

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

COMPREHENSIVE PROJECT REPORT

**PROPOSED REHABILITATION AND EXPANSION OF OSUKUNUA EARTH
DAM FOR IRRIGATION AND OTHER WATER NEEDS**

IN

OSUKUNUA VILLAGE LOITA WARD

NAROK SOUTH SUB COUNTY, NAROK COUNTY



GPS Coordinates: Latitude(-1.817508°S) Longitude (35.685964°E)

PROPONENT:

Osukunua Irrigation Water Users Association

P.O. Box, 128-20500

Narok

LEAD EXPERT:

Vincent I. Kinyua

February, 2026

PROJECT FACT SHEET

Name of Project	Osukunua earth dam and irrigation
Proponent	Osukunua Irrigation Water Users Association
Sub County	Narok south.
Ward	Loita
Purpose	To supply water for irrigation, domestic and livestock use
Postal Address	P.O. Box 128, 20500 Narok
Contact Person	David Reson Phone: 0703768197
Proposed Project	Construction of Osukunua earth dam and irrigation
Altitude at dam site (TBM ₁)	2100.20msl
Coordinates	-1.817508°
	35.685964°
Number of Target Beneficiaries	Direct beneficiaries- 125 Indirect beneficiaries- 1,500
Key Financiers	NAVCDP, County Government of Narok, Community
Project Cost	KE 83,640,542.20
Altitude at dam site (TBM ₂)	2122 msl
Elevation	2681.39meters
Date	August, 2025

CERTIFICATION

CERTIFICATION

This Environmental and Social Impact Assessment (ESIA) was prepared by NEMA registered EIA/EA in line with the Environmental Management & Coordination Act Cap 387, the Environmental (Impact Assessment/Audit) (amended) regulations, 2019 gazetted on 30th April 2019 under legal notice No. 31 and 32 for submission to the National Environment Management Authority (NEMA).

We, the undersigned, certify that to the best of our knowledge and belief, this report is correct & truly reflects the environmental status, stakeholder's views, concerns & benefits of the project and adverse impacts mitigation.

EIA/EA LEAD EXPERT:

Name: VINCENT I. KINYUA

NEMA REG. NO...11968

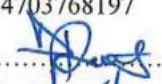
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Sign.....

Date.....

14/05/2025

Proponent	: OSUKUNUA IRRIGATION WATER USERS ASSOCIATION
Postal address	: 128-20500, Narok
Contact person	: David Reson
Designation	: Chairman- Osukunua Irrigation Water Users Association
Mobile No	: +254703768197
Signature	: 
Date	: 14/05/2025

DISCLAIMER

This EIA Comprehensive project report is strictly confidential to **OSUKUNUA IRRIGATION WATER USERS ASSOCIATION** (proponent) and any use of the materials thereof should strictly be in accordance with the agreement between the proponent and the ESIA/EA Expert/s mentioned herein (VINCENT I. KINYUA ET AL.). It is subject to conditions spelt out in the Environmental (Impact Assessment and Audit) Regulations Amended in 2019 under the Kenya Gazette Supplement No. 62, Legislative Supplement No. 16, and Legal Notice No. 31 of 2019. It provides information on the proposed project as per the time of EIA in the year 2024 and reviewed in 2025.

TABLE OF GENERAL INFORMATION

A1: LOCATION		
Name of Project	-	Osukunua earth dam and irrigation
Sub County	-	Narok south
Ward		Loita
Purpose		To supply water for irrigation, domestic and livestock use
Altitude at dam site (TBM ₁)	ELEVATION	2100.20msl
Coordinates	E	-1.817508°
	N	35.685964°
Altitude at dam site (TBM ₂)	ELEVATION	2122 msl
Catchment		
Area (Km ²)		3.97
Average slope		7%
Design area for irrigation and population		
Irrigable area		40Ha
Human		7817
Small stock (goat and sheep)		20,412
Donkeys		200
Cows		7,560
Total Water Demand (M ³ /DAY)		1,855.1
Dry Spell Assumed		Three months
Yield (m ³ /day)		1,915.4
Deficit		None
Evaporation (M ³ /day)		186.49

Seepage (M ³ /day)		41.645
Embankment		
Embankment Length	-	223m
Maximum depth		6.0m
Crest Width	-	6m
Base Width	-	51m
Side slopes	-	1:3
Gross Free Board	-	1.5m
Embankment volume		22,969m ³
Reservoir		
Area	-	40,987m ²
Effective storage capacity	-	172,384m ³
Volume of excavation	-	95,762m ³
Storage capacity/excavation	-	1:1.93
Spillway		
Bottom width	-	15m
Top width	-	17m
Length	-	167m
Excavation Volume		1,603m ³
Slopes	-	1:1
Fence		
Length		1725m
Gate		4m

ACRONYMS AND ABBREVIATIONS

'	Minutes
0 ⁰	Degrees
A.S.L:	Altitude above sea level
ASALS:	Arid and Semi-Arid Lands
ASU	Areal Standard Unit
CBD:	Convention on Biological Diversity
CIDP:	County Integrated Development Plan
CITES	Convention on International Trade in Endangered Species
COC:	Code of Conduct
CSOs	Civil Society Organizations
DAF	Dissolved Air Flotation
DD	Deficient Data
DOALF	Department of Agriculture Livestock and Fisheries
DOSH:	Directorate of Occupational Safety
EA	Environmental Audit
EBS	Environmental Baseline Study
EMCA:	Environmental Management and Coordination Act
EMPs:	Environmental Management Plans
ES	Endangered Species
ESIA:	Environmental Social Impact Assessment
EIA:	Environmental Impact Assessment
ESMMP	Environmental and Social Management & Monitoring Plan
EWf	Environmental Water Flow
FAO	Food and Agriculture Organization
FBOs	Faith Based Organizations
FGDs	Focus Group Discussions
GBV	Gender Based Violence
GWH	Giga Watt Hour
HH	Households

IEC	Information Education Communication
KIIs	Key Informant Interviews
KFS	Kenya Forest Services
Km ²	Kilometers Squared Square km
KNBS	Kenya National Bureau of Statistical
KWS	Kenya Wildlife Service
LU	Livestock Unit
LEQ	Equivalent Continuous Noise Level / Sound Level
MASL	Meter above sea level
ME	Metres East
MW	Mega Watt equal to 1000 kW
NAVCDP	National Agricultural and Value Chain Development Project
NEAP	National Environmental Action Plan
NEMA	National Environmental Management Authority
NGO	Non-Governmental Organization
NPEP	National Poverty Eradication Plan
NTU	Nephelometric Turbidity Unit
OSH:	Occupational, Safety and Health
OSHA:	Occupational, Safety and Health Act.
PAPs:	Project Affected Persons (PAPs)
PDRA	Participatory Drought Risk Assessment
PICD	Participatory Integrated Community Development
PM	Particulate Matter
PPE	Personal Protective Equipment
PPM	Parts per Million
SCTT	Sub County Technical Team
SEA	Sexual Exploitation and Abuse
SERC	Standards and Enforcement Review Committee
SH	Sexual Harassment
SIA	Social Impact Assessment

SK	Survey of Kenya
SOP	Standard Operating Procedure
TCU	True Color Unit
TH	Total Hardness
TOR:	Terms of Reference.
UTM	Universal Transverse Mercator
VIP	Ventilated Improved Pit Latrine
WHO	World Health Organization

DEFINITION OF TERMS

Baseline: A set of measurements, statistics, or conditions used as a basis for later comparison. The baseline refers to the pre-project conditions, prior to the initiation of the project, against which post-project changes can be compared.

Cultural heritage: The legacy of physical artifacts and intangible attributes of a group or society that are inherited from past generations, maintained in the present and bestowed for the benefit of future generations.

Cumulative impacts: Cumulative impacts are those that result from the incremental impact of the project when added to other past, present, and reasonably foreseeable future actions.

Displaced persons: Persons who lose land or the right to use land or access to legally designated parks and protected areas resulting in adverse impacts on livelihoods whether such losses and restrictions are full or partial, and permanent or temporary.

Flow: Volume of water, expressed as cubic feet or cubic meters per second, passing a point in a given amount of time.

Head: Vertical change in elevation, expressed in either feet or meters, between the head water level and the tail water level.

Impact: Effect or consequence of an action or event; the degree to which an impact is interpreted as negative or positive depends on context and perspective.

Involuntary Resettlement: Resettlement is involuntary when it occurs without the informed consent of the displaced persons or if they give their consent without having the power to refuse resettlement.

Management plan: A management plan is a tool used as a reference for managing a particular project issue, and establishes the why, what, how, who, how much, and when for that issue.

Management system: The framework of processes and procedures used to ensure that an organization can fulfill all tasks required to achieve its objectives.

Mitigation: Moderation, alleviation, and/or relief of a negative impact.

Project Displaced Persons: All the people affected by a project who through involuntary acquisition and/ or encumbrance placed upon the land on account of the execution of the project, necessitating the moving and resettlement from the affected land; includes any person, household, firms, or public or private institutions who as a result of a project would have their standard of living adversely affected; right, title or interest in all or

any part of a house, land (including residential, commercial, agricultural, plantations, forest and grazing land) or any other moveable or fixed assets acquired or possessed, in full or in part, permanently or temporarily adversely affected; or business, occupation, place of work, residence, habitat or access to forest or community resources adversely affected, with or without displacement.

Project-Affected Person: Any person who, as a result of the implementation of a project, loses the right to own, use, or otherwise benefit from a built structure, land (residential, agricultural, or pasture), annual or perennial crops and trees, or any other fixed or moveable asset, either in full or in part, permanently or temporarily.

Relocation: Physical moving of PAPs from their pre-project place or residence, place for work or business premises, to an area that is not affected by the project.

Reservoir area: The area that is inundated when the reservoir is at its maximum expected level and the dry buffer zone above this level.

Resettlement Action Plan: The document in which a project sponsor or other responsible entity specifies the procedures that it will follow and the actions that it will take to mitigate adverse effects, compensate losses, and provide development benefits to persons and communities affected by an investment project.

Stakeholders: Any and all individuals, groups, organizations, and institutions interested in and potentially affected by a project or having the ability to influence a project.

Vulnerable Groups: People who by virtue of gender, ethnicity, age, physical or mental disability, economic disadvantage, or social status may be more adversely affected by resettlement than others and who may be limited in their ability to claim or take advantage of resettlement assistance and related development benefits.

EXECUTIVE SUMMARY

The proposed Osukunua Earth Dam and Irrigation project is located in Ilmarai Sub Location, Ilkerin location, Loita Ward, Narok south Sub-County in Narok County. The proposed site for the project is located at GPS Coordinates Latitude (-1.817508°S) and Longitude (35.685964°E), at an altitude of 2122m ASL. The proposed site for the development of the Earth dam is owned by the community. The project's main objective is to increase livestock and crops productivity and profitability and build resilience to climate change for the target community by improving water and pastures availability and accessibility. The Earth Dam will support a small-scale community irrigation project, targeting an area of 40Ha. The project is estimated to cost **KShs 83,640,542.20** of which **KShs 1,599,040.00 will be community contribution**. Economic and financial analyses of the projected cash flows indicate a positive Net Present Value of **KShs 252,516,988.97** with an internal rate of return of 52% far exceeding the current/average market interest rate of 15% making the project economically viable.

The main objective of carrying out an ESIA was to ensure compliance with the provisions of Environmental Management and Co-ordination Act (EMCA) CAP.387 and the Environmental (Impact and Audit) Regulations, 2003 and the World Bank Environmental and Social Framework. The Second schedule of the EMCA outlines the projects which are likely to have adverse environmental impacts and hence require ESIA study. The report has also taken cognizance of other relevant national and international laws and protocols.

The methodologies used in this ESIA study included preparatory meetings, reconnaissance and field surveys, literature review, Focus Group Discussions (FGDs) undertaken during public Barazas and Key Informant Interviews (KIIs). A total of 64 participants participated in the community meetings, and 25 key collaborators participated in the Key Informant Interviews.

The main components of this project include the construction of 172,384m³ earth dam, irrigation conveyance pipelines, livestock troughs, community water point, sanitation facilities, solar powered pumping system and catchment conservation measures. The dam catchment is estimated at 3.97km².

This report reviewed key national policies that support sustainable development in ASAL areas, climate resilience, land rights, livestock production, agricultural transformations and gender equity, which shows how the project aligns with the goals of food security, poverty reduction, environmental conservation and community empowerment.

The area is gently sloping and geologically volcanic with poorly to imperfectly drained clay soils, bimodal rainfall, averaging about 784mm annually and predominantly rangeland vegetation. Water resources are mainly seasonal springs, forcing long distance livestock migrations during dry periods hence the need for the proposed earth dam.

The report evaluated four project alternatives which include no project alternative, alternative location, alternative layout and design and alternative construction materials and technologies. Upon analysis of the alternatives, the ESIA team recommended that the project should be

implemented at the current location, using the engineers design and the proposed construction materials and technology.

The study identified the potential positive impacts that would arise from the project. This will include job creation, improvement of infrastructure, increased incomes for the communities, improvement of food security, sustainable management of natural resources, strengthened public-private partnerships, enhancement of research and development, improved micro-climate and promote domestic and international trading opportunities. On the other hand, the potential negative impacts expected include risk of increased soil erosion, loss of vegetation cover and biodiversity, air, noise, water and soil pollution, conflicts associated with influx of labour, spread of Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS) and other communicable diseases, introduction of exotic plants or animals, human-wildlife and resource use conflicts, Gender-based Violence (GBV), Sexual Exploitation and Abuse (SEA), Sexual Harassment (SH), Child welfare and exploitation and accidents.

This report has proposed mitigation measures for the potential negative impacts which include integration of soil conservation measures during and after project implementation, construction of community water collection points and livestock troughs to minimize pollution, ensuring strict adherence to communicable diseases protocols and sensitization on and enhancing Voluntary Counseling and Testing (VCT). To minimize risks of accidents, the report proposes acquisition of first aid kits, provision of Personal Protective Equipment (PPEs) and effective maintenance of machinery. Operationalization of the Grievance Redress Mechanism (GRM) at the community level will assist in addressing the expected socio-cultural issues. To reduce the water use conflicts, this report proposes the application of efficient water use technologies and daily livestock watering management plan. In addition, adherence to the code of conduct for employees will reduce cases of sexual harassment and other forms of gender-based violence.

The study has developed an Environmental and Social Monitoring and Management Plan (ESMMP) presented in Chapter 8 with an approximate cost of KES. 3,350,000. An extract of this ESMP for the construction phase will be used in the development of the contractor ESMP (C-ESMP) as part of the tender document and will be implemented during this phase by the relevant authorities and NAVCDP safeguards staff.

Having analyzed the benefits and the cost of mitigating the potential negative impacts, this report recommends approval of the proposed project by NEMA for implementation.

TABLE OF CONTENTS

Contents

PROJECT FACT SHEET	I
CERTIFICATION	II
DISCLAIMER	III
TABLE OF GENERAL INFORMATION	IV
ACRONYMS AND ABBREVIATIONS	VI
DEFINITION OF TERMS	IX
EXECUTIVE SUMMARY	XI
CHAPTER ONE: INTRODUCTION	20
1.1 BACKGROUND	20
1.2	22
1.2.1	22
1.2.2	22
1.3	22
1.4	23
1.4.1	23
1.4.2	23
1.5	23
1.6	24
1.7	25
1.7.1	25
1.7.2	25
1.7.3	25
1.7.4	25
1.7.5	26
1.8	26
1.9	26
1.10	26
CHAPTER 9: CONCLUSIONS AND RECOMMENDATION: PROVIDES A BRIEF NON-TECHNICAL SUMMARY OF THE REPORT FINDINGS AND RECOMMENDATIONS.	25
1.11	27
CHAPTER TWO: PROJECT DESCRIPTION	26
2.1	28
2.2	28
2.3	28
2.3.1	28
2.3.2	29
2.3.3	30

2.3.4	30
2.3.5	31
2.3.6	31
2.4	32
2.4.1	32
2.4.2	32
2.4.3	36
2.4.4: <i>General Design Guidelines</i>	35
2.4.5	46
2.4.6	47
2.4.7	47
2.4.8	48
2.4.9	48
2.4.10	48
2.4.11	49
2.4.12	51
2.5	52
2.5.4	52
2.6	53
2.6.1	53
2.7	54
2.7.1	54
2.7.2	54
2.7.3	54
2.7.4	54
2.7.5	54
2.8	54
CHAPTER THREE: POLICY, LEGAL AND REGULATORY FRAMEWORK	52
3.1	56
3.2	56
3.2.1	56
3.2.2	56
3.2.3	57
3.2.4	57
3.2.5	57
3.2.6	58
3.2.7	58
3.2.8	59
3.3	59
3.3.1	59
3.3.2	59
3.3.3	59
3.3.4	59

3.3.5	60
3.3.6	60
3.3.7	60
3.3.8	61
3.3.9	61
3.3.10	61
3.4	61
3.4.1	61
3.4.2	62
3.4.3	63
3.4.4	63
3.4.5	64
3.4.6	64
3.4.7	64
3.4.8	65
3.4.9	65
3.4.10	65
3.4.11	66
3.4.12	66
3.4.13	67
3.4.14	67
3.4.15	67
3.4.16	68
3.4.17	68
3.4.18	68
3.4.19	69
3.4.20	69
3.4.21	70
3.4.22	71
3.5	71
3.5.1	71
3.5.2	72
3.5.3	72
3.5.4	72
3.5.5	73
3.5.6	73
CHANCE FIND PROCEDURE	69
3.5.7	74
CHAPTER FOUR: ENVIRONMENTAL AND SOCIAL BASELINE	71
4.0	76
4.1	76
4.2	77
4.3	77

4.4	79	
4.5	81	
4.5.1		81
4.5.2	81	
4.5.3		81
4.5.4		82
4.5.5		82
4.5.6		82
4.5.7		84
4.5.8		85
4.5.9		85
4.5.10		85
4.5.11		86
4.15	SOCIO-ECONOMIC CONDITIONS	80
4.5.1	<i>Economic Activity</i>	80
4.6	86	
4.6.1		86
4.6.2		87
4.6.3		87
4.6.4		87
4.6.5		87
4.6.6		87
4.6.7		87
4.6.8		87
4.6.9		87
4.6.10		87
4.7	87	
4.7.1		87
4.7.2		88
4.7.3		88
4.7.4		88
4.7.5		88
4.7.6		88
4.7.7		88
4.8	88	
4.8.1		89
4.8.2		89
4.8.3		89
4.8.4		89
CHAPTER FIVE: PUBLIC AND STAKEHOLDER CONSULTATION		85
5.1	92	
5.2	92	
5.3	92	
5.3.1		93

5.3.2	93
5.4	94
5.4.1	94
5.4.2	94
5.4.3	94
5.4.4	95
5.4.5	96
CHAPTER SIX: ANALYSIS OF PROJECT ALTERNATIVES	91
6.0	98
6.1	98
6.2	98
6.3	99
6.4	99
CHAPTER SEVEN: ANALYSIS OF POTENTIAL IMPACTS AND MITIGATION MEASURES	93
7.0	100
7.1	100
IMPACTS DURING CONSTRUCTION PHASE	93
7.1.1	100
7.1.2	100
7.2	104
7.2.1	104
7.2.2	105
7.3	109
7.3.1	109
7.3.2	110
CHAPTER EIGHT: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)	107
8.1. CONSTRUCTION PHASE	108
8.2	122
8.3	130
8.3 DECOMMISSIONING PHASE	129
	129
CHAPTER NINE: CONCLUSIONS AND RECOMMENDATIONS	130
9.1 CONCLUSION	130
9.2 RECOMMENDATIONS	130
REFERENCES	131
CHAPTER ELEVEN	133
11.0	141
11.1	141
11.1.1	141
11.1.2	142

11.1.3	143
11.1.4	144
11.1.5	148
11.2	151
11.3	159
11.4	163
11.5	163
11.6	167
11.7	176
11.8	180
11.9	183
11.10	185
11.11	186
11.12	187
11.13	195
11.14	196
11.15	197
11.16	218
11.17	234
11.18	236
11.19	246

LIST OF TABLES

Table 1: List of ESIA team	24
Table 2: Human Population and Projection	27
Table 3: Domestic water demand projection	27
Table 4: Livestock water demand	28
Table 5: Total Water Demand	28
Table 6: Runoff factor, Kr	29
Table 7: Volume of Soil from Reservoir	31
Table 8: Indicative Sediment Yields	33
Table 9: Recommended Values for Outflow Channel Slopes	35
Table 10: Tentative values for Q_{100} for small catchments	35
Table 11: Runoff factor, Kr	36
Table 12: Using iteration (trial and error) to determine T_c	38
Table 13: Manning n Values for Typical Spillway Channel Material (Source: Chow 1959)	39
Table 14: Values of q and h_a	40
Table 15: Summary of pipe details	47
Table 16: Irrigation water requirement	48
Table 17: Equipment/Machinery to be used	49
Table 18: Narok County Population by sex	74
Table 19: Environmental and Social Management Plan: Construction Phase	108

Table 20: Environmental and Social Management plan: Operational Phase	116
Table 21: Crop Value Chains IPMP	123
Table 22: Livestock Value Chain IPMP	127
Table 23: ESMP for decommissioning phase	129

LIST OF FIGURES

Figure 1: Scheme Water requirements for the project in lits/sec/Ha at field level	27
Figure 2: Spillway Earth Works	32
Figure 3: Spillway Section	34
Figure 4: Dam water level vs water balance chart	43
Figure 5: Seepage Analysis	45
Figure 6: Sample of PV Panels That Would be Required to Run the Proposed System (Details from Davis and Shirlif Data Base)	47
Figure 7: Map of Sub Counties of Narok County	73
Figure 8: Project Location Map	73
Figure 9: Osukunua Watershed Map	74
Figure 10: Loita Ward Soil Map	76
Figure 11: Map showing Land use and Land cover for Osukunua Catchment	76
Figure 12: Map showing Average Annual Rainfall for Narok County	78
Figure 13: Monthly totals rainfall over the Osukunua Catchment	78
Figure 14: Map showing drainage streams of the Osukunua watershed	79
Figure 15: Narok County Vegetation Map	80

CHAPTER ONE: INTRODUCTION

1.1 Background

The proposed construction of Osukunua Earth Dam and Irrigation Project is one of the activities enumerated under schedule II of the Environmental Management and Co-ordination Act (EMCA, CAP 387) that necessitate an Environmental and Social Impact Assessment (ESIA). This assessment endeavors to observe to the environmental management guidelines as well as the World Bank Environmental and Social standards, which include Environmental Assessment (ESSI: Assessment and Management of Environmental and Social Risks and Impacts) which will help in reducing long-term costs by avoiding environmental damage, promotes transparency and community involvement, leading to decisions that reflect diverse stakeholder concerns and provides a structured framework for identifying risks and opportunities, leading to more informed and balanced decisions .

The study aims to promote sustainable development in the project area by integrating environmental costs and benefits into proposed development activities which in the long run, will minimize the negative environmental impacts and promote environmental conservation.

1.2 Sub Project objectives

1.2.1 Broad Objective

The main objective of the project is to improve access to water for sustainable irrigation and improved livelihoods for Osukunua community in Loita Ward, Narok south Sub- County.

1.2.2 Specific Objectives are

1. To provide water access to 125 farmers to irrigate 40 Ha by 31st December 2025.
2. To conserve 397 Ha dams' catchment area by 31st March 2026
3. To Build the capacity of the 125 IWUA members on irrigation techniques by 31st March 2026
4. To Build the capacity of IWUA committee members on operation and maintenance of the project for sustainability by 31st December 2025
5. To increase by 50% local agricultural production by 30th June 2026
6. To achieve a 100% market participation for IWUA by 30th June 2026

1.3 Sub-Project Justification

The Participatory Integrated Community Development (PICD) process held in the ward identified inadequate water supply for human, livestock and crop production as one of the major challenges contributing to low production and commercialization of the county priority value chains. The catchment area of the earth dam measuring approximately 397Ha was also identified as a degradation hotspot. As a result, the community prioritized in their CDP and SLMP construction of earth dams and household storage water structures and also to undertake interventions in the area to address inadequate water and land degradation challenges.

The proposed Earth Dam will be a source of water for the dairy and crops value chains development. Consequently, the community will be able to upgrade their dairy cattle and crops resulting to high productivity and hence increased household incomes.

1.4 Objectives of the ESIA

1.4.1 General Objectives

- To identify and describe baseline conditions including physical and biological factors of the project area.
- To analyze the social-economic and cultural set up of the community and obtain the social license through engagement with the projects' stakeholders.
- To identify the potential environmental and social impacts and propose measures to enhance positive impacts and mitigate negative risks and impacts.

1.4.2 Specific Objectives

- To identify and assess the potential adverse and beneficial effects of proposed Osukunua Earth Dam and Irrigation Project on the environment.
- To provide information to decision-makers and stakeholders to help them make informed choices regarding project approval, modification, or rejection.
- To involve the public and stakeholders in the decision-making process, ensuring that their concerns and perspectives are considered.
- To ensure that project are aligned with sustainable development principles, balancing economic growth with environmental protection.
- To identify mitigation measures that can minimize or eliminate adverse environmental impacts.
- To establish a framework for monitoring and managing environmental impacts throughout the project lifecycle.
- To ensure that the project comply with environmental laws and regulations.
- To increase awareness of environmental issues among project proponents, stakeholders, and the public.
- To prepare an ESIA report in accordance to the EMCA 1999 (revised 2015).

1.5 Term of reference

The terms of reference for this ESIA included but not limited to the following;

- Description of the environment and environmental activities of the site
- Reviewing the requirements of Kenya's environmental standards applicable to implementation and operation of the project
- Identify socio-economic and biophysical benefits analysis to the local community and nation in general

- Undertake public participation and consultation; views of public and other stakeholders around the project indicating representation of potentially affected people
- Identification of likely significant environmental hazards, risks and impacts of the proposed project
- Assessment of these hazards, risks and impacts and evaluation of possible alternatives
- Propose mitigation measures for the significant negative impacts of the proposed project
- Formulation of baseline data for monitoring and evaluating the implementation of the proposed mitigation measures throughout the project cycle
- Reviewing of materials to be used, products and by-products and wastes to be generated and their eventual disposal
- Development of an Environmental Management Plan and an Environmental Performance Monitoring Phase
- Preparation of an ESIA report incorporating a comprehensive Environmental management and monitoring plan (EMMP)

1.6 Scope of the ESIA Study

This study is designed in accordance with the terms of reference to address the following issues: -

- Review of the activities of the project
- Review of relevant institutional, policy and legal framework
- To verify compliance with the World Bank ESS standards and other Environmental, Social regulations and Industry standards
- To identify and assess all potential environmental and socio-economic impacts of the proposed project
- To identify all potential significant adverse impacts of the project and recommend mitigation measures
- To identify problems (non-conformity) and recommend measures to improve the existing management system
- Scoping and screening of impacts
- Consultation of all relevant stakeholders
- Development of an Environmental, Social Management and Monitoring Plan (ESMMP)
- To prepare an Environmental and Social Impact Assessment (ESIA) Report in compliance with the Environmental Management and Coordination Act (1999), and the Environmental (Impact Assessment and Audit) Regulations (2003) and World Banks Environmental and Social Standards.

1.7 Assessment Methodology

1.7.1 Environmental and Social screening

Environmental and social screening was done to confirm and verify whether or not the particular project falls within a category that requires an ESIA prior to commencement. Osukunua dam and irrigation project is listed under schedule 2nd schedule of EMCA, 1999 among projects requiring an ESIA prior to implementation.

1.7.2 Environmental and social scoping

This was done as a preliminary physical assessment of the site and its surroundings, and helped to narrow down to the most critical environmental and social issues requiring attention at evaluation. Stakeholder consultations, sites visit, photography and inductive methods were used at this stage. Baseline information was gathered through physical inspections and observations.

1.7.3 Secondary data review

This involved a review on the nature of the proposed activities, policy and legal framework, environmental setting of the area and other available relevant data. Some of the documents reviewed included: -

- Project proposal
- PICD report
- SLMP report
- Relevant policies and legislations
- Project appraisal document
- Ecological and survey reports
- Narok County Integrated Development Plan (CIDP)-2023-2028
- EMCA and attendant regulations
- Agriculture Departmental reports
- Hydrological and geological reports (WRA)

1.7.4 Public Consultations

This involved extensive consultations with various stakeholders that are directly and indirectly affected by the project. A total of 25 Key informants were interviewed using structured questionnaires from 9th to 14th day of October, 2024 (see annex 4). The community was engaged through Focused Group Discussions (FGDs). The entry meeting was conducted on 8th day of October, 2024 with an attendance of 35 community members (annex 2), while the exit Baraza was conducted on 21st of January, 2025, with an attendance of 29 community members (annex 11).

The stakeholders participated in identifying and evaluating the social and environmental issues, and potential mitigation measures. The outcome of public participation is presented in Chapter 6 of this report.

1.7.5 Reporting

The findings and recommendations of this study will be reported on a regular basis. It will serve as the official document submitted to regulatory authorities, stakeholders, and the public for review and decision-making.

1.8 ESIA Team

The ESIA team composed of different professional as outline below

Table 1: List of ESIA team

Name	Field of Profession
Vincent Kinyua	Environment- Lead expert
Jamin Rutto	Livestock and Environment
Saitoti Ole Saaya	Livestock and Environment
Joseph Meriki	Environment and Agricultural Economics
Elijah Mututua	Environment
John Mugo	Agronomist

1.9 Project implementing agency

The proposed construction of Osukunua Earth Dam and Irrigation Project is a Farmer Led Irrigation Development Infrastructure Investment supported under NAVCDP's sub-component 2.1, implemented by Osukunua Irrigation Water Users Associations.

1.10 Structure of the report

The output of the ESIA was captured in an ESIA report whose structure is as follows;

Executive Summary: Provides the general background and descriptive information of the project in a summary.

Chapter 1: Introduction: This chapter gives the background information relevant to the project and describes the objectives and requirements of the study.

Chapter 2: **Project Description:** Describes the project design, project construction and operation.

Chapter 3: Policy, Legal and regulatory framework: This chapter outlines Government policy on the environment, the relevant legislation relating to natural resource management and environmental protection and the institutions that deal with various aspects of environmental management.

Chapter 4: Environmental and Social baseline: Provides a description of the existing environmental conditions of the project area to achieve an understanding of the bio-physical and social environment setting.

Chapter 5: Public consultation: Describes the consultation process, views of stakeholders and future consultations.

Chapter 6: Project Alternatives: This section explores the alternatives of the project in terms of site, technology and budgetary issues. The alternative consists of the proponent's final project with inclusion of the NEMA guidelines and regulations and procedures. This is as stipulated in the Environmental Management Plan and Co-ordination Act (EMCA) of 1999, which aims at reducing environmental impacts to the minimum extent practicable.

Chapter 7: Potential Impacts and mitigation measures: Identifies the potential impacts on the bio-physical and socio-economic environment, together with appropriate mitigation measures to minimize and manage the impacts on the environment.

Chapter 8: Environmental Management Plan: The EMP provides framework within which identified negative environmental impacts would be mitigated and monitored. In addition, the EMP assigns responsibilities of actions to various actors and provides a timeframe for the implementation of mitigation measures and monitoring.

Chapter 9: Conclusions and Recommendation: **Provides a brief non-technical summary of the report findings and** recommendations.

1.11 Study Methodology

In order to carry out ESIA's, there is need for sufficient preparation and collection of accurate information using appropriate methods of data collection to assist in proper decision making. The study therefore used the following methodologies:-

- Discussion with the potential project beneficiaries
- Desk review of the relevant project documents
- Undertaking of site visits and surveys to establish baseline information.
- Assessment of the site to establish possible impacts of the project on the environment
- Assessment of health and safety issues
- Consultation of the public to allow for public participation in planning and development

CHAPTER TWO: PROJECT DESCRIPTION

2.1 Introduction

The proposed construction and expansion of Osukunua Earth Dam and Irrigation Project is located in Ilmarai Sub-Location Loita Ward, Narok County. The project is a small-scale community irrigation intended to improve access to water for 125 households irrigating over 40Ha where each household will irrigate 0.8 acres. Water scarcity is one of the most pressing challenges identified during the Participatory Integrated Community Development (PICD) process that significantly impacts the livelihoods of Osukunua Community that predominantly relies on rain-fed crop farming. This has led to low or no production during the dry seasons.

2.2 Location of the project

The proposed Osukunua Earth Dam and Irrigation project is located in Ilmarai sub location, Ilkerin location, Loita Ward, Narok South Sub- County in Narok County. The proposed site for the dam and irrigation is located at GPS Coordinates Latitude (-1.817508°S) Longitude (35.685964°E), at an altitude of 2122m asl. The proposed site for the development of the dam is owned by the community. The Earth Dam is expected to collect run-off water from an estimated 397Ha watershed.

2.3 Project Design

The proposed Sub-project entails construction of a 172,384m³ earth dam, laying of about 4.2 kms water conveyance and distribution pipelines, construction of two livestock troughs and a communal water point, sanitation facilities, fencing and construction of water tanks with a solar powered water pumping system. The project will also involve sustainable land management interventions in the dam's catchment area.

