records ▪ Repair records 	10,000
Deviated natural water flow	Dam operation	<ol style="list-style-type: none"> 1) Spill way/overflow designed to return water to its natural flow 2) Construction of retention ditches by farms on the lower side of the dam 3) Training on Soil & Water Conservation(S&WC) 	Proponent and Farmers	Throughout the dam operation	Excess water is returned to its natural course	<ul style="list-style-type: none"> ▪ Spill way designed to return water to its natural course ▪ Farmers downstream construction of retention ditches 	In the budget

Water use conflicts	Dam decommissioned	1) Committee to ensure equitable water distribution 2) Operational rules	Department of Internal Affairs/chiefs and Dam management committee	Dam decommissioning stage	<ul style="list-style-type: none"> ▪ No conflicts occur as a result of dam decommissioning 	<ul style="list-style-type: none"> ▪ Chiefs reports 	5,000
Excess soil material	Dam decommissioned	To be used in landscaping at an appropriate site	Dam management committee	Dam decommissioning stage	<ul style="list-style-type: none"> ▪ No misplaced excess soil and debris 	<ul style="list-style-type: none"> ▪ Decommissioning report on materials disposed 	30,000
Erosion	Dam decommissioned	1) Plant grass and trees around the dam area 2) Erosion control	Department of Agriculture, Dam management committee and farmers	Dam decommissioning stage	<ul style="list-style-type: none"> ▪ No occurrence /controlled soil erosion around the dam 	<ul style="list-style-type: none"> ▪ Department of agriculture report on soil and water conservation in at the dam site. 	20,000

CHAPTER 9

9.0 MONITORING GUIDELINES

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

- Public and workers safety
- Malaria and other diseases prevention and control
- Livestock/crop conflict reports
- Improved vegetation cover
- Safety of equipments and property
- Capacity building and skills improvement
- Structural integrity of the dam

CONCLUSION AND RECOMMENDATIONS

The environmental and social impacts from the implementation of this project are minimal and can be addressed by putting in place mitigation measures to ensure that they pose no threat to the environment to the community. These measures are part of the project component and will bring no added cost in the implementation process. There will be no abstraction of water from any natural water course but is essentially a water conservation structure. The advantages of placing the structure are enormous and it will address chronic problems that have affected the community for a long time. Establishment of a tree nursery and the protection of the catchment area are positive impacts on the environment. The livestock crop conflict will be mitigated by the area chiefs and local administration assisted by the dam management committee enforcing dam water use rules. Water borne diseases that may occur including malaria (as the dam may act as breeding site of mosquitoes), calls for creation of awareness to the public on prevention and control of the diseases. Further, adult literacy classes should be put up to address the low levels of literacy in the village. Zero grazing dairy cows, improved variety of birds/chicken, among other modern technologies should be advocated so as to improve the household incomes with emphasis on empowerment for all agendas. These technologies can be promoted by the KCSAP project and the County Government of Taita Taveta Livestock department staff through extension to the farming and livestock keeping community in Kishushe Sub location.

Generally the potential negative impacts of the project are few and achievable to mitigate, therefore they should not prevent the project from proceeding. Moreover the KCSAP project has a strong environmental resilient component whose aim is expected to take into consideration the proposed mitigation measures. The positive impacts and the benefits to the community are immense and welcomed. It is recommended therefore that the project proceeds as planned with the mitigation measures integrated in the implementation.

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5. Farm Management Guidelines for Taita District July 2007
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APENDICES

Appendix1: EIK Membership Certificate



Appendix2: NEMA Lead Expert Practicing License



Appendix3: Minutes of ESIA Public Participation

1) 1st Public Consultation Meeting

PUBLIC PARTICIPATION DURING ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT(ESIA) FOR CONSTRUCTION OF MUKURU DAM IN WUMINGU/KISHUSHE WARD, IN TAITA SUB-COUNTY-1ST MARCH 2019 .

ATTENDANT LIST- Officers

S.NO.	NAME	ORGANISATION	CONTACTS
1.	Quentin Ngati	ESIA Lead Expert	0722797326
2.	Irene Wanjiku	ESSO KCSAP	0725018304
3.	Mwadime Mbui	County Coordinator- Department of Social Services(CCSS)	0795718028
4.	Musyimi Simon	Sub-County Irrigation Officer(SCIO)- Taveta Sub-County	0713810276
5.	Starman Onamu	Ward Agricultural Officer (WAO)	0725706503
6.	David Mwandagina	Chief- Wumingu Kishushe	0714379073

AGENDAS

Prayer and introduction

- | | |
|--------------------------------|------------------|
| 1. Opening remarks: | Chief |
| 2. KCSAP Overview | ESSO |
| 3. Mukuru Dam Project Overview | SCIO |
| 4. ESIA Overview | ESIA Lead Expert |

Plenary session

- | | |
|---|------------------|
| 5. Environmental Issues | ESIA Lead Expert |
| 6. Social/health Issues | CCSS |
| 7. Economic/Agricultural Issues | WAO |
| 8. Economic/Livestock Issues | ALPO |
| 9. Presentation of findings/discussions | Each team leader |
| 10. Way forward/Closing Remarks | ESSO |
| 11. AOB | |

Prayers- Odina Sau

MIN.01/01/03/19: OPENING REMARKS

- The meeting was called to order by the Chief- Mr. David Mwandagina at 1.00pm then called for self-introduction.
- He thanked the members of community for the continued support they have accorded the KCSAP project so far in making preparations for the implementation of the construction of the Mukuru Dam.
- He generally pointed out that the purpose of the meeting is a public participation exercise for the Environment and Social Impact Assessment (ESIA) exercise where officers who are before them are going to discuss with them various categorized issues about the project at hand.

4. He reminded them that the project was identified by the community during the CIDP II public baraza and hence the KCSAP project picked it after considering several other options.
5. The project is meant to assist the community alleviate the persistent problem of inadequate water for crops, livestock and domestic use.
6. He finally requested them to continue according to the project officers the cooperation they have been according to them before.

MIN: 02/01/03/19: Kenya Climate Smart Agricultural Project Overview-by ESSO

1. The KCSAP project was formulated by the Government of Kenya in 2016 in collaboration with the World Bank
2. The project focuses primarily on improving water/soil management, especially within smallholder maize systems in the marginal rainfall zones like Kishushu area and hence the Mukuru dam project
3. Climate change is a key challenge to the county in its efforts to achieve the sustainable development goals (SDGs) of ending poverty, hunger and combating climate change and its impacts
4. In the places like Wumingu/Kishushu, extremes and variability of weather, irregular and unpredictable rainfall, frequent draughts and severe floods are now common and negatively affect livelihoods of small holder farmers, agro-pastoralists and pastoralist.
5. The project therefore focuses on increasing agricultural productivity, enhancing resilience to impacts of climate change, and contributes to reduction in green house gasses.
6. The project Development Objective (PDO) is to increase agricultural productivity and build resilience to climate change risks in the targeted smallholder farming and pastoral communities
7. The Mukuru dam is implemented under component 1 of up calling climate-smart agricultural practices such as water harvesting and building water pans or dams to harness the harvested water

MIN: 03/01/03/19: Mukuru Dam Overview -by SCIO

1. The dam will have a capacity of 642m³
2. The project duration was 2 months.
3. It is expected to assist over 1230 households
4. It also aims at Improvement of sanitation, crop and livestock production and livelihood resilience to climate change.
5. The project will create jobs for the local community from agricultural labor (consider youth, women and vulnerable) as a result of increased agricultural income generating activities around the pan.

MIN: 04/27/02/19: ESIA Overview -by ESIA Lead Expert

1. ESIA's are carried out in order to identify potential positive and negative impacts associated with the proposed project with a view to taking advantage of the positive impacts and developing mitigation measures for the negative ones.
2. The guidelines on ESIA's are contained in Sections 58 to 67 of the Act. According to Section 68 of the Environmental Management and Coordination Act (EMCA) 1999, the Authority shall be responsible

for carrying out environmental audits on all activities that are likely to have a significant effect on the environment.

3. The government has established regulations to facilitate the process on ESIA's and environmental audits. The regulations are contained in the Kenya Gazette Supplement No. 56, Legislative Supplement No. 31, and Legal Notice No. 101 of 13th June 2003. In the past, the government has established a number of National policies and legal statutes to enhance environmental conservation and sustainable development.
4. Thus ESIA are done to assist the community around such projects to anticipate both positive and adverse negative environmental and social impact so as to promote or enhance the positive impacts while proposing and implementing the mitigation measures to downplay them.
5. The Lead expert thus told the community members that he has organized officers to handle a focused discussion of 4 different topics with them. Therefore he divided the group into 4 according to environment, social/health, economic/agricultural and economic/livestock issues.

Reports and Discussions from the Plenary Sessions

MIN: 05/27/02/19: Environment Issues –Led by ESIA Lead Expert

1. Water for the downstream farmers will reduce
2. increase in availability of water and evaporation hence humid conditions
3. There will need to be a fencing element against chances of deaths from drowning especially on their children
4. The project will assist arresting the excess surface water that destroys their farms, roads and other infrastructure
5. It will also assist in catchment protection and conservation of environment if we plant trees and do soil and water conservation in our farms
6. there will be some trees and grass destroyed during project construction
7. There can be chances of the breakdown of the structure resulting to destruction of farms and property down stream

MIN: 06/27/02/19: Social/health Issues –Led by CCSS

1. Improved agriculture production and variety of crops will enhance nutritional status
2. Water borne diseases i.e. typhoid and diarrhea may reduce as enough water will be available for domestic sanitation
3. There will be also increase to some water borne diseases like malaria and bilharzia
4. Proceedings from the improved production will assist paying for school fees as the literacy levels in the area are very low.
5. Employment opportunities for locals will be created both during construction and accrued created business
6. The dam will reduce water related conflicts brought about by scarcity of the commodity. Distances to fetching water will be reduced
7. However, more people into the area will promote strange culture and immorality that may promote infection of social diseases like HIV/AIDs. There are only a few health centers i.e. Kishushe dispensary which is about 7km away.

MIN: 07/27/02/19: Economic/Agricultural Issues –Led by WAO

1. There may be crop/livestock conflicts as more herdsmen from very far may bring their livestock for drinking. Their main livelihood is crop production and livestock rearing. Their main challenge is inadequate water
2. The dam will provide a reliable source of domestic, livestock and agriculture water for the community
3. With enough water for crop production, there will be food security, increased household incomes and improved trade from sale of produce

MIN: 08/27/02/19: Economic/Livestock Issues –Led by ALPO

1. Their livestock will not have to travel far but the pan will be enough.
2. There will be reduction of Livestock/ crop conflict as there will be enough water for both
3. Reduced livestock diseases as they will not have contact with livestock from outside who may have contracted some diseases.


MIN: 09/27/02/19: Way forward/Closing Remarks –by ESSO

1. The result of this meeting will be typed and summarize for confirmation by the Chief
2. Issues in this meeting will be put into consideration in preparation of the ESIA report by the Lead expert
3. A copy of the report will be made available to the dam management committee
4. The community unanimously agreed that the project should be implemented
5. She thanked the members present for their cooperation

There be no any other business, the meeting was closed by a word of prayer by the Lead Expert Mr. Quentin Ngati

Prepared By:-
Quentin M. A. Ngati
ESIA Lead Expert

Signature.....