2.3.1 Irrigation Water Demand

Crop water requirements-ET_c (CROPWAT Computation)

The amount of diversion water for the project is based on the irrigation method to be used, crops to be grown and the cropping pattern adopted. The Figure below is Cropwat 8.0 interface used to generate cropping pattern for Osukunua Irrigation Project based on the cropping calendar.

Scheme Supply												
ETo station	OSUKUNUA											
Rain station	OSUKUNUA											
											Cropping pattern	OSUKUNUA:2
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precipitation deficit												
1. TOMATO	0.0	0.0	4.9	0.0	43.6	103.7	84.8	0.0	0.0	0.0	0.0	0.0
2. MAIZE (Grain)	0.0	0.0	0.0	0.3	50.8	101.6	35.0	0.0	0.0	0.0	0.0	0.0
3. CABBAGE (Crucifers)	0.0	0.0	16.8	2.5	36.3	30.5	0.0	0.0	0.0	0.0	0.0	0.0
4. GREEN BEANS	0.0	0.0	1.8	5.2	34.7	6.5	0.0	0.0	0.0	0.0	0.0	0.0
5. TOMATO	101.1	43.9	0.0	0.0	0.0	0.0	0.0	0.0	14.5	57.7	51.3	93.5
6. CABBAGE (Crucifers)	9.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.7	76.6	59.6	76.4
Net scheme irr.req.												
in mm/day	1.8	0.8	0.2	0.1	1.3	2.3	1.3	0.0	0.5	2.2	1.8	2.7
in mm/month	55.1	22.0	5.7	1.6	41.8	69.2	40.9	0.0	16.1	67.2	55.4	84.9
in l/s/ha	0.21	0.09	0.02	0.01	0.16	0.27	0.15	0.00	0.06	0.25	0.21	0.32
Irrigated area	100.0	50.0	80.0	60.0	100.0	100.0	60.0	0.0	100.0	100.0	100.0	100.0
(% of total area)												
Irr.req. for actual area	0.21	0.18	0.03	0.01	0.16	0.27	0.25	0.00	0.06	0.25	0.21	0.32
(l/s/ha)												

Figure 1: Scheme Water requirements for the project in lits/sec/Ha at field level

From Figure 1, the critical water demand will be in the month of December at 0.32lits/sec/ha. Calculating the demand for the 90days dry period will be:

$$=0.32*60*60*24*40ha$$

$$=1,105.92M^3/day$$

2.3.2 Domestic water demand

The population of the area was obtained from Population of Loita ward, Ilmarai sub location (Source: 2019 Kenya Population and Housing Census: Volume II). This gave an estimated population of 746 households with an estimate of 5 persons per household

Future population estimates can be established based on Equation

$$P_{yn} = P_{y0} \left(1 + \frac{r}{100}\right)^n$$

Where:

n = number of years projecting forward from year 0.

P_{yn} = Population in year n.

P_{y0} = Population in year 0 i.e., year of census or year data collected.

r = projected annual population growth rate. Narok county population growth rate is 3.7% (KNBS, 2019).

Given P_{y0}= 3,730, r=3.7%, n=10

Then P_{y10}= 5436 and P_{y20}=7817

Table 2: Human Population and Projection

	Present	Future	Ultimate
Year	2025	2035	2045
Population	3730	5436	7817

Table 3: Domestic water demand projection

Initial (2025)			Future (2035)			Ultimate (2045)		
Popn	Rate (I/d)	M ³ /d	Popn	Rate (I/d)	M ³ /d	Popn	Rate (I/d)	M ³ /d
3780	20	75.6	5436	20	108.7	7817	20	156.34

2.3.3 Livestock Water Demand

The livestock population was estimated as shown below. (Source: survey count by the ward agriculture field officers).

Table 4: Livestock water demand

	Type of livestock	Livestock	Equivalent Livestock Unit (LU)*	Initial demand (m ³ /day)	Future demand (m ³ /day)	Ultimate demand
						(m ³ /day)
1	Cattle	7560	2520	126	126	126
2	Goats	11,340	756	37.8	37.8	37.8
3	Sheep	9,072	605	30.25	30.25	30.25
4	Donkeys	200	40	2	2	2
	Total			196.05	196.05	196.05

* 1LU \equiv 1 dairy cow \equiv 3 indigenous cattle \equiv 15 sheep or goats \equiv 5 donkeys \equiv 165 poultry

The population of the animals remains constant at the initial, future and ultimate period because the population growth is mostly affected by food availability; competition for other resources such as water, predation, diseases and other ecological factors hence it balances out thus no growth is recorded or experienced.

2.3.4 Summary of Water Demand

This demand is based on the envisaged period of storage for the driest period when water demand will be critical. This period is taken as 90 days extending from June to August for this selected site (3 months). Hence based on the projections and various water uses the demand is projected as **166,958.18m³** for the year 2045.

Table 5: Total Water Demand

Category of Consumer	Initial (2025) demand m ³ /d	Future (2035) demand m ³ /d	Ultimate (2045) demand m ³ /d	Duration (Days)	Total Demand m ³
Irrigation	1105.92	1105.92	1105.92	90	99,532.8
Domestic	75.6	108.7	156.34	90	14,070.6
Livestock	196.05	196.05	196.05	90	17,644.5
Sub-Total					131,247.9
Evaporation	186.49	186.49	186.49	90	16,784.18
Seepage	41.645	41.645	41.645	90	3,748.09
Total water required					151,780.17
Dead storage					15178.01
Required storage					166,958.18

2.3.5 Estimation of Catchment Yield

The dam will collect surface runoff water from a watershed area measuring 397Ha

2.3.6 Catchment Yield

The annual runoff for the catchment (the catchment yield in an average year), Y, in m³, is given by:

$$Y = R \times K_r \times A \times 1000$$

Where:

- A is catchment area in km²
- R is Annual Rainfall in mm
- K_r is the Runoff factor

Generalized values of the runoff factor, K_r are as shown in the table 5-: below: -

Table 6: Runoff factor, K_r

Catchment soil type	K _r
Rocky and impermeable	0.8 to 1.00
Slightly permeable, bare	0.6 to 0.80
Slightly permeable, partly cultivated or covered with vegetation	0.40 to 0.60
Cultivated, absorbent soil	0.30 to 0.40
Bare sandy soil	0.20 to 0.30
Heavy forest	0.1 to 0.2

Source: Table6, MWI, Practice Manual for design of small dams, pans and other water conservation structures in Kenya, 2015.

The runoff factor for Slightly permeable, partly cultivated or covered with vegetation was taken as 0.5.

Calculating the yield;

$$Y = 681 * 0.5 * 3.97 * 1000$$

Catchment yield = 1,351,785M³/year

The runoff yield is sufficient to meet the design capacity of dam (172,384 m³)

2.4 Dam Design

The design of Osukunua earth dam involved determination of the key parameters which are to be used in implementation of this project.

- Height of the Embankment
- Embankment crest width
- Volume of the reservoir
- Free board height
- Spillway size

The survey work was undertaken for the Osukunua site and the data was used to calculate the above parameters.

2.4.1 Design of Height of Embankment –Dam Height

The pan height was determined by considering the following parameters which are crucial to the safety and the life of the dam; no

- Highest flood level
- Free board
- Settlement allowance owing to rain and reservoir water

Total height of dam = Highest Flood Level + Freeboard + Settlement allowance

2.4.2 Highest Flood Level (HFL)

From the survey data and using the contour levels for the site, the actual height was determined by getting the difference of reduced level of the highest flood level and the reduced level of the bed surface.

- Reduced level of bed surface = (2116.00) m
- Reduced Level of Highest Flood Level = (2122.00) m
- Height of water up to HFL = 2122.00 - 2116.00 = 6m

2.4.2.1 Freeboard (FB)

This is the height of the embankment provided as a safety factor to prevent waves and runoff from storms greater than the design frequency from overtopping the embankment. It is the vertical distance between the elevation of the highest flood level and the top level of the dam after all settlement has taken place. It depends upon the height as well as length of the dam. For this site a height of 1.5m was adopted.

According to Molitor Stevenson et al formula - Irrigation Engineering by T.K.Sharma, freeboard is given by:

$$FB = 1.5 \left[0.032 \times (FV)^{\frac{1}{2}} + 0.763 - 0.271(F)^{\frac{1}{4}} \right] \text{ - For a fetch less than 32 km.}$$

Where: FB Freeboard (m)

F Fetch (km) = 0.440km

V Wind velocity (km/hr) = 10 km/hr. (source: FAO Cropwat 8.0 software and the weather data from NASA DATA Power, Morijo station)

The fetch (F) for the site under consideration is 440m (0.44Km)

- The average Wind Velocity (V) is 10 Km/hr

Hence,

$$FB = 1.5 [0.032 * (0.44 * 10)^{1/2} + 0.763 - 0.271(0.44)^{1/4}]$$

$$FB = 1.2178M$$

2.4.2.2 Settlement Allowance

Settlement includes the consolidation of the fill materials and the foundation materials due to the weight of the dam and increased moisture caused by the storage of water. It depends on the type of fill material and the method and speed of construction.

Thus settlement = $0.05 * 7.5m = 0.3m$ a settlement of 0.3m was adopted

Total freeboard height = $1.21788 + 0.3$

Adopt a free board of = 1.5M

2.4.2.3 Total Height of the dam

Height of dam = $6.0 + 1.2 + 0.3 = 7.5m$

Hence totals Height of dam = 7.5m was adopted

2.4.2.4 Embankment Crest Width

This was determined through the use of Sharma and Sharma method.

Using this method, crest width is taken to be a function of dam height using the formula,

$$W = \frac{5}{3} \times H^{1/2}$$

Where: W is crest width

H the dam height

$$\text{Therefore } W = \frac{5}{3} \times 7.5^{1/2}$$

$$= 4.71\text{m}$$

A stability analysis of the embankment as shown in annex 3 was also conducted to determine the slope suitable for the stability of the embankment. The analysis indicated that a crest width of 4.7m was not adequate and thus a width of 6.m should be adopted for the wall to be stable.

2.4.2.5 Embankment Side Slopes

Embankment slopes are required for stability of the embankment on stable foundations. Side slopes depend primarily on the stability of the material in the embankment. The greater the stability of the material, the steeper will be the side slopes or vice versa.

From the slope and seepage analysis (annex 3 and 4) conducted for the embankments the sides slope recommended were 1:3 upstream and 1:3 downstream for more stable walling on both sides.

2.4.2.6 Computations of the volume of earth works needed

i. Computation of volume soil removed for reservoir

Table 7: Volume of Soil from Reservoir

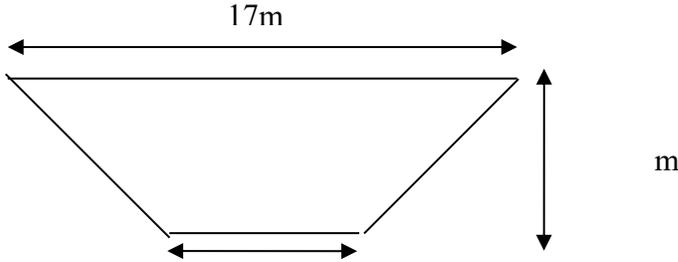
PROFILES	EXCAVATION (m ³)	STORAGE CAPACITY (m ³)
A	5,782	7,684
B	8540	17,960
C	8,420	17,340
D	7,840	15,820
E	10,680	18,660
F	12,900	19,940
G	8,960	13,660
H	3,940	11.320
I	3,340	8,800
J	4,060	7,200
K	4,160	8,000
L	3,340	8,800
M	4060	7,200
N	4,160	6,000
P	2,540	3.360
Q		380
TOTAL	95,762	172,384

Note: The Volume of the reservoir in this case 172,384m³ represents the total storage capacity of the earth dam. Any more inflow from the catchment must be discharged through the spillway.

ii. Spillway Earth Works

The final spillway design diagrammatically is as illustrated below and as designed in section 5.8.5 has the side slopes were chosen as 1:1 and given the selected width as 15m bottom and depth of 1m, then top width(w) will be;

$$W=15+ (2*1\text{m}\tan 45^\circ) = 15+ (2*0.6) = 15+2 = 17\text{M}$$



NB: Not to scale 15m

Spillway Earth Works (with side slopes of 1:1)

Vol. of spillway = Length * X - sectional area

Breadth = 15m (at the spillway bed)

Depth = 0.6m,

Length = 167m

Vol. of spillway earth works = 1603.2m³

iii. Excavation of Silt trap

The silt trap increases the lifespan of the reservoir by collecting the sediments from the catchment.

Table 8: Indicative Sediment Yields

Erosion Rate	Sediment Yield (m ³ /km ² /year)
Low	500
Moderate	1000
heavy	1500

Source: practice manual for small dams and pans and other water conservation structures 2nd edition

Since the catchment is covered with grassland the erosion rate will be moderate giving a sediment yield of 1000m³/km²/year.

Determining the size of the silt trap

$$\begin{aligned} \text{Silt load from the catchment} &= 1000*3.97 \\ &= 3970\text{m}^3/\text{year} \end{aligned}$$

Provide a silt trap of capacity = $(50 \times 40 \times 2) = 4,000\text{m}^3$

iv. Inlet channel Excavation

An inlet channel of dimensions; length of 10m, 20m wide and 0.5m depth rectangular shape will be provided to direct runoff into the reservoir.

Volume to be excavated = $(10 \times 20 \times 0.5) = 100\text{m}^3$

v. Computation of Total volume of earth works

$$\begin{aligned} \text{Total volume of earth works} &= (\text{Reservoir excavation} + \text{Spillway} + \text{inlet channel} + \text{silt trap}) \\ &= 95,762 + 1603.2 + 100 + 4000 \\ &= 101,465\text{m}^3 \end{aligned}$$

2.4.3 Design of Spillway structures

The function of the spillway is to discharge the normal and flood flows safely around the embankment and back to the water course without compromising the long-term functionality and integrity of the pan.

2.4.3.1 Location and Type of Spillways

The common type of spillway used with earth embankments is a side channel spillway, excavated in earth next to the embankment. The incorporation of relatively large concrete structures as spillways for small earth pans is difficult to justify on economic grounds. The basic factors to be taken into account when choosing a spillway location are:

- The spillway should be kept away from the embankment in order to avoid the need for concrete protection structures, and
- Excessively steep valleys should also be avoided, in order to prevent erosion problems in the spillway channel and to reduce excavation volumes.

A site may require a side spillway on both sides of the embankment. The side spillway normally consists of three parts: Inflow Section, Control and Outflow Channel.

2.4.3.2 Control Section

The normal water level in the reservoir is controlled by the height, length (i.e., width of spillway channel) and geometry of the spillway sill. The spill level is controlled by a reinforced concrete sill (minimum width 300 mm), thus preventing lowering of the crest level by erosion. This sill is usually aligned with the dam axis. The depth of the sill (minimum 1.00 m) below ground level should be determined by the engineer to minimize seepage underneath the sill. Where the sill is proud of the spillway bed and there is a risk of erosion and undercutting of the sill, a 150 mm thick reinforced concrete apron should be placed downstream of the sill. The width of the control section should be a minimum of 10 m unless a detailed analysis justifies otherwise. Consideration should be given to the likelihood of erosion along the spillway floor and side slopes, particularly in the control section. Grouted masonry can be laid along the floor and side slopes to protect against erosion where the spillway is cut into soil and where a good grass cover cannot be guaranteed.

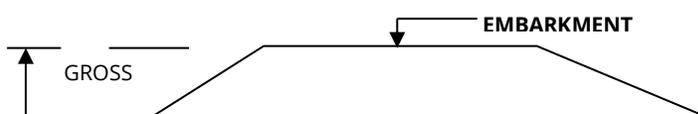


Figure 3: Spillway Section

2.4.3.3 In-flow Section

The inflow section leads the flood water to the control section. Usually, it slopes moderately (maximum 1%) upwards to the sill. The cross-section is usually narrowed down gradually towards the sill. Care should be taken that the water flowing to the control section remains far enough from the earth embankment to minimize the risk of erosion of the embankment face.

2.4.3.4 Out-flow Channel

The outflow channel discharges the flood water back into the riverbed at acceptable velocities that do not cause erosion. For spillways excavated in undisturbed earth, a maximum velocity of 2.5m/s is usually acceptable under Kenyan conditions. Control of the outflow channel water velocity is usually achieved through adequate slope selection. Otherwise lining of the channel (or parts thereof) with riprap will be required. In such cases velocities up to 6-7 m/s can be accepted. In case of unacceptably long outflow channels, the possibility of incorporating a gabion or concrete drop structure can offer a solution. The Manning formula can be used to establish the velocity in the outflow channel for different gradients, widths and channel roughness.

Table 9: Recommended Values for Outflow Channel Slopes

Type of Soil	Slope (%)
Earth	<0.5
Murram	0.5 – 1
Hard rock	1-2

Consideration should be given to the velocity of the water as it re-enters the water course as this can create unwanted erosion of the river bank. There are various options to reduce the speed of flow including changing the slope to induce a hydraulic jump, creating a stilling basin or placing chute blocks in the line of flow. Reference should be made to detailed design documents where

energy dissipaters are required. Energy dissipaters should not impede flow through the control section.

2.4.3.5 Training Walls for Control and Outflow Channel

Training walls are required if the control and outflow channels are cut into soil to prevent erosion of the channel side walls. The height of the training wall should exceed the flood water level. A masonry walls, anchored on a secure footing, with appropriate buttresses, is acceptable for heights less than 2 m. A reinforced concrete retaining wall is required for wall heights above 2 m. Well-constructed gabions are feasible where wall heights are less than 1m. The services of an engineer should be engaged to establish the full design for a reinforced concrete retaining wall.

2.4.3.6 Return to Water Course

The point at which spillway flows join the water course should be examined and protected against erosion that may occur if high velocity flows are expected. Maintaining well vegetated river banks, or placing well-constructed gabion boxes, are options to minimize river bank erosion.

2.4.4: General Design Guidelines

For small earth dams or large pans, it is imperative to determine the flood flow (Q) with a probability of being exceeded once in 50 to 100 years (Q_{50} or Q_{100}) for the purpose of determining the spillway dimensions. Q_{100} was recommended for the proposed dam.

2.4.4.1 The Peak Discharge:

The approximate area of the catchment for Osukunua dam is about 3.97Km². The Table 9 below gives a tentative conservative estimate of 100 years flood flows for small catchments.

Table 10: Tentative values for Q_{100} for small catchments

Catchment area in km ²	Q_{100} (m ³ /s/km ²)
0.5-1	15
1-5	12-10
5-25	3-6
25-100	3-2
100-1000	1-0.4
>1000	<0.3

Source: Ministry of Water Development, 2005

Using the Richards' Method for estimating Flood Flows (refer to Practice Manual for design of small dams, pans and other water conservation structures in Kenya, 2015) which is an empirical method well suited for Kenya conditions.

This formula is used to calculate the time of concentration **T_c**, which is the time it takes for the rain falling on the furthest point of the catchment to reach the river at the point where the peak flow is to be estimated. The method takes into account the rainfall pattern and intensity, catchment's characteristics, run-off, shape, slope, soil and vegetation type.

Generalized values of the runoff factor, Kr are as shown in the Table 10: below: -

Table 11: Runoff factor, Kr

Catchment soil type	Kr
Rocky and impermeable	0.8 to 1.00
Slightly permeable, bare	0.6 to 0.80
Slightly permeable, partly cultivated or covered with vegetation	0.40 to 0.60
Cultivated, absorbent soil	0.30 to 0.40
Bare sandy soil	0.20 to 0.30
Heavy forest	0.1 to 0.2

Source: MWI, Practice Manual for design of small dams, pans and other water conservation structures in Kenya, 2015.

Adapted to S.I Units, the formula for calculating the time of concentration reads as follows:

$$\frac{T_c^3}{T_c + 1} = \frac{CL^2}{Kr \times R \times S \times f(a)}$$

Where: **T_c** = Time of concentration in hours 5/01/2025

L = The longest path of the catchment in km

C = a coefficient function of (Kr, R) which can be obtained from (MWI, Practice Manual for design of small dams, pans and other water conservation structures in Kenya, 2015)

Kr = Run-off factor, which can be obtained from Table 5-12

R = Rainfall coefficient $R = [(t+1)] / t$. F

F = Total rainfall in mm for the selected storm duration, obtained from Intensity is obtained from the rainfall intensity maps or from the Rainfall Frequency Atlas of Kenya (KMS). (MWI, Practice Manual for design of small dams, pans and other water conservation structures in Kenya, 2015)

t = Selected storm duration (usually 12 hours can be adopted)

S= the average slope of the catchment

f (a) = ratio of the average (i) to the maximum rainfall intensity (I) over the catchment area, obtained from Figure (Richard’s method i/I, MWI, Practice Manual for design of small dams, pans and other water conservation structures in Kenya, 2015).

a = the area of the catchment in Km²

Once the time of concentration T_c has been found, the estimated maximum rainfall intensity can be calculated as follows:

$$I = \frac{R}{T_c + 1} \text{ mm / hr}$$

and the average rainfall intensity i as

$$i = I \times f(a) \text{ mm / hr}$$

Finally, the rational formula is used to calculate the expected maximum flood flow

$$Q = \frac{K \times r \times i \times a}{3.6} \text{ m}^3 / \text{s}$$

2.4.4.2 Calculations for T_c for Osukunua:

T_c =1.4hr

L=3.0 KM

S=7%

a=3.97Km²

F= 10mm/hr

t=12Hrs

R= 104mm/hr

Kr. R=0.5*104=52

C=0.16

f(a)=0.78

Table 12: Using iteration (trial and error) to determine T_c

T _c	T _c ³ /(T _c +1)	(C x L ²) / (Kr x R x s x f(a))	Difference
1.0	0.32212	0.32082	0.00130
1.1	0.3211	0.32015	0.000985

1.2	0.3202	0.31953	0.000671
1.3	0.3182	0.3178	0.000357
1.4	0.316	0.31595	0.0000451
1.6	0.314	0.31463	-0.000266

Therefore, $T_c=1.4$ hrs since the difference is closest to zero

2.4.4.3 Conclusion

Solving by trial and error, Time of concentration (T_c); $T_c = 1.4$ hrs since the difference is least. The estimated average rainfall intensity i (mm/hr)

$$I = R / T_c + 1 = 104 / 1.4 + 1 = 43.33 \text{ mm/hr}$$

$$\text{Therefore, } i = I \times f(a)$$

$$= 43.33 \times 0.78 = 33.8 \text{ mm/hr}$$

The expected maximum flood (Q_p) from the catchment by rational formula is given by:

$$Q_p = \frac{K_r \times i \times A}{3.6}$$

$$Q_p = (0.5 \times 33.8 \times 3.9) / 3.6$$

$$= 22.486 \text{ m}^3 / \text{s}$$

2.4.4.4 : Determining the Height, Width and Slopes of the Spillway

The design of the spillway determines the water level in the reservoir or approach height (h_A). There are two conditions that can apply:

- 1) Flow in the outflow section is supercritical and the spillway sill acts as a broad crested weir and therefore the sill controls the approach height;
- 2) Flow in the outflow section is subcritical and the depth of flow in the outflow channel controls the approach height.

It is therefore important to determine which condition applies or to design the spillway width and slopes so that the selected condition applies. Typically, the design of the spillway aims to ensure that the first condition applies i.e., the spillway sill controls the flow and level of water in the reservoir. This is achieved by ensuring that:

- The capacity of the outflow section exceeds the capacity at the control section;
- The flow condition in the outflow channel is supercritical. For channels excavated in soil ($n=0.025$) this implies a gradient of more than 0.75% (0.0075);
- The depth of water in the outflow channel is less than the depth of flow over the sill.

When these conditions are met, the sill in the control section will act as a broad crested weir. Flow characteristics in the outflow channel will correspond to the Manning equation as shown in the below equation

$$\text{Thus, } V = \left\{ \frac{1}{n} \right\} R^{2/3} i^{1/2}$$

Where:

V= water velocity [m/s]

n = channel roughness factor equal to 0.025 for earth channels (See Table 14 below for appropriate Manning n values))

R = the hydraulic radius of the channel [m] = [channel cross sectional area]/[wetted perimeter]
i = the channel slope [m/m]

Table 13: Manning n Values for Typical Spillway Channel Material (Source: Chow 1959)

Type of channel and material	Minimum n value	Normal n value	Maximum value n
Concrete lined	0.015	0.017	0.020
Masonry line with cemented rubble	0.017	0.025	0.030
Straight, uniform channel excavated in clean earth	0.018	0.022	0.025
Straight, uniform, earth channel with short grass, few weeds	0.022	0.027	0.033
Straight, uniform, earth channel not maintained with dense weeds	0.050	0.080	0.120
Rock cut – smooth and uniform	0.025	0.035	0.040
Rock cut – jagged and irregular	0.035	0.040	0.050

The water depth corresponding with the Manning equation (the " normal depth" h_N which will occur at sufficient distance downstream from the sill) may be determined by writing the Manning equation in terms of discharge as shown in Continuity Equation below.

$$Q = V \times A$$

$$Q = \frac{1}{n} \times R^{2/3} \times i^{1/2} \times A$$

Where: Q = design flow for the specified return period [m³/s]
A = channel cross-section [m²]

Substituting for A and R expressions involving h and other necessary dimensions of the channel cross section, the resulting equation can then be solved by trial and error to determine h_N . When supercritical flow occurs in the outflow channel, the sill (control) will basically play the role of a weir, and the water depth over the sill will be equal to the critical depth h_c . The depth of approach h_A will then be 1.5 times the critical depth as shown in Equation below. Table 13 presents values of approach depth for a range of unit discharge values (q).

$$H_A = \frac{3}{2} \times h_c = \frac{3}{2} \times \sqrt[3]{\frac{q^2}{g}}$$

Where:

q = discharge per unit width of the spillway sill [m³/s/m or m²/s] = Q/L
 L = length of sill [m]

g = 9.81 [m/s²]

Table 14: Values of q and ha

<i>q [m³/s/m]</i>	<i>h_A [m]</i>	<i>h_c [m]</i>
0.25	0.28	0.19
0.50	0.44	0.29
1.00	0.70	0.47
1.50	0.92	0.61
2.00	1.11	0.74
2.50	1.29	0.86
3.00	1.46	0.97
3.50	1.62	1.08
4.00	1.77	1.18
4.50	1.91	1.27
5.00	2.05	1.37
5.50	2.18	1.46
6.00	2.31	1.54
6.50	2.44	1.63

7.00	2.56	1.71
7.50	2.68	1.79
8.00	2.80	1.87
8.50	2.92	1.95
9.00	3.03	2.02
9.50	3.14	2.10
10.00	3.25	2.17

For supercritical flow conditions, the normal depth of flow in the outflow channel (h_N) is smaller than the critical depth (h_C). If h_N is greater than h_C the flow in the outflow channel is subcritical, and the depth of approach h_A will depend of the water velocity and height in the outflow as in Equation above

$$h_A = h_1 + \frac{5}{4} \times \frac{v_1^2}{2g}$$

h_1 = depth of flow in the outflow section [m]

v_1 = velocity of flow in the outflow section [m/s]

The procedure for spillway design is an iterative process that can follow the sequence described below:

For the inflow design flood (Q), use:

- 1) Equation above to test different values of sill length (L) to determine an acceptable approach height (h_A), noting the equation that determines the gross freeboard (GF) and the final embankment crest elevation;
- 2) Select trial widths and slopes for the outflow section and use Equation above to establish the depth of flow (h_N);
- 3) Check that flow conditions in the outflow channel are supercritical and that the flow depth in the outflow section (h_N) is less than the flow depth over the sill (h_C);
- 4) Check that flow velocities are acceptable (less than 2.5 m/s for earth channels, less than 6m/s for rock lined channels).

CALCULATIONS:

$$Q = V \times A = \frac{1}{n} \times R^{2/3} i^{1/2} \times A \text{ m}^3/\text{s}$$

Where:

$Q = \text{Discharge in m}^3/\text{s}$

$A = \text{Channel cross sectional area in m}^2 = d(d + b)$

$R = \text{Hydraulic radius of channel} = \frac{d(d+b)}{2(2d^2)^{1/2}+b}$

$V = \text{Water velocity in m/s}$

Hence, $Q = \left\{\frac{1}{n}\right\} \times \left\{\frac{b \times d}{b+2d}\right\}^{2/3} \times i^{1/2} \times b \times d$

Where:

$b = \text{spillway width}$

$d = \text{normal water depth}$

$i = \left[\frac{v_n}{R^{2/3}}\right]^2$ and $Q = V \times A$

Hence $Q = V \times b \times d$

Dividing by b on both sides of the equation, we get discharge per meter width q ($\text{m}^3/\text{s}/\text{m}$) given by:

$q = \frac{Q}{b} = Vd$

Since $Q=22.486\text{m}^3/\text{s}/\text{km}^2$ from the catchment and velocity $V=2.5$ m/s, then

$q = 22.486 / b = 2d, bd = 22.486/2.5 = 8.9944\text{m}^2$

$b=8.9944\text{m}^2/d$

Therefore, taking $d=0.6\text{M}$

$A= 9.9944$

$P= 10.9944$

$R= 0.595416932$

$i= 0.0179018451$

Solving by iteration

v	Q	Q/v	n	vn
2.5	22.486333	8.945733333	0.025	0.0625

ITERATIONS FOR d							
N O.	d	$b = (Q/v)/d$	$P = 2*(2*d*d)^{(1/2)}+b$	$A=d(d+b)$	$R=A/P$	$R^{(2/3)}$	$i=(vn/(R^{(2/3)}))^2$
1	1	8.945733333	11.77416046	9.945733333	0.8447	0.8935892	0.005

2	0.6	14.90955556	16.60661183	9.305733333	0.5604	0.6796934	0.008
3	0.4	22.36433333	23.49570418	9.105733333	0.3875	0.5315584	0.014
4	0.8	11.18216667	13.44490837	9.585733333	0.713	0.7980774	0.006
5	0.35	25.5592381	26.54918759	9.068233333	0.3416	0.4886309	0.016
6	0.38	23.54140351	24.61620582	9.090133333	0.3693	0.5147141	0.015
7	0.39	22.93777778	24.04086436	9.097833333	0.3784	0.523189	0.014
8	0.32	27.95541667	28.86051335	9.048133333	0.3135	0.4614981	0.018
9	0.45	19.87940741	21.15219961	9.148233333	0.4325	0.5719014	0.012

From the above table, the depth of flow (also equal to critical height H_c above the sill) is 0.60m, whereas spillway bottom width is $14.91 \approx 15M$. A bottom width of 15M is adopted for a trapezoidal shaped channel for this design.

$$q=Q/b= 22.486/14.99=1.5m^3/s/KM^2$$

$$H_c= 0.6123M$$

$$H_A=^{3/2}*H_c=0.91845M$$

$$H_N= 0.8546M$$

H_N Is greater than H_c hence the outflow section is sub critical.

The chart below illustrates the effect on dam level after the all the withdrawals plus loses and recharge are taken into account. The analysis indicates that water level in the dam will remain constant (full) despite the abstractions and losses. The chart depicts that there will always be some discharge running through the spillway.

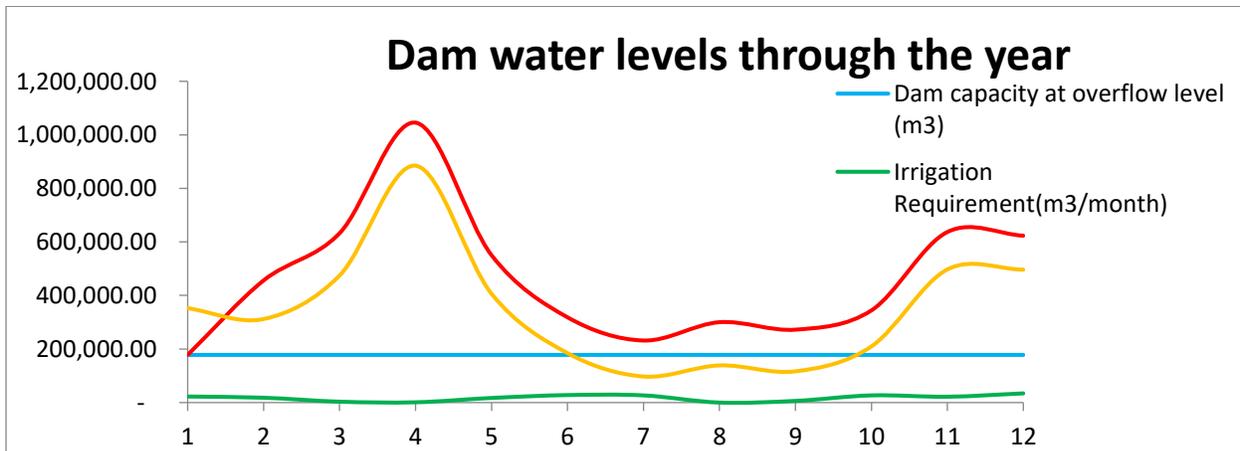


Figure 4: Dam water level vs water balance chart

2.4.5 Design of Draw-Off Works

A typical draw-off system consists of an intake at the bottom of the reservoir with a draw-off pipe passing through the embankment or foundation. This pipeline is then connected to a pump house

or valve chamber from where water will usually be provided to the distribution system and consumer points.