Ward Administrator/Chief DAVID K. Mwangi Signature..... Date.....1/3/2019
Secretary STARMAN ONAMU Signature..... Date.....1/3/2019

COUNTY GOVERNMENT TAITA TAVETA
 DEPARTMENT OF AGRICULTURE, LIVESTOCK PRODUCTION, FISHERIES AND IRRIGATION
 KENYA CLIMATE SMART AGRICULTURAL PROJECT

ATTENDANCE LIST
 ACTIVITY: Nurture and Conservation ESIA Duanis Dam Dairies Dairies
 DATE: 1/3/2019
 LOCATION: Kenya

S NO	NAME	ORGANISATION	TELEPHONE	EMAIL	SIGNATURE
1	Odina sau	Kishushe	0723004438		<i>[Signature]</i>
2	Rus musokkudusa		0729465312		<i>[Signature]</i>
3	mark mato		0706266691		<i>[Signature]</i>
4	Charleston m. mwarasi		0796984002		<i>[Signature]</i>
5	Samuel mwariga		07133607		<i>[Signature]</i>
6	Sivante markusa		240386827		<i>[Signature]</i>
7	Roel Mwalili		0716764902		<i>[Signature]</i>
8	Felix Mwalikwera		0704677530		<i>[Signature]</i>
9	mark mira				<i>[Signature]</i>
10	Ella Mwarasi		0715200657		<i>[Signature]</i>
11	Helmes mabela		0703829154		<i>[Signature]</i>
12	Coraine Mwachuri		0798524450		<i>[Signature]</i>
13	Naomi wairighe		0705624787		<i>[Signature]</i>
14	Shako Mwangi		0720069107		<i>[Signature]</i>
15	Erigata wairighe		071876573		<i>[Signature]</i>

S NO	NAME	ORGANISATION	TELEPHONE	EMAIL	SIGNATURE
16	Ruth Kuro		0791961373		Ruth
17	Emad Gideon m. Rigma		0707767959		Emad Gideon
18	Secilia Masobil		0706857260		Sec
19	Christos Mwakera		0743458806		Christos
20	Jedida Mshai		0704119414		Jedida
21	Anthony M. Huma		0744344089		Anthony
22	Robt. M. Riga		0798524504		Robt. M. Riga
23	David F. Mwakera		0714379073		David F. Mwakera
24	Rose N. Mwakera		0735870225		R.N.
25	Angelica Taka		0717217870		Angelica
26	Foster Mwakera		0726263478		Foster
27	Nawidah Molegwa		0702222976		Nawidah
28	Mwires Kambele		0706635258		Mwires
29	Mwako Heron		0708826126		Mwako
30	Hu/Ngstone MSHAI		0790806271		Hu/Ngstone
31	Wilson Mwakera		0706117852		Wilson
32	Stamam Oramu		0757557577		Stamam

S NO	NAME	ORGANISATION	TELEPHONE	EMAIL	SIGNATURE
1	CATHELINE CYAO		0706355610		Ce
2	SAMUEL MAMBA		0740921578		Sen
3	NORICK MWANGIYA		0715775182		
4	MWACHARA MUMBA				N. Bura
5	ELISTON NDERIKA NDETU		071774969		
6	FUSTAS KIMONGE		07112445923		

2ndPublic Consultation Meeting

MINUTES OF ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT FOR MKURU DAM CONSTRUCTION HELD ON 14TH NOVEMBER 2019 AT KISHUSHE CDF HALL STARTING AT 1530HRS.

Officers and Officials Present

1. Mr. Andrew Mbinga:	KCSAP CPC
2. Mrs. Irene Wanjiku:	KCSAP M&E
3. Mr. Quentin Ngati:	ESIA Lead Expert
4. Mr. Simon Musimi:	Civil Engineering Expert
5. Mr. Mwadime Mbui:	Sociologist
6. Mr. Peter Mwashighadi:	Livestock/Agriculture Expert
7. Mr. Wilbard Chomba:	Hydrologist/Water Expert
8. Mr. Starman Onamu:	Ward Agricultural Officer
9. Mr. David F. Mwandagina:	Chief-Kishushse
10. Mr. Antony M. Njumwa:	Chairman- Mukuru Dam Management Committee
11. Ms. Cecilia Chao Mwabli:	Treasurer- Mukuru Dam Management Committee
12. Mr. Raphael M. Righa:	Member- Mukuru Dam Management Committee

Agenda

1. Opening prayers
2. Self-introduction
3. Opening remarks
4. Project overview
5. Plenary
6. Questionnaire
7. AOB

Min01/14/11/2019 prayers

The meeting opened with a word of prayer from Raphael Mombo at 1630hrs.

Min 02/14/11/2019 Self-Introduction

This session was done by every person who was in this baraza stating their name, village and the position they have in the Mkuru project they represent whether a beneficiary of community member.

Min03/14/11/2019 Opening Remarks By The Area Chief

He welcomed the community members and the officers to the meeting and asked them to contribute their views in the meeting at ease. He further stated that those views would be used for compiling the environment and social impact assessment (ESIA) report for the Mkuru dam construction.

Min 04/14/11/ 2019.Project Overview

a. By the dam chairperson Anthony Njumwa

The Mkuru dam chairperson stated that the idea of the re-construction of the dam was identified by the community members during a public participation CIDPbaraza that was held on September 2018 at Kishushe CDF hall. During this baraza, the community stated that the Mkuru dam if re-constructed would ease water shortage challenge facing the local community especially during the dry seasons.

He asked the community members to air their views as they are very key in the ESIA report which would be a prerequisite in this project. He latter introduced Raphael Mombo, Alfred Njumwa, andJedidaMshal who were part of the committee members for the dam.

The chair further stated that the dam construction tendering had been done and the only remaining issues was certification from the National Environment Management Authority NEMA. In addition the chair said that today's exercise was a requirement from NEMA that further public participation needed to be done for the certification and this was the reason for the baraza and that there would be more barazas at Kwaafiti, Paranga and Mlilo in order to collect more views on the Mkuru dam construction.

b. By ESIA Expert Quentin Ngati

He stated that the dam had a capacity of 40,000m³. This was massive water for the livestock, domestic and small irrigation in the area. He said that a survey done in the area did show that the main water source in the area was Kishenyi Dam water that has ever since faced challenges of inadequacy especially during the dry season.

This project, he stated, would be implemented through funds from Kenya Climate Smart AgriculturalProject(KCSAP) which is funded by the Government of Kenya and World Bankwith 20% of the total cost of the project contribution by the County Government of Taita Taveta county.

The goal of the project was explained is to improve the livestock production by storing enough water to be used during the dry seasons.

The objectives of the project are:

1. To harvest enough surface runoff for livestock watering.
2. Reduce soil erosion
3. To reduce covered by livestock to water sources during the dry periods

The following four are the main project parts the ESIA expert explained to the members

1. Dam construction
2. Win wall construction
3. Fencing
4. Cattle trough construction

To break it further, he said, the following activities would be carried out.

Site clearing, mechanical and partially manual land excavation, backfilling around the excavated area, delivery of building materials and equipment to the site, reinforcement and non-reinforcement concrete/cement works, building works and form works.

Min 05/14/11/2019 Plenary By Mr. Mwandime The County Social Services Director

The community members present were given a chance to ask questions or air their suggestions regarding the Mkuru dam project. This session was under the guidance from Mr. Mwandime County social services officer.

Q. Danson Koronge- The dam was previously constructed by other organizations and collapsed. What measures have the project taken this time in order to avoid the collapsing of the dam like what happened in the previous occasions.

A. This time there is sufficient dam design and that the dam will be constructed using concrete 50m long, 5m high, 5.5m wide base and 1m wide crest dam wall across the end of Mkuru water way. Then there is dam management committee who will be given the design and make sure that the contractor will follow the design to the letter. And finally the resident engineer will monitor the work.

Q. by Mr. Festus Mwasi- He gave an opinion stating that he has been to the neighboring Makueni county and made observations that dams are constructed by diverting water from the main water way so that when the dam is full of water the water is redirected to the main water way. There is dust on the road because of the lorries carrying iron ore in the area and that there should be bumps on the road.

A. There is a difference between a dam and a water pan. A dam is usually constructed in the water way and if it gets filled with water, the excess water is directed to the spill way.

There will be check dams constructed to avoid soil erosion and stone pitching will also be done.

Opinion by Mr. Joshua Mwawasi- He stated that the environment will be destroyed in a small margin and that construction will take a short time compared to the benefits the community will get from the water which is 40,000m³.

Q. by Mr. Albert Mwambonu- Which design will be used to make sure that the water will be retained for long time?

A- Construction will be a concrete 50m long, 5m high, 5.5m wide base and 1m wide crest dam wall across the end of Mkuru water way. The dam design is expected to retain water as long as the weather in terms of temperature/evaporation and the expected use by livestock.

Q by Mr. Albert Mwasombo- Are there check dams to be constructed in order to make sure that there is no silt moving into the dam?

A- There will be trainings on soil and water conservation around the area and farms on the upper areas of the catchment area to reduce soil erosion into the dam. There has been recommendation of tree nurseries as a livelihood income generating activities as may be proposed in the Environmental and Social Management Plan (ESMP) of the dam. The committee should give copies of the plan to the community so that they are aware the plan.

Q. by Mr. Geoffrey Mwawasi- What will happen to the back of the water and will the back flow affect the individuals living around the dam? Mwawasi was worried of the boundaries of the dam and safety of the community in general.

A- The dam is designed to over top when its full thus is self controlling in terms of storage of water and water level. Further, proper survey work was done by the relevant department and the level of water and throw back wont reach settlement area as the dam site is very far away from them. Fencing will be done to avoid any accidents like what in previous occasions where a herdsboy died in the dam.

Q. by Mrs. Janet Ngele (NGCDF representative)- Will that water be used for irrigation?

A- The first priority of the dam is to take care of livestock water needs. However, other needs like domestic water use are taken care of through construction of a water drawing off point for domestic use. Further, this water can be used to do setting up of demonstration plots of Good Agricultural Practices (GAP) for farmers to learn on how to do efficient utilization of irrigation water for small scale irrigation purposes. This suggestion can be part of the ESMP.

She latter thanked the community members for the airing their views they made and asked them to support the project because it will ease the challenge of water in the area especially during the dry seasons. She asked the community members to think of other sites where such dams could be constructed in future by other development partners in order to make Kishushe a well empowered community.

Min06/14/11/2019 Questionnaire

The community members selected ten members who were guided on the filling of the questioner by the ESIA expert.

Min 07/11/2019. AOB

There were no AOB

Vote of Thanks- by Area Chief: He thanked community members and the lead team for making the baraza successful.

The meeting was adjourned at 1745hrs with a word of prayer from Raphael Mombo.

Picture Gallery



The lead Expert giving a brief about the public consultation process



A Female beneficiary to the project giving her views

Minutes Prepared by:

Quentin M. A. Ngati

ESIA Lead Expert

Signature: 

Date: 1st 12. 2019

Officials Signature

1. Chief

Name: DAVID F. MURAMBAWA

Signature: 

Date: 4/12/2019. CHIEF KISHUSHE LOCALITY

2. Mкуру Dam Committee Chairman/On Behalf of the Community

Name: ANTHONY M. HAJUMWA

Signature: 

Date: 4/12/2019

COUNTY GOVERNMENT TAITA TAVETA

DEPARTMENT OF AGRICULTURE, LIVESTOCK PRODUCTION, FISHERIES AND IRRIGATION

KENYA CLIMATE SMART AGRICULTURAL PROJECT

ATTENDANCE LIST

DATE: 19th November, 2019

ACTIVITY: NYKUBAU BANI CONSTRUCTION - PUBLIC CONSULTATION - ESCA STUDY - KISUMU - KISUMU

S/NO.	NAME	WARD	ORGANIZATION	TELEPHONE	EMAIL	SIGNATURE
1	NAINASA MASHIMANGI	KISUMU	STW KISUMU	07282924	STW@kisumu.go.ke	[Signature]
2	MUKHOMBI MUKHOMBI	KISUMU	STW KISUMU	0745236407		[Signature]
3	DEJINE MURAGURI	MURANGI	STW KISUMU	070356453		[Signature]
4	MAYEE MURANGI	MURANGI	STW KISUMU	071529421		[Signature]
5	DINESH MURANGI	KISUMU	KISUMU	074536179		[Signature]
6	ROSINA MURANGI	KISUMU	MURANGI	071461783		[Signature]
7	RUTH MURANGI	KISUMU	MURANGI	072924077		[Signature]
8	SOLOMON MURANGI	KISUMU	MURANGI	072924077		[Signature]
9	JERUSA MURANGI	KISUMU	MURANGI	070054119		[Signature]
10	SARA MURANGI	KISUMU	MURANGI	0795907657		[Signature]
11	VINCENT MURANGI	KISUMU	MURANGI	0722461862		[Signature]
12	FLORENCE MURANGI	KISUMU	MURANGI	0702571255		[Signature]
13	MURANGI MURANGI	KISUMU	MURANGI	072924077		[Signature]
14	MURANGI MURANGI	KISUMU	MURANGI	070192241		[Signature]
15	MURANGI MURANGI	KISUMU	MURANGI	079611818		[Signature]