2.4.5.1 Intake Structure

The intake structure will generally consist of a concrete anchor block supporting a vertical perforated galvanized steel pipe. The pipe up stand will be surrounded by a protective steel structure or a cone of rubble stone and large diameter gravel which serves to protect the up stand from debris, livestock, wildlife and vandalism. The stand pipe diameter depending on the demand for irrigation and domestic will be 300mm as shown in the drawings.

The perforations on the up stand, starting above the expected silt level, should be at least 12mm diameter and should constitute at least 10% of the surface area of the pipe. The flanged joint for the up-stand should be above the concrete anchor block. This means that the up-stand can be replaced if needed without damaging the anchor block. However, this introduces a risk of vandalism or theft of the up-stand when the reservoir is dry.

2.4.5.2 Draw-Off Pipe

The draw-off pipe should have a minimum diameter of 400mm up to a length of 200m downstream then with a reducing Tee reduced to 315mm to the pump to distribute upstream (irrigation) and to 110mm to distribute downstream to the communal water point. The pipe will be galvanized iron, As the draw-off pipe forms a preferential seepage path, it should be situated on firm ground preferably below the foundation level of the embankment. Anti-seep collars should be provided at regular intervals (e.g., one per every six-meter pipe length) so that the length of the potential flow path is increased to at least 115% the length of the pipe.

Consequently, the trench for the draw-off pipes should be at least one meter below the construction working surface. In order to minimize the risk of damage to the pipe, the pipe itself should be surrounded with concrete.

2.4.6 Pumping works

The pumping works will include construction of a pump house to house the solar pump, solar hoisting structure and a 100m³masonry tank at a high elevation to distribute water to the farms through the hydrants. The size of the sump is a function of inflow and demand. A surface pump with a minimum power rating of 39kw capable of pumping 89.6lits/sec against a total dynamic head of 32m will be required. Motor power rating is estimated at 44 Kw will be installed.

2.4.7 Outlet Works

The outlet works usually consist of a valve chamber at or below the downstream toe of the embankment where fittings are placed on the draw-off pipe for purposes of controlling and directing the flow. The arrangement of pipe, tees and valves should allow water to be directed to the consumer points and allows flushing of the draw-off pipe to remove any sediment. The pipe and fittings should be securely anchored to ensure that the action of opening and closing the valves does not result in any movement of the pipe.

2.4.8 Core Trench

A core trench is used to cut off bad underlying layers. In case a machinery will be used for the construction the minimum width of the core trench should be about 1.5 times the excavation width of the machine. The depth of the core trench will be determined on site by the project manager depending on the conditions of the site.

2.4.9 Toe drain

The work of a toe drain / rock toe is to control seepage to protect the downstream embankment from internal erosion and relief uplift pressures. Embankment slope stability and seepage analysis was carried out using GEOSTUDIO Software. The results indicated that the embankments are safe from slip failure with a slope of 3:1 both the upstream slopes and downstream slopes. In case of seepage, the results showed that the seepage line will come off at the dam downstream toe, hence seepage will occur. Introduction of a toe drain can correct the seepage line into the embankment as shown in Figure 5-9.

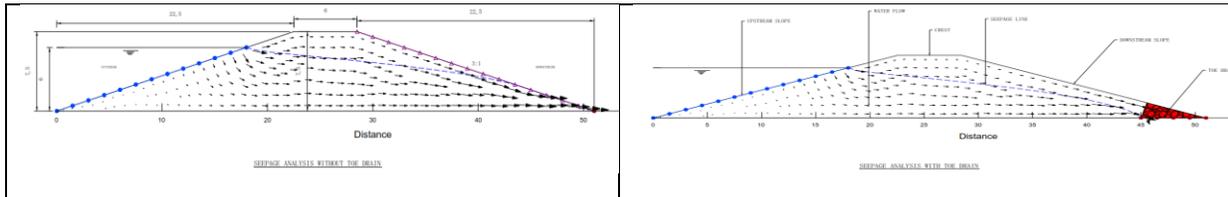


Figure 5: Seepage Analysis

The thickness of the toes drain should not be less than 1.5m, width of not less than 4m and should extent up-to where the elevation is 4m below the crest. If a rock toe is to be used, it should comprise of variable size rip-rap (25 – 250mm). The rock toe can be 1 m in height and placed at a 1.5 (h): 1(v) slope. The rock toe is distinguished from the toe drain which has graded material designed to convey seepage water away from the embankment.

A toe drain will be adopted. The dimensions of the toe drain will be 2m height and 6m wide from seepage analysis drawing and 20m long based on elevation of 4m below the crest.

2.4.10 Other ancillary structures

These facilities were incorporated to avoid the community members and livestock from directly accessing the dam for purposes of protection.

1. Sanitary facilities

An ablution block comprising of at toilets and a bathroom will be constructed at suitable location as part of promotion of health and safety environment measures around the reservoir.

2. Cattle trough

A Cattle trough will be constructed at the downstream part of the dam to draw water from the outlet structure. Standard designs will be used for the animal troughs which are specific

to cattle, sheep and camels. Gate valves should be placed securely in close proximity to the livestock trough to facilitate servicing of the ballcock.

3. Community water point

At the upper end of the reservoir, a silt trap will be incorporated to reduce the amount of silt reaching the dam wall substantially.

Key issues on the design of the standpipe include siting, ensuring the up-stand pipe is firmly secured against regular use, ensure a firm platform at the appropriate height for the water-drawer to place his/her container, stop-cock/gate valve near the standpipe to facilitate repairs of the tap, and the overflow water drains away from the collection point to avoid muddy pools of water impeding access to the stand pipe and creating a potential breeding ground for insects. Any meter should be placed in a secure meter chamber.

2.4.11 System Components Design

2.4.11.1 Sizing of pipeline

2.4.11.2 Rising Main and Distribution lines

Size of pipeline is calculated as shown below:

From continuity equation

$$Q = v a$$

Where Q = Project flow rate (m^3/s)

v = velocity of water in pipeline (m/s)

a = x-sectional area of pipeline (m^2)

$$Q = \frac{v * \pi d^2}{4}$$

$$d = \sqrt{\frac{4 * Q}{\pi v}}$$

Operating flow velocities in the pipes are fixed within the maximum and minimum allowable velocities in pipes of $0.5 \leq v \leq 1.5 \text{ m/s}$

Besides this consideration, hydraulics along the pipeline plays a major role in selection of the pipe size.

Excel spread sheet is used to determine the pipe sizes while considering the optimal operating pressures in the system.

2.4.11.3 Sizing of the pump

The sizing of the pumping unit is given by the equation below:

$$\text{Pump power, } P = \frac{\delta \times Q \times H \times 2.72 \times 10^{-3}}{h_p \times h_m}$$

Where P = pump power in Kw,

δ = density of water (unity)

Q = Discharge / Flow rate in m³/h,

H = Total system head in m,

2.72×10^{-3} = Conversion factor,

h_p = Pump efficiency,

h_m = Motor efficiency.

Q and H represent the duty that the pump must deliver. For this case, the Q is 0.09m³/sec and TDH is 32.02m. The TDH is the sum of the static head, friction losses and the suction losses. Assuming a pump efficiency of 75% and a motor efficiency of 85%, pump power requirement becomes 37.2Kw.

This pump will be powered by solar panels and will therefore operate for a maximum of 10hrs per day.

2.4.11.4 System Power Requirements and solar panel sizing

The required power by the pumps from the panels assuming efficiencies of 85% from motor to pump and 90% from PVs to motor is 23.4 kw.

The PV solar panels will be sized on the basis of the above estimates. The figure below shows sample panels that could be selected to run the system.

Model	Rated Power (W)	Nominal Voltage (V)	Peak Voltage (V)	Open Circuit Voltage (V)	Short Circuit Current (A)	Number of Cells	Dimensions (mm)						Weight (kg)
							A	B	C	D	E	F	
TP85M	85	12	20.9	24.4	4.45	36	875	528	715	350	100	23	2
TP125M	125		21.3	24.9	6.14		765	516					
TP150M	150		37.2	43.3	4.45	64	910	875	750	588		25	4
TP200M	200		37.5	43.5	5.95		1190	1030	665				
LO350M	350	24	34.4	40.4	10.18	60	1755	1038	1300	942	500	35	18
AS545M	545		41.6	49.8	13.98		144	2279	1134	1279	942		
LO560M	560		43.5	51.6	13.94	132		2278	1134	1093	439	30	33.3
TR660M	660		37.8	45.7	18.53		1303	1400	1261	492	35		
TR665M	665	38.0	45.9	18.57	1303								

Figure 6: Sample of PV Panels That Would be Required to Run the Proposed System (Details from Davis and Shirlif Data Base)

2.4.12 Proposed Irrigation System Development

2.4.12.1 Pumping works

A pumping unit complete with solar power system and automatic switches will be installed on the downstream of the dam.

The water will be pumped to a masonry tank at an elevated site for distribution.

2.4.12.2 Pipe network

The proposal is to use HDPE and GI pipes. GI pipes will only be used for road crossing and rocky sections. The pipes will be buried to a minimum of 1m below the ground level. Total length of the pipe network is 4,188m. The table below summarizes the sizes and classes of pipe networks to be used.

Table 15: Summary of pipe details

No	Line	Class	Length, m	Diameter, mm
1	Conveyance/Rising main	PN6	344.00	315
2	Mainline	PN6	438.00	315
		PN6	277.00	280
3	SM2	PN6	70.00	90
		PN6	199.00	160
		PN6	57.00	180

4	SM1	PN6	325.00	140
5	Distribution 1	PN6	257.00	90
6	Distribution 2	PN6	465.00	90
7	Distribution 3	PN6	389.00	90
8	Distribution 4	PN6	700.00	90
9	Distribution 5	PN6	667.00	90
10	Laterals (Community Contribution)	PN6	2,790.00	50

2.4.12.3 Hydrants

There will be a total of 16 hydrants from where farmers will draw water for Irrigation.

2.5 PROJECT WATER REQUIREMENT

2.5.4 Net Irrigation Requirements

Based on the crop water requirement, and the cropping pattern, the scheme water requirement will be as presented in the table below.

Table 16: Irrigation water requirement

Months/Precipitation deficit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1. TOMATO	0	0	4.9	0	43.6	103.7	84.8	0	0	0	0	0
2. MAIZE (Grain)	0	0	0	0.3	50.8	101.6	35	0	0	0	0	0
3. CABBAGE (Crucifers)	0	0	16.8	2.5	36.3	30.5	0	0	0	0	0	0
4. GREEN BEANS	0	0	1.8	5.2	34.7	6.5	0	0	0	0	0	0
5. TOMATO	101.1	43.9	0	0	0	0	0	0	14.5	57.7	51.3	93.5
6. CABBAGE (Crucifers)	9.2	0	0	0	0	0	0	0	17.7	76.6	59.6	76.4
Net scheme irr.req.												
in mm/day	1.8	0.8	0.2	0.1	1.3	2.3	1.3	0	0.5	2.2	1.8	2.7
in mm/month	55.1	22	5.7	1.6	41.8	69.2	40.9	0	16.1	67.2	55.4	84.9
in l/s/h	0.21	0.09	0.02	0.01	0.16	0.27	0.15	0	0.06	0.25	0.21	0.32

Irrigated area (% of total area)	100	50	80	60	100	60	0	10	10	10	10	
Irr.req. for actual area, (Lits/s/Ha)	0.21	0.18	0.03	0.01	0.16	0.27	0.25	0	0.06	0.25	0.21	0.32

2.6 Materials Inputs during Construction Phase

Various construction materials which meet the KEBS standards for the construction of the dam will be purchased locally. This will include:-

- i. Soil- Borrow material used in the construction on dam wall
- ii. Stones-Riprap placed on the upstream face of the dam wall to protect it from erosion
- iii. Cement -For the construction of chambers and concrete collars and sill
- iv. Sand- Used as material for filter blanket and in construction of chambers and concrete collars and sill
- v. Ballast -Used as material for filter blanket and construction of sill
- vi. Reinforcement steel bars-For construction of sill on the spillway
- vii. UPVC Pipe-Used as pipeline for abstracting water from the dam
- viii. Grass-Planted on the downstream phase of the dam to protect it from erosion

2.6.1 Equipment and Tools

The following equipment shall be used:-

Table 17: Equipment/Machinery to be used

S/No.	Equipment	Machinery Function
1.	Bulldozer	Site clearance, excavation, trimming
2.	Excavator	Borrow excavation and loading of tippers
3.	Dam scoops	Borrow excavation and placement
4.	Tippers	Earth movement from borrow area to dam site
5.	Graders	Leveling, trimming placed construction material
6.	Sheep foot roller	Compaction of leveled material
7.	Water Bowser	Applying water to material
8.	Harrow	Turning material to ensure proper mixing with water
9.	Mixer	Mixing concrete
10.	Vibrator	Consolidate fresh concrete by releasing trapped air
11.	Tractor	Water supply, compaction among other uses

2.7 Project activities during operation phase

2.7.1 Operational Monitoring

Regularly monitoring rainfall, reservoir water levels, and inflow/outflow volumes is crucial for effective operation.

2.7.2 Flow Control

Operating gates, valves, and other flow control equipment is essential for regulating water release and preventing floods.

2.7.3 Reservoir Management

Managing the reservoir's water level and ensuring sufficient storage for various uses (i.e., irrigation, watering livestock and domestic) is a key aspect.

2.7.4 Safety and Maintenance:

- **Dam Safety**

Regular inspections and maintenance are crucial to ensure the structural integrity and safety of the dam.

- **Infrastructure Maintenance:**

Maintaining the dam's infrastructure, including roads, spillways, and other related structures, is vital for long-term operation.

2.7.5 Emergency Response:

Having procedures in place to handle potential emergencies, such as gate malfunction or flood events is critical.

2.8 Wastes to be generated and methods of disposal

The following will be the main wastes outputs resulting from implementation of the proposed project:

a) Waste Output

- i. Site clearance wastes
- ii. Domestic waste/ Waste associated with workers
- iii. Metallic wastes
- iv. Containers (plastic/papers)
- v. Wooden pallets
- vi. and Concrete wastes mortar among others

These wastes will be disposed of by the contractor who will follow the Waste Management Regulations, Legal Notice 121 of September 2006. These regulations aim to ensure the proper management of waste, including collection, segregation, disposal, and transportation, while protecting public health and the environment.

b) Other Outputs Include:-

- vii. Noise emissions from construction machinery, motor vehicles, among others; and
- viii. Air emissions from machinery (Carbon Dioxide (CO₂), Carbon Monoxide (CO), Nitrogen Oxide (NO_x), Nitrogen Dioxide (NO₂), PPM etc.)

CHAPTER THREE: POLICY, LEGAL AND REGULATORY FRAMEWORK

3.1 Introduction

This chapter summaries the policy, legal and institutional frameworks governing environmental issues in Kenya, it also provides relevant policies, laws and institutions that are applicable to the proposed construction Osukunua Earth Dam and Irrigation project and associated proposed projects. The chapter further reviews applicable international conventions and legislation including that of the World Bank Environmental and Social Standards.

3.2 Relevant Policies

Kenya has a rigorous environmental policy to match conservation with development. It has put in place over 77 statutes that relate to environmental issues. Most of these statutes are sector specific. The statutes administrate issues related to public health, soil erosion, protected areas, endangered species, water rights and water quality, air quality, noise and vibrations, cultural, historical, scientific and archeological sites, land use, resettlements among other. Initially environmental management activities were implemented through a variety of instruments such as policy statements and sectoral laws and also through permits and licenses. With the enactment of Environmental Management and Coordination Act (1999), the institutional framework for environmental management was strengthened.

Some of the policies identified to be relevant to this dam project include:

3.2.1 Kenya ASAL Policy-Sessional Paper No. 8 of 2012

The national policy titled; '*Releasing our full potential*', affirmative action that equitable development needs the support of all Kenyans; an enabling environment for accelerated investment and growth; a responsive government to the uniqueness of arid lands which include; ecology, mobility, population distribution, economy and social systems, sustainable utilization and conservation of natural resources.

The ASAL Policy is complemented by Vision 2030 Development Strategy for Northern Kenya and other Arid Lands in Kenya, which accommodates the unique realities of the **ASALs** to achieve the goals of Kenya Vision 2030.

The proposed project is located in ASAL area and the interventions proposed in the ESIA are aimed at building resilience of the community around the project area to negative impacts change. The project itself will build resilience of the community against climate shocks such as droughts.

3.2.2 Vision 2030 Development Strategy for Northern Kenya and other Arid Lands

The strategy was developed to complement Vision 2030 by explaining how its goals would be realized in the specific context of Northern Kenya and other ASALs. The main goal of the policy is to ensure food and nutrition security in a sustainable manner in environments that are prone to drought, insecure access to and control over livelihood resources such as land, and where climate change increase unpredictability. The strategy envisions a holistic and sustainable management of

land and natural resources across the ASALs to allow for maintenance of their traditional movement arrangements.

The proposed interventions include Earth Dam and irrigation will be planned and managed to avoid overexploitation of water resources. It should contribute to improved water access for agriculture, livestock, and domestic use without compromising ecosystem balance. Further, the project will undertake holistic sustainable land management activities, which will contribute to conserving the environment on which the people depend on.

3.2.3 Sessional Paper No. 2 of 2008 on the Livestock Policy (Revised 2014)

The policy recognizes that ASAL's had an enormous potential but are characterized by low development indicators and high incidence of poverty. Other factors that have negatively affected the development of the ASALs include: shift from pastoralism to agro-pastoralism due to increase in human population with settlement on pastoral lands, increased cultivation, land subdivision, land degradation, resource use conflicts, reduced dry season grazing reserves and human-wildlife conflicts.

The policy proposes a number of measures to support livestock production. These include initiatives to enhance water and feed availability by encouraging appropriate grazing management strategies, fodder and pasture conservation.

The proposed project will address issues of environmental degradation, conflicts associated with resource use and decline in dry season grazing areas by improving the availability of pastures/fodder and water for dairy development.

3.2.4 National Land Policy (2009)

The overall objective of the National Land Policy is to secure rights over land and provide for sustainable growth, investment and the reduction of poverty. The key thrust of the policy is to ensure that; citizens have opportunity to access and constructively occupy and use land; equitable and sustainable use of land; efficient, effective and economical operation of land markets; efficient and effective utilization of land and land-based resources; and efficient and transparent land dispute resolution mechanisms. The policy adopts a plural approach, in which different systems of tenure coexist and have equal guarantees of tenure security.

This policy will ensure recognition of customary and community land rights, Fair distribution of water and land benefits from the dam, promote environmentally sustainable agriculture/livelihoods, Facilitate inclusive and beneficial land development and Prevent and manage land conflicts proactively.

3.2.5 National Climate Change Action Plan

The National Climate Change Action Plan (2018-2030) identifies priority adaptation and mitigation actions for transforming to a low carbon climate resilient development pathway. The priority adaptation actions for agriculture in the plan include coordination and mainstreaming of

climate change into agricultural extension; establishment and maintenance of climate change related information for agriculture; and up-scaling specific adaptation and mitigation actions. These actions include promotion and bulking of drought tolerant pastures/fodder, traditional high value crops, water harvesting for crop production, index-based weather crop insurance, conservation agriculture, agro-forestry, and integrated soil fertility management.

The proposed project will promote water storage and irrigation function of the dam, Opportunity to grow resilient fodder and traditional crops, Integrate farmer training on resilient practices around the project, Reduce land degradation, increase productivity and carbon sequestration, Enable financial resilience for irrigated crop farmers and Use dam-related data for localized climate adaptation planning.

3.2.6 Agricultural Sector Transformation and Growth Strategy (2019-2029)

Agricultural transformation is critical to growing the economy, reducing the cost of food, alleviate poverty and delivering 100% food and nutrition security. The strategy is based on the belief that food security requires a vibrant, commercial and modern agricultural sector that supports Kenya's economic development sustainably and its commitment to regional and global growth.

The development of this Earth Dam and irrigation project will support dairy and tomato value chains to enhance food and nutrition security and also increase house hold incomes, thereby contributing to the goals of the Strategy.

3.2.7 National Policy on Gender and Development, Sessional Paper No. 2 of 2019

The goal of the policy is to “achieve gender equality and women’s empowerment in national development so as to enhance participation of women and men, boys and girls, vulnerable and marginalized groups for the attainment of sustainable development”. The policy sets, legislative and administrative measures to address the existing gaps in the realization of gender equality and women’s empowerment.

To ensure that gender equality and women’s empowerment is integrated into sectoral policies, planning and programmes, the policy identifies key thematic areas, namely: labour and employment, education, health, land, housing, agriculture, environment and natural resources, peace and security, governance, power and decision making, information and communications technologies, respect for the human rights, Sexual and Gender Based Violence; the girl child and the boy child, intersectional discrimination, media and access to justice. The policy recognizes that achievement of gender equality and women’s empowerment requires the concerted effort of all actors. In this respect, the policy calls upon the National and County Governments, Constitutional Commissions and Independent Offices, Faith Based Organizations (FBOs) and Civil Society Organizations (CSOs) and the private sector to work together in ensuring its implementation. Partnership with development partners will complement national efforts in this noble cause.

The policy ensure equitable land and water access for women and marginalized groups, inclusion of women in project planning and leadership structures, it will also create equal work opportunities during dam construction and related agricultural development, this policy again will integrate safeguards and reporting systems to prevent gender-based violence, Provide gender-sensitive training, especially for women in farming and resource management and collaborate with local government and development partners to implement gender strategies

3.2.8 National Irrigation Policy, 2017

The National Irrigation Policy 2017 and Strategy (2022-2026) aim to accelerate development by 40,000 ha annually, focusing on food security, modernized infrastructure, and sustainable water management. It promotes public-private partnerships, smallholder support, and climate-resilient agriculture.

The development of this Earth Dam and irrigation project is in tandem with this policy as it is intended to increase food security and incomes.

3.3 Institutional Framework

3.3.1 Institutional Framework

There are a number of institutional frameworks that are relevant to the development of this water dam project. These frameworks have been brought to the attention of the proponent, the contractor and projector beneficiaries. They include:-

3.3.2 The National Environmental Complaints Committee

The revised Act (EMCA) 2015 replaced the Public Complaints Committee with the National Environmental Complaints Committee. The section 20 of the Amendments Act outlines the functions of the National Environment Complains Committee which are: prepare annual reports on the state of the environment and undertake public interest litigation on behalf of the citizens in environmental matters.

3.3.3 The Standards and Enforcement Review Committee

In addition to NEMA, the Act provides for the establishment and enforcement of environmental quality standards to be set by a technical committee of NEMA known as the Standards and Enforcement Review Committee (SERC). The SERC will be involved in the monitoring of the implementation of ESMMP.

3.3.4 Water Resources Authority

The Water Resources Authority (WRA) is a state corporation established under Section 11 of the Water Act, 2016. It is mandated through delegated Authority on behalf of the National government to safeguard the right to clean water by ensuring that there is proper regulation of the management and use of water resources, in order to ensure sufficient water for everyone- now and in the future.

WRA's approach as an organization in safe guarding the resource is entrenched in the Country's Big 4 development agenda, Vision 2030 strategic objective on water and sanitation and the SDG 6 all these agenda's and objectives aim to increase water resources availability for multipurpose use but also improve the quality and sustainability of water resources. The Authority is vested with various functions and powers as provided under Sections 12 and 13 of the Water Act, 2016.

3.3.5 The National Environmental Management Authority

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

3.3.6 County Government of Narok

The County Government Act of 2012 provides for the election, functioning, control of, tasks and powers, etc. of county governments as provided for under Article 176 of the Constitution. It also provides for a wide variety of matters relating to public administration at the local level such as civic participation, access to information, public communication and the protection of minorities. The act also stipulates that the County Government will be responsible for functions stipulated in article 186 and assigned in the Fourth Schedule of the Constitution which includes control of air pollution, noise pollution, other public nuisances and outdoor advertising. The County Departments of Environment and Agriculture (Agricultural Officer and Environment Officer) among others will take responsibility for guiding the community to guarantee proper implementation and functioning of the project. including but not limited to: pollution control, biodiversity conservation.

3.3.7 National Irrigation Authority

Part III, Section 7(1) of the Irrigation Act 2019 establishes the National Irrigation Authority (NIA) whose functions are; develop and improve irrigation infrastructure for national or public schemes; Provide irrigation support services to private medium and smallholder schemes, in consultation and cooperation with county governments and other stakeholders; provide technical advisory services to irrigation schemes in design, construction supervision, administration, operation and maintenance under appropriate modalities, including agency contracts, as may be elaborated in regulations to this act. In consultation with county governments and other stakeholders;

- i. Facilitate formation and strengthening of irrigation water users' associations at scheme level for operation, maintenance and management;
- ii. Facilitate formation and strengthening of scheme management and dispute resolution committees at scheme level for management of the schemes and resolution of disputes relating to scheme management;

The National Irrigation Authority will provide the technical advisory services required for this project and continuously build the capacity of the Osukunua Irrigation Water Users Association.

3.3.8 Directorate of Occupational Safety and Health

The State Department of Labour and skills Development carries out health and safety services through the Directorate of Occupational Safety and Health Services (DOSHS). These services are carried out to ensure that every workplace is free of any hazards, and complies to laid down standards to assure safety of employees. Some of these services include but are not limited to Registration of workplaces, Registration of plant, Registration of Approved persons and institutions, workplace inspection and audits, Examination and testing of plants, Accident investigation & WIBA processing.

The proponent and other stakeholders will work closely with DOSHS, to ensure safety of the workers and the community.

3.3.9 NAVCDP, CPCU AND NPCU

The National Agricultural Value Chain Development Project (NAVCDP) is implemented by the Ministry of Agriculture and Livestock Development (MoALD), and is funded by the World Bank (WB). It focuses on transforming smallholder farmers across 33 counties in Kenya from subsistence to commercial farming through increased value addition and market participation. The project builds on previous initiatives (like NARIGP and KCSAP) and includes key investments in infrastructure, irrigation, access to financial services, and sustainable agricultural practices.

The County Programme Coordinating Unit (CPCU) and the National Programme Co-coordinating Unit (NPCU) will provide the bulk of the funding required to implement this project and also provide the technical backstopping.

3.3.10 Osukunua IWUA

Irrigation Water Users Association is an association established by residents of a catchment area who are crop farmers, livestock producers, fish pond users, or small rural industry entrepreneurs or otherwise uses water for irrigation purposes from a common water source/irrigation facility. The members are responsible for installing, operating, maintaining and managing the irrigation system. At catchment level the IWUA should operate as a member of a Water Resource Users Association (WRUA).

The IWUA will be responsible for managing this water project sustainability.

3.4 Legal Framework

There are various legislations and policy documents related to the development of water projects in Kenya. These include:-

3.4.1 Constitution of Kenya 2010

Article 42 of the Kenya Constitution, 2010, recognizes a healthy environment as a right to every person and calls for “sustainable exploitation and utilization of natural resources.

Chapter 5 of the document provides the main pillars on which the 77 environmental statutes are hinged. **Part 1** of the chapter dwells on land, outlining the principles informing land policy, land classification as well as land use and property.

The second part of this chapter directs focus on the environment and natural resources. It provides a clear outline of the state's obligations. The state shall:-

- Ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;
- Encourage public participation in the management, protection and conservation of the environment;
- Protect genetic resources and biological diversity;
- Establish systems of environmental impact assessment, environmental audit and monitoring of the environment;
- Eliminate processes and activities that are likely to endanger the environment; and
- Utilize the environment and natural resources for the benefit of the people of Kenya.

In conformity with the Constitution of Kenya, every activity or project undertaken within the republic must be in tandem with the statutes '*adherence to the right of every individual to a clean and healthy environment*'.

This ESIA report incorporated public participation processes during which the community and the technical team laid strategies for sustainable utilization of natural resources for dairy development. Furthermore, the ESMMP has outlined measures to mitigate adverse impacts and enhance beneficial ones.

3.4.2 The land Act, 2012 (Legal Notice 6)

This is an act of parliament to give effect to Article 68 of the constitution to revise, consolidate and rationalize land laws; to provide for the sustainable administration and management of land and land based resources, and for connected purposes. The Act applies to all land declared as: (a) public land under Article 62 of the constitution; (b) private land under Article 64 of the constitution; and (c) community land under article 63 of the constitution and any other written law relating to community land. The utilization of land resources under these categories as provided in the constitution, this act or any other written law is guided by the following values and principles of land management and administration:-

- a) Equitable access to land,
- b) Security of land rights,
- c) Sustainable and productive management of land resources,
- d) Transparent and cost effective administration of land,
- e) Conservation and protection of ecologically sensitive areas,
- f) Elimination of gender discrimination in law, customs and practices related to land property.

The proposed project is located on community land. The proposed Earth Dam development project incorporates strategies for sustainable production, protection of environment and gender inclusivity. It safeguards the community from land grabbing and ensures land available is utilized for its intended purpose.

3.4.3 Environmental Management and Coordination Act (EMCA, 1999), Cap 387

Part II of the Environmental Management and Coordination Act entitles every person in Kenya to a clean and healthy environment. It seeks to safeguard and enhance sustainability of the environment. The act is a consolidation of the various sectoral laws on the environmental conservation, which had hitherto made it difficult to coordinate environmental protection. The act provides guidelines on issues of environment and stipulates offences and penalties for failure to adhere to the act. Further, this report took cognizance of the attendant regulations, such as the Environmental Management and Co-ordination (Waste Management) Regulations, 2006, Environmental Management and Coordination (Noise and Excessive Vibration Pollution) Control Regulations, 2009, and the Environmental Management and Coordination (Fossil Fuel Emission Control) Regulations, 2006

This project is listed in second schedule of EMCA Act as the type of projects which must be subjected to the ESIA process. This ESIA study has been examined, compiled and written in accordance with the Environmental and Social Impact Assessment and Audit regulations, 2003, regulation 7(1). It has also consulted the public and beneficiary community as required by law.

In addition, the proposed Earth Dam may result into accumulation of various types of wastes. In this report thereof, proposals have been made to manage these wastes through interventions such as provision of toilets, bathrooms, fencing and dustbins. Further, measures have been prescribed in the ESMMP for the management of other wastes such as cement as well as oil spills, in line with the Environmental Management and Co-ordination (Waste Management) Regulations, 2006.

It is also important to note that to comply with the Environmental Management and Coordination (Fossil Fuel Emission Control) Regulations, 2006, this ESIA report has given guidelines for maintenance of machinery and handling of fossil fuels and oils. This shall apply to equipment and machinery used in ferrying construction materials in the project locality during all the phases of the project.

3.4.4 County Government Act, 2012

The act gives effect to Chapter Eleven of the Constitution, which provides the county governments the powers to function and take responsibilities for the delivery of services within their designated counties including management of environment and natural resources among other responsibilities. The functions are provided for in Article 186 of the constitution as assigned in the Fourth Schedule of the Constitution.

The development of this report involved public participation through KIIs and FGDs as required by sections 87-92 and 115 of this Act. This ESIA report has outlined the role of the County government and prescribed actions to be taken by the project beneficiaries and contractor in order to ensure sustainability of the environment and natural resources. Agriculture including livestock and fisheries development is one of the devolved functions. By supporting this project, it will contribute to supporting and building capacity of the County Government of Narok to implement devolved agricultural functions.

3.4.5 Water Act, No. 43 of 2016

The Act provides for the regulation, management, development and use of water resources, and water and sewerage services. It has provisions for formulation of five-year integrated water services strategy with plans, programs for protection, conservation, control and management of water resources; establishment of water sector institutions which include Water Resources Authority (in place of Water Resources Management Authority) to regulate water rights and works; the National Water Harvesting and Storage Authority (in place of National Water Conservation and Pipeline Corporation); the Water Services Regulatory Authority (in place of Water Services Regulatory Board); Water Works Development Agencies (in place of Water Services Boards); the Water Sector Trust Fund (in place of Water Services Trust Fund) to enhance water services; the Water Services Regulatory Authority to control water service providers, and the Water Tribunal (in place of Water Appeals Board) for dispute resolution.

This ESIA report has proposed the formation of a water management committee to oversee the utilization of the water resource. In addition, efficient water use technologies have been prescribed in the report. The envisaged land management measures will also contribute to soil and water conservation in the area.

3.4.6 Forest Act

The forest Act, 2005 recognizes that forests play a vital role in the stabilization of soils and ground water, thereby supporting the conduct of reliable agricultural activity and that play a crucial role in protecting water catchment in Kenya and moderating climate by absorbing greenhouse gases. The act recognizes that forests provide diversity and a major habitat for wildlife.

The project is not located in a protected forest area. This ESIA report prescribes planting of various agroforestry trees to ensure a good ground vegetation cover that stabilizes the soils and hence enhance groundwater recharge.