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COUNTY GOVERNMENT TAITA TAVETA
DEPARTMENT OF AGRICULTURE, LIVESTOCK PRODUCTION, FISHERIES AND IRRIGATION
KENYA CLIMATE SMART AGRICULTURAL PROJECT

ATTENDANCE LIST DATE: 14/11/2019

ACTIVITY: Nikauu dam construction - Public consultation - ESCA Study - KISHICHE

S/No.	NAME	WARD	ORGANIZATION	TELEPHONE	EMAIL	SIGNATURE
1	AMWET NGELE	MUKUSHE	SPU KISHICHE	0710616514	ngengera2@gmail.com	
2	MARY SBU	MUKUSHE	C. Person	0710616514		
3	GRACE MURICHU	MUNDANI	Sto wambuyi	0724855909		
4	JULET MUKONGI	MUKUSHE	Sto Mukong	0726851016	miradungu@ku.ac.ke	
5	MATY MURDINO	KISHICHE	gym Kishiche	0726279550		
6	Clarence Nyaraha	KISHICHE	Stu Kishiche	0705654582		
7	Cedric Chao Muehisi	"	Stu	0714085260	mustashigro	
8	Flister Wakeshe	Kishiche	SYW	0705503317		
9	VERONICA MUKANJUMWA	Kishiche	SYW	0712329290		
10	Sabina Nyang'oro	Kishiche	SY	07153093072		
11	Dorothy Mwalumbi	Parange	SYW	0799181502		
12	Beatrice Mwachofi	M/Kishiche	Syua	0792653478		
13	Pu JENIA MUSHICHIPI	WANG'ATA	Syua	0744821150		
14	DR MARIAS MURUGUWA	WANG'ATA	Syua			
15	Elizabeth Mwanerwa	Kobushe	Wang'ata	0796136115		

COUNTY GOVERNMENT TAITA TAVETA

DEPARTMENT OF AGRICULTURE, LIVESTOCK PRODUCTION, FISHERIES AND IRRIGATION

KENYA CLIMATE SMART AGRICULTURAL PROJECT

ATTENDANCE LIST

DATE 14/11/2019

ACTIVITY: MISURAN DANI CONSTRUCTION - DUBAR CONSULTATION - ECA STUDY - KICHUŠHE

S/No.	NAME	WARD	ORGANIZATION	TELEPHONE	EMAIL	SIGNATURE
1.	ANTHONY M. NJIRANGA	KUMINGI KISHUŠHE	MAKORU CHUKUBAH	074324489	quwest9@gmail.com	
2.	MURUMU ECEMIAH	WUMU KISHUŠHE	Kenya Green Kampyaka	077314276		
3.	FESTUS M. MURATI	KUMINGI KISHUŠHE		0726263228		
4.	Alfred Njiru wa Mwangi			070026213		
5.	Stephen Mwarika		Mwambila Chiripian Mwangi	0774524092		
6.	Timoteo Kibenderi	)		072669324		
7.	Chagay Mwangi	)	Makulungu	074835586		
8.	Mthoko Mwangi	)	Makulungu	074692848		
9.	Jedida Kishi	)	Kang'ya	020000000		
10.	Rose Makena	)	Makua			
11.	Dani Mwangi	KISHUŠHE	Makua	0713587005		
12.	Dani K. M.	)	Makua	0791961373		
13.	Godfrey Mwangi	Makua	Makua	072400071		
14.	William Mwangi	KISHUŠHE KUMINGI	Mwambila Mwangi	0725672307		
15.	Ayub Mwangi	KISHUŠHE	Makua	07087933	mthoko200@gmail.com	

	NAME	WARD	DRGA	TEL	EMAIL	SIGNATURE
16.	Samuel Mkingo	KISHUSHE	Kayunga	079613607		<i>Samuel</i>
17.	RACHE WAMBUGHA	KISHUSHE	KATAGHA	0716409149		<i>Rachel</i>
18.	ELZABETH KIMBEU	KISHUSHE	WANG'ALA	0711255050		
19.	CHRISTINE KID	WASHUCHU	KOROGORUA	0719117293		<i>CK</i>
20.	DANSON KOKOSE.	KISHUSHE	MWANG'ARA	071558762		<i>DK</i>
21.	ALBERT MURIBOU.	KISHUSHE	MIRIA	07112529		<i>Muribou</i>
22.	FRANCIS MURIBOU	KISHUSHE	MIRIA	0713972607		<i>Francis</i>
23.	STARMAN ONAMUN	KISHUSHE	NG'ICUNGU	079790673		<i>Starmun</i>
24.	FESTUS MWASA	KATAGHA	MIRIA	0705853930		<i>Festus</i>
25.	Raphael M. B. B.	KISHUSHE	Katungu	079872664		<i>Raphael</i>
26.	ANTHONY KOKU	MURIBOU	KOROGORUA	072244521		<i>Anthony</i>
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COUNTY GOVERNMENT TAITA TAVETA

DEPARTMENT OF AGRICULTURE, LIVESTOCK PRODUCTION, FISHERIES AND IRRIGATION

KENYA CLIMATE SMART AGRICULTURAL PROJECT

DATE: 14/11/2019

ATTENDANCE LIST

S/No.	NAME	WARD	ORGANIZATION	TELEPHONE	EMAIL	SIGNATURE
1.	DRESDEN WAREWE	Kamunge W/M		01271617758		
2.	Nobias Mwarusa	Kisumu	Sy W	0110924466		
3.	Sara Mwakimu	Kisumu	Sy W	0763789008		
4.	Evelyn Mumburi	Kidua	Sy W	0707913532		
5.	Marijess Ng'ethe	Kisumu	Sy W	0951854887		
6.	Wycliffe wa zoe	Panzaga	Sy W	0795661065		
7.	Kobe Njiru	Kamuhai	Sy W	0702866030		
8.	BHAI MURINDI	Kakaba	Sy W	0716359215		
9.	David E. Mwangi	Kisumu	Sy W	0744379078	damwangi99@gmail.com	
10.						
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3) 3rdPublic Consultation Meeting

MINUTES OF ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT FOR MKURU DAM CONSTRUCTION HELD ON 15TH NOVEMBER 2019 AT KWAAFITI STARTING AT 1400HRS.

Officers and Officials Present

1. Mr. Andrew Mbinga:	KCSAP CPC
2. Mrs. Irene Wanjiku:	KCSAP M&E
3. Mr. Quentin Ngati:	ESIA Lead Expert
4. Mr. Simon Musimi:	Civil Engineering Expert
5. Mr. Mwadime Mbui:	Sociologist
6. Mr. Peter Mwashighadi:	Livestock/Agriculture Expert
7. Mr. Wilbard Chomba:	Hydrologist/Water Expert
8. Mr. Starman Onamu:	Ward Agricultural Officer
9. Mr. David F. Mwandagina:	Chief-Kishushse
10. Mr. Antony M. Njumwa:	Chairman- Mukuru Dam Management Committee
11. Ms. Cecilia Chao Mwabili:	Treasure- Mkuru Dam Management Committee
12. Mr. Raphael M. Righa:	Member- Mkuru Dam Management Committee

Agenda

- i. Opening prayers
- ii. Self-introduction
- iii. Opening remarks
- iv. Project overview
- v. Plenary
- vi. Questionnaire
- vii. AOB

Min01/15/11/2019 Prayers

The meeting was called to order and started with a word of prayer from Gibran Lumbo at 1505hrs.

Min 02/15/11/2019 Self-introduction

Every person who was in this baraza introduced themselves stating their name, village and the position they hold in the Mkuru dam project or in other ongoing projects and in the community.

Min03/15/11/2019 Opening remarks by the area chief

The area chief welcomed the community members and the officers to the meeting and asked them to feel free when expressing their views on the project. He further stated that those views would be used for compiling the environment and social impact assessment (ESIA) report for the Mkuru dam construction. He said that the community have been having challenges during the dry seasons to get water especially for their livestock and the this project which is funded by World Bank and both levels of the government will go a long way in helping the community solve that water shortage challenge.

Min 04/15/11/ 2019. Project overview

i. By Mkuru dam chairperson.

The chairperson, Mr. Anthony Njumwa, explained to the community members that Mkuru dam is funded by World Bank, the National Government and County Government through KCSAP project. He stated that today's meeting was about taking views of community members on Mkuru dam.

Mr. Mwadime Mbui, stated that Mkuru dam will change livelihoods of the community and that it will benefit all community members in the Kishushe location.

ii. By Project overview ESIA expert

Gave overview of the project, reasons for identification of the project and how the project was identified.

He gave a brief history of the project and explained to the community members the reasons as to why the views are needed by the project funding sources and implementers.

The goal of the project was explained is to improve the livestock production by storing enough water to be used during the dry seasons.

The objectives of the project are:

- 1) To harvest enough surface runoff for livestock watering.
- 2) Reduce soil erosion
- 3) To reduce covered by livestock to water sources during the dry periods

The following four are the main project parts the ESIA expert explained to the members

- 1) Dam construction
- 2) Win wall construction
- 3) Fencing
- 4) Cattle trough construction

Project activities that would be carried out of concern are: Site clearing, mechanical and partially manual land excavation, backfilling around the excavated area, delivery of building materials and equipment to the site, reinforcement and non-reinforcement concrete/cement works, building works and form works.

Min 05/11/2019 plenary by Mr. Mwadime the county social services director

The community members were given a chance to ask questions regarding the Mkuru dam project. This session was under the guidance from Mr. Mwadime County social services officer.

Q. Sarah Mwamburi-Ngongondinyi- She has been living in this locality for many years and was wondering which areas will be sources of the Mkuru dam water.

A-The water will come from Mgange-Mwandahills surface runoff and on normal occasions that water usually and flows through the Mkuru water way and into very far

ahead into the Tsavo West National Park. This water will be harvested during the rainy season. This is the reason as to why more public participation is needed to be done for the community members to be fully aware of the project.

Q. JosphineNdighila- Will Mkuru dam water serve Daku, Ngongodinyi, and Mashashagho villages?

Answer- If at all the water will be used for domestic water piping, water should be cleaned /purified then pumped to a higher ground tank in order to flow to these villages by gravity by the community and with the support of other developing partners in future. But for now, the dam water is planned to be used for livestock use at a water trough constructed beside it. A domestic water draw off point/a simple water tap structure will be constructed to draw water for domestic use.

Q.JosphineMasingaMwasinenyi-Will Mkuru dam water serve Mwasinenyi village

A. the community will receive water in future if pumping of this water is done after the primary goal of watering the livestock was done. This would happen in future planning and in partnership with other development partners the community being the lead stakeholders.

Opinion: Listen Mshamba.He gave an opinion that the project will be successful if the community members supported it. He further said that Tsavo River has enough water to feed Kishushe through irrigation.

Q.Gilbran Lumbo- How long will construction take to be completed? He gave an opinion that there is Aruba Dam in Tsavo park that can be a good source of water for the Kishushe community

A-Contractor was given the tender and by June 2020 the dam should be complete. The committee should share with the community the environment conservation plan for them to further understand the project.

Opinion: ConstanceMengo- She gave an opinion stating that if water will be accessible to them then they do support the project because their main water source is Kishenyi dam water and currently this water project is facing many challenges such as breaking of the pipes.

Min 06/15/11/2019 Questionnaire

The community members selected ten members who were guided on the filling of the questionnaire by the ESIA expert.

CLOSING REMARKS

Chairperson:Farmers/community members should come in numbers during Barazas to enhance development. He further mentioned the 4 value chains under the KCSAP: Dairy and meats, local poultry, Irish potato and Green grams.

Area Chief –Gave hope to the community members that World Bank was ready to work with them and support development in Kishushe. They should stop politicizing any projects in the area but rather support development.

The meeting was closed by a word of prayer from Gibran Lumbo. At 1635hrs.

Picture Gallery



Minutes Prepared by:

Quentin M. A. Ngati

ESIA Lead Expert

Signature.....

Date: 1st 12. 2019.....

Officials Signature

1. Chief

Name: David S. Mwanambiki

Signature: [Handwritten Signature]

Date: 4/12/2019

CHIEF
KISHUSHE LOCATION

2. Mkuru Dam Committee Chairman/On Behalf of the Community

Name: Anthony M. Mjumba

Signature: [Handwritten Signature]

Date: 4/12/2019

COUNTY GOVERNMENT TAITA TAVETA

DEPARTMENT OF AGRICULTURE, LIVESTOCK PRODUCTION, FISHERIES AND IRRIGATION

KENYA CLIMATE SMART AGRICULTURAL PROJECT

ATTENDANCE LIST

DATE: 15/11/2019

ACTIVITY: MUKHOU DAM CONSTRUCTION - PUBLIC CONSULTATION - ESTIA STUDY - KWA AHTI

S/No	NAME	WARD	ORGANIZATION	TELEPHONE	EMAIL	SIGNATURE
1	ATIMPHLET MUKHOUZI	MUMUNGU/KISUMBU		0719885800		<i>[Signature]</i>
2	Sharon Lusobo	Kisumu		0748769867		
3	Patience Mwachage Masingani					R. POSE
4	ROZI KIMONGE	Baku				
5	SREAT MUNSICHWA	Musungu		0716703322		<i>[Signature]</i>
6	SARAH MUMUKILI	Mwendonyi				S.P. AITA
7	JOSEPH MURIGWAS	Muminyi		0705720164		<i>[Signature]</i>
8	Nura Waweso	Muyogoo		0715332118		<i>[Signature]</i>
9	CHRISTINE FRANSI	MUAFITI		0799881924		<i>[Signature]</i>
10	JUDITH WAGAI	Daku		0714262402		<i>[Signature]</i>
11	CONSTANCE W. AKENGA	Mwingi		0348329090		<i>[Signature]</i>
12	ANTHONY KIKIKI	Mwingi	Agriculture	072244831	anton.kiki@gmail.com	<i>[Signature]</i>
13	David J. Mwanasasi	Mwingi	Chiefs	0714379071	david.j.mwanasasi@gmail.com	<i>[Signature]</i>
14						
15						

COUNTY GOVERNMENT TAITA TAVETA

DEPARTMENT OF AGRICULTURE, LIVESTOCK PRODUCTION, FISHERIES AND IRRIGATION

KENYA CLIMATE SMART AGRICULTURAL PROJECT

ATTENDANCE LIST

DATE: 15/11/2019

ACTIVITY: NYUNDAI CONSTRUCTION DURING CONSTRUCTION OF ECIA STUDY - KVA-AR172

S/No.	NAME	WARD	ORGANIZATION	TELEPHONE	EMAIL	SIGNATURE
1.	ANTHONY M. NYUNDAI	WUNDURU	REV. GABRIEL	0714304889	gabriel9@gmail.com	<i>[Signature]</i>
2.	RAPHAEL M. KESIM	KISHUKE	WUNDURU	0798520000		<i>[Signature]</i>
3.	Saidia Mshai	KISHUKE	VICAR	0710441910		<i>[Signature]</i>
4.	Petraina Muthi	KISHUKE		0798719207		<i>[Signature]</i>
5.	Rachel Mlade	KISHUKE				<i>[Signature]</i>
6.	Sarah Mwaribu	KISHUKE				<i>[Signature]</i>
7.	Spring Mwareru	KISHUKE		0713879515		<i>[Signature]</i>
8.	MPTibe	KISHUKE		0790339615		<i>[Signature]</i>
9.	GIDWOPAN WUNDURU	KISHUKE		0700103015		<i>[Signature]</i>
10.	Liste Mshai	KISHUKE		0719662068		<i>[Signature]</i>
11.	AGRICULTURE	WUNDURU				<i>[Signature]</i>
12.	STANLEY ONYIA	KISHUKE	AGRICULTURE	0727906721	stanleyonyia@gmail.com	<i>[Signature]</i>
13.						
14.						
15.						

4) 4thPublic Consultation Meeting

MINUTES OF ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT FOR MKURU DAM CONSTRUCTION HELD ON 18TH NOVEMBER 2019 AT PARANGA STARTING AT 1000HRS.

Officers and Officials Present

1. Mr. Andrew Mbinga:	KCSAP CPC
2. Mrs. Irene Wanjiku:	KCSAP M&E
3. Mr. Quentin Ngati:	ESIA Lead Expert
4. Mr. Simon Musimi:	Civil Engineering Expert
5. Mr. Mwadime Mbui:	Sociologist
6. Mr. Peter Mwashighadi:	Livestock/Agriculture Expert
7. Mr. Wilbard Chomba:	Hydrologist/Water Expert
8. Mr. Starman Onamu:	Ward Agricultural Officer
9. Mr. David F. Mwandagina:	Chief-Kishushye
10. Mr. Antony M. Njumwa:	Chairman- Mukuru Dam Management Committee
11. Ms. Cecilia Chao Mwabli:	Treasure- Mkuru Dam Management Committee
12. Mr. Raphael M. Righa:	Member- Mkuru Dam Management Committee

Agenda

- i. Preamble
- ii. Self-introduction
- iii. Opening remarks
- iv. Project overview
- v. Plenary
- vi. Questionnaire
- vii. AOB

Min01/18/11/2019 Preamble

The chair to Action Aid project called the meeting to order by informing the community members to keenly listen and ask questions to the officers who were from KCSAP project.

Min 02/18/11/2019 Self-Introduction

The village chairpersons and Action AID officials introduced themselves to the community members.

Min 03/18/11/2019 Opening remarks by the area chief

The area chief welcomed the community members and the officers to the meeting .He further stated that those views would be used for compiling the environment and social impact assessment (ESIA) report for the Mkuru dam construction.

He said that the community has been having challenges during the dry seasons and that if supported by the community members the Mkuru dam project would solve water challenge problem.

Min 04/18/11/ 2019.Project Overview

a. By the dam chairperson Anthony Njumwa

The chair stated that the dam construction tendering had been done and the only remaining issues was certification from the National Environment Management Authority NEMA. In addition the chair said that there report from NEMA was that further public participation needed to be done for the certification and this was the reason for the baraza in Paranga irrespective of the area being far from the Mkuru. In addition he said that other barazas had or were to take place in Kwaafiti, Kishushe hall and Mlilo in order to collect more views on the Mkuru dam construction.

b. Project overview-Starman Onamu

He informed the community members that Mkitina Group had been selected from the sub location for a Sub project.-there is a proposal for farm pond with liner in the area. He stated that the Mkuru dam had a capacity of 40.000m³.

In addition he explained to members about CDDC Community Driven Development,i.e. project-Micro project and Sub project.

This project, he stated, would be implemented through funds from Kenya Climate Smart Agricultural Project which is funded by the Government of Kenya and World Bank with 20% of the total cost of the project contribution by the County Government of Taita Taveta county.

The goal of the project was explained as to improve the livestock production by storing enough water to be used during the dry seasons.

The objectives of the project are:

- 1) To harvest enough surface runoff for livestock watering.
- 2) Reduce soil erosion
- 3) To reduce covered by livestock to water sources during the dry periods

The following four are the main project parts the ESIA expert explained to the members

- 1) Dam construction
- 2) Win wall construction
- 3) Fencing
- 4) Cattle trough construction

To break it further, he said, the following activities would be carried out.

Site clearing, mechanical and partially manual land excavation, backfilling around the excavated area, delivery of building materials and equipment to the site, reinforcement and non-reinforcement concrete/cement works, building works and form works.

Min 05/18/11/2019 plenary by Mr. Mwadime the county social services director

The community members were given a chance to ask questions regarding the Mkuru dam project. This session was under the guidance from Mr. Mwandimu County social services officer.

Q. Catherine Wakio –How are we sure that the dam will not collapse

A. This time there is sufficient dam design which in this case is a masonry construction design as compared to the previous case when it was an earth dam hence weaker. The local contractor will be monitored by the site engineer, works officer, and the dam committee.

Q. Benson Nyambu- Will Mkuru dam water serve to Paranga location?

A. Yes indirectly through farmers sending their animals to the cattle water trough to be constructed beside the dam. However, the current design is not for piping water into homesteads even those near by. Therefore the Paranga community members will benefit with sub projects and micro-projects.

Min 06/18/11/2019 Questionnaire

The community members selected ten members who were guided on the filling of the questionnaire by the ESIA expert.

Min 07/11/2019. AOB

There were no AOBs it was a vote of thanks from the area chief to the community members and the lead team for making the baraza successful.

The meeting was handed back to the Action AID group at 12:00hrs.

Picture Gallery



Minutes Prepared by:
 Quentin M. A. Ngati
 ESIA Lead Expert

Signature: *[Handwritten Signature]*

Date: 4th 12 2019

Officials Signature

1. Chief

Name: *David H. Mwarungi*

Signature: *[Handwritten Signature]*

Date: 4/12/2019 KISHUSHE LOCATION

2. Mkuu Dam Committee Chairman/On Behalf of the Community

Name: *ANTHONY M. NJUMWA*

Signature: *[Handwritten Signature]*

Date: 4/12/2019

COUNTY GOVERNMENT NAITA TAVETA

DEPARTMENT OF AGRICULTURE, LIVESTOCK PRODUCTION, FISHERIES AND IRRIGATION

KENYA CLIMATE SMART AGRICULTURAL PROJECT

ATTENDANCE LIST

DATE 18/11/2019 10:00am

ACTIVITY: MUYON DAN CONSTRUCTION - PUBLIC CONSULTATION - EQ2 STUDY - PARANA

S/No.	NAME	WARD	ORGANIZATION	TELEPHONE	EMAIL	SIGNATURE
1	John Sherna	Kisumu		0795698000		[Signature]
2	Mwatta TUMA	KIRINA		0707622849	Mwatta@gmail.com	[Signature]
3	MWINJI RUDLI MO	KISUMU				[Signature]
4	Darius Nwadhwa	Kisumu		0745490659		[Signature]
5	Caroline Simwange	Kisumu		079276887	mwabengei	[Signature]
6	Pauline Mwangi	Kisumu		071799339	Kati	[Signature]
7	Asatine Mwangi	Kisumu		018854091	Vision	[Signature]
8	Doneni Mwangi	Kisumu		071661660	Kwawengy	[Signature]
9	Dulnessa Goga Mwangi	Kwawengy		085108510	Kati	[Signature]
10	MARSHY KIKOENI	KISUMU		071661708	Mwabengey	[Signature]
11	Clifford KIKIU	KISUMU			Mwabengey	[Signature]
12	Haines Mwangi	Kisumu		070804256	Mwabengey	[Signature]
13	Polina Mwangi	Kisumu		072396505	Kati	[Signature]
14	Pocul Nyamathi	Kwawengy		072863205	Kisumu	[Signature]
15	ANDREW KAMBO KAMBO			070823700	KISUMU	[Signature]
	Ko. Senthana Gogani	Kisumu		092590653	mwabengey	[Signature]

16	Alex Prasetya Murni	Kisile	0702354113			
17	Alvintha Mbayka	Kabupaten	670742204			
18	Simpel Ruvivis	Kisile				
19	Deficia Klokia	Kisile				
20	Adison N. Mearontio	Kisile	070516039			
21	Yudi Murnati	Kisile	079503982			
22	Alex Mardeng	Kisile	071168107			
23	Klebia Mulyanika	Kisile	075942388			
24	Lenita Mulyanika	Kisile	074695080			
25	Ay Derton Murtoto	Murungkai	072600340	mardjucheltd@gmail.com		
26	Estina Citadita	Waringin/Kisile	072444546			
27	Triana Wipriana	Murungkai	074159148			
28	Beatrice Soloma	Kisile	070300284			
29	Hendyta Joel	Kisile	0718945676			
30	Ginora Murnika	Kisile	070632765			
31	Liad M Molele	Kisile	0704534025			
32	Grace Kabatip	Kisile	0799109580			
33	Beatrice Murniang	Kisile	0707110515			
34	SO Purina Vita	Kisile				
35	Betinal metla	Kisile				
36	Yaid Murtati	Kisile	0797862230			
37	David P. Mulyanika Murungkai Kisile Ctlug = 074179073 davidpelo79@gmail.com					