3.4.7 Agriculture and Food Authority (AFA) Act No. 13 of 2013 (Revised 2015)

This Act provides for consolidation of the laws on the regulations and promotion of agriculture generally, to provide for the establishment of the Agriculture and Food Authority. It also makes provision for the respective laws of National and County Governments in agriculture, excluding livestock and fisheries and related matters in furtherance of the relevant provisions of the 4 schedule of the Constitution and for connected purposes. The Act provides for formulation of

policy guidelines on development, preservation and utilization of agricultural land; control of noxious and invasive weeds; and outlines the responsibilities of county governments.

This ESIA prescribes good agricultural practices that will enhance productivity and profitability of dairy and tomato value chains to ensure food and nutrition security, and increased incomes.

3.4.8 The Community Land Act, 2016

The Act was enacted (pursuant to Article 63 (5) of the Kenya Constitution 2010) to provide for the recognition, protection and registration of community land rights; management and administration of community land; to provide for the role of county governments in relation to unregistered community land and for connected purposes.

The Community Land Act (2016) also provides that the County governments shall hold in trust all unregistered community land on behalf of the communities. This provision does not however give the County Governments any authority to dispose off any Community Land. This part would be contradictory to the provision vesting the land with the Community and needs careful management. The County Government is simply expected to protect the Community land against annexation while at the same time receiving financial compensation for any community land that may be taken out for infrastructure development or mining after adequate discussions and agreement by the respective community.

The proposed Earth Dam project recognizes that the project is sited on Community land, dedicated for the water project construction and dairy and tomato value chains development activities. The Community has authorized the use of the area for the dam construction through an allocation letter of land to Osukunua earth Dam (David Reson-IWUA Chairman) by Ilkerin Land Adjudication Committee.

3.4.9 Kenya Agricultural and Livestock Research Act, 2013

The Act provides for the establishment and functions of the Kenya Agricultural and Livestock Research Organization (KALRO), to provide for organs of the organization and for the coordination of agricultural research activities.

This ESIA report recognizes the role of KALRO in the development of appropriate tomato seeds and livestock breeds. The proponent has been advised to adopt the improved pasture and livestock breeds for increased productivity and profitability.

3.4.10 Occupational Health and Safety Act, 2007

The Act provides for the safety, health and welfare of workers and all persons lawfully present at work place, as well as the establishment of the National Council for Occupational Safety and Health and for connected purposes. **Section 3(1) and (2)** of the Act explains that it applies in all workplaces where any person is at work, either temporarily or permanently. It expounds on the purpose, which is to secure the safety, health and welfare of persons at work as well as protecting

persons other than persons at work against risks resulting from, or connected to, activities at workplace. Further, sections 43 and 44 of part V give regulations on registration of work places

This ESIA report has prescribed safety measures such as provision of appropriate Personal Protective Equipment (PPE), provision of first aid kits and firefighting equipment. In addition, the report proposes the training of the workers and the proponent on fire safety and emergency response mechanisms.

3.4.11 Public Health Act (Cap 242), 2022

This Act makes provision for securing and maintaining health. Part III and IV of the Act focuses on notification, prevention and suppression of infectious diseases, including inspection, disinfection and provision of medical aid to affected parties in case of outbreaks of infectious diseases. Part IX regulates on sanitation and housing, granting health authorities powers to prevent or remedy any dangers to health arising from poor handling of sanitation issues as well as improper housing and nuisances arising there from. Besides, regulations governing prevention and destruction of mosquitoes, encompassing due maintenance of yards, premises, wells, cesspits and identification and destruction of breeding places are entailed in part XII and also disposal of wastes.

This report provides for provision of sanitation and waste disposal facilities and various methods for the control of mosquitoes. Further, this ESIA report has outlined measures to mitigate communicable diseases and other water borne diseases.

3.4.12 Work Injury Benefits Act (WIBA), 2007

The **WIBA** Act provides for compensation to employees for work related injuries and diseases contracted in the course of their employment in work places and for connected purposes.

Section 7(a) of the Act, on the obligations of the employer, requires an employer to obtain and maintain an insurance policy with an insurer approved by the State in respect of any liability that the employer may incur under this Act to any of his employees.

Section 10(1) States that an employee who is involved in an accident resulting in the employee disablement or death is subject to the provisions of this Act, and entitled to the benefits provided for under this Act. It also states expressly that an employer is liable to pay compensation in accordance with the provisions of this Act to an employee injured while at work. On First Aid covered in **section 45(1)**, an employer is supposed to provide and maintain such appliances and services for the rendering of first aid to his employees in case of any accident as may be prescribed in any other written law in respect of the trade or business in which the employer is engaged.

This ESIA report has outlined work place safety measures to be adhered to by the proponent and the contractor such as provision of first aid equipment, fire extinguisher and PPEs. The site will be registered with Directorate of Occupational Safety and Health (DOSHS) and the contractor will be required to secure insurance for workers and machinery.

3.4.13 HIV/AIDS Prevention and Control Act, 2006

It creates public awareness on causes, modes of transmission, consequences and means of prevention and control of HIV and AIDS. It protects the rights of the infected and affected and outlaws discrimination in all its forms against persons living with HIV and AIDS or those perceived or suspected to have HIV and AIDS.

It addresses the gender issues in sexual and reproductive rights which is the unequal social relations between men and women that give rise to gender inequalities in health. One of the key challenges identified is the inadequate integration of reproductive health and HIV and AIDS services. It proposes to ensure integration of HIV and AIDS information and services into reproductive health services at all levels and ensure adequate capacity for provision of the integration at all levels. The significant number of people that will be deployed during the development of the water project may lead to incidences of HIV/ AIDs and also there may be gender issues in all the stages of implementation.

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This ESIA team has already undertaken sensitization on the causes, dangers and impacts of HIV/Aids and has further proposed continued education on communicable diseases.

3.4.14 The Sexual Offences Act of 2006 [The Sexual Offences (Amendment) Bill, 2016

The aim of the Sexual Act is to explain sexual offences and make ways to prevention and protection of all persons from illegal Sexual Act.

The community was sensitized on Sexual Offences Act during the screening exercise and this ESIA has outlined measures to prevent Gender Based Violence (GBV).

3.4.15 The National Museums and Heritage Act, 2006

This is an Act of Parliament to consolidate the law relating to national museums and heritage; to provide for the establishment, control, management and development of national museums and the identification, protection, conservation and transmission of the cultural and natural heritage of Kenya; to repeal the Antiquities and Monuments Act (Cap. 215) and the National Museums Act; and for connected purposes

The National Museums shall:-

(a) Serve as national repositories for things of scientific, cultural, technological and human interest;

- (b) Serve as places where research and dissemination of knowledge in all fields of scientific, cultural, technological and human interest may be undertaken;
- (c) Identify, protect, conserve and transmit the cultural and natural heritage of Kenya; and
- (d) Promote cultural resources in the context of social and economic development.

This project will protect, conserve the national heritage and promote protection of cultural resources. In case of 'Chance finds', during implementation, the World Bank procedure on chance finds will be triggered.

3.4.16 The Children Act (Revised 2012)

The Children Act, Chapter 141 is a Kenyan law that addresses provision for parental responsibility, fostering, adoption, custody, maintenance, guardianship, care and protection of children; provision for the administration of children's institutions; and giving effect to the principles of the Convention on the Rights of the Child and the African Charter on the Rights and Welfare of the Child and for connected purposes.

This project will not engage children, in all phases of its development.

3.4.17 The Irrigation Act, 2019

Part III, Section 7(1) of the Irrigation Act 2019 establishes the National Irrigation Authority (NIA) whose functions are; develop and improve irrigation infrastructure for national or public schemes; Provide irrigation support services to private medium and smallholder schemes, in consultation and cooperation with county governments and other stakeholders; provide technical advisory services to irrigation schemes in design, construction supervision, administration, operation and maintenance under appropriate modalities, including agency contracts, as may be elaborated in regulations to this act. In consultation with county governments and other stakeholders;

- i. Facilitate formation and strengthening of irrigation water users' associations at scheme level for operation, maintenance and management;
- ii. Facilitate formation and strengthening of scheme management and dispute resolution committees at scheme level for management of the schemes and resolution of disputes relating to scheme management;

The National Irrigation Authority will provide the technical advisory required for this project and continuously build the capacity of the Irrigation Water Users Association.

3.4.18 Employment Act (2007) & Labour Laws

The Employment Act (2007) is the principal labour law in Kenya that governs employment relationships. It provides minimum standards on terms and conditions of employment, including recruitment, wages, working hours, leave entitlements, termination procedures, and protection against unfair dismissal and discrimination. Together with other labour laws such as the Labour Relations Act (2007), Occupational Safety and Health Act (2007), and the Work Injury Benefits Act (2007) it safeguards workers' rights while outlining employers' obligations.

The Employment Act (2007) and related labour laws are directly relevant to the Osukunua Project during both construction and operational phases in the following ways:

Fair Employment Practices

The project must ensure fair recruitment of workers (including casual, contract, and permanent staff), with written contracts, clear job descriptions, and non-discriminatory hiring especially important where local community members are engaged.

Wages, Working Hours, and Leave

Compliance with statutory minimum wages, regulated working hours, rest days, and leave provisions ensures lawful and ethical treatment of labourers involved in canal construction, maintenance, and farm operations.

Occupational Safety and Health

Under the Occupational Safety and Health Act, the project must provide a safe working environment, including protective gear, safe machinery operation, and training to reduce risks associated with excavation, water structures, and farm equipment.

Injury Compensation and Social Protection

The Work Injury Benefits Act requires the project to compensate workers for injuries sustained in the course of work, which is critical given the physical nature of irrigation infrastructure development.

Labour Relations and Dispute Resolution

The Labour Relations Act allows workers to form or join unions and provides mechanisms for resolving labour disputes, helping to maintain harmonious employer–employee relations within the project.

3.4.19 National Gender Policy

The National Gender Policy of Kenya provides a framework for promoting gender equality and equity in all sectors of development. Its main objective is to eliminate gender-based discrimination and ensure equal participation of women, men, boys, and girls in socio-economic, political, and environmental development. The policy emphasizes equal access to resources, decision-making, employment opportunities, and benefits of development projects.

Applying the National Gender Policy in the Osukunua Project ensures inclusive development by promoting gender equity in access to resources, employment, and decision-making. This enhances social acceptance, improves project sustainability, and maximizes the socio-economic benefits of the irrigation scheme for the entire community.

3.4.20 National Policy for Prevention & Response to GBV (2014):

The National Policy for the Prevention and Response to Gender-Based Violence (2014) provides a comprehensive framework for preventing all forms of GBV including physical, sexual, psychological, and economic violence and for ensuring timely, coordinated response and support to survivors. The policy emphasizes prevention, protection, reporting, referral, and accountability, particularly in development settings where power imbalances and economic pressures may increase GBV risks.

Relevance to the Osukunua Earth dam and Irrigation Project

Prevention of GBV in Project Activities

During construction and operation, the irrigation project may attract an influx of workers and create new economic dynamics. The policy guides the project to adopt GBV prevention measures, such as worker codes of conduct, awareness training, and zero-tolerance policies against sexual exploitation, abuse, and harassment.

Safe and Inclusive Work Environment

The project must ensure safe working conditions for all workers, especially women and girls, by providing secure worksites, adequate lighting, separate sanitation facilities, and mechanisms to prevent workplace harassment.

Reporting and Grievance Redress Mechanisms

In line with the policy, the Osukunua Project should establish confidential and accessible reporting channels for GBV incidents, linked to local health facilities, social services, and law enforcement for referral and support.

Community Awareness and Engagement

The policy encourages community sensitization on GBV prevention. Integrating GBV awareness into community meetings and farmer group trainings helps address harmful social norms and promotes respectful interactions within the project area.

Protection of Vulnerable Groups

The project should pay special attention to protecting women, children, persons with disabilities, and other vulnerable groups who may face heightened GBV risks related to employment, water access points, or land-use changes.

3.4.21 National Guidelines on Prevention & Management of GBV (2024)

The National Guidelines on Prevention and Management of Gender-Based Violence (GBV) (2024) in Kenya are a set of government-endorsed standards designed to guide how GBV is prevented, identified, and managed across sectors, especially in healthcare, community services, law enforcement, and social support systems. They focus on a survivor-centered approach, ensuring that anyone affected by GBV receives dignified, confidential, and effective care, including medical treatment, psychosocial support, legal assistance and referral services. The guidelines also outline best practices for GBV prevention interventions, community engagement, and coordination among service providers.

Relevance to the Osukunua Earth Dam and Irrigation Project

Protecting Workers and Community Members

Large development projects often involve a mix of local residents, labourers, contractors and visitors. The guidelines help the project establish clear protocols for identifying and responding

to any incidents of GBV that may occur among staff or in the communities affected by the project. This includes knowing how to safely refer survivors to medical care, psychosocial counseling, or legal support.

Community Awareness and Prevention

The guidelines include recommendations for education and outreach that can be integrated into community engagement plans. Training local staff and water users on GBV prevention can help address harmful norms and promote respectful behavior around the project area

3.4.22 County-level GBV Policies & County Gender Desk Frameworks

At the county level in Kenya, county governments have flexibility to develop policies and institutional arrangements that respond directly to local needs around Gender-Based Violence (GBV) and gender equality. This builds on national laws and policies (like the National Policy on Prevention & Response to GBV) but is tailored to local social, cultural, and development contexts. Narok County launched a Sexual and Gender-Based Violence (SGBV) Policy (2024), which strengthens local systems for prevention, protection, response and accountability, and sets up structures like gender desks in police stations and recovery centres.

For the Osukunua Earth dam and Irrigation Project, incorporating these frameworks into community engagement, safety planning, and worker support systems can help create a safer, more inclusive, and socially sustainable project environment.

3.5 World Bank Environmental Safeguards

3.5.1 ESS1: Assessment and Management of Environmental and Social Risks and Impacts

The World Bank has well-established environmental assessment procedures, which apply to its lending activities and to the projects undertaken by borrowing countries, in order to ensure that development projects are sustainable and environmentally sound. Although its assessment and requirements vary in certain respects, the World Bank follows a relatively standard procedure for the preparation and approval of an environmental assessment study, which:

- Identifies and assesses potential risks and benefits based on proposed activities, relevant site features, consideration of natural/human environment, social and trans-boundary issues,
- Compares environmental pros and cons of feasible alternatives,
- Recommends measures to eliminate, offset, or reduce adverse environmental impacts to acceptable levels (siting, design, technology offsets),
- Proposes monitoring indicators to implement mitigation measures,
- Describes institutional framework for environmental management and proposes relevant capacity building needs.

The World Bank considers Environmental and Social impact assessment (ESIA) as one among a range of instruments for environmental assessment. Other instruments used by the World Bank include; regional or sectoral environmental assessment, strategic environmental and social

assessment (SESA), environmental audit, hazard or risk assessment, environmental and management plan (ESMP) and Environmental and Social Management Framework (ESMF).

To comply with this standard, the project was screened for environmental and social risks, which led to the development of this ESIA report. Moreover, as required by this policy, the public was consulted not only on the project but also on possible environmental and social impacts and mitigation measures which will guide the proponent in implementing the ESMP.

3.5.2 ESS2: Labor and Working Conditions

The World Bank's Environmental and Social Standard 2 (ESS2) sets out requirements to ensure fair treatment, safe working conditions, and the protection of workers in projects financed by the World Bank. It covers various labor-related aspects, including workers' rights, health and safety, grievance mechanisms, and protection from exploitation.

To comply with this standard, the proponent will ensure that, all workers must receive clear, written terms and conditions of employment, non-discriminatory employment practices, provide timely payment of fair wages and legally mandated benefits and workers have access to rest days, leave, and holidays as per legal standards

3.5.3 ESS4: Community Health and Safety

ESS4 is one of the Environmental and Social Standards (ESS) under the World Bank's Environmental and Social Framework (ESF). It addresses the risks and impacts of project activities on the health, safety, and well-being of communities. ESS4 emphasizes that development projects should not only avoid harm to communities but also actively enhance their safety and resilience.

Recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts, in addition, communities that are already subjected to impacts from climate change may also experience an acceleration or intensification of impacts due to project activities

This ESIA report will be crucial in guiding the contractor and the proponent to minimize such risks and impacts, with particular attention to people who, because of their particular circumstances, may be vulnerable.

3.5.4 ESS5: Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement

The World Bank's Environmental and Social Standard 5 (ESS5) addresses the social and economic risks arising from land acquisition, restrictions on land use, and involuntary resettlement in projects it finances. Project-related land acquisition or restrictions on land use may cause physical displacement (relocation, loss of residential land or loss of shelter), economic displacement (loss of land, assets or access to assets, leading to loss of income sources or other means of livelihood), or both. It aims to mitigate adverse impacts while promoting sustainable development and ensuring that affected individuals are fairly compensated and assisted.

The proposed Osukunua Earth Dam and Irrigation Project will be implemented in a public land and therefore this will not cause both physical and economic displacement

3.5.5 ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

ESS6 recognizes that protecting and conserving biodiversity and sustainably managing living natural resources are fundamental to sustainable development.

It also recognizes the importance of maintaining core ecological functions of habitats, including forests, and the biodiversity they support since all habitats support complexities of living organisms and vary in terms of species diversity, abundance and importance

This standard again addresses sustainable management of primary production (cultivation or rearing of plants or animals, aquaculture, plantation forestry etc.) and harvesting of living natural resources

The proposed project is in compliance with this standard since the site selected for the project is away from critical habitats, wetlands and biodiversity hotspots.

3.5.6 ESS8: Cultural Heritage

Cultural Heritage recognizes that cultural heritage provides continuity in tangible and intangible forms between the past, present and future. ESS8 sets out measures designed to protect cultural heritage throughout the project life-cycle.

In line with this procedure, this ESIA took cognizance of the fact that the community must be involved in management of land and water resources. Further, this ESIA report includes a “chance finds” procedure as outline

Chance find procedure

If any person discovers a physical cultural resource, such as (but not limited to) archaeological sites, historical sites, remains and objects, or a cemetery and/or individual graves during excavation or construction, the following steps shall be taken:-

- Stop all works in the vicinity of the find, until a solution is found for the preservation of these artefacts, or advice from the relevant authorities is obtained;
- Immediately notify a supervisor. The foreman will then notify the Construction Manager and the Environment Officer (EO)/Environmental Manager (EM);
- Record details in Incident Report and take photos of the find;
- Delineate the discovered site or area; secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities take over;
- Preliminary evaluation of the findings by archaeologists. The archaeologist must make a rapid assessment of the site or find to determine its importance. Based on this assessment the appropriate strategy can be implemented. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage such as aesthetic, historic, scientific or research, social and economic values of the find;

- Sites of minor significance (such as isolated or unclear features, and isolated finds) should be recorded immediately by the archaeologist, thus causing a minimum disruption to the work schedule of the Contractor. The results of all archaeological work must be reported to the Ministry/Agency, once completed;
- In case of significant find the Agency/Ministry (the National Museums of Kenya) shall be informed immediately and in writing within 7 days of the find;
- The onsite archaeologist provides the National Museums of Kenya (NMK) team with photos, other information as relevant for identification and assessment of the significance of heritage items.
- The NMK must investigate the fact within 2 weeks from the date of notification and provide response in writing.
- Decisions on how to handle the finding shall be taken by the responsible authorities. This could include changes in the project layout (such as when the find is irremovable remain of cultural or archaeological importance) conservation, preservation, restoration and salvage;
- Construction works could resume only after permission is granted from the responsible authorities.
- In case no response received within the 2 weeks period mentioned above, this is considered as authorization to proceed with suspended construction works.

One of the main requirements of the procedure is record keeping. All finds must be registered. Photo log, copies of communication with decision-making authorities, conclusions and recommendations/guidance, implement

3.5.7 ESS10: Stakeholder Engagement and Information Disclosure

ESS10 recognizes the importance of open and transparent engagement between the Borrower and project stakeholders as an essential element of good international practice

Stakeholder engagement is an inclusive process conducted throughout the project life cycle

Stakeholder engagement supports the development of strong, constructive and responsive relationships that are important for successful management of a project's environmental and social risks.

This ESIA engaged public participation through; focused Group discussions (FGDs) and key informants' interviews (KIIs) involving men, women and youth identified among the participants. Individual interviews done using questionnaires in order to capture individual view on the project was also used

CHAPTER FOUR: ENVIRONMENTAL AND SOCIAL BASELINE

4.0 Characteristics of the Project area

4.1 Background information of the sub project investment

The proposed reconstruction and expansion of Osukunua Earth Dam and Irrigation Project is a Farmer Led Irrigation Development Infrastructure Investment supported under NAVCDP's sub-component 2.1. The project is located in Ilmarai Sub-Location, Ilkerin location, Loita Ward, Narok County. The project's irrigation command area is approximately 40 ha with the dam's catchment area estimated at 397ha. The main objective of the project is to improve access to water for sustainable irrigation and improved livelihoods for Osukunua community.

The proposed project entails construction of a 172,384m³ earth dam, laying of about 4.2 kms water conveyance and distribution pipelines, construction of two livestock troughs and a communal water point, sanitation facilities, fencing and construction of water tanks with a solar powered water pumping system. The project will also involve sustainable land management interventions in the dam's catchment area.

Osukunua Earth Dam was initially constructed in the year 1976 by the Norwegian Agency for Development Co-operation (NORAD) and sits on a 4.2ha piece of land which was set aside by the community for development of water harvesting and storage infrastructure. The Earth Dam has served the community for over 40 years, however, over time silt has accumulated in the reservoir, significantly reducing its water storage capacity. Additionally, the community's population has grown tremendously, coupled with lifestyle changes from pure pastoralists to mixed farming thus increasing the demand for water. To meet the current and future demands for domestic, livestock and irrigation the dam requires to be desilted and expanded to restore and increase water storage capacity from 70,000m³ to 172,384m³.

Vision 2030 identifies water resources as an enabler for social and economic development in Kenya. Further Agriculture which is a major user of water resources is one of the six sectors identified under Economic and Macro pillar that seeks to increase the country GDP. Under agriculture, irrigation is identified as one of the key strategies in the CIDP 2023-2027 to transform agriculture sector in Narok County.

The Participatory Integrated Community Development (PICD) process recently held in the Loita ward of Narok County identified inadequate access to water supply for livestock and crop production as one of the seven major challenges contributing to low production and commercialization of the county priority value chains. As a result, the community prioritized in their CDP and SLMP, the construction of Osukunua earth dam and irrigation project as a key intervention to address the challenges.

Osukunua Earth dam beneficiaries will be organized into a Irrigation Water Users Association (IWUA). Currently the beneficiaries comprising of 125 members are registered as Osukunua Earth

Dam Self-Help Group. The group has management committee of 15-members comprising of 11 males and 4 females.

4.2 Overview of the value chain to be financed

The proposed project will mainly support tomato and dairy value chains to increase their productivity and profitability.

Tomato production in Kenya is the top most promising commodity for horticultural expansion and development in Kenya. The fruit plays a critical role in meeting domestic food and nutritional requirements. It also generates income by creating employment for the country's rural and urban populations. By value, the crop contributed 29.5% of the total exotic vegetable produce in Kenya (AFA, 2023), valued at 22.5 billion.

Narok County is the second largest tomato producer in Kenya. The county's annual tomato production is around 54,000MT with an average yield of 22 tons per ha.

In Kenya, there are a total of 5,544,218 dairy cows which produced a total of 5.2 billion litres of milk translating to KES. 312,676.69. billion (National Agriculture Production Report, KNBS, 2023).

In Narok County there are total of 101,941 dairy cows and 1,387,727 crosses producing a total of 108,032.957 MT per annum translating to 4.86 billion (DoALFI, 2023).

The per capita milk consumption in Kenya is 110 litres per person per year (FAO, 2011). Therefore, in Narok County, the total quantity of milk for consumption is estimated at 127 million litres per year against the production of 108million litres. Therefore, the county has a deficit of 19 million litres per year. This shows that the county is a net importer of milk. Most of the milk imports to the county is from Bomet and Kericho Counties.

4.3 Location and Size

Narok County lies approximately between latitudes 0°27'43.72"S and 2°6'32.91"S and longitudes 34°35'23.86"E and 36°20'28.48"E. It borders the Republic of Tanzania to the South, Kisii, Migori, Nyamira and Bomet counties to the West, Nakuru County to the North and Kajiado County to the East. The county headquarters is at Narok Town. The county covers an area of 17,950 Sq. Km. The County is subdivided into 8 sub-counties.

Osukunua community is located in Ilmarai sub location, Ilkerin location, Loita Ward, Narok south Sub- County in Narok County.

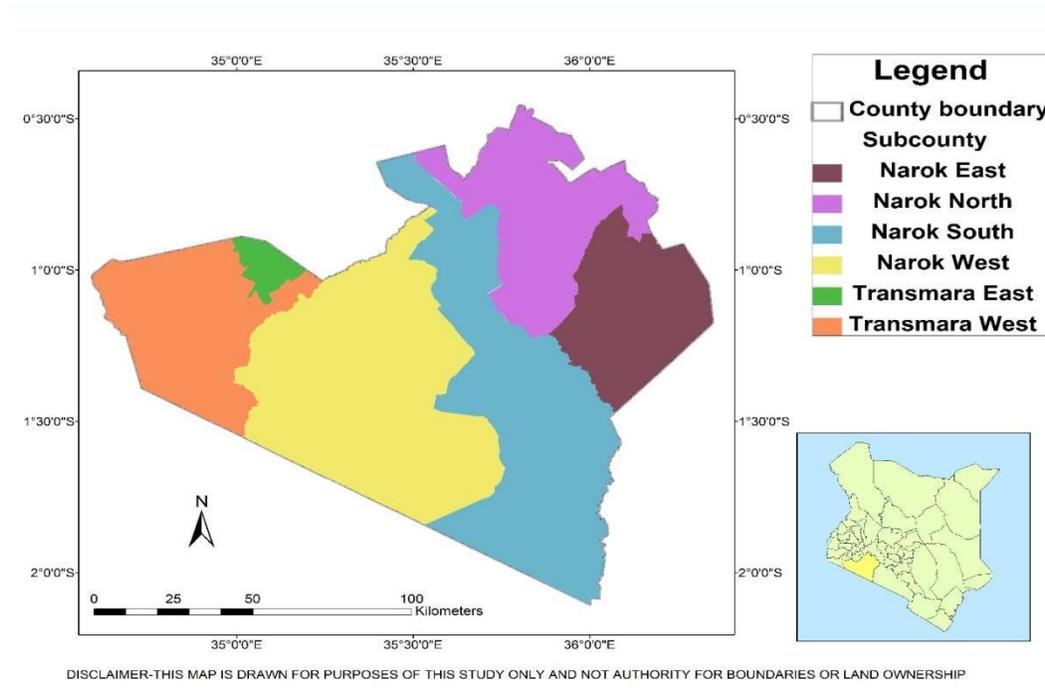


Figure 7: Map of Sub Counties of Narok County

(Source-CPCU 2019)

Project Location and Watershed Maps

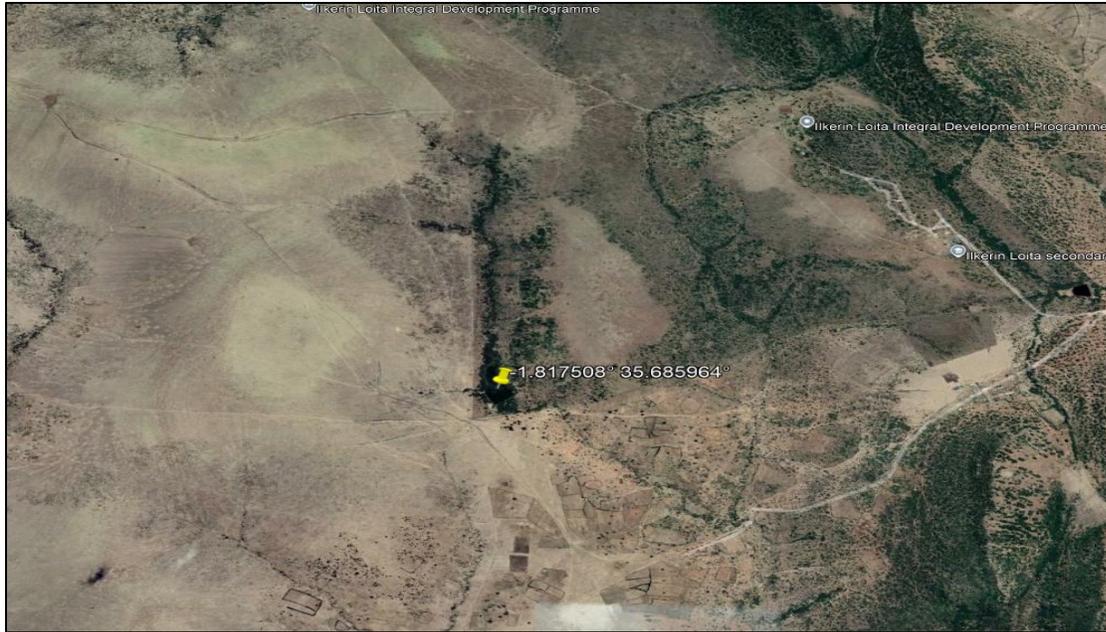


Figure 8: Project Location Map

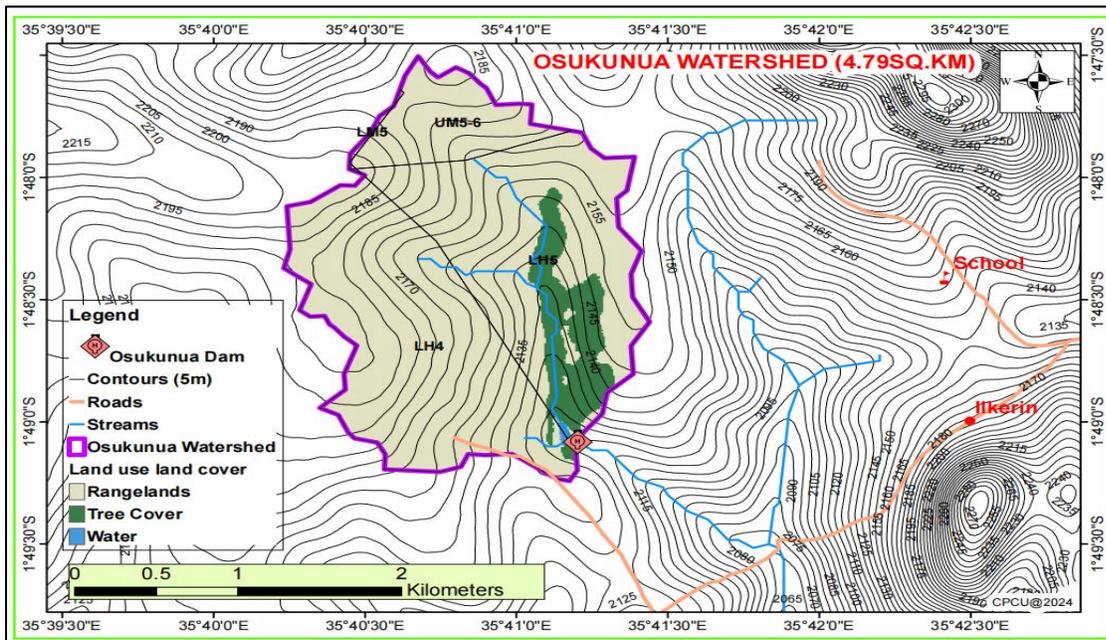


Figure 9: Osukunua Watershed Map

4.4 Demographic and population profile

The population in the county as per the 2019 Kenya Population and Housing Census is 1,157,873 consisting of 579,042 males and 578,805 females. This is an increase from 850,920 persons as per the 2009 by Kenya National Population and Housing Census, of whom 429,026 were male while 421,894 were female. The Inter-Censal Growth Rate is 3.13%.

(Number of households; and average household size, at county and sub-county level in 2019)

Table 18: Narok County Population by sex

County/Sub County	Population				Number of households	Average Household Size	Land Area (Sq. Km)	Pop. Density (No. per Sq. Km)
	Male	Female	Intersex	Total				
Narok	579,042	578,805	26	1,157,873	241,125	4.8	17950.3	65
Narok East	58,699	56,617	7	115,323	25,078	4.6	2042.0	56
Narok North	128,024	123,829	9	251,862	59,996	4.2	2159.4	117
Narok South	118,441	120,029	2	238,472	46,723	5.1	4577.3	52
Narok West	97,085	98,198	4	195,287	38,658	4.9	5563.0	35
Trans Mara East	54,545	56,637	1	111,183	20,506	5.4	309.8	369
Trans Mara West	122,220	123,491	3	245,714	50,132	4.9	2545.9	97
Mau Forest*	28	4	0	32	32	1.0	752.9	0

Source: KNBS, 2019 Kenya Population and Housing Census, Volume I

The investment will directly support approximately 1,500 beneficiaries and another 4,500 beneficiaries will benefit indirectly from the project. The project will also benefit a total number of 4, 855 livestock (3,289 Cattle, 596 Goats and 970 Sheep).