COUNTY GOVERNMENT TAITA TAVETA




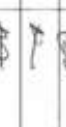


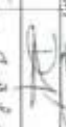



DEPARTMENT OF AGRICULTURE, LIVESTOCK PRODUCTION, FISHERIES AND IRRIGATION

KENYA CLIMATE SMART AGRICULTURAL PROJECT

DATE 19/11/2019 10:00am

ATTENDANCE LIST

ACTIVITY: NIKARU DAN CONTEMPORAN-Digital Communication - ESTIA STUDY - PARANGA

S/No.	NAME	WARD	ORGANIZATION	TELEPHONE	EMAIL	SIGNATURE
1	HILMUNDEGEBE NUNAWARVA	KISHUSHE		0727552468		
2	Penya deng	KISHUSHE		07920988		
3	BOROTH MURUMBA	KISHUSHE		0799181502		
4	NOES SHAKO	KISHUSHE		077752365		
5	MARTINEA W. JUMA	KISHUSHE		0797009911		
6	JAMES MUNDUNGAN	KISHUSHE		075457001		
7	RITA BAHATI	MLILO		0707225913		
8	MWAKIDAWIRO	PARANGA		079697889		
9	MUGHU SUNDU	WOMBO/KISHUSHE	WSC	0772057915	shirah.daniel@wsc.or.ke	
10	Baldson Njamen	KISHUSHE		079839844		
11	Stanley mureku	KISHUSHE		078822177	stanley.mureku@taita.go.ke	
12	VALD H GATIA	KISHUSHE		079209085		
13	Boccus B.K.HICUBU	KISHUSHE		0733248161		
14	Daniel G. MUNDUNGAN	KISHUSHE		079923298		
15	Paracia alumeu	KISHUSHE		070649600		
16	Joice Z. MURIA	KISHUSHE		0743754479		
17	Esther M Ngorodi	KISHUSHE		0702972163		

16	BEHAN DENNIS	M / W	W/SUSHE	0797030404	SP
17	JOSHUA NILELO	M / W	W/SUSHE	018872295	SP
18	JACKIE NYANGE	W / F	W/SUSHE	070202096	SP
19	JOHN NYAMBU	M / F	W/SUSHE	079705525	SP
20	ROPHUS MUMIKU MUKUNA	M / F	W/SUSHE	07558462	SP
21	MAGE ADPOSO	M / F	W / F	079570541	SP
22	SABLI PAH MABOKO	M / F	W / F	—	SP
23	LUCY KARAMA	M / F	W / F	078365259	SP
24	MARGARET CHENGO	M / F	W / F	074359185	SP
25	CHRISTINE WETIYUA	M / F	W / F	07075589	SP
26	DANIELA IKULALA	M / F	W / F	072250379	SP
27	BEATHA MUKO	M / F	W / F	079810557	SP
28	CLARA MANGA	M / F	W / F	071813119	SP
29	ENOCENT WACHARA	M / F	W / F	071536105	SP
30	AGATE NYEGE	M / F	W / F	079815905	SP
31	MARIA WIMBACH	M / F	W / F	071115187	SP
32	KACHAR MURUTICA	M / F	W / F	070202096	SP
33	LYDIAL WAZARUKHUA	M / F	W / F	079560106	SP
34	LUCY SAMBA	M / F	W / F	079697819	SP
35	SELVA WASSAI	M / F	W / F	—	SP
36	RABBAEL MUKOKA KISHUSHE	M / F	W / F	070202096	SP
37	Florence WONG WIKUSUSHE	M / F	W / F	070284535	SP

COUNTY GOVERNMENT TAITA TAVETA

DEPARTMENT OF AGRICULTURE, LIVESTOCK PRODUCTION, FISHERIES AND IRRIGATION

KENYA CLIMATE SMART AGRICULTURAL PROJECT

DATE: 19/11/2019 10:00am

ATTENDANCE LIST
 ACTIVITY: NYUNU XAN CONSTRUCTION - Public Construction - ESM STUDY - PAOANGA

S/No.	NAME	WARD	ORGANIZATION	TELEPHONE	EMAIL	SIGNATURE
1.	XIESON MUAHUA	KISUMU	CUSSORA	079782558		
2.	BOITHACE Njambome	KENKETE		0792074181	Njambome@gmail.com	
3.	Emmanuel M. Nyala	10 (MURURI) KENKETE	N. Othman	078822019	Emmanuel@gmail.com	
4.	Patrice MUAHA	11		0719162573		
5.	ABDULGEO MUSAABI	11		0703247932	Khalidnyaga@gmail.com	
6.	LUMBA KIRIGA	11				L.K
7.	Stanley MUSAABO	11				S. M
8.	Constance WAKO	11				Constance
9.	Imson Okiolo	11				
10.	ENOCK MUAHUA			0728634037	Enock@gmail.com	
11.	Mwandaniwa MUAHUA	11			Mwandaniwa	
12.	Rufrence MUAHUA	11		0714691022		Ruf
13.	Elizabeth Njombu	11		074556168	Mwaboelgu	Elizabeth
14.	XUKULWA SHILI	11		0791733221	Mwaguna	
15.	MARINETE MUAHUA	11			Sybil Prangea 0715371433 maragelkangor@gmail.com	

16	ALICE MCHAMBI	MURUMU KISUMU		0705768277	
17	PATIENCE KOE	MURUMU KISUMU			P. Ko
18	Caroline Mwachaka	MURUMU KISUMU		0742315593	S. wa
19	Daphne Mwachaka	MURUMU KISUMU		0707730399	Pa
20	Francis Mwachaka	MURUMU KISUMU		0718771444	Pa
21	DARIUS MUMBA	MURUMU KISUMU		0722549165	Pa
22	PEIRO KIBISA	MURUMU KISUMU		0772003076	Pa
23	EBDAB NYAMBU	MURUMU KISUMU		0795862217	Pa
24	HANATON NJUMBA	MURUMU KISUMU		0712004733	Pa
25	MICHEAL NJUMBA	MURUMU KISUMU		079033029	Pa
26	JOSHUA MERA	MURUMU KISUMU		0712003076	Pa
27	GILSON MURUMU	MURUMU KISUMU		0712003076	Pa
28	KIMALENGI KISUMU	MURUMU KISUMU		2661022	Pa
29	Elizabeth Kibet	MURUMU KISUMU			Pa
30	PHOTENCE NJUMBA	MURUMU KISUMU		077459122	Pa
31	Agnes W. Mumbiro	MURUMU KISUMU		0711245577	Pa
32	Agnes W. Mumbiro	MURUMU KISUMU		0710758189	Pa
33	PHOTENCE MURUMU	MURUMU KISUMU			Pa
34	EVERLY RUSI KISUMU	MURUMU KISUMU			Pa
35	Gracia Mwachaka	MURUMU KISUMU			Pa
36	JOSEPH MURUMU KATI	MURUMU KISUMU			Pa
37	CHRISTOPHER MUMBA KATI	MURUMU KISUMU		071318162	Pa
38	CELESTINA MURUMU KISUMU	MURUMU KISUMU		079852470	Pa

5) 5thPublic Consultation Meeting

MINUTES OF ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT FOR MKURU DAM CONSTRUCTION HELD ON 18TH NOVEMBER 2019 AT MLILO STARTING AT 1300HRS.

Officers and Officials Present

1. Mr. Andrew Mbinga:	KCSAP CPC
2. Mrs. Irene Wanjiku:	KCSAP M&E
3. Mr. Quentin Ngati:	ESIA Lead Expert
4. Mr. Simon Musimi:	Civil Engineering Expert
5. Mr. Mwadime Mbui:	Sociologist
6. Mr. Peter Mwashighadi:	Livestock/Agriculture Expert
7. Mr. Wilbard Chomba:	Hydrologist/Water Expert
8. Mr. Starman Onamu:	Ward Agricultural Officer
9. Mr. David F. Mwandagina:	Chief-Kishushse
10. Mr. Antony M. Njumwa:	Chairman- Mukuru Dam Management Committee
11. Ms. Cecilia Chao Mwabili:	Treasure- Mkuru Dam Management Committee
12. Mr. Raphael M. Righa:	Member- Mkuru Dam Management Committee

Agenda

- i. Opening prayers
- ii. Self-introduction
- iii. Opening remarks
- iv. Project overview
- v. Plenary
- vi. Questionnaire
- vii. AOB

Min01/18/11/2019 Prayers

The village chaircalled the community members to order and started the meeting with a word of prayer from Beatrice Mwakio at 1300hrs.

Min 02/18/11/2019 Self-Introduction

The village chairpersons and officers introduced themselves to the community members.

Min03/18/11/2019 Opening Remarks By The Area Chief

The area chiefwelcomed the community members and the officers to the meeting

He asked the community members to givetheir views on Mkuru dam and that those views and opinions would be used in compiling the environment and social impact assessment (ESIA) report for the Mkuru dam construction.

He said that the community had been having challenges during the dry seasons to get water especially for their livestock and the this project which is funded by World Bank

and both levels of the government will go a long way in helping the community solve that water shortage challenge.

Min 04/18/11/ 2019. Project overview

i. By Mkuru dam chairperson.

The chairperson, Mr. Anthony Njumwa, explained to the community members that Mkuru dam is funded by World Bank, the National Government and County Government through KCSAP (Kenya Climate Smart Agricultural Project) project. He stated that apart from Mkuru dam, the KCSAP had Sub projects and Micro-Projects in the ward.

ii. By Mr. Mwadime

Gave overview of the project, reasons for identification of the project and how the project was identified.

He looked into a brief history of the project and explained to the community members the reasons as to why the views are needed by the project funding sources and implementers.

The goal of the project was explained as to improve the livestock production by storing enough water to be used during the dry seasons.

The objectives of the project are:

- 1) To harvest enough surface runoff for livestock watering.
- 2) Reduce soil erosion
- 3) To reduce covered by livestock to water sources during the dry periods

The following four are the main project parts the ESIA expert explained to the members

- 1) Dam construction
- 2) Win wall construction
- 3) Fencing
- 4) Cattle trough construction

He indicated that, project will involve activities that may impact the community environmentally and socially. These activities group together are as follows:

Site clearing, mechanical and partially manual land excavation, backfilling around the excavated area, delivery of building materials and equipment to the site, reinforcement and non-reinforcement concrete/cement works, building works and form works.

Min 05/18/11/2019 Plenary By Mr. Mwadime The County Social Services Director

The community members were given a chance to ask questions regarding the Mkuru dam project. This session was under the guidance from Mr. Mwadime County social services officer.

Q. by VainessWamboi-She asked why the project had delayed since last year?

A-This was due to approval from NEEMA and the need to have more public participation for the project to commence.

Q-Donald Mwawasi- Are there Mlilo community members who are part of the Mkuru dam committee?

A-No but for the CDDC there are members from Mlilo

Q. JaelMkacharo. How many members are required by KCSAP groups for Micro and sub projects?

A. About 30 members

Q. Rose Mwachanya. Will the project be interfered with by the wildlife?

A. by Area chief. There is electric fencing done by the Kenya Wildlife to prevent the wildlife getting to the community members

Q. How will Mlilo community benefit yet there are far from the Mkuru dam site

A.- There are micro- catchment projects and sub- projects that will benefit the Paranga sub location. Furthermore there is a second phases and the sub-location can write a proposal for another project.

Min 06/11/2019 Questionnaire

The community members selected ten members who were guided on the filling of the questioner by the Secretary Anthony Kariku.

Min 06/11/2019 Closing Remarks

Chairperson: Thanked members for their contributions and mentioned the value chains as Dairy and meats, local poultry, Irish potato and Greengrams.

The meeting was closed by a word of prayer from Beatrice Mwakio. At 1545hrs.

Picture Gallery



Community in attendance, being addressed by the Sociology Expert and filling in the questionnaires at Milio market shade in Milio Village

Minutes Prepared by:
 Quentin M. A. Ngati
 ESIA Lead Expert

Signature: *[Handwritten Signature]*

Date: 4th - 12 - 2019

Officials Signature

1. Chief

Name: *DAVID P. MURANGIWA*

Signature: *[Handwritten Signature]*

Date: 4/12/2019 - KISHUSHE LOCATION

2. Mкуру Dam Committee Chairman/On Behalf of the Community

Name: *ANTHONY M. MUMWA*

Signature: *[Handwritten Signature]*

Date: 4/12/2019

COUNTY GOVERNMENT TAITA TAVETA

DEPARTMENT OF AGRICULTURE, LIVESTOCK PRODUCTION, FISHERIES AND IRRIGATION

KENYA CLIMATE SMART AGRICULTURAL PROJECT

ATTENDANCE LIST

DATE 18/11/2019 13:00 pm

ACTIVITY: MIKUU DAN CONSTRUCTION - PUBLIC CONSULTATION - ESIA STUDY - MULLO

S/No.	NAME	WARD	ORGANIZATION	TELEPHONE	EMAIL	SIGNATURE
1	PATIENCE MURCHUKI	KISHUSHE	TELEUKI MEMBER	0706555901	F	
2	DONKENICIA PAITHANY	KISHUSHE	MEMBER	0710226902	F	
3	Lucia Mwarumbuu	Mungu	Munguni	0795539603	F	
4	Nancy Samu	Mungu	Munguni	072530095	F	
5	Lola Mwangi	KISHUSHE	Stom's Samu	0705310127	F	
6	Floreana Magwara	KISHUSHE	Stom's Samu			
7	Delphine waigala	"	"	0714619357	F	
8	Josphina -W. Mwangi	Mungu	Munguni	090530555	F	
9	Agness Mudo	KISHUSHE	felengy	0705369402	F	
10	BEATRICE MURAKI	KISHUSHE	felengy	0713158105	F	
11	Juitha Mwariboo	KISHUSHE	MILLO	0795185101	F	
12	Keston Mwariboo	KISHUSHE	MILLO	0798184007	F	
13	VANESSA WAMBALI	Mungu	MILLO	0705617639	F	
14	SYLA MICHERRAO	MULLO	MILLO	0705585911	F	
15	CEARICE WAMBURA	MULLO	MILLO	0719358907	F	

16.	BRENDHA MURAHITA	Kishushe	shambisan	0702061156		
17.	Fiora Mwangala	Kichusi	TEHENYI			
18.	Faith MUSAALICHA	Kishushe	MILIO	072590220		
19.	Wamboni WIRGUDA	Wamboni	Munguni	07100331657		
20.	JOSPHINE WAMBONI	Kishushe	Shambisan	0702060882		
21.	Grace Mwangali	Kishushe	Milio	0702060885		
22.	Dorcas LUMBWA	Kishushe	Milio	0712283200		
23.	DEBORAH WAKO	Kishushe	Munguni	07020698393		
24.	HANNAH WATARA	Kishushe	Munguni	0710033414		
25.	HOGVEL MANGA	Kishushe	Munguni			
26.	Selida Mola	Kishushe	Kang'ya	0710044144		
27.	MILLA F. MURAHITA	Kishushe	CHAGI	0714879071		
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COUNTY GOVERNMENT TAITA TAVETA

DEPARTMENT OF AGRICULTURE, LIVESTOCK PRODUCTION, FISHERIES AND IRRIGATION

KENYA CLIMATE SMART AGRICULTURAL PROJECT

ATTENDANCE LIST

ACTIVITY: MARKET BANN CONSTRUCTION - Public Consultation - ESTA SUBB - MUKIRO DATE: 18/11/2019 18:00pm

S/No.	NAME	WARD	ORGANIZATION	TELEPHONE	EMAIL	SIGNATURE
1	Charles Wanjau	MUKIRO		079752448		
2	Violet Mwangi	MUKIRO		070768574		
3	BISHON MURRAYA	MUKIRO		0717415909		
4	CHRISTINE KAMENGE	MUKIRO		0708259484		
5	ROSE MURACUNDA	MUKIRO		070351519		
6	Margaret Kile	MUKIRO		072622569		
7	Margaret Mwangi	MUKIRO		0705494490		
8	LUCY MUKIRO	MUKIRO		074682274		
9	IRENE MURUKU	MUKIRO		0790898325		
10	LADIA WANGU	MUKIRO		0718424086		
11	Leticia Zenge	MUKIRO		079789573		
12	JANEKE WANGU	MUKIRO		074657622		
13	STACEY MURRAYA	MUKIRO		0740635579		
14	MARIONA MURRAYA	MUKIRO		0768357897		
15	CHRISTINE SHU	MUKIRO		070891630		

16	JOSEPH MATHIAU	MILLO	0202280534	<i>Joseph</i>
17	Phelicia WAKO	MILLO	070089747	<i>Ph</i>
18	Susan Mwachang	MILLO	071315378	<i>Susan</i>
19	ESTHER Mwachang	MILLO	073928806	<i>ESTHER</i>
20	NZILALI MUNDILO	MILLO	0711697596	<i>NZILALI</i>
21	Beritina Mwachang	MILLO	079533462	<i>Beritina</i>
22	FITH FITH Mwachang	MILLO	0708653544	<i>fith</i>
23	MASHACK Mwachang	MILLO	0715927658	<i>MASHACK</i>
24	VERONICA MWAURE	MILLO	0715519742	<i>VERONICA</i>
25	VICTORINE MATHIAU	MILLO	0708222851	<i>VICTORINE</i>
26	BERTINA SARU	MILLO	0798272856	<i>BERTINA</i>
27	FLORENCE TOLE	MILLO	0791980976	<i>FLORENCE</i>
28	JARED MUNDILO	MILLO	0712231692	<i>JARED</i>
29	CHARIS SHELLA	MILLO	0722505487	<i>CHARIS</i>
30	BONFEE MUNDILO	MILLO	0739472561	<i>BONFEE</i>
31	EVERT Mwachang	MILLO	0740918278	<i>EVERT</i>
32	ELISABETH TOLE	MILLO	0748240561	<i>ELISABETH</i>
33	ELITHA Mwachang	MILLO		<i>ELITHA</i>
34	MADISON TOLE	MILLO		<i>MADISON</i>
35	JASHIN MWAURE	MILLO	0707463407	<i>JASHIN</i>
36	CHRISTOPHER MWAURE	MILLO	0704041587	<i>CHRISTOPHER</i>
37	NICHOLAS MWAURE	MILLO	0711557279	<i>NICHOLAS</i>

COUNTY GOVERNMENT TAITA TAVETA

DEPARTMENT OF AGRICULTURE, LIVESTOCK PRODUCTION, FISHERIES AND IRRIGATION

KENYA CLIMATE SMART AGRICULTURAL PROJECT

ATTENDANCE LIST

ACTIVITY: MURU DAM CONSTRUCTION - Public Consultation - BGR Survey - MUA DATE: 12/11/2019 TIME: 13:00 PM

S/No.	NAME	WARD	ORGANIZATION	TELEPHONE	EMAIL	SIGNATURE
1.	Nancy Mwangi	Kisusua		0714690987		Nancy
2.	Esther Mwangi	Kisusua		0710124203		Esther
3.	Sonye Mwangi	Kisusua				Sonye
4.	Constance Mwangi	Kisusua		0705158771		Constance
5.	Christine Mwangi	Kisusua		0790325149		Christine
6.	Mary Mwangi	Kisusua		0711289808		Mary
7.	Costance Mwangi	Kisusua		070698977		Costance
8.	Philippina Ngala	Kisusua		0793007392		Philippina
9.	JANE Mwangi	Kisusua		070698977		Jane
10.	MOSES Mwangi	Kisusua		0725998418		Moses
11.	HELEN Bhatti	Kisusua		0757338774		Helen
12.	Luisa Mwangi	Kisusua		0719583156		Luisa
13.	ALBINA Mwangi	Kisusua				Albina
14.	PAUL Mwangi	Kisusua		0725729534		Paul
15.	MURIEL Mwangi	Kisusua		0791446597		Muriel

COUNTY GOVERNMENT TAITA TAVETA

DEPARTMENT OF AGRICULTURE, LIVESTOCK PRODUCTION, FISHERIES AND IRRIGATION

KENYA CLIMATE SMART AGRICULTURAL PROJECT

ATTENDANCE LIST

ACTIVITY: Nyaua Pani Conservation - Dugic Discussion - ESTA Street - Njira. DATE: 12/11/2019 12:30 pm.

S/NO.	NAME	WARD	ORGANIZATION	TELEPHONE	EMAIL	SIGNATURE
1	ARTHUR M. NJUMWA	WUNYU KISHUSHE	CHATHAM METERI DPA	07434484	unitec@equation	Ar-
2	MELAY GOSARE	POKONGA	STAMBISHA CLUBMAN	07980878		Mel
3	MICHELLE MURWASI	WUNYU KISHUSHE	member	079822264		Mel
4	Leah, m Liza	WUNYU KISHUSHE	member	0715133571		Lea
5	Key MURUNDAU	PARANGA	member	070844522		Key
6	William MURWALI	PARANGA	member	078555197		Wiliam
7	BENSON KIMBEKE CHIMBO	PARANGA	member	070411359		Benson
8	Flurista MURKALO	MILLO	member	074002313	calygnor@equation	Flurista
9	Grace PACHID	MILLO	member	0740251861		Grace
10	Diana NOKUNBI	MILLO	member			Diana
11	Sangali Linal	MILLO	member			Sangali
12	PATRIK MURIBIKI MILLO					Patrick
13	Delmasa MURIBIKI MILLO					Delmasa
14	RUPHENCE WAKESHI			0743341173		Ruphence
15	ELIZA MARIKA					Eliza

16.	Setiadi M. M. N. I.	Kusumah	Kulilo	Orissasa	M.	1
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Appendix4: Land Ownership Document



THE PRESIDENCY

MINISTRY OF INTERIOR AND CO-ORDINATION OF NATIONAL GOVERNMENT

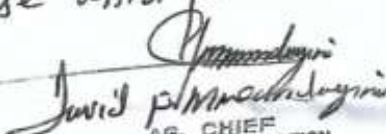
Telegrams: "DISTRUCOM",
Telephone: 0714379073
E-mail:
When replying please quote
Ref. No.
and date

OFFICE OF THE CHIEF
KISHUENGE LOCATION
P.O. Box 33
KISHUENGE
19/3/2019

TO WHOM IT MAY CONCERN.

RE: THE AREA OF MUKURU DAM KISHUENGE SUB-LOC

The above mentioned plot of land was set aside by the Community for the construction of dam.
I confirm to you that this plot has no dispute
Please assist where it is necessary.


Javid P. Mwachindi
AG. CHIEF
KISHUENGE LOCATION

Appendix 5: Dam Design Drawings
DAM DESIGN FOR MKURU WATER PAN
DAM SITE CONDITIONS

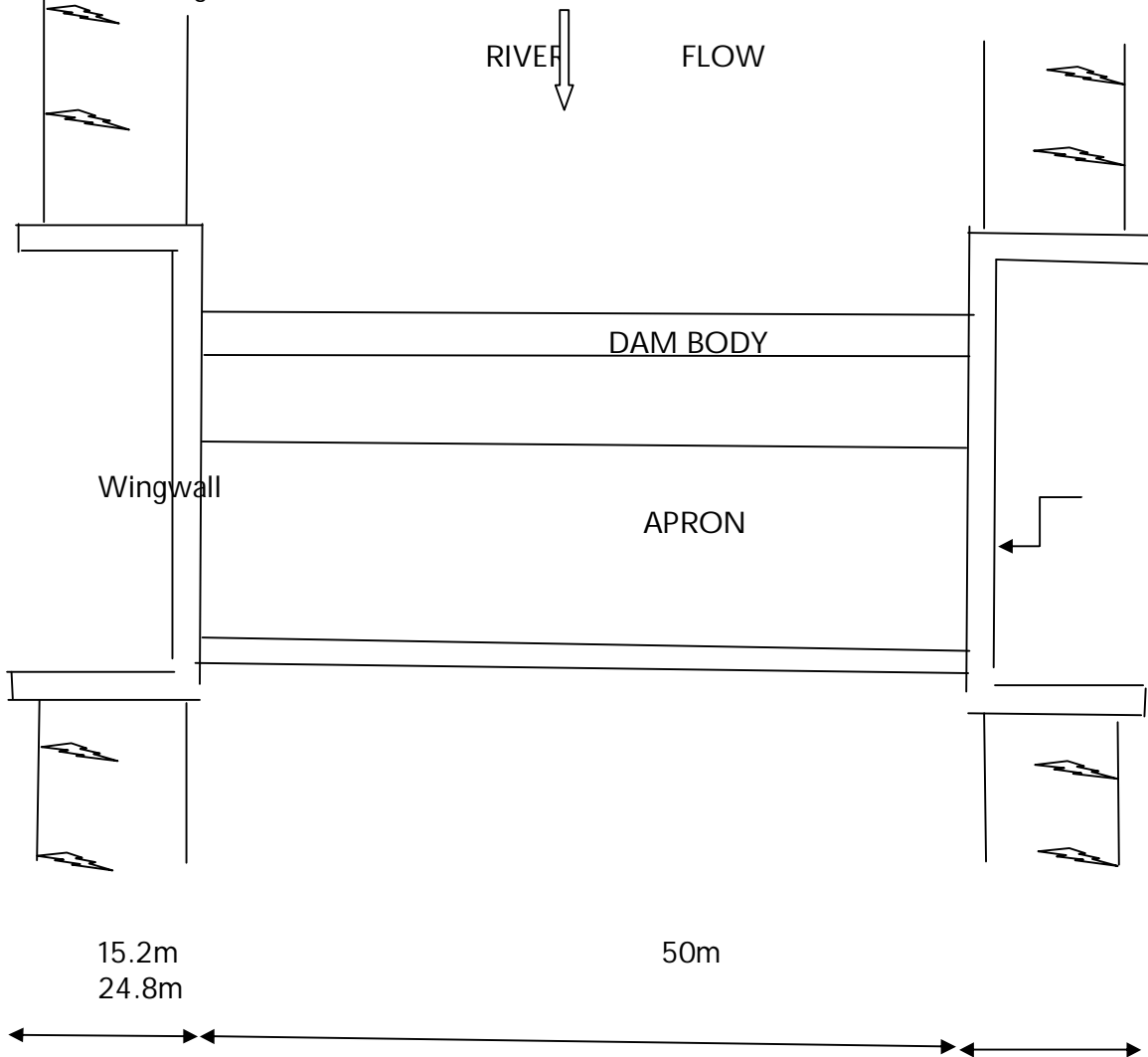
1. The site offers a wide channel of more than 90m
2. The bottom of the channel is silted up to about 3.3m deep over the bed rock.
3. The site offers a dam height of 5m allowing an extra 3m to top of the bank.
 The RL at the bed of the channel is at 93.00m and the top of the bank is at 101.00m.