4.5 Physical characteristics of the area

4.5.1 Topography

Topography of Narok County can broadly be divided into two the highlands and lowland. Altitude – 3,000 meters above sea level while lowlands 1,000 to 1,400 meters above sea level. The site is gently sloping with an altitude of 694m above sea level. Topography falls from North East to South West. Most predominant geological formation in the locality is basement volcanic rocks. Fragments of weathered tuff are seen near the inferred edge of the phonolite. The extrusion of these rocks is related to the formation of the Great Rift Valley. They are found outcropping along conspicuous ridges and demonstrate the essential structure of the area.

4.5.2 Soils

According to *Farm Management Handbook for Narok County*, Osukunua project area comprises soils of type UPN+A that are imperfectly drained, moderately deep to deep, dark brown to dark grey, firm, sandy clay to clay; on convex to straight slopes: verto-eutric PLANOSOLS and: imperfectly drained, very deep, very dark greyish brown to black, firm to very firm, cracking clay, with a calcareous and sodic deeper subsoil; on concave slopes: pellic VERTISOLS, sodic phase

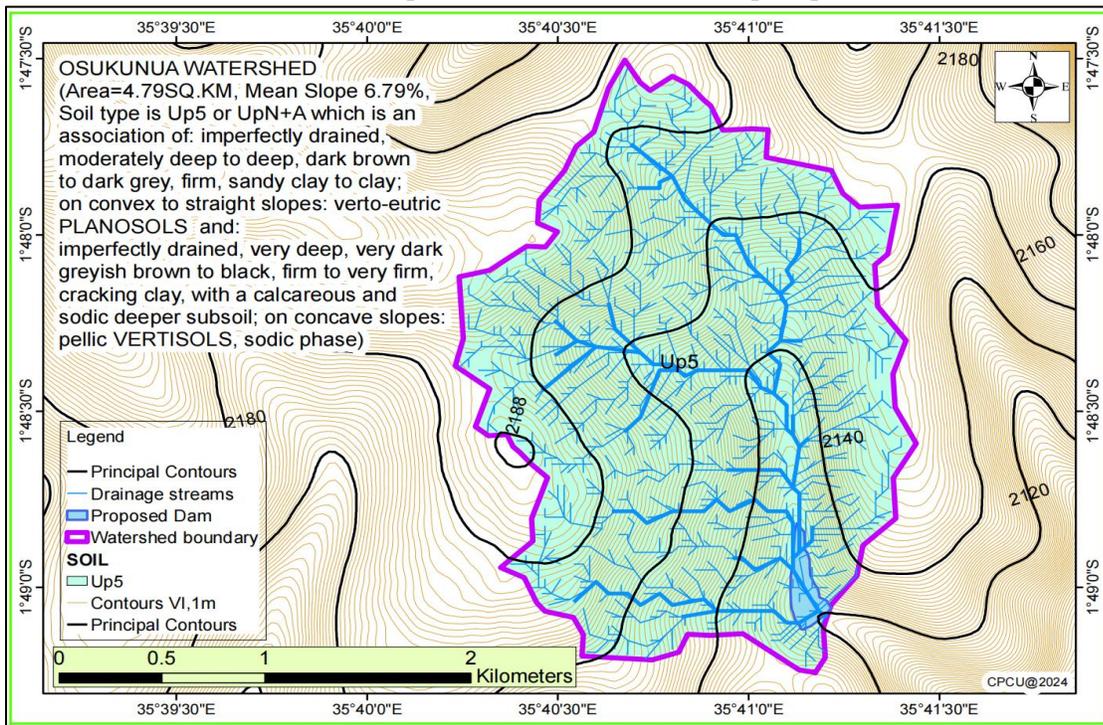


Figure 10: Loita Ward Soil Map

4.5.3 Rainfall Patterns

The climatic condition of Narok County is strongly influenced by the altitude and physical features. Temperatures range from 20°C (January- March) to 10°C (June- September) with an average of 18°C. Rainfalls amounts are influenced by the passage of inter tropical convergence zones giving rise to bi-modal rainfall pattern. Long rains are experienced between the months of

February and June while the short rains are experienced between August and November. Rainfall ranges from 2,500 mm in wet season to 500 mm during the dry season.

4.5.4 Land Use

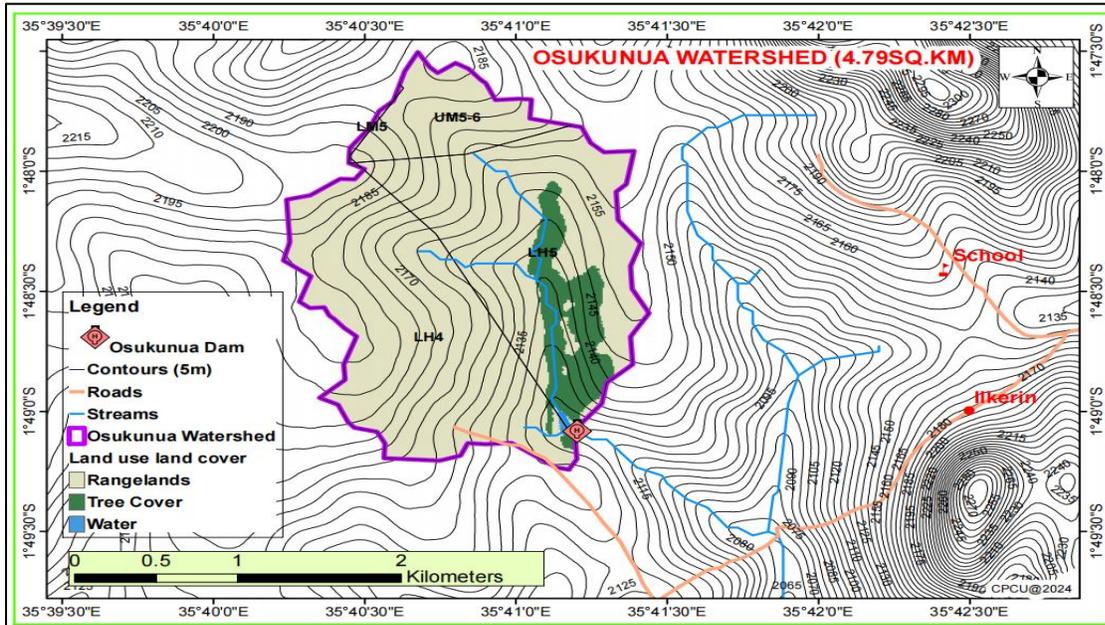


Figure 11: Map showing Land use and Land cover for Osukunua Catchment

Figure 7 above shows the catchment area land use land cover. Vegetation cover in the area mainly depends on rainfall occurrence and hence changes in land cover are observed in different years. The area is majorly rangelands cover with grass with minimal degradation since there are minimal cultivation activities in the area.

4.5.5 Environmental Degradation

The area has a good vegetation cover, which is characterized by natural grass and indigenous trees and shrubs.

However, overstocking and opening up of land for crop cultivation has resulted to increased soil erosion and loss of biodiversity.

4.5.6 Climatic Variability

The Sub catchment falls within a upslope altitude compared to the surroundings terrain. The area’s rainfall is characterized from long term data obtained and downloaded from Climate Hazards Infrared Precipitation with Stations (CHIRPS) web site (<http://chg.geog.ucsb.edu/data/chirps/>). The area mean annual rainfall is 784 mm against a 679 mm of the whole of Kenya (The National Water Master Plan 2030). The area rainfall is characteristic of that in east Africa widely reported by Ogallo (1993) and consists of two seasons, that of March, April and May (MAM) and the ‘short’ rains October to December (OND). This is associated with the northward and southward movement of the Intertropical Convergence Zone (ITCZ), respectively. However, a third peak season as strong as that of MAM experienced in July and August in all stations in Rift Valley has

been observed. Beltrando, (1990) categorized the seasons as: March–May, June–September and October– December (Figure 8). Rainfall over the years shows anomalously high rainfall as falling in the years 1989, 1997, 1998, 2001, 2002, 2006, 2010, 2012, 2013, 2015, 2019, 2020. Spectral analysis by Ogallo (1979) shows a 5–6 years peak. Annual rainfall series in the region indicate an oscillatory characteristic with no significant trend.

In East Africa, the controlling factor for vegetation types is generally accepted to be climate, and in particular, rainfall and temperature and their combined effect on moisture availability. As reported, there is a close correlation between these variables and altitude (Vincens and Casanova, 1987) and some authors have demonstrated clearly the importance to vegetation type of the rainfall/altitude relation (Trapnell and Griffiths, 1960). This phenomenon is well shown in the Natron-Magadi basin where Loita Hills fall, where the limits of the main vegetational boundaries follow hypsometric curves and rainfall isohyets.

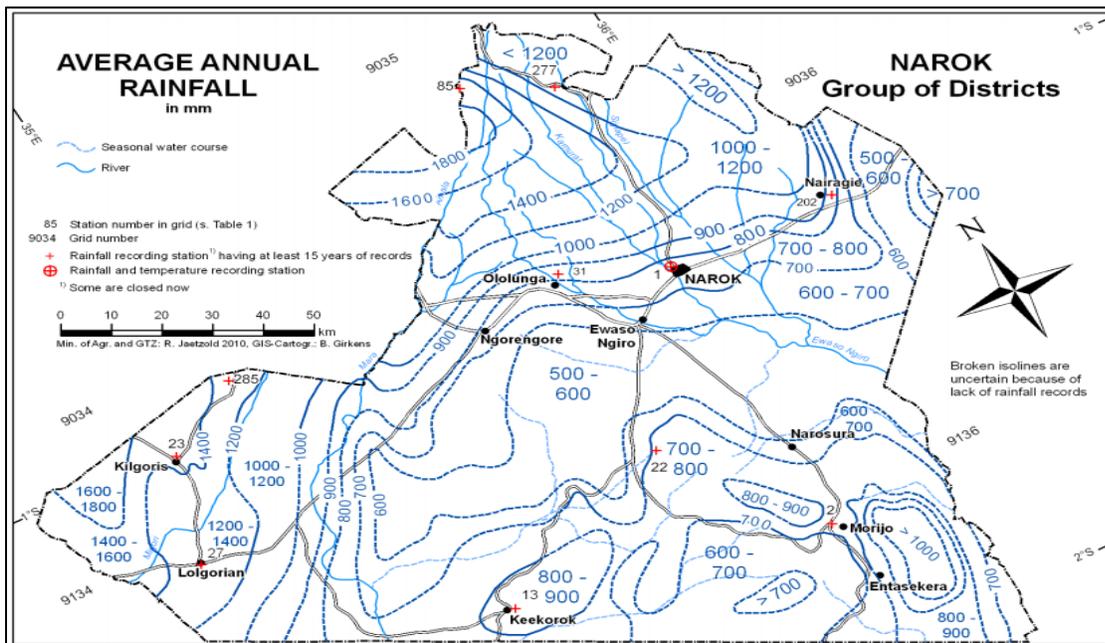


Figure 12: Map showing Average Annual Rainfall for Narok County

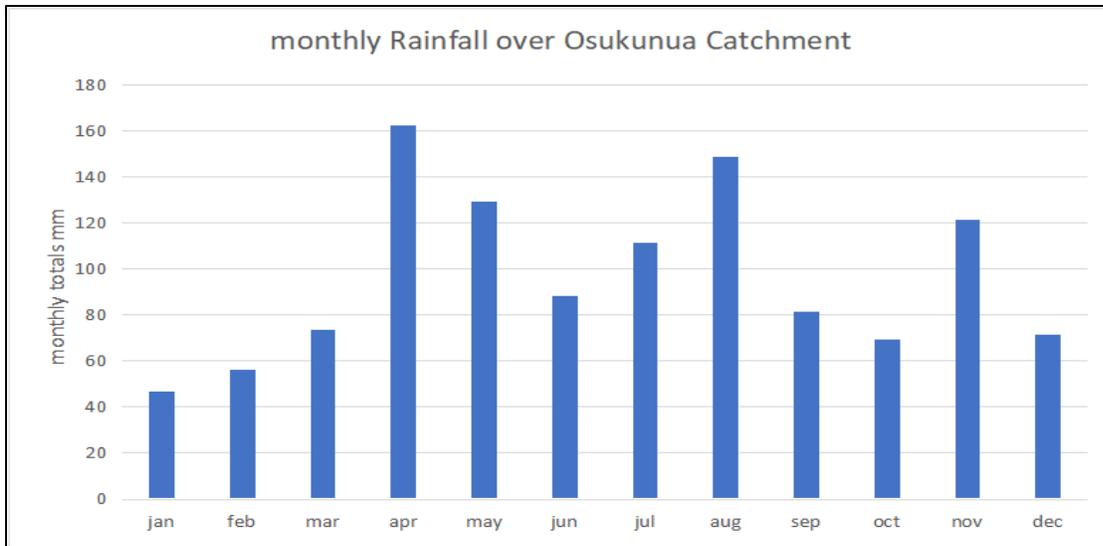


Figure 13: Monthly totals rainfall over the Osukunua Catchment

4.5.7 Existing water bodies

The earth dam's watershed covering approximately 397 Ha is located within Osokunua catchment area. The catchment does not have permanent rivers and therefore the community mainly relies on seasonal streams which are only reliable during the rainy seasons.

During dry spells the community moves their livestock to Tanzania up to 20km away. The movement is very challenging not only due to long distances covered but also due to the presence of numerous wild animals and the rough terrain. Consequently, this results to deterioration of livestock and human-wildlife conflicts. The proposed Osukunua earth dam will improve water access to the community.

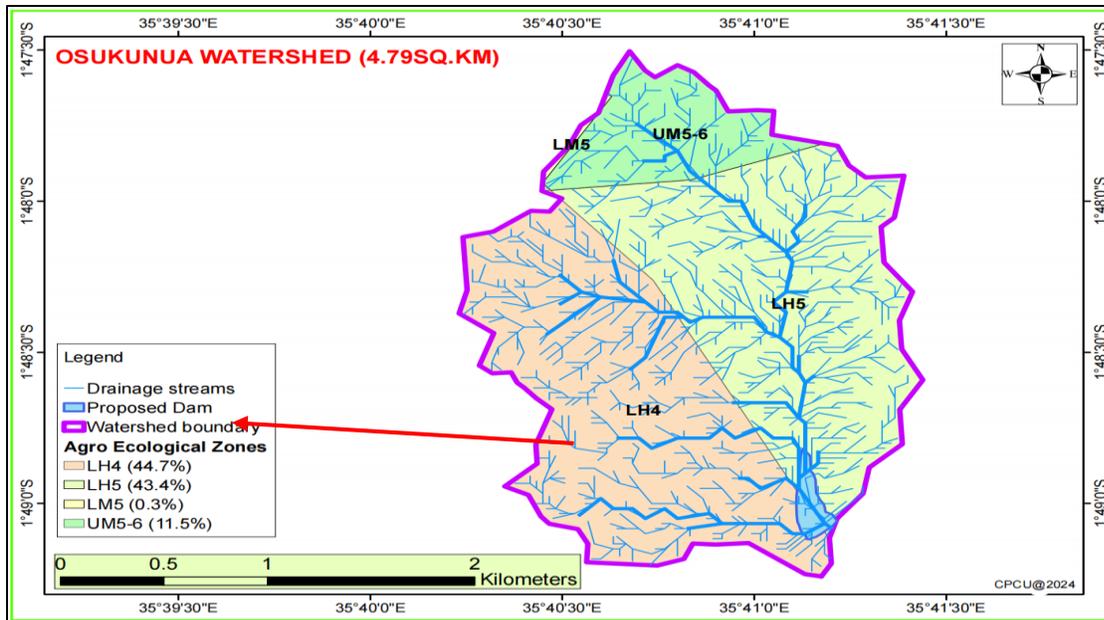


Figure 14: Map showing drainage streams of the Osukunua watershed

4.5.8 Agro-Ecological Zones

The county has four main agro-climatic zones namely: humid, sub-humid, semi-humid, arid and semi-arid. Two-thirds of the county is classified as semi-arid. The project area is in Agro-Climatic Zone II which is sub humid in the transitional agro-ecological zone UM2-4. Mean annual temperature range between 16°C-18°C. The altitude ranges from 1693m-1917m above sea level. The land slopes from the east to the west and northwards.

4.5.9 Geology of Narok

The emperals are covered by Tertiary volcanic while the other areas are covered by Quaternary volcanic (Refer to figure 10).

4.5.10 Vegetation

The area is covered by clumps and impeded drainage areas (Refer to Figure 10). The area is sparsely populated by indigenous trees and bushes. There are no species of ecological importance.

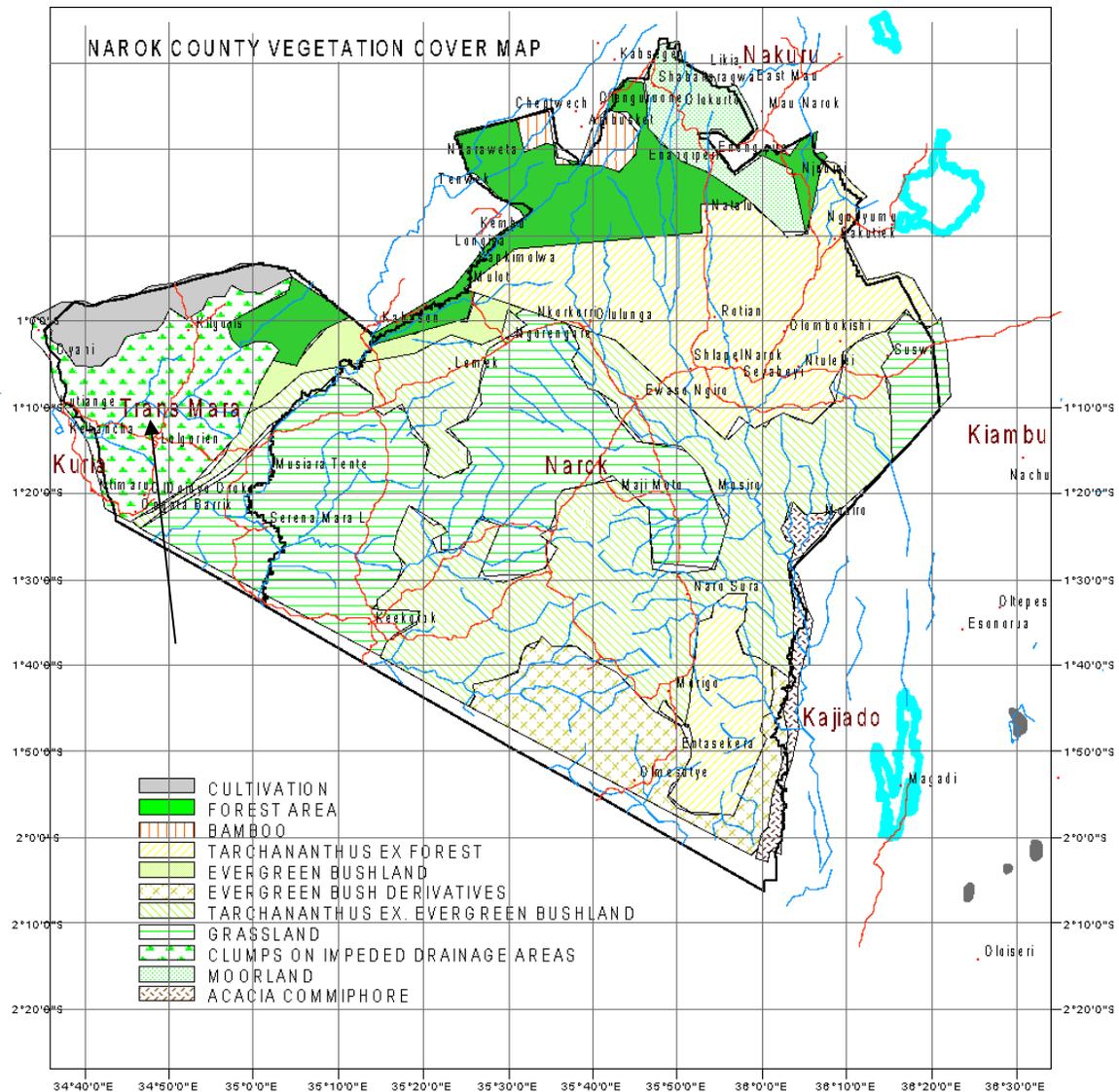


Figure 15: Narok County Vegetation Map

4.5.11 Land Tenure

Land ownership in Narok is either community land, trust land or private land. The project is located on community land.

4.15 Socio-Economic Conditions

4.5.1 Economic Activity

The main economic activity is livestock rearing. The main livestock breeds reared in the area include dairy cattle crosses, goats, sheep and local chicken.

4.6 Socio economic characteristics of the area

4.6.1 Household Headship

Majority of the households in the area are male headed (PICD report, 2024).

4.6.2 HIV/AIDS prevalence

HIV/AIDS prevalence in Narok County stands at 3.1% (CIDP, 2018/22). To address this problem, several programmes exist within the County done by the County and National Government, National Aids Control Council and other partners. These activities include care and treatment, counseling and testing, and advocacy.

4.6.3 Cultural attributes of the project area/ Religion

The area is inhabited by the Maasai community, who live a mix of traditional and modern lifestyle. The main religion is Christianity.

4.6.4 Water sources

The main sources of water in the area are water pans, farm ponds and roof catchment.

4.6.5 Hygiene and waste disposal practices

The community members have adopted pit latrines as way of managing human waste. Other solid wastes including plastics, paper and organic matter are generally burned at the household level.

4.6.6 Sources of energy for cooking and lighting

The main source of energy for households is wood fuel.

4.6.7 Common diseases and sources of health services

The main diseases include water borne diseases such as typhoid and diarrhea. Others are Malaria and nutrition related diseases.

4.6.8 Education/Literacy levels

The Literacy levels in Narok County stands at 13% (World Vision, 2019). The Children mainly attend day government-maintained schools located within the area or the neighboring villages.

4.6.9 Conflict-resource based/inter community conflicts

There are few reported cases of human wildlife conflicts in the area.

4.6.10 Gender Based Violence-prevalence

There has been no study on Gender Based Violence in the area.

4.7 Physical infrastructure

4.7.1 Markets and Urban Centres

There are 3 major markets in Loita Ward which include; Ilkerin, Entasikira and Moriyo. The County Government of Narok is currently constructing modern market structures in Ntulele market which 17kms away from the project site.

Main trading centers include Narosura (42kms), Entasikira (25kms), Moriyo (17kms) and Ilkerin which is 5kms from Osukunua.

4.7.2 Education Institutions

Educational institutions in Ilkerin Location consist of both primary and secondary schools. The primary schools in the area include Ilkerin, Loita Plain Academy, Morijo, Olmesutiet, and Entasikira. There is only one secondary school, Ilkerin Secondary School. No tertiary colleges are located nearby; the closest options are Maasai Mara University and other institutions in Narok town, approximately 98 kilometers away.

4.7.3 Health Facilities

The nearest health facility to the proposed project site is Ilkerin Health Centre, located approximately 5 kilometers away. Morijo Health Centre is situated about 17 kilometers from the site. For serious medical cases, patients are referred to Narok County Referral Hospital, which is around 98 kilometers away.

4.7.4 Police and prisons

There is a police post at Ilkerin Centre while the nearest prison is in Narok Town.

4.7.5 Administration

Loita Ward is located in Narok South Sub-county in Narok County. The nearest Deputy County Commissioner's (DCCs) office is in Ololulunga which is the sub-county headquarters. There is an assistant chief's office for Ilkerin Sub-location located near the project site. Narok County Government administration is represented by the Loita Ward administrator.

4.7.6 Social amenities

Recreation facilities within the Narok Municipality include playgrounds, stadiums, and open spaces. The William Ole Ntimama Stadium is well developed with facilities such as offices, washrooms, changing rooms, modern football pitch among other structures. There are no formal public parks and stadium in Loita ward.

4.7.7 Financial institutions including cooperatives

Most banking services are available in Narok town. However, Ilkerin Centre hosts agents of MPESA, KCB, and Equity Bank. Additionally, a tomato-based producer cooperative society operates in the area, with its offices located in Narosura and drawing membership from the project's catchment area.

4.8 Demographic Make-Up around Osukunua (Loita Ward)

4.8.1 Ethnic and Cultural Identity

The dominant populations in Loita Ward, including the area around Osukunua, are the Loita Maasai, a subgroup of the larger Maasai ethnic group. They make up the vast majority of residents. In a community study, about 97.5 % of respondents were Loita Maasai, with only very small numbers of other ethnicities like Kalenjin, Luhya, and Somali in the area as migrants or employees.

4.8.2 Population Size & Distribution

According to national census data (2019), Loita Ward had about 33,703 people. This includes sub-locations such as Entasekera, Ilkerin, Morijo, and others near Osukunua.

The ward had 11,350 registered voters in 2022, which suggests a sizable adult population though exact age breakdowns aren't published publicly for Osukunua specifically.

4.8.3 Social Characteristics

The Loita Maasai have traditionally lived a rural, pastoral lifestyle with strong cultural identity dominated by age-set systems (morans, elders) and customary institutions.

Levels of formal education have historically been low, though primary and some secondary schooling is increasingly common; literacy rates in older surveys showed a majority had no formal education, with only a small share attaining secondary or higher education.

The community has been somewhat isolated geographically and socially compared with other groups in Narok, which has helped preserve traditional culture.

4.8.4 Main Sources of Livelihood around Osukunua

People in Osukunua and the broader Loita Ward rely on a combination of traditional and subsistence activities:

a) Pastoralism (Livestock Keeping)

The most important economic base is livestock herding — including cattle, sheep, and goats. This pastoralism is semi-nomadic or mobile, moving herds seasonally to access pasture and water. Cattle provide milk, occasional meat, hides, and cultural wealth.

b) Small-Scale Agriculture

Alongside herding, families practice small-scale crop farming (e.g., maize and beans) where land and conditions permit.

As land adjudication and titling are being introduced, there is more potential for settled agriculture and diversified farming.

c) Use of Forest and Wild Resources

The nearby Loita Forest (Naimina Enkiyio) is an important source of grazing, firewood, medicinal plants, honey, construction materials, and water. Its resources contribute directly to households' material needs and cultural practices.

d) Informal and Wage Labor

A smaller portion of locals earn income as casual laborers, tradespeople, shop workers, or employees in education and health services often in nearby trading centers like Morijo and around Osukunua Junction.

CHAPTER FIVE: PUBLIC AND STAKEHOLDER CONSULTATION

5.1 Introduction

Public participation is enshrined in the Constitution of Kenya and the NEMA regulations and World Bank Environmental and Social Standards (ESS). The consultative process is a requirement for all community projects and is a useful tool for seeking community views about a proposed project, gathering environmental and social data, understanding the benefits and likely negative impacts and involving the project beneficiaries and stakeholders in proposing the appropriate mitigation measures. Public consultation process for the Earth Dam project took place at the screening stage, scoping stage and the ESIA study stage. A Participatory Integrated Community Development (PICD) process was supported by NAVCDP to establish the baseline data.

5.2 Purpose for the public and stakeholder consultation

The purpose of the consultation process is to disseminate project information and to incorporate the views of the Project Affected Persons (PAPs) in the design of the mitigation measures and the management plan. The specific aims of the consultation process were to:-

- Enable the community conceptualize the proposed project in terms of its scope, magnitude and future operations
- Advance project design and thereby, minimize struggles and delays in implementation,
- Facilitate the development of appropriate and acceptable entitlement options,
- Increase long term project sustainability and ownership and
- Reduce hitches of institutional coordination.

The key stakeholders for Osukunua Earth Dam project consulted included;

- The Osukunua community comprising of men, women and the youth. In addition, widows and widowers and differently abled people were also involved.
- The Local area administration, County government administration, the provincial administration and the political representatives.
- Line ministries, departments and agricultural sector partners
- Non-Governmental Organizations operating in the area

5.3 Public Consultation process

Reconnaissance visit was organized to the proposed water dam project development site by the project team. A transect walk was undertaken to allow the team make detailed examination of the socio-ecological set up of the project area as well as reconcile baseline information. During the transect walk, the team observed the types of existing flora and fauna, soil characteristics, environmental characteristics and land use practices as well as environmentally sensitive areas.

The public consultations were achieved through the following methods:-

- i. Focused Group discussions (FGDs) and Key Informants Interviews (KIIs) involving men, women and youth identified among the participants.

- ii. Individual interviews done using questionnaires in order to capture individual view on the project.

The entry meeting was conducted on 8th October, 2024 with an attendance of 25 community members, while the exit Baraza was conducted on 21st January, 2025 with an attendance of 29 community members. A total of 25 Key informant Interviews (KIIs) were conducted between the 12th and 14th October, 2024

The experts liaised with the local administration through the office of the Chief (Ministry of Interior and Coordination of Government) for permission to conduct the meetings.

5.3.1 Environmental Impacts and Mitigation Process

Public participation was important in identifying the benefits and possible negative impacts of the proposed project. The exercise was conducted through administration of pre-designed questionnaires by a team of NEMA registered environmental experts.

The participating community representatives were asked to give views concerning the proposed project at planning, design, and construction and operations phases. The community identified the benefits and positive impacts that will be anticipated and the potential negative impacts of the proposed project, including the appropriate mitigation measures for these negative impacts.

The interviews aimed at establishing whether the project would have impact on the community with respect to following aspects:-

- Environmental issues
- Socio-economic issues
- Natural habitats
- Health and safety
- Indigenous peoples
- Access to land and land resources

5.3.2 Administration and Analysis of the Questionnaire

Prior to administering the questionnaires, the residents and stakeholders were taken through the ESIA questions concerning the proposed rehabilitation and expansion of the proposed Earth Dam and Irrigation project. Each respondent was asked to fill the questionnaires individually and give independent opinion regarding the questions asked. Although the questionnaire was written in English, illiterate members of the community were assisted to fill them through assistance of interpreters.

5.4 Issue raised during the Consultation

Some of the concerns raised by the community included the following:-

5.4.1 Issue raised by Youth

5.4.1.1 Conflicts associated with employment

The youth was concerned that the jobs available will be taken by the outsiders. To mitigate, it was agreed that the community will be given first priority for the semi-skilled and unskilled labour.

5.4.1.2 Accidents during construction

There is likelihood that during the construction phase of the proposed project, construction workers may get involved in accidents as a result of falling building stones/bricks, sharp metals and machines used in the construction. The proponent will strictly adhere to safe working practices to protect the workers, neighbors and passers-by.

5.4.2 Issues raised by Women

5.4.2.1 Availability of water for domestic and livestock

There will be minimal livestock migration and mortalities as result of adequate water. Livestock will be sold at good prices in the market due to good body condition. Issues of overgrazing will be reduced. There will also be minimal conflicts over access to natural resources.

5.4.2.2 Gender Based Violence and Sexual Harassment

The beneficiaries raised concern of gender based violence and sexual harassment that is likely to be triggered during Project Construction Phase if the Contractor fails to *adhere to Gender Inclusivity requirements in hiring of workers as required by Gender Policy 2011 on 2/3 gender rule*. To mitigate this, proper enforcement of human resource policy against sexual harassment that is aligned with national law and Integration of provisions related to sexual harassment in the employee Code of Conduct.

5.4.2.3 Human wildlife conflicts

The community observed that there was a possibility of escalating the human wildlife conflicts over the water resource. To remedy this, the contractor will erect a solar powered fence. In addition, the community was advised to liaise with KWS to minimize human wildlife conflicts.

5.4.3 Issues raised by Men

5.4.3.1 Improved Economic status

Income at household level will be enhanced because communities will be able to sell their livestock and livestock products like milk, horticultural crops such as tomatoes and onions at fairly good prices. Poverty incidences will be reduced and food security status of the community members will be enhanced.

5.4.3.2 Enhanced livelihood resilience and alternatives

The respondents noted the youth and women will be involved in irrigation of horticultural crops and production. Along the value chain there will be marketing hence strengthening the resilience of the beneficiaries within and around the project area

5.4.3.3 Improved local socio-economy

During public participation, neighbors anticipated that the proposed development will contribute to improved household incomes, water availability and the county Government revenue.

5.4.3.4 Noise pollution

There was concern over the possibility of high noise and vibration levels in the project site as a result of excavation and construction works. The sources of noise pollution will include transport vehicles, construction machinery and metal grilling and cutting equipment. However, the proponent will take appropriate steps to minimize noise impacts including provision of appropriate protective equipment to construction workers, planning and minimizing the frequency of materials transport, ensuring that all equipment are well maintained.

5.4.3.5 Accumulation of solid waste

The community also observed that, there will be a likelihood of solid waste accumulation arising from the construction works and include metals, timber, plastics, papers, stones, soil and organic matter. To mitigate this, the contractor shall ensure that the right amount of materials is procured and delivered. The contractor will provide waste handling bins for collection and separation of the above wastes. Stones and soil will be used for landfilling or re used or recycled. Plastics, metals and paper, shall be handled in separate bins for safe offsite disposal by a NEMA licensed waste collector.

5.4.4 Grievance Management Mechanism

NAVCDP will facilitate formation of a five-member grievance management committee, comprising members selected from the IWUA. This committee's primary role will be to address grievances related to the project. Any complaint raised will be documented in a grievance register and logged using a specific form designed for the project's grievance resolution process. The committee's secretary will be responsible for recording grievances and noting whether they are resolved at that level.