The expected flood flow in 100 years Q_{100} is approximated at 150 m³/s. From google maps the catchment area for the Mkuru gulley is estimated at 250 km². (reference: Practice manual for small dams, pans and other water conservation structures in Kenya. Prepared by the MW&I.)

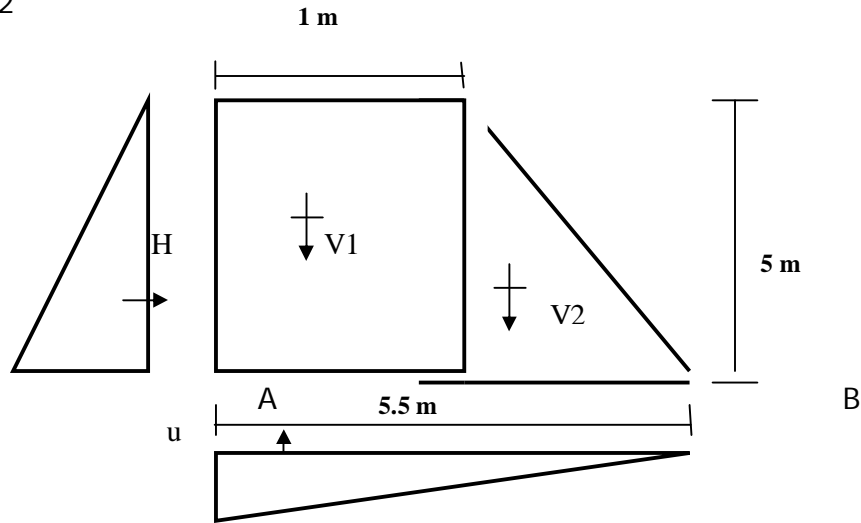
Considering a crest length of 50m, the weir formula gives a depth (d) of water of 1.413m required to pass the flood over the dam.

Therefore for the condition $D = d \times 1.5 + 0.1m$ of depth of water over the dam considering safety is satisfied. Where D is depth of flood flow plus free board.

Drawing no 1: PLAN OF DAM



Drawing no 2



Assume weir dimensions as above.

STABILITY ANALYSIS

Also assume the following;

- Weight of water = 10KN/M³
- Weight of sediment = 20KN/M³
- Depth of sediment = 1.5 M
- Weight of concrete = 24 KN/M³
- Co-efficient of neutral soil pressure $k_a = 0.5$
- Angle of internal friction of soil = 35°

Horizontal forces;

- Water:
 Pressure = 5 M x 10 KN/M³ = 50 KN/M²
 Average force = $[50 + 0] \frac{1}{2} \times 5 \text{ M} = 125 \text{ KN/M}$
 Distance to toe = $\frac{1}{3} \times 5 \text{ M} = 1.667 \text{ M}$
- Sediment;
 Pressure = $\frac{1}{2} \times 1.5 \text{ M}^2 \times 0.5 \times [20 - 10] \text{ KN/M}^3$
 = 3.75 KN/M²
 Average force = $[3.75 + 0] \times \frac{1}{2} \times 1.5 \text{ M} = 2.81 \text{ KN/M}$
 Distance to toe = $\frac{1}{3} \times 1.5 = 0.5 \text{ M}$

Vertical forces;

- $V_1 = 1 \text{ M} \times 5 \text{ M} \times 24 \text{ KN/M}^3 = 120 \text{ KN/M}$
 Distance to toe = $[\frac{1}{2} \times 1 \text{ M}] + 4.5 \text{ M} = 5 \text{ M}$
- $V_2 = \frac{1}{2} \times 5 \text{ M} \times 4.5 \text{ M} \times 24 \text{ KN/M}^3 = 270 \text{ KN/M}$
 Distance to toe = $[\frac{2}{3} \times 4.5 \text{ M}] = 3 \text{ M}$
- **Uplift force :**
 Uplift pressure = pgh
 = 10 KN/M³ x 5 M = 50 KN/M²
 Average force = $[50 + 0] \frac{1}{2} \times 5.5 \text{ M} = 137.5 \text{ KN/M}$

$$\text{Distance to toe} = 2/3 \times 5.5 \text{ M} = 3.667 \text{ M}$$

CHECK OVERTURNING

- M due to water = 125 KN/M x 1.667 M = 208.375 KNM
- M due to sediment = 2.81KN/Mx 0.5 M = 1.405 KNM
- M due to V_1 = 120 KN/M x 5 M = 600 KNM
- M due to V_2 = 270 KN/M x 3 M = 810 KNM
- M due to Uplift = 137.5 KN/M x 3.667 M = 504.2 KNM

$$\begin{aligned} \text{a] Vertical moments / horizontal moments} &= [600 + 810 - 504.2] / [208.4 + 1.4] \\ &= 4.3 > 1.5 \quad \text{Okay} \end{aligned}$$

$$\begin{aligned} \text{b] Stabilizing moments / Overturning moments} &= [600 + 810] / [208.4 + 1.4 + 504.2] \\ &= 1.97 > 1.3 \quad \text{Okay} \end{aligned}$$

CHECK SLIDING

$$\text{Angle of internal friction of soil} = 35^\circ$$

$$\text{a] } \{ [\text{Vertical forces} - \text{Uplift force}] \times \tan 35^\circ \} / [\text{Horizontal forces}] .$$

$$\{ [120 + 270 - 137.5] \tan 35^\circ \} / [125 + 2.81] = 1.38 > 1.3 \quad \text{Okay}$$

$$\text{b] } [\text{Horizontal forces}] / [\text{Vertical forces} - \text{Uplift}]$$

$$[125 + 2.81] / [120 + 270 - 137.5] = 0.506 < 0.8 \quad \text{Okay}$$

CHECK BEARING PRESSURE ON FOUNDATION

Maximum allowable bearing capacity of the foundation [Sand stone rock] is 600 KN/M².

$$\begin{aligned} a &= [M_v - M_H] / [V_f - U] \\ &= [600 + 810 - 208.375 - 1.4 - 504.2] / [120 + 270 - 137.5] \\ &= 2.76 \\ e &= [\text{Bottom width} / 2] - a \\ &= [5.5/2] - 2.76 \end{aligned}$$

$$= -0.01$$

a is within the middle third of the base, therefore Okay.

$$\begin{aligned} \text{Bearing pressure on downstream face} &= \{ V_f / B \} + \{ 6[V_f \times e] / B^2 \} \\ &= \{ [120 + 270 - 137.5] / 5.5 \} + \{ 6[120 + 270 - 137.5] \times - \\ &0.01 \} / 5.5^2 \\ &= 45.4 \text{ KN/M}^2 < 600 \text{ KN/M}^2 \quad \text{Okay} \end{aligned}$$

$$\begin{aligned} \text{Bearing pressure on upstream face} &= \{ V_f / B \} - \{ 6[V_f \times e] / B^2 \} \\ &= \{ [120 + 270 - 137.5] / 5.5 \} - \{ 6[120 + 270 - 137.5] \times -0.01 \} / 5.5^2 \\ &= 46.4 \text{ KN/M}^2 < 600 \text{ KN/M}^2 \quad \text{Okay} \end{aligned}$$

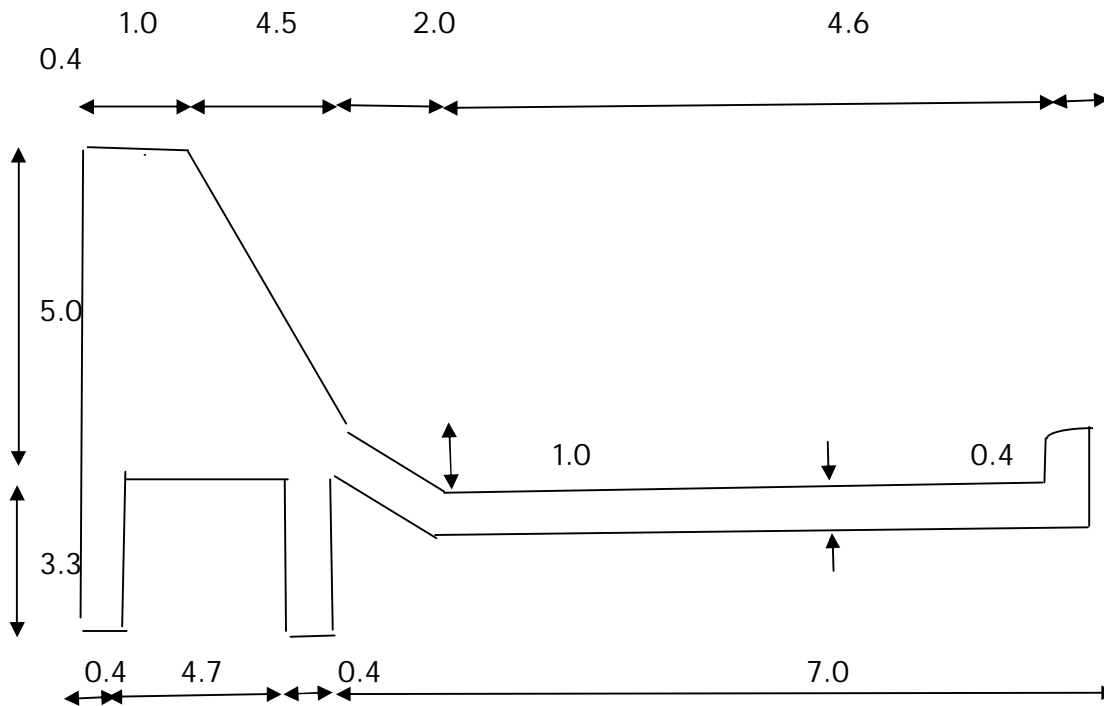
CHECK STRESSES IN CONCRETE

Load factor = 1.7

$$\begin{aligned} \text{COMPRESSION} &= \{[V_f - U] / B\}1.7 + \{6[V_f - U]e/B^2\}1.7 \\ &= \{[120 + 270 - 137.5]/5.5\}1.7 + \{6[120 + 270 - 137.5] \times -0.01 \times 1/5.5^2\}1.7 \\ &= 78.045 - 0.85 \\ &= 77.195 \text{ KN/M}^2 < 500 \text{ KN/M}^2 \quad \text{Okay} \end{aligned}$$

$$\begin{aligned} \text{TENSION} &= \{[V_f - U] / B\}1.7 - \{6[V_f - U]e/B^2\}1.7 \\ &= \{[120 + 270 - 137.5]/5.5\}1.7 - \{6[120 + 270 - 137.5] \times -0.01 \times 1/5.5^2\}1.7 \\ &= 78.045 + 0.85 \\ &= 78.896 \text{ KN/M}^2 < 500 \text{ KN/M}^2 \quad \text{Okay} \end{aligned}$$

$$\begin{aligned} \text{SHEAR} &= F_H / B \times 1.7 \\ &= \{[125 + 2.81] / 5.5\} \times 1.7 \\ &= 39.5 \text{ KN/M}^2 < 250 \text{ KN/M}^2 \quad \text{Okay} \end{aligned}$$