If the grievance cannot be resolved at the IWUA level, it will be forwarded to the ward level, where it will be received by the SAIC secretary. If still unresolved, it will then be escalated to the county level and handled by the County Environmental Safeguard Compliance Officer (CESCO), who also serves as the secretary to the County Grievance Management Committee (CGMC).

Grievances at both ward and county levels will be tracked using a log register and the "Tusuluhishe" form. At the national level, grievances will be managed through a log register and an online platform.

Communities will be educated on how to use the web-based grievance redress mechanism (GRM), including the toll-free number and procedures for lodging complaints and following up on their resolution. This aims to enhance transparency and ensure communities are satisfied with project outcomes.

Complaints related to the project will first be handled by the IWUA grievance sub-committee, and if unresolved, escalated sequentially to the ward, county, and eventually national level. The goal is to resolve all grievances promptly, ideally within seven days to the satisfaction of the complainant. If a grievance cannot be resolved through these channels, it may be referred to the courts as a final option.

5.4.5 Operation and maintenance (O&M)

This will be attained through training of IWUA management committee on operations and management, group dynamics, financial management and sustainable smart agricultural practices. The committee will also be sensitized on monitoring and evaluation, environmental management plan to track project success, risks and negative impacts.

The committee will establish project by-laws and constitution to govern the project activities, set tariffs for water use and to ensure equitable sharing of water, gender mainstreaming, conflict management and environmental management as well as operation and maintenance of dam and irrigation system. The committee will collect revenue to provide money required for maintenance by charging for the use of water. The common way of raising funds and payment can be done in several ways such as: -

- In kind-in the form of labour for maintenance
- In cash-per the size of land irrigated
- In cash-per animal watering, or per jerrican collected.
- Through a monthly/annual fee per household. In some communities' women and men are charged separately.

In doing so, the committee will maintain proper records including user fees, register of members, size of irrigable land per farmer, number of livestock served, store records, repairs and maintenance works as well as incomes & expenditure records. All unused funds will be kept in a bank account with 3 signatories. All dam and irrigation scheme information will be shared with community members through printed reports, community meetings and notices placed at the site notice board.

Inlets and silt traps will be cleaned regularly, to be able to direct surface runoff from the catchments area and to trap silt away from the dam during the rainy seasons. Side slopes will also be cleared on a regular basis. The fence and gate will also be kept in good condition to control access and ensure safety of people and livestock and to protect reservoir embankments and minimize contamination.

The intake works will basically be draw -off system from the dam, a pumping sump, pumping unit complete with solar power system and its controls and a pump house. Maintenance at this level will entail regular checks to ensure that there is no unnecessary vegetation around the dam; the pumping unit system, no cracks to the sump and to ensure that the automatic controls installed operate as intended.

Regular patrolling of the pipe route to detect any leaks and or pipe damage will be done as well as checking the air-release valves, inspection chambers and washouts working conditions. Every beneficiary will maintain his/her own field system.

CHAPTER SIX: ANALYSIS OF PROJECT ALTERNATIVES

6.0 Introduction

There are four project alternatives available. These include; an alternative project site/location, alternative layout and designs, alternative construction technology and ‘no project’ alternative. An analysis of each of these alternatives is as outlined:-

6.1 No Project Alternative

The “No Project” alternative implies that no development is undertaken on the proposed site and thus retains the original state. Without the project the land would not be put into optimum use. Although the “no project” alternative would mean that no negative impacts will occur on the intended project site, it does not make economic sense not to undertake the development. The no project option would mean that the land owners will not benefit from their own land and would not enjoy the benefits of food and nutrition security, improved income and job opportunities for the local population. The Government of Kenya and the Narok County government will not benefit from the additional tax revenues from sale of the agriculture produce. Furthermore, the proposed project has the overall project benefit of promoting the local economy and the agricultural sector in the country which will be forgone if the “no project” alternative is adopted. Therefore, having status quo would not only deprive the proponent the opportunity to improve resilience on the effects of climate change but also lead to loss of livestock during prolonged droughts. In addition, the ‘no project option,’ would deprive the local community the opportunity of improving the dairy value chain.

6.2 Alternative project location

An alternative location would entail acquiring land elsewhere to carry out the development. From public and stakeholder participation, the following reasons justify the use of the proposed site for the development:-

- The site on which the Earth Dam will be located is public land set aside by the community. This solves issue of land ownership that would have arisen in case the site was within private land. The project beneficiaries have their private parcel of land and they will share the dam as a common resource.
- It eliminates the cost implications and time wastage in seeking to develop the project on an alternative land including seeking all the necessary approvals. This would be time consuming for the proponent and hence delay the implementation of the project.
- There is adequate space for the proposed development on the proposed site/land.
- The project is suitable and compatible with existing land uses within the area, which and also is in line with the project objectives in enabling the community to improve their dairy and tomato production. Other considerations for the project siting are that the area has suitable terrain, suitable soils and is within a strategic catchment area where the community has shown a sense of project ownership.

6.3 Alternative layout and designs

The project design and layout has been done by qualified engineers, having determined the water flows and geo-physical conditions of the project area. The designs have integrated simplicity, cost effectiveness and optimization of locally available materials. Therefore, it may not be feasible to look for other alternative project designs and layouts.

6.4 Analysis of alternative construction materials and technology

In order to achieve environmental safety, public health, security and as well as aesthetic requirements, the proposed Earth Dam and Irrigation project will be done using modern, locally and internationally accepted materials without compromising on quality of the works. The main structural components including the auxiliary structures will be made using quality locally available materials that shall meet the Kenya Bureau of Standard requirements.

Due to hydro-geological realities of the area, construction of the dam is the most feasible way of harnessing the run off. The project component will also include livestock watering troughs, toilets and bathrooms and perimeter fence.

CHAPTER SEVEN: ANALYSIS OF POTENTIAL IMPACTS AND MITIGATION MEASURES

7.0 Introduction

This chapter identifies the potential positive and negative impacts associated with the development of the Osukunua Earth Dam Project and the proposed mitigation measures.

7.1 Construction phase

The construction phase shall begin with excavation of the dam site, embankment laying and compaction, piping and masonry works such as construction of the cattle troughs, latrines and bathrooms. The identified impacts and the proposed mitigation measures are outlined below:-.

Impacts during Construction phase

7.1.1 Positive impacts

7.1.1.1 Employment opportunities

The respondents indicated that the project will create employment opportunities for the inhabitants of the area, during the construction phase. The farmers will provide unskilled and semi-skilled labour.

7.1.1.2 Improved Economic status

The local economy shall gain much from the project in that materials for building such as fencing poles will be sourced locally. During the construction, small scale traders within and outside the community will be able to sell their merchandise such as bread, sugar and maize flour, hence increase household incomes in the area.

7.1.2 Potential Negative impacts

7.1.2.1 Air quality deterioration

Dust emissions may lead to nuisance conditions and increased dust levels, hence lead to health (respiratory and eye) complications. Emissions of other contaminants (Nitrogen oxides, Carbon dioxide, Sulphur dioxides, and diesel related particulate matter) that would occur in the exhaust from excavation equipment are also included.

Mitigation measures

The contractor and the proponent shall implement the following measures to minimize these impacts:-

- Cover all the materials including soil with tambourine while being transported
- Apply water to subdue dust on all unpaved access roads and parking areas at the construction site

7.1.2.2 Noise pollution

Increased noise levels are likely to be recorded mainly associated with moving automobiles and equipment in use.

Mitigation measures

The Contractor and the Proponent shall ensure that the following techniques are employed to minimize the impact of noise at the construction site:-

- Use equipment designed with noise control elements such as the ‘*Silencers*’.
- All the machinery and equipment shall be maintained in serviceable conditions.
- All workers/personnel at the project site shall be provided with ear muffs.

7.1.2.3 Water quality degradation

This deterioration of surface and groundwater may be caused by solid and liquid wastes. The main sources of wastes in the area may emanate from open defecation, oils spills from construction and soil erosion from the catchment.

Mitigation measures

To mitigate this, the contractor and the proponent shall provide waste holding facilities such as litter bins and a temporary dumping site. To manage the faecal matter, the contractor will provide temporary pit latrines/mobile toilets. The community will be sensitized on appropriate disposal of faecal matter to avoid open defecation.

To avoid oil spills, all motor vehicles, machines and equipment shall be serviced appropriately. Whenever there is an oil spill, Caustic soda shall be applied to the affected area.

7.1.2.4 Solid waste generation

This will arise from the construction works and include metals, timber, plastics, papers, stones, soil and organic matter. To mitigate this, the contractor shall ensure that the right amount of materials is procured and delivered. The contractor will provide waste handling bins for collection and separation of the above wastes. Stones and soil will be used for backfilling, landscaping or re used or recycled or creating site levels. Plastics, metals and paper, shall be handled in separate bins for safe offsite disposal by a NEMA licensed waste collector.

7.1.2.5 Accidental Oil spills

The project will involve use of heavy machinery during the construction phase which may present a risk of oil spills.

Mitigation measures

To mitigate this menace, the contractor will:-

- Use well maintained machinery
- Train workers on safe handling procedures and spill preventions

7.1.2.6 Loss of Vegetation

The construction phase may involve clearance of the vegetation in the dam area.

To mitigate this, the contractor and the proponent will:-

- Restrict site clearing only to areas absolutely necessary for construction
- Implement a re-vegetation immediately after construction using native grass and tree species

7.1.2.7 Increase to exposure to communicable diseases including HIV/AIDS

7.1.2.7.1 Increase in incidences of HIV/AIDS and STIs

The influx of people may bring communicable diseases to the project area, including Sexually Transmitted Diseases (STDs), or the incoming workers may be exposed to diseases to which they have low resistance. This can result in an additional burden on local health resources. Local health and rescue facilities may also be overwhelmed and/or ill-equipped to address the industrial accidents that can occur in a large construction site.

Proposed **mitigation measures** for this include:-

- HIV/AIDS Awareness Program and other communicable diseases to be instituted and implemented as part of the Contractor's Health and Safety Management Plan to be enforced by the Supervising Engineer.
- This will involve periodic HIV/AIDS and other communicable diseases Awareness Creation Workshops for Construction personnel.
- Controlled access to Contractor's Workforce Camps by outsiders.
- Contractor to provide standard quality condoms to personnel on site.

7.1.2.8 Labour risks including labour influx and associated Gender Based Violence (GBV)

7.1.2.8.1 Risks associated with labour influx

The excavation work will be mechanical and the labour required for the construction of auxiliary structures (water troughs, fencing, latrines) will mostly use the local labour force. The installation of the solar pump will require skilled labour and anticipated to be very small. The proposed works does not anticipate a big number of influx of workers.

The proposed **mitigation measures** in this case include:-

- The proponent adherence to national labour code and WB E&S Standards through incorporating the same in the Procurement and Contract Agreement document for implementation by the contractor.
- Local community members will be given priority in employment opportunities, in unskilled and semi-skilled labour.

7.1.2.8.2 Sexual Exploitation and Abuse (SEA)

This impact refers to sexual exploitation and abuse committed by Project staff against communities and represents a risk at all stages of the Project, especially when employees and community members are not clear about prohibitions against SEAH in the Project.

Mitigation Measures to Risk of SEA

- Develop and implement a SEA action plan with an Accountability and Response Framework as part of the C-ESMP. The SEA action plan will follow guidance on the World Bank's Good Practice Note for Addressing Gender-based Violence in Investment Project Financing involving Major Civil Works (Sept 2018).
- The SEA action plan will include how the project will ensure necessary steps are in place for:
 - Prevention of SEA: including COCs and ongoing sensitization of staff on responsibilities related to the COC and consequences of non-compliance; project-level IEC materials;
 - Response to SEA: including survivor-centered coordinated multi-sectoral referral and assistance to complainants according to standard operating procedures; staff reporting mechanisms; written procedures related to case oversight, investigation and disciplinary procedures at the project level, including confidential data management;
 - Engagement with the community: including development of confidential community-based complaints mechanisms discrete from the standard GRM; mainstreaming of PSEA awareness-raising in all community engagement activities; community-level IEC materials; regular community outreach to women and girls about social risks and their PSEA-related rights;
 - Management and Coordination: including integration of SEA in job descriptions, employments contracts, performance appraisal systems, etc.; development of contract policies related to SEA, including whistle blower protection and investigation and disciplinary procedures; training for all project management; management of coordination mechanism for case oversight, investigations and disciplinary procedures; supervision of dedicated PSEA focal points in the project and trained community liaison officers.

7.1.2.8.3 Gender-based Violence (GBV) at the community level

This impact refers to gender-based violence that women and girls may experience as a result of Project implementation. This includes, for example, an increase in intimate partner violence (IPV) when compensation schemes that share funds equally among husband and wife at the household level do not provide adequate sensitization and safety measures to reduce potential for increased tensions due to females receiving funds. This also refers to other GBV-related risks incurred as a result of water and sanitation projects that do not adequately consult women and adolescent girls in the community about safety and security issues related to the delivery of water and sanitation services.

Mitigation Measures to Risk of GBV at the community level

Develop and implement provisions that ensure that gender-based violence at the community level is not triggered by the Project, including:

- effective and on-going community engagement and consultation, particularly with women and girls;
- Review of specific project components that are known to heighten GBV risk at the community level, e.g. compensation schemes; employment schemes for women; delivery of water supplies; etc.
- Specific plan for mitigating these known risks, e.g. sensitization around gender-equitable approaches to compensation and employment; water services; etc
- Ensure adequate referral mechanisms are in place if a case of GBV at the community level is reported related to project implementation.

7.1.2.9 Public/Occupational Health and Safety Issues

During the construction phase, the personnel will use various tools, equipment and machines. These, if not properly handled can be a source of injuries. To mitigate the contractor shall higher qualified personnel with skills on proper handling of tools, equipment and machines. The workers will be sensitized on safe use of the tools, equipment and machines. The Contractor will provide PPEs to the workers. The Contractor will ensure that the workers have basic training on first aid skills and firefighting. In addition, the contractor will provide the First Aid Kits and firefighting equipment, and erect warning signs appropriately within the construction site. Serious injuries will be referred to the nearest hospital.

7.2 Impacts during Operation phase

7.2.1 Positive impacts

7.2.1.1 Employment opportunities

The proposed project is expected to create employment opportunities for the community during the construction and operational phases and a big number of man days for inhabitants of the area will be made available. The farmers will provide semi-skilled and skilled labour during the project operations. In addition, the farmers will be engaged in dairy value chain development.

7.2.1.2 Availability of water for livestock

There will be adequate water for dairy throughout the project life.

7.2.1.3 Improved Economic status

Income at household level will be enhanced because men, women and youth in the community will be able to keep dairy animals, for increased incomes. During the operational phase, small scale traders within and without the community will be able to sell their merchandise such as bread, sugar and maize flour, hence increase household incomes.

7.2.1.4 Enhanced livelihood resilience

The productivity of the prioritized values chains will be sustained even during the dry spell due to availability of water. This will make them more resilient to effects of climate change.

7.2.1.5 Improved Environmental Services

The community noted that the water availability would enable them plant more trees. Increased afforestation and reforestation will improve environmental services such as provision of clean air, shades, carbon sequestration; improve water recharge and general aesthetics of the environment.

7.2.1.6 Availability of water for domestic use

The community especially will not travel long distances to fetch water as is the case currently. The time saved will be directed to other economic activities. Further, the water will be used for cleaning, bathing and cooking hence improving the health and sanitation for the community.

7.2.2 Negative impacts

7.2.2.1 Water quality degradation

This deterioration of surface and groundwater may be caused by solid wastes. The main sources of wastes in the area may emanate from open defecation and soil erosion from the catchment. To mitigate this, the proponent shall practice proper waste management at the household level through provision of litter bins and dumping sites. To manage the faecal matter, the proponent will provide pit latrines/toilets. The community will be sensitized on appropriate disposal of faecal matter to avoid open defecation.

To mitigate the problem of soil erosion and eutrophication, the proponent will undertake holistic catchment management, which will include terracing and tree planting.

7.2.2.2 Conflicts at Household and Community levels

Disagreements may arise over sharing of proceeds at the household level. Conflicts may also be associated with the competition for water especially during the dry spells.

To mitigate this, there will be sensitization of households on benefit sharing. In addition, the Grievance Redress Mechanism will be activated and domiciled at the community level, to address community-based conflicts.

7.2.2.3 Gender-based Violence (GBV) at the community level

This impact refers to gender-based violence that women and girls may experience as a result of Project implementation. This includes, for example, an increase in intimate partner violence (IPV) when compensation schemes that share funds equally among husband and wife at the household level do not provide adequate sensitization and safety measures to reduce potential for increased tensions due to females receiving funds. This also refers to other GBV-related risks incurred as a result of water and sanitation projects that do not adequately consult women and adolescent girls in the community about safety and security issues related to the delivery of water and sanitation services.

Mitigation Measures to Risk of GBV at the community level

Develop and implement provisions that ensure that gender-based violence at the community level is not triggered by the Project, including:-

- Effective and on-going community engagement and consultation, particularly with women and girls;
- Review of specific project components that are known to heighten GBV risk at the community level, e.g. compensation schemes; employment schemes for women; delivery of water supplies; etc.
- Specific plan for mitigating these known risks, e.g. sensitization around gender-equitable approaches to compensation and employment; water services; etc
- Ensure adequate referral mechanisms are in place if a case of GBV at the community level is reported related to project implementation.

7.2.2.4 Accumulation of solid waste

This will arise from the project operations and include metals, timber, plastics, papers and organic matter. To mitigate this, the proponent will provide waste handling bins for collection and separation of the above wastes. Plastics, metals and paper, shall be handled in separate bins for safe disposal.

7.2.2.5 Increased water use

Water will be used mainly for watering livestock. To ensure efficient and effective use, the proponent shall install water use efficient measures such as use of cattle troughs and automatic taps. The community will be sensitized on alternative sources such as roof water harvesting to complement the water from the project.

7.2.2.6 Human wildlife conflict

There exist wild animals such as the elephant, warthogs and hyena in the project area. There is potential human-wildlife conflict associated with competition for pasture/fodder and water resources.

The proponent shall liaise with KWS to sensitize communities on human-wildlife conflict and how to minimize this, and respond in case farms are invaded by wildlife. Further, the proponent will install solar powered electric to the water dam and associated accessories from wildlife encroachment.

7.2.2.7 Public/Occupational Health and Safety Issues

During the operation phase, the personnel will use various tools, equipment and machines. These, if not properly handled can be a source of injuries. To mitigate the proponent shall be sensitized on safe use of the tools, equipment and machines. The proponent will ensure PPEs are in use. Any injuries will be referred to the nearest health facility.

7.2.2.8 Water logging and soil salinity

Poor irrigation management and seepage from canals or the dam may raise the groundwater table, leading to water logging. This reduces soil aeration, stunts crop growth, and lowers yields. In the long term, evaporation of stagnant water can cause salt accumulation in the root zone (soil salinity), making soils unproductive and degrading land quality.

Mitigation Measures

- Design and maintain proper drainage systems
- Promote controlled irrigation scheduling to avoid overwatering.
- Conduct periodic soil salinity monitoring.
- Train farmers on efficient water management practices.

7.2.2.9 Increase in water borne diseases

Stagnant water in canals, reservoirs, and poorly drained fields may create breeding grounds for mosquitoes and other vectors, increasing malaria and other vector-borne diseases. Contaminated irrigation or domestic water sources may increase waterborne illnesses such as diarrhea and typhoid.

Mitigation Measures

- Avoid stagnant pools through proper drainage
- Promote use of mosquito nets and community health education.
- Sensitize the community on safe water handling and sanitation practices.
- Work with local health authorities on disease surveillance and awareness campaigns.
- Fence the dam and manage access points to reduce unsafe domestic use.
- Introduce fish in the dam to act as a biological control for mosquito

7.2.2.10 Intensified Use of Agrochemicals and Soil Degradation

Irrigated farming may lead to increased use of fertilizers, herbicides, and pesticides. Excessive or improper use can cause:

- Soil acidification and nutrient imbalance
- Contamination of water bodies
- Harm to beneficial soil organisms
- Health risks to farmers and consumers

Mitigation Measures

- Promote Integrated Pest Management (IPM) to reduce chemical reliance.
- Train farmers on correct agrochemical application, dosage, and timing.
- Encourage use of organic manure and soil conservation practices.
- Establish buffer zones near the dam.
- Safe storage and disposal of agrochemical containers.

7.2.2.11 Child labor in irrigated agriculture

Expansion of irrigated farming may increase demand for labor, potentially leading to involvement of children in farm work, which can interfere with schooling and expose them to hazardous tasks.

Mitigation Measures

- Enforce strict prohibition of child labour in project activities.
- Sensitize farmers and IWUA on child protection laws.
- Collaborate with local leaders and schools to monitor school attendance.

7.2.2.12 Theft of Farm Yield and Vandalism of Infrastructure

Improved agricultural productivity may attract theft of crops, irrigation pipes, and fittings. Vandalism can disrupt water supply and increase maintenance costs, leading to conflict among users.

Mitigation Measures

- Establish a subcommittee at the IWUA
- Install lockable gates and protective fencing where necessary.
- Promote collective responsibility through IWUA by-laws.
- Coordinate with local administration and police.

7.2.2.13 Breakdown of Irrigation Infrastructure

Poor maintenance of pipes, pumps, and control structures may lead to system failure, water losses, and inequitable distribution, reducing project sustainability.

Mitigation Measures

- Develop a routine maintenance schedule.
- Train IWUA members in basic technical maintenance.
- Establish a maintenance fund through user fees
- Provide periodic technical backstopping from relevant authorities

7.2.2.14 Management Challenges within the IWUA

Weak governance, poor financial management, or internal conflicts within the IWUA could lead to inequitable water allocation, fee collection issues, and project collapse.

Mitigation Measures

- Provide capacity building in leadership, financial management, and conflict resolution.
- Develop clear by-laws and water allocation rules.
- Ensure inclusive representation of women and vulnerable groups.
- Conduct regular audits and transparent reporting.

7.2.2.15 Risk of Drowning

The dam reservoir poses drowning risks, especially to children and livestock.

Mitigation Measures

- Fence critical sections of the dam and install warning signage.
- Provide designated livestock watering points.

- Conduct community awareness campaigns on water safety.
- Prohibit swimming and unsafe domestic use of the reservoir

7.2.2.16 Occupational Health and Safety (OHS) Risks

Workers may face:

- Injuries from machinery and tools
- Slips, trips, and falls
- Chemical exposure
- Heat stress

Mitigation Measures

- Provide appropriate PPE (boots, gloves, helmets, reflective jackets).
- Conduct regular OHS training and toolbox talks.
- Enforce safe work procedures and supervision.
- Provide first aid kits and trained first aiders on site.
- Install warning signs in hazardous areas.
- Ensure compliance with OSHA 2007 and WIBA 2007.

7.3 Impacts during decommissioning phase

For this project, decommissioning is not envisaged in the near future, since the proponent have indicated their willingness to implement the mitigation outlined in order to reap the benefits associated with the implementation of the project. The community has also established the management structures to oversee the project activities. However, in the event that decommissioning has to occur, the proponent will file a decommission plan with NEMA for approval.

The ESIA team and the community identified the following environmental and social impacts during decommissioning:-

7.3.1 Positive impacts

7.3.1.1 Job creation

The demolition works will create jobs for the local community.

7.3.1.2 Improved Aesthetics

Upon demolition of the project infrastructure, the proponent will undertake rehabilitation, landscaping and planting of trees and grass. This will enhance the beauty of the landscape.

7.3.1.3 Reuse and recycle of the recovered construction materials

The recovered materials such as metals, bricks, stones and pipes will have alternative use for construction and fabrication.

7.3.2 Negative impacts

7.3.2.1 Air quality deterioration

Dust emissions may lead to nuisance conditions and increased dust levels, hence lead to health (respiratory and eye) complications. Emissions of other contaminants (Nitrogen oxides, Carbon dioxide, Sulphur dioxides, and diesel related particulate matter) that would occur in the exhaust from excavation equipment are also included.

Mitigation measures

The contractor and the proponent shall implement the following measures to minimize these impacts:-

- Cover all the materials including soil with tambourine while being transported
- Apply water to subdue dust on all unpaved access roads and parking areas at the decommissioning site

7.3.2.2 Noise pollution

Increased noise levels are likely to be recorded mainly associated with moving automobiles and equipment in use.

Mitigation measures

The Contractor and the Proponent shall ensure that the following techniques are employed to minimize the impact of noise at the decommissioning site:-

- Use equipment designed with noise control elements such as the ‘*Silencers*’.
- All the machinery and equipment shall be maintained in serviceable conditions.
- All workers/personnel at the project site shall be provided with ear muffs.

7.3.2.3 Water quality degradation

This deterioration of surface and groundwater may be caused by solid and liquid wastes. The main sources of wastes in the area may emanate from open defecation, oils spills from decommissioning and soil erosion from the catchment.

Mitigation measures

To mitigate this, the contractor and the proponent shall provide waste holding facilities such as litter bins and a temporary dumping site. To manage the faecal matter, the contractor will provide temporary pit latrines/mobile toilets. The community will be sensitized on appropriate disposal of faecal matter to avoid open defecation.

To avoid oil spills, all motor vehicles, machines and equipment shall be serviced appropriately. Whenever there is an oil spill, Caustic soda shall be applied to the affected area.

7.3.2.4 Solid waste generation

This will arise from the decommissioning works and include metals, timber, plastics, papers, stones, soil and organic matter. To mitigate this, the contractor shall ensure that the right amount

of materials is procured and delivered. The contractor will provide waste handling bins for collection and separation of the above wastes. Stones and soil will be used for backfilling, landscaping or re used or recycled or creating site levels. Plastics, metals and paper, shall be handled in separate bins for safe offsite disposal by a NEMA licensed waste collector.

7.3.2.5 Accidental Oil spills

The project will involve use of heavy machinery during the decommissioning phase which may present a risk of oil spills.

Mitigation measures

To mitigate this menace, the contractor will:-

- Use well maintained machinery
- Train workers on safe handling procedures and spill preventions

7.3.2.6 Loss of Vegetation

The decommissioning phase may involve clearance of the vegetation in the dam area.

To mitigate this, the contractor and the proponent will:-

- Restrict site clearing only to areas absolutely necessary for decommissioning
- Implement a re-vegetation immediately after decommissioning using native grass and tree species

7.3.2.7 Increase to exposure to communicable diseases including HIV/AIDS

7.3.2.7.1 Increase in incidences of HIV/AIDS and STIs

The influx of people may bring communicable diseases to the project area, including Sexually Transmitted Diseases (STDs), or the incoming workers may be exposed to diseases to which they have low resistance. This can result in an additional burden on local health resources. Local health and rescue facilities may also be overwhelmed and/or ill-equipped to address the industrial accidents that can occur in a large decommissioning site.

Proposed **mitigation measures** for this include:-

- HIV/AIDS Awareness Program and other communicable diseases to be instituted and implemented as part of the Contractor's Health and Safety Management Plan to be enforced by the Supervising Engineer.
- This will involve periodic HIV/AIDS and other communicable diseases Awareness Creation Workshops for decommissioning personnel.
- Controlled access to Contractor's Workforce Camps by outsiders.
- Contractor to provide standard quality condoms to personnel on site.

7.3.2.8 Labour risks including labour influx and associated Gender Based Violence (GBV)

7.3.2.8.1 Risks associated with labour influx

The excavation work will be mechanical and the labour required for the decommissioning of auxiliary structures (water troughs, fencing, latrines) will mostly use the local labour force. The installation of the solar pump will require skilled labour and anticipated to be very small. The proposed works does not anticipate a big number of influx of workers.

The proposed **mitigation measures** in this case include:-

- The proponent adherence to national labour code and WB E&S Standards through incorporating the same in the Procurement and Contract Agreement document for implementation by the contractor.
- Local community members will be given priority in employment opportunities, in unskilled and semi-skilled labour.

7.3.2.8.2 Sexual Exploitation and Abuse (SEA)

This impact refers to sexual exploitation and abuse committed by Project staff against communities and represents a risk at all stages of the Project, especially when employees and community members are not clear about prohibitions against SEAH in the Project.

Mitigation Measures to Risk of SEA

- Develop and implement a SEA action plan with an Accountability and Response Framework as part of the C-ESMP. The SEA action plan will follow guidance on the World Bank's Good Practice Note for Addressing Gender-based Violence in Investment Project Financing involving Major Civil Works (Sept 2018).
- The SEA action plan will include how the project will ensure necessary steps are in place for:
- Prevention of SEA: including COCs and ongoing sensitization of staff on responsibilities related to the COC and consequences of non-compliance; project-level IEC materials;
- Response to SEA: including survivor-centered coordinated multi-sectoral referral and assistance to complainants according to standard operating procedures; staff reporting mechanisms; written procedures related to case oversight, investigation and disciplinary procedures at the project level, including confidential data management;
- Engagement with the community: including development of confidential community-based complaints mechanisms discrete from the standard GRM; mainstreaming of PSEA awareness-raising in all community engagement activities; community-level IEC materials; regular community outreach to women and girls about social risks and their PSEA-related rights;
- Management and Coordination: including integration of SEA in job descriptions, employments contracts, performance appraisal systems, etc.; development of contract

policies related to SEA, including whistle blower protection and investigation and disciplinary procedures; training for all project management; management of coordination mechanism for case oversight, investigations and disciplinary procedures; supervision of dedicated PSEA focal points in the project and trained community liaison officers.

7.3.2.8.3 Gender-based Violence (GBV) at the community level

This impact refers to gender-based violence that women and girls may experience as a result of Project decommissioning. This includes, for example, an increase in intimate partner violence (IPV) when compensation schemes that share funds equally among husband and wife at the household level do not provide adequate sensitization and safety measures to reduce potential for increased tensions due to females receiving funds. This also refers to other GBV-related risks incurred as a result of water and sanitation projects that do not adequately consult women and adolescent girls in the community about safety and security issues related to the delivery of water and sanitation services.

Mitigation Measures to Risk of GBV at the community level

Develop and implement provisions that ensure that gender-based violence at the community level is not triggered by the Project, including:

- effective and on-going community engagement and consultation, particularly with women and girls;
- Review of specific project components that are known to heighten GBV risk at the community level, e.g. compensation schemes; employment schemes for women; delivery of water supplies; etc.
- Specific plan for mitigating these known risks, e.g. sensitization around gender-equitable approaches to compensation and employment; water services; etc
- Ensure adequate referral mechanisms are in place if a case of GBV at the community level is reported related to project implementation.

7.3.2.9 Public/Occupational Health and Safety Issues

During the decommissioning phase, the personnel will use various tools, equipment and machines. These, if not properly handled can be a source of injuries. To mitigate the contractor shall higher qualified personnel with skills on proper handling of tools, equipment and machines. The workers will be sensitized on safe use of the tools, equipment and machines. The Contractor will provide PPEs to the workers. The Contractor will ensure that the workers have basic training on first aid skills and firefighting. In addition, the contractor will provide the First Aid Kits and firefighting equipment, and erect warning signs appropriately within the decommissioning site. Serious injuries will be referred to the nearest hospital.

CHAPTER EIGHT: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

Environmental and Social Management and Monitoring Plan (ESMMP) provide a logical framework within which identified negative environmental and social impacts can be mitigated and monitored. In addition, the ESMMP assigns responsibilities of actions to various actors and provides a timeframe within which mitigation measures and monitoring shall be done. The ESMMP is a vital output of an Environmental and Social Impact Assessment.

The ESMMP outlined below proposes mitigation measures that will address the identified potential negative impacts of the proposed water project.

The ESMMP is detailed in the table below:-

8.1. Construction Phase

Table 19: Environmental and Social Management Plan: Construction Phase

Potential Environmental/ Social Impacts	Recommended Actions	Monitoring indicator	Responsibility	Monitoring frequency	Who to monitor	Estimated Costs (kshs.)
Trampling of vegetation	Re-vegetation of trampled areas	Area in acres re-vegetated	-Contractor -Resident Engineer	Weekly	-Proponent -ESIA Team -CESCO	50,000
Noise pollution	Use serviceable vehicles/machinery Use equipment designed with noise control elements such as the 'Silencers'. All workers/personnel at the project site shall be provided with ear muffs.	No. of serviceable vehicles/machinery in use No. of equipment fitted with, 'Silencers'. No. of workers provided with ear muffs	-Contractor -Resident Engineer -Proponent -ESIA Team -CESCO	Weekly	-Proponent -ESIA Team -CESCO	100,000
Accidental Oil spills	Use well maintained machinery	No. of Machinery maintained No. of workers trained	-Contractor -Resident Engineer	Weekly Monthly	-Proponent -ESIA Team -CESCO	100,000

	Train workers on safe handling procedures and spill preventions		-Proponent -ESIA Team -CESCO			
Loss of Vegetation	Restrict site clearing only to areas absolutely necessary for construction Implement a re-vegetation immediately after construction using native grass and tree species	No. of trees planted No. of acres planted with grass	-Proponent -ESIA Team -CESCO	Monthly	-ESIA Team -CESCO	50,000
Soil erosion	Backfilling of excavated areas	Area in acres backfilled	-Contractor -Resident Engineer -Proponent -ESIA Team -CESCO	Weekly	-Proponent -ESIA Team -CESCO	100,000
Accumulation of solid wastes	Provision of solid waste management facilities e.g. bins	No of Solid wastes bins in use	-Contractor -Resident Engineer -Proponent	Weekly	-Proponent -ESIA Team -CESCO	50,000

			-ESIA Team -CESCO			
	Clean, uncontaminated excavated soil and rocks will be re-used within the project site for backfilling, land scaping or creating site levels	Amount/Volume of soil or rock material re-used within the project site for backfilling, land scaping or creating site levels	-Contractor -Resident Engineer -Proponent -ESIA Team -CESCO	Weekly	-Proponent -ESIA Team -CESCO	50,000
Accidents/Injuries from equipment/machinery or motor vehicle accidents	Erect Proper Signage (DANGER/HATARI/... WORKS AHEAD) Adherence to safety requirements and standard procedures Awareness creation on possible accidents Provision of PPEs for workers	No. of signage in use Site safety rules and standard in place and in use No. of awareness creation meetings held No of PPEs in the use	-Resident engineer -Contractor -Proponent -ESIA Team -CESCO	Preparation stage	-Proponent -ESIA Team -CESCO	100,000

Destruction of vegetation	Remove vegetation only where necessary Replanting trees, shrubs and grass	Area in acres re-vegetated with trees, shrubs and grass	-Contractor -Proponent -ESIA Team -CESCO	Weekly	-Proponent -ESIA Team -CESCO	50,000
Excessive emission of dust	Restrict excavation to the project site Provision of dust masks Frequent watering of the site	No. of dust masks provided Records on watering schedule	-Contractor -ESIA Team -CESCO	Daily	-Proponent -ESIA Team -CESCO	50,000
Conflicts associated with competition for labour	Unskilled and semi-skilled labour shall be sourced from the community	The number of local community members engaged in unskilled and semi-skilled labour	-Contractor -Proponent	Weekly	-Proponent -ESIA Team -CSS&GMO -Chief	50,000
Gender-based violence at the community level	The contractor will implement provisions that ensure that gender-based violence at the community level is not triggered by the Project, including: Effective and on-going community engagement and consultation,	Record of the GBV incidences reported Number of GBV cases referred for counseling and care	Supervision Consultant GBV Expert	Monthly	-Proponent -ESIA Team -CSS&GMO Gender officer	20,000

	<p>particularly with women and girls; Review of specific project components that are known to heighten GBV risk at the community level, e.g. compensation schemes for women, employments schemes for women, etc.;</p> <p>Specific plan for mitigating these known risks, e.g. sensitization around gender-equitable approaches to compensation and employment</p> <p>The contractor will ensure adequate referrals mechanisms are in place if a case of GBV at the community level is reported related to project implementation</p>					
Sexual Exploitation and Abuse by project workers against community members	Develop and implement a SEA action plan with an Accountability and Response Framework as	SEA Action Plan in place Code of Conduct in place	Supervision Consultant GBV Expert	Monthly	-Proponent -ESIA Team -CSS&GMO	50,000

	<p>part of the C-ESMP. The SEA action plan will follow guidance on the World Bank's Good Practice Note for Addressing Gender-based Violence in Investment Project Financing involving Major Civil Works (Sept 2018). The SEA action plan will include how the project will ensure necessary steps are in place for:</p> <p>Prevention of SEA: including COCs and ongoing sensitization of staff on responsibilities related to the COC and consequences of non-compliance; project-level IEC materials;</p> <p>Response to SEA: including survivor-centered coordinated multi-sectoral referral and assistance to complainants according to standard operating procedures; staff</p>	<p>Number of staff trainings on SEA Community Liaison trained in PSEA</p> <p>IEC materials for workers sites and community</p> <p>Discrete SEA reporting pathway in place</p> <p>Relevant policies, e.g. investigations and discipline and whistleblower protection framework</p> <p>Monthly minutes from SEA coordination meetings</p>			<ul style="list-style-type: none"> -Gender officer -Children officer -Chief 	
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	<p>reporting mechanisms; written procedures related to case oversight, investigation and disciplinary procedures at the project level, including confidential data management;</p> <p>Engagement with the community: including development of confidential community-based complaints mechanisms discrete from the standard GRM; mainstreaming of PSEA awareness-raising in all community engagement activities; community-level IEC materials; regular community outreach to women and girls about social risks and their PSEA-related rights;</p> <p>Management and Coordination: including integration of SEA in job descriptions, employments contracts, performance</p>					
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	appraisal systems, etc.; development of contract policies related to SEA, including whistle blower protection and investigation and disciplinary procedures; training for all project management; management of coordination mechanism for case oversight, investigations and disciplinary procedures; supervision of dedicated PSEA focal points in the project					
Total ESMP Cost Under Construction Phase						820,000

8.2 Operational Phase ESMP

The following table outlines the mitigation measures for the impacts during the operation phase.

Operational Phase of Environmental Management Plan

Table 20: Environmental and Social Management plan: Operational Phase

Potential Environmental/ Social Impacts	Recommended Actions	Monitoring indicator	Responsibility	Monitoring frequency	Who to monitor	Estimated Costs (kshs.)
Accumulation of solid wastes	Sensitize on waste reduction practices	No. of sensitization workshops	-The Proponent -Dept. of water	Monthly	-ESIA Team -CESCO -NEMA	100,000
	Compost making of farmyard manure	No. of compost bits in use				
	Apply the 3Rs (reduce, re-use or recycle)	Amount of solid wastes material recycled/reused				
	Use of dust bins to manage wastes	No. of dust bins in place				

Accidents/injuries	<p>Training workers on operations of OSHA</p> <p>Installation of the safety signs</p> <p>Provision of PPEs to the workers</p>	<p>No. of training on OSHA conducted</p> <p>No. of safety signs in place</p> <p>No. of PPEs kits in use</p>	<p>-The Proponent</p> <p>-The Community</p> <p>-Dept. of Health</p> <p>-DOALF</p>	<p>Daily</p>	<p>-ESIA Team</p> <p>-CESSCO</p> <p>-DOSH</p>	50,000
Water logging and soil salinity	<p>Design and maintain proper drainage systems</p> <p>Promote controlled irrigation scheduling to avoid overwatering.</p> <p>Conduct periodic soil salinity monitoring.</p>	<p>No. of monitoring of soil salinity conducted</p>	<p>-Resident Engineer</p> <p>-Proponent</p> <p>-ESIA Team</p> <p>-CESSCO</p>	<p>Weekly</p> <p>Monthly</p>	<p>-ESIA Team</p> <p>-CESSCO</p>	60,000
Increase in water borne diseases	<p>Avoid stagnant pools through proper drainage</p> <p>Promote use of mosquito nets and community health education.</p> <p>Sensitize the community on safe water handling and sanitation practices.</p>	<p>No. of mosquito nets acquired by the community</p> <p>No. of community members sensitized on safe water handling and sanitation practices</p>	<p>-Proponent</p> <p>-ESIA Team</p> <p>-CESSCO</p> <p>-DOALF</p>	<p>Weekly</p> <p>Monthly</p>	<p>-ESIA Team</p> <p>-CESSCO</p>	50,000

	<p>Work with local health authorities on disease surveillance and awareness campaigns.</p> <p>Fence the dam and manage access points to reduce unsafe domestic use.</p> <p>Introduce fish in the dam to act as a biological control for mosquito</p>	<p>No. of fish introduce to the dam</p> <p>Area in acres fenced</p>				
Loss of vegetation cover	Re-vegetation through tree planting	No. of trees planted	<p>-The Proponent</p> <p>-DOALF</p> <p>-The Community</p>	Monthly	<p>-The Proponent</p> <p>-The Community</p>	100,000
Water loss through collapsing and leakage of dam.	Repair and maintenance of dam embankment, pipeline, taps and troughs	Records of repairs and maintenance	<p>-The Proponent</p> <p>-DOALF</p> <p>-Dept. of Water</p>	Monthly	<p>-DOALF</p> <p>-Dept. of Water</p>	100,000
Siltation of the reservoir	<p>Conservation of the catchment area</p> <p>Maintenance of silt traps at various points</p>	<p>Area in acres conserved</p> <p>No of silt traps maintained</p>	<p>-The Proponent</p> <p>-The Community</p> <p>-DOALF</p> <p>-Dept. of Water</p>	Monthly	<p>-The Proponent</p> <p>-Dept. of Water</p>	500,000

	Scheduled de-siltation of silt traps	Records of de siltation activities				
Intensified Use of Agrochemicals and Soil Degradation	<p>Promote Integrated Pest Management (IPM) to reduce chemical reliance.</p> <p>Train farmers on correct agrochemical application, dosage, and timing.</p> <p>Encourage use of organic manure and soil conservation practices.</p> <p>Establish buffer zones near the dam.</p> <p>Safe storage and disposal of agrochemical containers.</p>	<p>No. of farmers trained on correct agrochemical application, dosage, and timing.</p> <p>No. of buffer zones established near the dam.</p>	<p>-The Proponent</p> <p>-The Community</p> <p>-DOALF</p>	Monthly	<p>The Proponent</p> <p>-The Community</p> <p>-DOALF</p>	70,000
Child labor in irrigated agriculture	Enforce strict prohibition of child labour in project activities.	<p>No. of enforced strict prohibition on child labour in project activities.</p> <p>No. of farmers and IWUA sensitized</p>	<p>-The Proponent</p> <p>-The Community</p>	Monthly	<p>-Ministry of Interior and Co-ordination</p> <p>-ESIA Team</p> <p>-CESSCO</p>	60,000

	Sensitize farmers and IWUA on child protection laws	on child protection laws.	-Ministry of Interior and Co-ordination -ESIA Team -CESSCO			
Theft of Farm Yield and Vandalism of Infrastructure	Establish a security subcommittee at the IWUA Install lockable gates and protective fencing where necessary. Promote collective responsibility through IWUA by-laws.	No. of lockable gates and protective fencing installed	-The Proponent - Contractor	Monthly	-ESIA Team -CESSCO	30,000
Breakdown of Irrigation Infrastructure	Develop a routine maintenance schedule. Train IWUA members in basic technical maintenance. Establish a maintenance fund through user fees	No. of routine maintenance schedule developed No. of IWUA members trained on basic technical maintenance. Amount of maintenance fund	-ESIA Team -CESSCO - Proponent -IWUA	Monthly	-ESIA Team -CESSCO	70,000

		collected through user fees				
Management Challenges within the IWUA	<p>Provide capacity building in leadership, financial management, and conflict resolution.</p> <p>Develop clear by-laws and water allocation rules.</p> <p>Ensure inclusive representation of women and vulnerable groups.</p> <p>Conduct regular audits and transparent reporting.</p>	<p>No. of capacity building in leadership, financial management, and conflict resolution conducted</p> <p>No. of regular audits conducted</p>	<p>-ESIA Team</p> <p>-CESSCO</p> <p>- Proponent</p> <p>-IWUA</p>	<p>Weekly</p> <p>Monthly</p>	<p>-ESIA Team</p> <p>-CESSCO</p>	30,000
Risk of Drowning	<p>Fence critical sections of the dam and install warning signage.</p> <p>Conduct community awareness campaigns on water safety.</p> <p>Prohibit swimming and unsafe domestic use of the reservoir</p>	<p>No. of critical sections fenced</p> <p>No. of community awareness campaigns on water safety conducted</p>		Monthly	<p>-ESIA Team</p> <p>-CESSCO</p>	30,000

Increase in conflicts associated with use and sharing of water	Constitute a project management committee with TORs Develop the rules and regulations governing the use of water Activate the GRM Fencing off the project area	A project management committee in place Rules and regulations on water use in operations A GRM mechanism in place Project area fenced	-The Proponent -The Community -Ministry of Interior and Co-ordination -ESIA Team -CESSCO	Monthly	-The Community -Ministry of Interior and Co-ordination -ESIA Team -CESSCO	50,000
Pollution and poisoning due to use of pesticides and other agricultural chemical	Training on safe use of pesticides Use of PPEs Safe disposal of used containers	No. of trainings on safe use conducted No. of PPEs in use No. of disposal points in place	-DOALF -The Proponent -The Community members	Monthly	-DOALF -The Proponent	100,000
Increase in waterborne diseases especially malaria, typhoid and diarrhea.	Provision of mosquito nets Boiling of water Adopt biological control of mosquitos through stocking of fish in dam	No. of mosquito nets issued No. of HH using boiled water No. of fish stocked	-The Proponent -DOALF -Dept. of Health	Monthly	-The Proponent -Dept. of Health	100,000

Land degradation and soil erosion (throughout the catchment)	Capacity building of farmers on stocking rates and grazing management Construct soil and water conservation structures Tree planting	No. of farmers trained on stocking rates No. of Kms of terraces constructed No. of trees planted	-The Proponent -DOALF -The Community -ESIA Team -CESSCO	Quarterly	-DOALF -The Community -ESIA Team	100,000
Gender Based Violence (GBV) associated with sharing of proceeds associated with the project	Sensitize the community on the potential GBV conflicts and control Register the conflicts with the relevant institutions e.g. Chief, police	No. of sensitization meetings held A register of GBV cases recorded with the chief/or the police	-The Community -Ministry of Interior and National co-ordination	Daily	-The Community -Ministry of Interior and National co-ordination	50,000
Total ESMP Cost under Implementation Phase						1,650,000

8.3 Integrated Pest Management Plan (IPMP)

Table 21: Crop Value Chains IPMP

Impact issue / Pest & pesticide threat	Mitigation Measures/ Recommended actions	Monitoring indicators	Responsibility to take action	Monitoring Frequency	Who to Monitor	Cost In KES.
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<p>Poisoning from improper disposal of pesticide containers</p>	<ul style="list-style-type: none"> ● Train farmers, farm assistants and local communities on health and environmental hazards. ● Set up container-return points at agrovets and cooperatives. ● Sensitize farmers on set up container-return points at agrovets and cooperatives. ● Train farmers and agrovets on Triple-Rinse, puncture method in disposing agrochemical containers. 	<ul style="list-style-type: none"> ● No. of training events on health and environmental hazards done. ● No. of container-return points at agrovets/co-operatives set up. ● No. of farmers sensitized on set up container-return points at agrovets and cooperatives. ● No. of farmers and agrovets retailers trained on Triple-Rinse, puncture method in disposing agrochemical containers 	<p>County Dept. of Agriculture (CDA); agro-input retailers; farmer groups.</p>	<p>Quarterly and after every spray season.</p>	<p>Public health officers; extension staff.</p>	<p>40,000</p>
<p>Pollinator decline from broad-spectrum insecticides</p>	<ul style="list-style-type: none"> ● Train farmers on use selective insecticides products (spinosad, flubendiamide). 	<ul style="list-style-type: none"> ● No. farmers trained on use selective insecticides products 	<p>CDA, Farmers; beekeepers' groups.</p>	<p>Quarterly</p>	<p>Extension officers.</p>	<p>30,000</p>

		(spinosad, flubendiamide).				
Production and market losses from fruit fly and armyworm	<ul style="list-style-type: none"> Farmer Field Schools on Good Agricultural Practices (GAP) – field sanitation, baiting, pheromone traps, timely harvest. Establish pest-surveillance network (lure traps & light traps). Train farmers on use of parasitoids/biocontrol agents (e.g. <i>Diachasmimorpha longicaudata</i>, <i>Trichogramma</i>). 	<ul style="list-style-type: none"> No. of farmers trained (Registers). No. of pest-surveillance network (lure traps & light traps) established No. of trainings on use of parasitoids/biocontrol agents (e.g. <i>Diachasmimorpha longicaudata</i>, <i>Trichogramma</i>) done. 	CDA; Kenya Plant Health Inspectorate Service (KEPHIS); Export companies.	Quarterly	CDA, Extension officers	120,000
Ground and surface-water contamination from pesticide runoff	<ul style="list-style-type: none"> Construct grassed buffer strips (3 m) along waterways. Promote drip irrigation to reduce foliar wash-off. 	<ul style="list-style-type: none"> Pesticide residue ppm in water samples (quarterly lab tests). % fields with buffers installed. Incidence of fish kills reported. 	Water Resources Authority (WRA); CDA; community water user associations.	Quarterly sampling; post-rainstorm inspections.	WRA water quality teams.	100,000

	<ul style="list-style-type: none"> ● Implement 48-hour no-spray rain forecast rule. 					
Occupational exposure of sprayers	<ul style="list-style-type: none"> ● Mandate full PPE (nitrile gloves, respirator, goggles, and coveralls). ● Adopt low-volume knapsack sprayers with anti-drip nozzles. ● Annual medical check-ups and cholinesterase tests. 	<ul style="list-style-type: none"> ● % sprayers with complete PPE during random checks. ● No. of low-volume knapsack sprayers with anti-drip nozzles in use. ● No. of annual medical check ups and Cholinesterase levels tests done. 	Employers (farm owners); CDA OSH officers.	Monthly PPE spot-checks; annual medical exam.	Occupational health nurses.	45,000
Tomato leaf-miner (<i>Tuta absoluta</i>)	<ul style="list-style-type: none"> ● Install pheromone funnel traps (40/ha). ● Release predatory bug <i>Nesidiocoris tenuis</i>. ● Apply <i>Bacillus thuringiensis</i> (Bt) 	<ul style="list-style-type: none"> ● No. of pheromone funnel traps installed and trap catches per night. ● % damaged leaflets and fruits. 	Farmer cooperatives; CDA; private bio-control firms.	Twice-weekly trap reading; weekly scouting.	Agronomists; cooperative IPM committees.	75,000
Total Cost						410,000

Table 22: Livestock Value Chain IPMP

Impact issue / Pest & pesticide threat	Mitigation Measures/Recommended Actions	Monitoring Indicators	Responsibility to Take Action	Monitoring Frequency	Who to Monitor	Cost (Ksh)
Tick infestation leading to disease (e.g. ECF, anaplasmosis)	<ul style="list-style-type: none"> ● Use of Acaricide rotation to avoid resistance. ● Integrated Tick Control (ITC): pasture management, strategic dipping, Tick-resistant breeds. ● Regular deworming and vaccination. ● Train farmers on ITC 	<ul style="list-style-type: none"> ● Tick load per animal (count/10cm²). ● Number of clinical cases reported. ● Number of farmers trained on ITC. 	County director of Veterinary services and livestock production.	Monthly during high tick seasons; quarterly training.	Livestock extension officers; private vets.	85,000
Antimicrobial resistance (AMR) from misuse of veterinary drugs	<ul style="list-style-type: none"> ● Train farmers and animal health providers on AMR stewardship. ● Promote use of diagnostics before treatment. 	<ul style="list-style-type: none"> ● % of treatments preceded by diagnostics. ● Sales records of antibiotics. 	County director of Veterinary services and livestock production. Agrovets associations.	Bi-annually; random prescription audits.	County veterinary lab; veterinary inspection teams.	95,000
Milk/meat contamination from pesticide-treated feed	<ul style="list-style-type: none"> ● Ensure withdrawal periods are observed. ● Approve only certified feed and fodder sources. ● Farmer awareness on feed traceability and pesticide risks. 	<ul style="list-style-type: none"> ● Residue levels in milk/meat (lab results). ● % of feed samples tested for pesticides. ● No. of farmers awareness sessions conducted. 	County director of Veterinary services and livestock production. Dairy cooperatives.	Quarterly sampling and bi-annual training.	Dairy QA officers; veterinary officers.	70,000

Poisoning of scavenging livestock from pesticide spills or residues	<ul style="list-style-type: none"> Secure pesticide storage areas on farms. Train herders and farmhands on pesticide hazard zones. Train farmers on proper disposal of crop residues post-spraying. 	<ul style="list-style-type: none"> No. of reported livestock poisoning cases. % farms with secure storage. Training attendance lists. 	Livestock producers; agrovet shops; CDA.	Every spray season; quarterly inspections.	Public health and livestock officers.	40,000
Fly nuisance and spread of diseases (e.g. myiasis)	<ul style="list-style-type: none"> Promote use of biological fly control (parasitic wasps, traps). Timely manure management and proper drainage. 	<ul style="list-style-type: none"> Fly trap counts. Incidence of fly-related infections. 	County director of Veterinary services and livestock production. County environment dept.	Monthly fly counts; seasonal inspections.	Extension staff; environmental officers.	60,000
Tsetse and Trypanosomiasis	<ul style="list-style-type: none"> Deploy insecticide-treated targets (ITT) and traps. Use pour-on insecticides on animals in endemic areas. Vector surveillance and community sensitization. 	<ul style="list-style-type: none"> Tsetse fly counts/trap/day No. of cases reported in animals. % coverage of treated animals. 	County Director of Veterinary Services	Bi-weekly trap monitoring; seasonal treatment campaigns.	Extension staff. County vet officers.	120,000
Total Cost						470,000

8.3 Decommissioning phase

This project is expected to serve the beneficiaries and the future generations. However, in the event that it has to come to an end, decommissioning plan will be activated. The table outlines the mitigation measures to be undertaken during decommissioning.

Table 23: ESMP for decommissioning phase

Recommended Mitigation Measures	Responsible party	Time frame	Cost (KSH)
Demolition Waste Management			
Develop a decommissioning plan and submit to NEMA for approval	Proponent	One-off	ESIA lead expert cost
All buildings, machinery, equipment, structures and partitions that will not be used for other purposes must be removed and recycled/reused	Contractor, Proponent	One-off	To be determined
All foundations must be removed and recycled, reused or disposed of at a licensed disposal site.	Contractor, Proponent	One-off	To be determined
Where recycling/reuse of the machinery, equipment, implements, structures, partitions and other demolition waste is not possible, the materials should be taken to a licensed waste disposal site.	Contractor, Proponent	One-off	-
Donate reusable materials to charitable organizations, individuals and institutions.	Contractor, Proponent	One-off	-
Demolition works to be done in accordance to noise, waste and air pollution regulations.	Contractor, proponent		
Rehabilitation of project site			
Leveling and landscaping of the area	Contractor, Proponent.	One-off	To be determined
Implement an appropriate re-vegetation programme(s) to restore the site to its original status.	Contractor, Proponent.	One-off	To be determined

CHAPTER NINE: CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusion

From the Results of this ESIA study, it can be concluded that the impact of the proposed project is positive on the socio-economic circumstances. Both the community members and the collaborators have pronounced their overwhelming support for the implementation of this project. However, the contractor must use the ESMMP to support in mitigating the impacts of the project.

Having considered all the information collected, collated and analyzed during the study, it is the experts considered judgment that:-

- The project does not pose any serious environmental concern, other than those of minor scale, which shall be properly mitigated
- The proposed project will contribute to increased productivity and profitability of dairy and other potential agricultural based value chains
- The proposed project shall contribute to the rise in socio-economic status of the residents and thus improving food and nutrition security in line with the government's Bottom-Up Economic Transformation Agenda (BETA), Kenya Vision 2030 and SDGs.
- The proponent has commissioned the ESIA that has embraced public participation as per the requirement of the appropriate laws and procedures that govern implementation of such projects.
- The ESIA report clearly outlines the potential negative impacts and proposes mitigation measures to reduce these impacts, hence guaranteeing the sustainability of this project.

9.2 Recommendations

The proponent, the contractor, the beneficiaries and other stakeholders shall use the ESMMP to operationalize the proposed Osukunua Earth Dam and Irrigation Project. The ESIA team recommends the registration of IWUA under the Water Act. Further, the IWUA should apply and maintain the water abstraction permit from Water Resource Authority.

Therefore, the ESIA team recommends the approval of the proposed project by NEMA for implementation.

REFERENCES

- The Environmental Management and Coordination (Strategic Assessment, Integrated Impact Assessment and Environmental Audit) Regulations, 2018
- The Environmental Management and Co-ordination Act, 1999 No 8 of 1999 Date of Commencement: 14th January, 2000.
- Narok County Integrated Development Plan (2023– 2027).
- Narok County Physical and Land Use Development Plan 2023-2032
- Narok County Trade and Markets Act, 2019
- KNBS. 2019. Kenya Population and Housing Census (Volume I: Population by County and Sub-County).
- Agriculture and Food Authority (AFA) Act No. 13 of 2013 (revised 2015)
- The Occupational Safety and Health Act No. 15 of 2007
- The Physical and Land Use Planning Act, 2019 No. 13 of 2019 5th August 2019
- Legal Notice No. 101 The Environmental (Impact Assessment and Audit) Regulations, 2003
- The Constitution of Kenya Republic of Kenya 2010
- Legal Notice No. 121 Environmental Management and Co-ordination (Waste Management) Regulations 2006-*29th September, 2006*
- County Governments Act No. 17 of 2012 Printed and Published by the Government Printer, Nairobi
- The Environmental Management and Co-ordination (Amendment) Act 2015 NAIROBI,3rd June,2015 Republic of Kenya Printed and Published by the Government Printer, Nairobi
- The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009

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

Public Health Act Chapter 242 Revised Edition 2012 [1986] Published By The National Council
For Law Reporting www.Kenyalaw.Org 2017 – 2026

The Environment Management and Coordination (Air Quality) Regulations, 2014

The National Construction Authority Act, Number 41 of 2011

HIV/AIDS Prevention and Control Act, 2006

Sustainable Waste Management Act, 2022, Published under Kenya Gazette Supplement No.
121(Acts No. 31)

Work Injuries and Benefits Act, 2007

World Bank Environmental and Social Standards

CHAPTER ELEVEN

11.0 ANNEXTURES

11.1 Land Ownership

11.1.1 Confirmation of land ownership from Sub County Land Adjudication and Settlement Officer



MINISTRY OF LANDS, PUBLIC WORKS, HOUSING AND URBAN DEVELOPMENT
STATE DEPARTMENT FOR LANDS AND PHYSICAL PLANNING
DIRECTORATE OF LAND ADJUDICATION AND SETTLEMENT

Telephone: 0208012509

Land Adjudication and Settlement Office
Narok South.
P.O. Box 9 - 20503
Ololulunga.

When replying please quote:

Ref: LA/NRK/S/L/ILKERIN/VOLI/25

6th December, 2024

TO WHOM IT MAY CONFIRM

RE: CONFIRMATION OF OWNERSHIP – PARCEL NO. 2027 ILKERIN ADJUDICATION SECTION

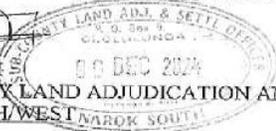
This is to confirm that as per records held in this office the above parcel of land is demarcated/ surveyed to COUNTY GOVERNMENT OF NAROK reserved for OSUKUNUA DAM the land is located in ilkerin Adjudication Section, Narok South Sub County.

It measures approximately 10.54Ha (Approx. 26 acres). There is no pending land dispute in our records.

The section is still under adjudication process and is yet to be issued with Title Deed as per Land Adjudication Act Cap. 284 laws of Kenya.

Any assistance accorded will be highly appreciated


M. K. MURITHI
FOR: SUB COUNTY LAND ADJUDICATION AND SETTLEMENT OFFICER
NAROK SOUTH/WEST



11.1.2 Land ownership from office of the area Chief



OFFICE OF THE PRESIDENT
MINISTRY OF INTERIOR
AND
CO-ORDINATION OF NATIONAL GOVERNMENT

Telephone: 0717835121

OFFICE OF THE CHIEF
ILKERIN-LOTA LOCATION

EMAIL:

P.O BOX 92

GLODURUNGA

DATE: 3rd 12-2024

OUR REF: TO BOTTOM TITLES CONCERN:

RE: OSUKONVA DAM LIP 2027. 10. 54 ACCEP

Dear Sir/Madame,

The above subject matter refer, we wish to confirm to you that the proposed project site for Osukonva Community Dam is a community land allocated the Ilkerin Land Adjudication Committee during the last year coordinated Adjudication exercise in Ilkerin Section.

The said site is a waiting title like all other individual parcels. For any other clarification please kindly don't hesitate to inquire.

I thank you for partnering/co-operate with our community.

Yours faithfully,



Milton Karkar Area Chief

11.1.3 Allocation of land to Osukunua earth Dam by Ilkerin Land Adjudication Committee

ILKERIN LAND ADJUDICATION SECTION
L/PARCEL NO: 2027
NAME: OSUKUNUA DAM
CHAIRMAN SIGN: [Signature]

ILKERIN LAND ADJUDICATION COMMITTEE
OFFICE
P.O. BOX 128, NAROK
14/10/2024.
Tel. 0728035884
CERN

ILKERIN LAND ADJUDICATION SECTION
P.O. BOX 128, NAROK.
CHAIRMAN SIGN: [Signature]

RE: OSUKUNUA DAM L/P 2027. 10.54 ACRES

Dear sir/Madam.

The above Subject Matter refer. We wish to confirm to you that the proposed Project site for Osukunua Community Dam is a Community land allocated by the said Committee during the recently concluded Adjudication exercise in Ilkerin section. The said site is a waiting title like all other Individual parcels. For any other clarification kindly don't hesitate to Enquire.

We Thank you for Partnering with our Community.

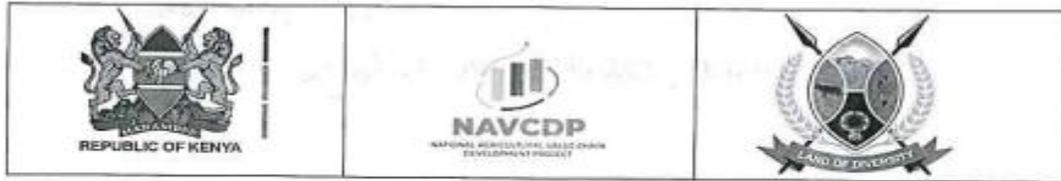
yours faithfully,

John ole Kikonya

Chairman Ilkerin land Adjudication Committee. [Signature]

11.1.4 Community land Resolution and Consent Form

Community Land Resolution and Consent Form



COMMUNITY LAND RESOLUTION AND CONSENT FORM

ITEM	DESCRIPTION
Project name	NAVCDP
Name of Investment	O Sukuma Earth Dam & Irrigation Project
Detailed specifications of investment	Rehabilitation and Expansion
Project Location:	Narok South, Laita Ward
GPS coordinates	E -1.517508° N 35.685964°
Estimated cost of the investment	KE 83,640,542-20

Please attach the community Barraza minutes and summary safeguards report explaining how the requirements for voluntary land donation for this investment have been met.

TERMS OF THE AGREEMENT

1. As discussed in our community Barraza on 11th June 2025 to which all residents and regular users of the investment area (specify) Loita Ward, Osukunua Village were invited. We the nominated representatives at that meeting confirm that the following issues were discussed and the residents and regular users of this land are in unanimous agreement.
2. That, Land Parcel No: 2027 shall be site of the proposed Osukunua Earth Dam & Irrigation Project and that:
3. We all are aware that the land set aside for the investment is community land and no one is claiming individual ownership because it belongs to all of us and negative impacts on particular individuals using the land will be addressed by the community, and no alternative claims will be made later on the land.
4. We have all agreed unanimously that the project implementation should continue.
5. We all shall strive to peacefully resolve any conflicts with other communities concerning the investment.
6. We will strive to peacefully co-exist and resolve any conflict arising out of the investment facility following due process provided by the laws of Kenya.
7. The land to be donated was identified in consultation with all residents and users of the land.
8. We all understand the likely impacts of proposed activities on donated land.
9. We all understand that the community could have refused this investment.
10. We all agreed to this investment and donation of the land without coercion, manipulation, or any form of pressure on the part of public or traditional authorities.
11. We all agreed that we do not require any monetary or non-monetary benefits or incentives as a condition for the donation or detail the benefits expected as condition for donation
12. The land being donated will not reduce the remaining land area to a level below that required to maintain the livelihoods of occupiers and users of land at current levels and will not require the relocation of any household.
13. If any structure will be moved or any access to land be limited as a result of the investment, the individual affected will be compensated so their livelihood will be unaffected.
14. The land is free of encumbrances or encroachment and is not claimed by any individual and its ownership is not contested.

We have been designated by the community of ILKERIN LOITA OSUKUNWA Village Itmarai Sub-Location.

Confirm the above information to be true and that we have resolved to abide by ALL terms of this agreement. (Please attach minutes of the community meeting including the signed attendance sheet and photos of the meeting).