Drawing no 2: Showing footing and apron details

CHECK ADEQUACY OF THE FOOTING WALLS

Taking moments about A

$$V_1 \times 0.5\text{m} + V_2 \times 2.5\text{m} = R_B \times 5.5\text{m}$$

$$120 \times 0.5 + 270 \times 2.5 = R_B \times 5.5\text{m}$$

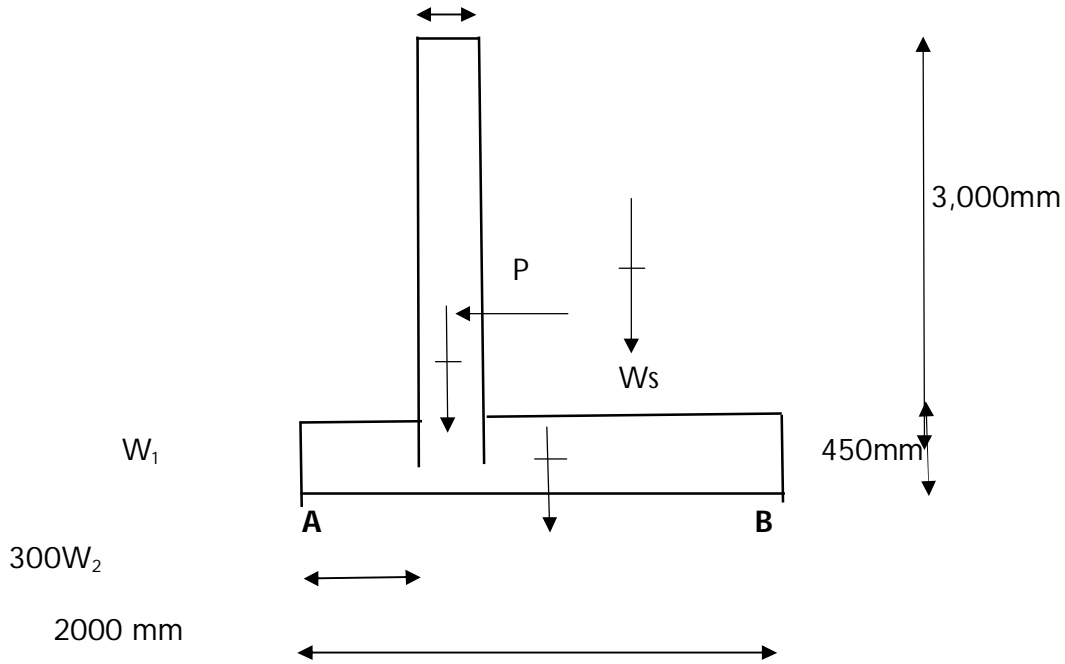
$$R_B = 735/5.5 = 133 \text{ KN}$$

$$R_A = 257 \text{ KN}$$

Maximum compressive stress at wall footing A = $257 \text{ KN}/(0.4 \times 1) \text{ M}^2 = 642.5 \text{ KN}/\text{M}^2$
 Allowable direct compressive stress in concrete = $5300 \text{ KN}/\text{M}^2$ therefore Okay (CP 114)
 For nominal reinforcement = $0.15/100 \times 400 \times 1000 = 600 \text{ mm}^2$
 Use Y12 @ 200 mm c/c as main steel as well as distribution steel.

DESIGN OF WING WALLS AS RETAINING WALLS

300



The dam site offers the height of wing walls as RL bank 101.00M – RL of crest 98.00 M = 3M
 The dimensions of the retaining wall are as shown above.
 The retained material is loose sand of internal frictional resistance of 35°
 Its bulk density is 1,800 kg/m³
 The bearing capacity of the foundation material is 300 KN/M² (sandy clays)

STABILITY ANALYSIS

Rankines coefficient $K_a = 1 - \sin 35^\circ / 1 + \sin 35^\circ$
 $= 1 - 0.57 / 1 + 0.57 = 0.43 / 1.57 = 0.27$
 $P_a = \frac{1}{2} \times 0.27 \times 1800 \times 9.81/1000 \times 3.45^2 = 28.37 \text{ KN}/\text{M}$
 Weight of wall $W_1 = 3\text{m} \times 0.3\text{m} \times 2,500 \text{ kg}/\text{m}^3 \times 9.81/1000 = 22.1 \text{ KN}/\text{M}$
 Weight of base $W_2 = 2\text{m} \times 0.45\text{m} \times 2,500 \text{ kg}/\text{m}^3 \times 9.81/1000 = 22.1 \text{ KN}/\text{M}$
 Weight of soil $W_s = 3\text{m} \times 1.4\text{m} \times 1,800 \text{ kg}/\text{m}^3 \times 9.81/1000 = 74.16 \text{ KN}/\text{M}$
 Total N = 118.36 KN/M

CHECK OVERTURNING

Take moments about B

$$118.36 x = 22.1 \times 1.550 + 22.1 \times 0.1 + 74.16 \times 0.7$$

$$x = 0.9 \text{ which is within the middle third and therefore OK}$$

CHECK SLIDING

Angle of wall friction = Angle of shearing resistance = 35°

$$\text{Sliding resistance } R_s = V \tan 35^\circ = 118.36 \times 0.7 = 82.87 \text{ KN/M}$$

$$\text{Factor of safety } F_s = R_s/P_a = 82.87/28.37 = 2.9 > 1.6 \text{ therefore OK}$$

CHECK BEARING CAPACITY

$$\text{Bearing stress at A (toe) } q_A = 2 \times 118.36 / 3(1 - 0.9) = 71.7$$

$$F_s = 300/71.7 = 4.18 > 3 \text{ therefore OK}$$

DESIGN OF REINFORCEMENT

I. WALL

Horizontal force = $F_s \times P_a$

$$= 1.4 \times 28.37 = 39.72 \text{ KN/M}$$

$$M_{\max} = 3.45/3 \times 39.72 = 45.67 \text{ KNM}$$

Assuming use of 20mm dia bars to both faces of wall and minimum cover of 40mm

$$d_1 = 250 - 20 - 80 = 150 \text{ mm}$$

$$A_{st} = M/P_{st} \times l_a \quad \text{Where } A_{st} = \text{Area of steel}$$

P_{st} = Allowable stress in steel

l_a = Lever arm

$$= 45.67 \times 10^6 / 230 \times 0.87 \times 150 = 1,521 \text{ mm}^2$$

Use Y 20 @ 200mm c/c

$$\text{Distribution steel} = 0.15/100 \times 300 \times 1000 = 450 \text{ mm}^2$$

Use Y 12 @ 250mm c/c

II. BASE

Factor of safety $F_s = 1.4$

Take moments about center line of wall

$$M = F_s \times 28.37 \times 3.45/3 + 22.1(1 - 0.45) - 74.16 \times (1 - 1.4/2)$$

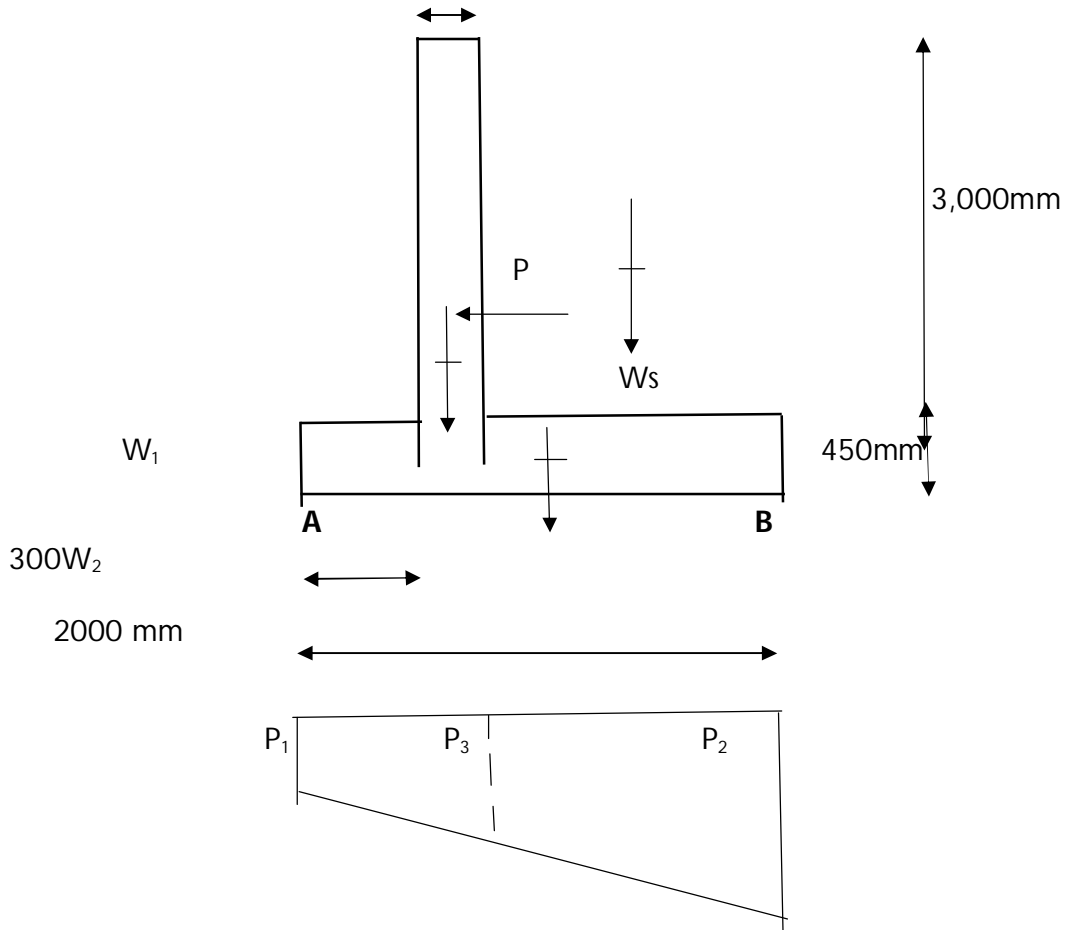
$$= 45.67 + 12.155 - 22.248$$

$$= 35.58 \text{ KNM}$$

$$N = F_s(22.1 + 22.1) + 74.16$$

$$= 136.04 \text{ KN}$$

300



$$P(\text{uplift pressure}) = N/D + \text{or} - 6M/D^2$$

$$P_1 = 136.04 / 2 + 6 \times (35.58)/2^2 = 68.02 + 53.37 = 121.39 \text{ KN/M}^2$$

$$P_2 = 68.02 - 53.37 = 14.65 \text{ KN/M}^2$$

$$P_3 = 14.65 + (121.39 - 14.65) \times 1.4/2 = 89.368 \text{ KN/M}^2$$

Take moments about centerline of wall

HEEL:

$$M = 22.1 \times 0.85 \times 1.4/2 + 74.16 \times 0.85 - 14.65 \times 1.4 \times 0.85 - (121.39 - 14.65) \times 1.4/2 \times 0.616$$

$$= 13.149 + 63.036 - 17.433 - 46.03 = 12.72 \text{ KNM}$$

$$A_{st} = 12.72 \times 10^6 / (230 \times 0.87 \times 390) = 163 \text{ mm}^2$$

$$\text{Distribution steel} = 0.15/100 \times 450 \times 1000 = 675 \text{ mm}^2$$

Use Y16 @ 200mm c/c in both cases

TOE:

$$M = 22.1 \times 0.45 \times 0.3/2 - 121.39 \times 0.3 \times 0.45$$

$$= 1.49 - 16.38 = -14.89 \text{ KNM}$$

$$A_{st} = 14.89 \times 10^6 / (230 \times 0.87 \times 390) = 190 \text{ mm}^2$$

Use Y16 @ 200mm c/c for main steel and distribution steel.