S/No.	Name	Village/ Location	ID/No.	Signature
1.	Daniel Tunul	osukunwa	34169488	
2.	David Resan	OSukunwa	30096675	
3.	Dan. meigeti	Pohihitubai	4057396	
4.	JAMES' KOB I	WOPopokungi	30980099	
5.	Ohoiputa mahaai	Kussas	40708616	

Witnessed on this Thursday Day of 17th in the Year 2025
by:

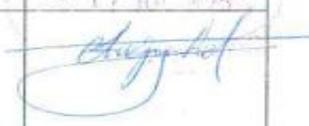
1. Area Chief

Name	ID/No.	Signature & R/Stamp
Milton Karker Area Chief	9174044	

2. Ward Administrator

Name	ID/No.	Signature & R/Stamp
Samuel ledidi Loita ward administrator	26041966	

3. County Project Coordinator

Name	ID/No.	Signature & R/Stamp
LIVINGSTONE MBEPUKE	20517433	

4. Land Registrar/adjudication officer

Name	ID/No.	Signature & R/Stamp
ERNEST AGHAMBAY 17 JUL 2015 NAROK NORTH, CENTRAL & EAST SUB-COUNTIES	11355335	

5. County Government (Physical Planning Department)

Name	ID/No.	Signature & R/ Stamp
Daudi Naishe	7117019	 COUNTY GOVERNMENT OF NAROK CHIEF OFFICER PHYSICAL PLANNING AND URBAN DEVELOPMENT 17 JUL 2015 P. O. Box 898-20500 NAROK

6. County Ministry Relevant to the project e.g. Water/Livestock Production etc.

Name	P/No.	Designation	Signature & R/ Stamp
QUEEN KIMORGO	1980006560	Chief Officer	 GOVERNMENT OF NAROK CHIEF OFFICER 17 JUL 2015 LIVESTOCK P. O. Box 898 - 20500, NAROK

11.1.5 Minutes of Public Consultation on land allocation for Osukunua Earth Dam and Irrigation Project

MINUTES OF PUBLIC CONSULTATION MEETING ON LAND ALLOCATION FOR OSUKUNUA EARTH DAM AND IRRIGATION PROJECT HELD ON 9th SEPTEMBER 2024 AT PROPOSED OSUKUNUA EARTH DAM AND IRRIGATION PROJECT SITE.

PRESENT:

S/NO.	NAME	DEPARTMENT/ORGANIZATION	PHONE NO.
1.	Elijah Mututua	NAVCDP	0725135837
2.	Mary Marindich	NAVCDP- PoE	0792614408
3.	John Mugo	DOALF	0723014440
4.	David Reson	IWUA	0703768197
5.	30 community members		

Agenda

1. Presentation of the Osukunua Earth Dam and Irrigation Project
2. Discussion on Proposed Land Allocation
3. Community Feedback and Concerns
4. Project Sustainability

PRELIMINARIES

OPENING AND WELCOME REMARKS

The meeting was officially opened at 10:30 AM by David Reson, the Chairperson of the IWUA, who welcomed all attendees and emphasized the importance of community participation in decision-making on land matters.

INTRODUCTION OF STAKEHOLDERS AND PURPOSE OF THE MEETING

The representative (CESCO) from the County Project Coordinating Unit introduced the purpose of the meeting, which is to consult the community on the proposed allocation of community land for the development of the Osukunua Earth Dam and Irrigation Project.

The lead expert (Mr. Vincent Kinyua) was introduced and given the floor to present the objectives, scope, benefits, and implications of the project.

- A community liaison committee to be established to follow up on implementation and grievance handling.

MIN 4/ OSUKUNUA COMMUNITY/2024: PROJECT SUSTAINABILITY

Mrs. Mary Marindich guided the meeting on project sustainability, requirements for a water pan as follows:-

- i. That there should be a water users association to oversee the operations of the project
- ii. That the community should continue to protect the environment, and undertake soil and water conservation in the farms surrounding the water pan
- iii. That the community should continuously repair the fence and other structures associated with the project
- iv. That the community should endeavor to undertake routine meetings to ensure the sustainability of the project and associated enterprises
- v. That the ESMP should be followed to the letter

MIN 4/ OSUKUNUA COMMUNITY/2024: ADJOURNMENT

The members thanked the NAVCDP Project for the commendable initiative which would greatly bridge the gap in milk and tomato production through water access.

There being no other business, the meeting was adjourned with a word of prayer

Minutes confirmed by:

Name: Samuel Saki Sign: [Signature] Date: 9/9/24

Secretary

Name: David Reson Sign: [Signature] Date: 9/9/24

Chairman



NATIONAL AGRICULTURAL VALUE CHAIN DEVELOPMENT PROJECT (NAVCDF)
County Project Coordinating Unit

Activity: Public Participation on land allocation for Bukuma Earth Dam and Irrigation Project
Venue: Bukuma Earth Dam and Irrigation Project Date: 9/09/2024

ATTENDANCE LIST

No.	Name	ID/FF No.	Dep./Org.	Desig.	Gender		Age		Phone No.	Contact Email	Sign
					M	F	<35 Youth	>35 Adult			
1	Njirani Lige										
2	Carole Mwend										
3	Rosi Mwangi	4057802						073490206			
4	James Mwachuk	116799121						073477004			
5	Bukuma Karami	25999538						073424274			
6	Okumuwa Mwangi							0705033774			
7	Njiru Kari										
8	Kachwa Kamnie										
9	Kariuki Karami										
10	Njiru Karami	2662122						0732601001			
11	Noelundi Tugape										
12	Mwaka Karami										
13	Njiru Karami										
14	Njiru Karami										
15	Njiru Karami										



NATIONAL AGRICULTURAL VALUE CHAIN DEVELOPMENT PROJECT (NAVCDF)
County Project Coordinating Unit

Activity: Public Participation on land allocation for Bukuma Earth Dam and Irrigation Project
Venue: Bukuma Earth Dam and Irrigation Project Date: 9/09/2024

ATTENDANCE LIST

No.	Name	ID/FF No.	Dep./Org.	Desig.	Gender		Age		Phone No.	Contact Email	Sign
					M	F	<35 Youth	>35 Adult			
1	Tate Maa	1174272									
2	PARMIGAT Kari	3898009						073022960			
3	David Rason	30076622	Tumbi	Gen				073055215			
4	Olusoga Rason							073059197			
5	Daniel Mwangi	3418248						073560260			
6	Musoke Rason	4028301						070622004			
7	Asie Tumwes							073007102			
8	Okumuwa Mwangi										
9	Diankim Mwachuk										
10	Jonathan Mwangi										
11	Kari Karami							0701567891			
12	Olusoga Mwangi							070293768			
13	Moses Mwangi	2861826						0704161822			
14	Sarah Rason	40475642						0705848027			
15	JOSEPH SILAMA							0745897229			

11.2 Sample filled questionnaires

QUESTIONNAIRE

Environmental & Social Impact Assessment for the proposed construction of Osukunua water Pan at Loita Ward, Narok South Sub-County, Narok County

QUESTIONNAIRE FOR NEIGHBOURS, LOCAL COMMUNITY MEMBERS /SURROUNDING ENTERPRISES

Our client, County Government of Narok (Development of Agriculture, Livestock and Fisheries), has received funding from the World Bank under the National Agricultural Value Chain Development Project (NAVCDP) to construct Osukunua water pan at Loita Ward, Narok South Sub-County, Narok County

As a stakeholder/member of the local community neighbouring the project, we request for your comments on the expected Environmental and Social-Economic Impacts of the proposed project. As a requirement of EMCA 1999 section 58 on Environmental Impact Assessment and audit, public participation is an important exercise for achieving the fundamental principles of sustainable development.

General information:

Reference No. 070516497 Date of Interview 12/01/2024 Name of

Interviewer David Reson

Respondent

Name AKLOS SHUMA ID/Telephone 0111 300 708 Age 28

1. A) What is the distance between your house/enterprise/residence and the project?

(Tick where applicable)

(A) Less than 100m (B) Between 100-500m (D) Over 1km

B) Do you think you or your enterprise will be affected by the proposed project

() Yes (v) No

2. What positive socio-economic and environmental impacts do you anticipate during the construction and operation phases of the proposed Project?

Opening of a new road leading to the farm that has previously been blocked by the person migrating to own parcels.

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3. What negative socio-economic and environmental impacts do you anticipate during the construction and operation phases of the proposed Project?

1. Create long distance for persons using the dam to fetch water

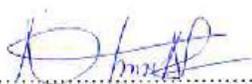
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4. Make suggestion on the measures the developer needs to put in place during the construction and operation phases of the project.

1. Increase number of water troughs for animals drinking
2. Build water taps separately from that of troughs for animals
3. Build bathrooms and pit latrines for people around/using the facility

5. Do you support the proposed Project?

Yes No I don't know

Signature: 

Thank you

QUESTIONNAIRE

Environmental & Social Impact Assessment for the proposed construction of Osukunua water Pan at Loita Ward, Narok South Sub-County, Narok County

QUESTIONNAIRE FOR NEIGHBOURS, LOCAL COMMUNITY MEMBERS /SORROUNDING ENERPRISES

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As a stakeholder/member of the local community neighbouring the project, we request for your comments on the expected Environmental and Social-Economic Impacts of the proposed project. As a requirement of EMCA 1999 section 58 on Environmental Impact Assessment and audit, public participation is an important exercise for achieving the fundamental principles of sustainable development.

General information:

Reference No. 0227CE/197 Date of Interview 12/10/24 Name of Interviewer David Reson

Respondent Name Nelson Parmina ID/Telephone 0727587998 Age 38yrs

1. A) What is the distance between your house/enterprise/residence and the project?

(Tick where applicable)

(A) Less than 100m (B) Between 100-500m (D) Over 1km

B) Do you think you or your enterprise will be affected by the proposed project

Yes () No

2. What positive socio-economic and environmental impacts do you anticipate during the construction and operation phases of the proposed Project?

The water will be for domestic use in my place

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3. What negative socio-economic and environmental impacts do you anticipate during the construction and operation phases of the proposed Project?

Mosquito breeding zone if not treated well.

Water pollution

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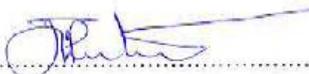
4. Make suggestion on the measures the developer needs to put in place during the construction and operation phases of the project.

Put fence for safety use of the users

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5. Do you support the proposed Project?

Yes () No () I don't know

Signature: 

Thank you

QUESTIONNAIRE

Environmental & Social Impact Assessment for the proposed construction of Osukunua water Pan at Loita Ward, Narok South Sub-County, Narok County

QUESTIONNAIRE FOR NEIGHBOURS, LOCAL COMMUNITY MEMBERS /SORROUNDING ENERPRISES

Our client, County Government of Narok (Development of Agriculture, Livestock and Fisheries). has received funding from the World Bank under the National Agricultural Value Chain Development Project (NAVCDP) to construct Osukunua water pan at Loita Ward, Narok South Sub-County, Narok County

As a stakeholder/member of the local community neighbouring the project, we request for your comments on the expected Environmental and Social-Economic Impacts of the proposed project. As a requirement of EMCA 1999 section 58 on Environmental Impact Assessment and audit, public participation is an important exercise for achieving the fundamental principles of sustainable development.

General information:

Reference No. 0283765197 Date of Interview 12/10/2024 Name of

Interviewer David Reson

Respondent

Name Patrick MURUKU ID/Telephone 0706-035-626 Age 31

1. A) What is the distance between your house/enterprise/residence and the project?

(Tick where applicable)

(A) Less than 100m (B) Between 100-500m (D) Over 1km

B) Do you think you or your enterprise will be affected by the proposed project

() Yes (X) No

2. What positive socio-economic and environmental impacts do you anticipate during the construction and operation phases of the proposed Project?

- Irrigation activities can be carried out
- livestock usage
- human consumption
- better transportation activities as growth around the Dam may be cleared

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3. What negative socio-economic and environmental impacts do you anticipate during the construction and operation phases of the proposed Project?

Deforestation can be avoided cost

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4. Make suggestion on the measures the developer needs to put in place during the construction and operation phases of the project.

- Create some roads that lead to the water point

- Re-construction of the trenches

- Re-construction of the pipelines for sufficient water flow

- Construction of some Re-Home and trailers

5. Do you support the proposed Project?

Yes () No () I don't know

Signature: *Abdulmutalib*

Thank you

QUESTIONNAIRE

Environmental & Social Impact Assessment for the proposed construction of Osukunua water Pan at Loita Ward, Narok South Sub-County, Narok County

QUESTIONNAIRE FOR NEIGHBOURS, LOCAL COMMUNITY MEMBERS /SORROUNDING ENTERPRISES

Our client, County Government of Narok (Development of Agriculture, Livestock and Fisheries), has received funding from the World Bank under the National Agricultural Value Chain Development Project (NAVCDP) to construct Osukunua water pan at Loita Ward, Narok South Sub-County, Narok County

As a stakeholder/member of the local community neighbouring the project, we request for your comments on the expected Environmental and Social-Economic Impacts of the proposed project. As a requirement of EMCA 1999 section 58 on Environmental Impact Assessment and audit, public participation is an important exercise for achieving the fundamental principles of sustainable development.

General information:

Reference No. 070376397 Date of Interview 02/10/2024 Name of Interviewer David Kison

Respondent Name Daniel Mureke ID/Telephone 0718323758 Age 50

1. A) What is the distance between your house/enterprise/residence and the project?

(Tick where applicable)

(A) Less than 100m (B) Between 100-500m (D) Over 1km

B) Do you think you or your enterprise will be affected by the proposed project

() Yes (/) No

2. What positive socio-economic and environmental impacts do you anticipate during the construction and operation phases of the proposed Project?

It can create light duties to youth
It also gives hope of getting water for long droughts
The major problem of water for human and animals will come to an end

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3. What negative socio-economic and environmental impacts do you anticipate during the construction and operation phases of the proposed Project?

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4. Make suggestion on the measures the developer needs to put in place during the construction and operation phases of the project.

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① The developer to consider the Indigenous to get right jobs

② The developer to ensure to Put Security of the destruction of people and animals

5. Do you support the proposed Project?

Yes () No () I don't know

Signature *[Handwritten Signature]*

Thank you

11.3 Osokunua Earth Dam beneficiaries

	Name	HH Size	Land Size (Acres)	Cattle	Sheep	Goats	Donkeys
1	Lentano Siloma	11	30	60	260	110	3
2	Arami Siloma	5	15	15	60	25	
3	Lekere Siloma	6	30	30	120	28	
4	Meeyu Siloma	3	15	21	30	15	1
5	Ntuala Reson	9	90	40	20	15	2
6	Kikanae Shuma	7	30	60	100	30	
7	Nooltuka Shuma	5	30	40	60	10	1
8	Noomeshuki Sarara	3	15	7	15	5	
9	Noonkipa Sarara	7	60	100	250	40	3
10	Mepukori Siloma	12	45	30	60	30	
11	Ntekerei Shuma	13	120	60	80	40	4
12	Manchau Olonuku	6	60	100	180	60	
13	Lekaun Kayoi	7	90	20		40	
14	Olkinyi Maoi	6	30	10	5	2	
15	Kaiki Koei	8	30	8	4	2	
16	Ologolemot Koei	5	30	10	11	18	
17	Sein Uka	3	15	15	10	8	
18	Moses Maoi	6	30	10	5	2	
19	Tate Maoi	5	60	30	60	15	2
20	Parmuat Kikonya	9	45	20	30		
21	Kisonkoi Kikonya	4	30	10	50	8	6
22	Narikunkera Kikonya	7	90	40	60	30	4
23	Nootomon Kikonya	6	15	25	35	15	2
24	Noolama Kikonya	7	45	20	30	40	2
25	Oltetia Kironyi	6	45	15	12	8	2
26	Olkutuuk Kironyi	5	30	40	50	70	
27	Kone Kironyi	11	60	100	200	150	6

28	Lekanasa Kikonya	8	45	10	15	25	1
29	Letiyia Ngera	7	45	20	35	40	1
30	Musayo Meingati	4	30	75	15	10	
31	Nakoyia Murkuk	6	5	15			
32	Rakancha Kironyi	5	30	14	10		
33	Oloishuro Kironyi	5	30	5	7		
34	Lekitony Siloma	10	120	30	40	60	5
35	Matikoi Malees	7	45	18	15	5	
36	Lesile Tumpes	5	30	60	30	14	6
37	Noorkisarui Tumpes	11	15	30		16	3
38	Kashua Naikum	13	45	40	60	40	
39	Benson Sokoine	4	30	21	10	17	
40	Akoi Reson	5	15	10	12	8	
41	Kirkam Murkuk	14	120	50	40	20	4
42	Tongi MeiNgati	3	45	20	10	40	
43	Olpetete Reson	5	15	30		5	
44	Momposhi Reson	12	90	10		10	
45	Oltutu Reson	8	105	30	20	5	3
46	Ntetuka Reson	5	60	12	7	15	
47	Lemoc Reson	4	10	5	30	15	
48	Mwatat Reson	6	60	40	30	25	
49	Kelempu Reson	11	45	25	50	15	
50	Kiaro Turumi	7	30	120	180	30	2
51	Timayio Siloma	8	90	30	40	50	
52	Senchura Mayia	8	45	60	100	25	
53	Kipoin Nayia	7	45	30	25	20	2
54	Nolkisaruni Kiag	9	90	20	30	35	
55	Samuel Seki	5	30	15	10	18	
56	Dominic Meigarakini	5	8	12	5	7	

57	Lulunken Reson	6	60	170	130	45	
58	Ntiaku Nkima	10	90	27	100	70	
59	Olongui Simpano	8	45	28	15	15	
60	Simat Siloma	9	90	10	15	15	6
61	Tompoi Reson	11	90	40	150	40	4
62	Partarakui Reson	4	30	80	40	18	
63	John Mwatat Naikum	4	30	14	40	30	
64	Daniel Mwatat Naikum	6	30	15	18	6	
65	Nolmeyagari Naikum	7	30	30		10	
66	David Patiat	6	15	10			
67	Oloningo Turuni	13	45	50	30	10	
68	Moripet Reson	5	30	40	60	30	
69	Noolaitete Patiat	6	90	30	10	15	
70	Tumate Patiat	7	45	40	60	30	
71	Kamomoi Kiopiro	11	90	80	100	80	12
72	Lekuta Patiat	11	30	10	30	15	
73	Daniel Tinkil	6	30	60	100	40	
74	Parkimalo Tinkil	11	45	50	40	15	
75	James Rocho	10	45	20	100	60	
76	Naboru Baarta	4	45	10	5		
77	Lerionka Baarta	9	45	11	18	20	
78	Sayianka Kiopiro	6	45	18	25	6	5
79	Kasinyenye Murkuk	5	30	40	20	13	
80	Tumpes Murkuk	4	30	10	18	8	
81	Nalepo Kiopiro	6	45	15			
82	Partali Kiopiro	4	15	6	10	11	
83	Kadiko Kiopiro	6	45	48	15	10	3
84	Kumari Murkuk	5	30	5	10	13	
85	Siamata Tumpes	30	60	28	60	30	

86	Nasha Kasiao	6	30	60	60	20	
87	Kapen Kasiao	6	30	35	50	27	2
88	Pempa Seki	5	30	40	30	10	
89	Johana Seki	6	30	18	40	45	
90	Muntet Shuma	8	45	20	40	40	
91	Turere Nayia	7	45	30	70	25	
92	Topiro Turuni	6	45	50	80	65	
93	Mokoroi Koyio	11	90	40	35	20	
94	Oloserian Ngabual	5	30	16	40	30	1
95	Singo Kikonya	7	45	18	32	40	
96	Miton Reson	6	45	70	150	40	
97	Sekento Matipe	8	90	19	60	30	
98	Munkei Siloma	7	45	15	100	80	
99	Liza Olorgeso	7	30	18	10	15	2
100	Kaango Olorgeso	5	30	12	18	10	
101	Noomakaa Reson	4	30	40	60	35	
		723	4598	3289	4717	2573	100
	AVERAGE		46	33	47	25	1

11.4 WRA Authorization Permit



WATER RESOURCES AUTHORITY

South Rift Valley Sub-Region
 RO Box 1029-20500
 NAROK

Tel: 0207907816
 Email: wrmanarok@gmail.com
 narok_sba@wra.go.ke

WRA/NRK/HRD/1/5/18/149

Date: 10th January, 2025.
 The Coordinator,
NAVCDP,
 County Project Coordinating Unit,
 P. O.Box 898-20500
 Narok,

Dear Sir,

RE: NO OBJECTION LETTER FOR OSUKUNUA EARTH DAM CONSTRUCTION-ILKERIN (NAROK SOUTH SUB-COUNTY).

This is in reference to your letter Ref, No. NCG/DOALF/AGR/NAVCDP/GEN/5/VOL.1/11/C dated 10th January 2025 on the above subject.

Water Resources Authority, as a government lead Regulatory Agency on water resources wish to register its appreciation to your department as you plan to support the community improve on their livelihood and avail water to them

The office has No Objection for the intended proposed development however, all the necessary regulatory and compliance requirements as regards Water Act 2016 and Water Resources Regulations 2021 must be fully adhered to before the commencement of the work.



Joshua O. Osio
Sub Basin Area Coordinator

11.5 Survey data

OSUKUNUA IRRIGATION PROJECT.					
CONVEYANCE					
EASTINGS	NORTHINGS	DISTANCE , m	CHAINAGE	ELEVATION	REMARKS

798937.8944	9799003.087	0	0	2112.176	PROPOSED PUMPING STATION
798917.4224	9798962.708	45	45	2119.393	PROPOSED PIPELINE
798892.5047	9798892.878	35	119	2128.936	PPL
798878.9846	9798858.769	37	156	2132.768	PPL
798870.7914	9798803.819	56	212	2136.514	PPL
798861.7519	9798765.132	40	252	2138.189	PPL
798849.7097	9798711.824	55	307	2138.865	PPL
798840.3245	9798676.353	37	344	2139.541	PROPOSED TANK SITE
MAIN LINE					
798840.3245	9798676.353	0	0	2139.541	PROPOSED TANK SITE
798818.5924	9798647.969	38	38	2138.964	ROAD CROSSING OFF TAKE SUB MAIN 2
798805.9121	9798633.273	15	53	2138.477	ROAD CROSSING OFF TAKE SUB MAIN 3
798771.4672	9798591.286	57	110	2136.452	PROPOSED PIPELINE
798739.9408	9798559.752	45	155	2134.138	OFF TAKE SUB MAIN 1
SUB AIN LINE 1					
798739.9408	9798559.752	0	0	2134.138	OFF TAKE SUB MAIN 1
798697.2603	9798614.922	70	70	2133.715	METONI HYDRANT

798651.5627	9798670.182	72	142	2133.158	END METONI LINE
SUBMAIN LINE 2					
798818.5924	9798647.969	0	0	2138.964	ROAD CROSSING OFF TAKE SUB MAIN 2
798842.4248	9798607.106	46	46	2138.454	PROPOSED PIPELINE
798867.5137	9798567.89	47	93	2137.552	PPL
798891.0506	9798527.18	47	140	2136.593	EWANGAN I
798908.8255	9798484.026	46	186	2135.382	NAIBOISH O
798928.6121	9798442.758	46	232	2133.927	PARANAI
798944.2611	9798410.32	36	268	2132.647	PPL
798961.2679	9798374.271	40	308	2131.366	PPL
798975.5592	9798345.443	32	340	2130.086	PPL
798991.2083	9798313.005	36	376	2128.805	PPL
799008.4336	9798276.279	41	417	2127.525	PPL
799022.5064	9798248.128	31	448	2126.244	PPL
799038.1554	9798215.69	36	484	2124.963	END NAKOYANI
SUBMAIN LINE 3					
798805.9121	9798633.273	0	0	2138.477	ROAD CROSSING OFF TAKE SUB MAIN 3
798828.5875	9798596.106	43	43	2137.825	PIPELINE
798850.1562	9798554.734	47	90	2136.998	PPL
798873.902	9798514.344	47	137	2136.138	PPL
798896.2721	9798473.46	47	184	2135.028	PPL

798922.1367	9798419.605	60	244	2132.958	PPL / ROAD CROSSING
798925.9272	9798409.213	11	255	2132.785	ROAD CROSSING / SAILONGI FARMERS GROUP
798946.1042	9798367.989	46	301	2131.243	PPI
798965.9333	9798326.885	46	347	2129.824	PPI
799006.861	9798243.843	47	394	2126.78	PPI
799024.0816	9798209.753	38	432	2125.419	PPI
799042.4221	9798167.972	46	478	2123.757	PPI
799068.4055	9798112.496	61	539	2121.63	END SAINGILO
TBMs					
798733.5199	9799040.782			2121.295	TBM1
798897.9465	9799154.624			2123.609	TBM2
798927.264	9798640.476			2137.17	TBM3

11.6 ESS Screening Checklist

ANNEX 3: ENVIRONMENTAL AND SOCIAL SCREENING CHECKLIST BY BENEFICIARY COMMUNITIES FOR COMMUNITY INVESTMENTS (DEMONSTRATIONS, FLID, EDP ETC)

Section A: Background Information

Name of County.....	KAROK
Name of CPCU - Environmental Safeguards Compliance Officer	
(i) Social Safeguard & Gender Mainstreaming officer.....	ALEX MUTUVA
(ii) County Environmental Compliance Officer.....	ELIJAH MUTUVA
INVESTMENT LOCATION (Include GPRS Co-ordinates)	
Latitude (-1.877508°S) Longitude (35.65964°E)	
Ward.....	LOITA
Zone.....	4 - ELKERIN
Name of CIG/MMG/Group	OSUKUNVA IRRIGATION WATER USERS ASSOCIATION.
Postal Address:	P.O Box, 128-20500 KAROK
Contact Persons	
(i) DAVID RESON..... Cell phone:	0703768197
(ii) KONE KIRONYI..... Cell phone	0702572688
Sub - Project/ Micro project Name	OSUKUNVA EARTH DAM & IRRIGATION PROJECT

Estimated cost (Kshs.).....83,640,522-99.....

Approximate size of land area available for the sub - project.....4 Ha for the Dam and 40 Ha for Irrigation Area......

Objectives of the Sub - project

- To provide water access to 125 farmers to irrigate 40 Ha by 31st December 2025.
- To conserve 397 Ha dams' catchment area by 31st March 2026
- To Build the capacity of the 125 IWUA members on irrigation techniques by 31st March 2026
- To Build the capacity of IWUA committee members on operation and maintenance of the project for sustainability by 31st December 2025
- To increase by 50% local agricultural production by 30th June 2026
- To achieve a 100% market participation for IWUA by 30th June 2026

Activities/enterprises to be undertaken (List)...

- Dam Excavation of 172,384m³ earth dam.
- Construction of Draw off system
- Construction of Silt Trap to control silt flow to the reservoir to control siltation
- Construction of Inlet Channels/spillway to direct and control flow to the reservoir.
- Construction 2 Nos. Ventilated Improved Pit Latrines for sanitation to ensure WASH regulations are adhered to as required
- Construction of 2 No. Cattle Trough for livestock use
- Construction of communal water point for domestic consumption
- Construction of pump house, 225m³ masonry tank and solar pump with accessories to supply water to the elevated tank for irrigation.
- Laying of pipe network including all the reticulation systems feeding water the in fields
- Fencing and environmental protection to protect the dam from unauthorized access and maintain cleanliness and hygiene for users

Section B: Environmental Issues

Will the Subproject/Investment:	Yes	No	Remarks (If yes, elaborate)
Create a risk of increased soil erosion?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>During Construction Phase</u>
Create a risk of increased deforestation?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

Create a risk of increasing any other soil degradation?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	During construction of the dam and laying of the pipe
Affect soil salinity and alkalinity?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Divert the water resource from its natural course/location?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Cause pollution of aquatic ecosystems by sedimentation and agro-chemicals, oil spillage, effluents, etc.?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Introduce exotic plants or animals?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Introduction of exotic plants due to pasture irrigation
Involve drainage of wetlands or other permanently flooded areas?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Cause poor water drainage and increase the risk of water-related diseases such as malaria?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Reduce the quantity of water for the downstream users?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Result in the lowering of groundwater level or depletion of groundwater?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Create waste that could adversely affect local soils, vegetation, rivers and streams or groundwater?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Reduce various types of livestock production?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Be on monoculture cropping?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Affect any watershed?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Focus on Biomass/Bio-fuel energy generation?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

Cause accumulation of solid wastes	<input checked="" type="checkbox"/>	<input type="checkbox"/>	During construction phase of the project
Cause accumulation of liquid wastes	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

If the answers to any of the above is 'yes', please include an ESMP with Subproject application.

Section C: Socio-economic Issues

Will the subproject/Investment:	Yes	No	Remarks (If yes, elaborate how)
Have challenges for women farmers to benefit	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Target vulnerable community members such as physically challenged, Child headed household etc..?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The mitigation project will benefit VMGs and IPs
Interfere with the normal health and safety of the worker/employee?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Reduce the employment opportunities for the surrounding communities?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Reduce settlement (.no further area allocated to settlements)?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Reduce income for the local communities?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Increase insecurity due to introduction of the project?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Increase exposure of the community to HIV/AIDS?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	It might occur due to Labour influx during construction
Induce conflict?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Household conflicts from benefits sharing
Have machinery and/or equipment installed for value addition?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Installation of solar Panel and Water Pumps
Introduce new practices and habits?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Lead to child delinquency (school drop-outs, child abuse, child labour, etc..?)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Lead to gender disparity?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Lead to poor diets?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

Lead to social evils (drug abuse, excessive alcohol consumption, crime, etc.)?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Drug abuse due to Increase Income.
Will engage community labour	<input type="checkbox"/>	<input checked="" type="checkbox"/>	If yes, Community labor engagement agreement required
Lead to exclusion of disadvantaged and vulnerable groups from participating and benefiting from the investments	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Exacerbate social exclusion of other members of the society	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Lead to increase GBV/SEAH issues	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

Section D: Natural Habitats

Will the Subproject:	Yes	No	Remarks (If yes, elaborate)
Be located within or near environmentally sensitive areas (e.g. intact natural forests, mangroves, wetlands) or threatened species?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Adversely affect environmentally sensitive areas or critical habitats – wetlands, woodlots, natural forests, rivers, etc.)?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Affect the indigenous biodiversity (Flora and fauna)?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Cause any loss or degradation of any natural habitats, either directly (through project works) or indirectly?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Affect the aesthetic quality of the landscape?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Reduce people's access to the pasture, water, public services or other resources that they depend on?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Increase human-wildlife conflicts?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Use irrigation system in its implementation?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Section E: Pesticides and Agricultural Chemicals

Will the subproject.....:	Yes	No	Remarks (If yes, elaborate)

Involve the use of pesticides or other agricultural chemicals, or increase existing use?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Agrochemicals will be used for crops production
Cause contamination of watercourses by chemicals and pesticides?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Cause contamination of soil by agrochemicals and pesticides?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Experience effluent and/or emissions discharge?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Involve annual inspections of the producers and unannounced inspections for Export produce?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Require scheduled chemical applications?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Require chemical application even to areas distant away from the focus?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Require chemical application to be done by vulnerable group (pregnant mothers, chemically allergic persons, elderly, etc.)?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

If the answer to the above is 'yes', please consult the **IPMF** that has been prepared for the project to help prepare **IPMP**.

Section F: Indigenous Peoples/VMGs as per ESS7

Are there:	Y	N	Remarks
IP/VMGs living within the boundaries of, or near the project?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Name of the VMG community - Adorobo
Members of VMGs in the area could benefit from the project?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	- They will benefit from the irrigation
IP/VMGs livelihoods to be affected by the subproject?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	If yes, How
Unique/specific challenges for VMGs to benefit from the project	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Explain
VMGs minority in the community	<input type="checkbox"/>	<input checked="" type="checkbox"/>	If yes, Explain/name of minority VMG
Does VMG require to donate land to benefit from the project		<input checked="" type="checkbox"/>	If yes, follow Free, prior and informed consent procedure

If the answer to any of the above is 'yes', please consult the **VMGF** that has been prepared for the project.

Section G: Land Acquisition and Access to Resources

Will the subproject/Investment:	Yes	No	Remarks
Require that land (public or private) be acquired (temporarily or permanently) for its development?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	If yes, elaborate the tenure type <i>Freehold Tenure System</i>
Require that community land be acquired (temporarily or permanently) for its development?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	If yes, elaborate the registration status and community claims. Community land agreement required following principles of FPIC.
Require more than 10 percent of the affected private land parcel	<input type="checkbox"/>	<input checked="" type="checkbox"/>	If yes, exclude from the project proposal
Use land that is currently occupied or regularly used for productive purposes (e.g. gardening, farming, pasture, fishing locations, forests)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	If yes, Elaborate the current use/Prepare IRP
Complete land documents are not available for the sub- project investment?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	If yes, what process is needed?
Is the land proposed have encumbrances?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	If yes, elaborate the encumbrance
Physically displace individuals, families or businesses?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	If yes, exclude from the project proposal
Cause loss of income for more than 30 days	<input type="checkbox"/>	<input checked="" type="checkbox"/>	If yes, how many. Exclude from the project proposal
Result in temporary or permanent loss of crops, fruit trees/fencing and pasture land/ loss of income from business activity?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	If yes, elaborate and prepare IRP
Adversely affect small communal cultural property such as funeral and burial sites, or sacred groves?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	If yes, avoid or exclude from project proposal
Result in involuntary restriction of access by people to legally designated parks and protected areas?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	If yes, exclude
Be on monoculture cropping?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

If the answer to any of the above is 'yes', please consult the mitigation measures in the ESMF.

Section H: Proposed action

(i) Summarize the above:	(ii) Guidance
---------------------------------	----------------------

<input type="checkbox"/> All the above answers are 'No'	<ul style="list-style-type: none"> ● If all the above answers are 'No', there is no need for further action;
<input type="checkbox"/> There is at least one 'Yes'	<ul style="list-style-type: none"> ● If there is at least one 'Yes', please describe your recommended course of action (see below).

(iii) Recommended Course of Action

If there is at least one 'Yes', which course of action do you recommend?

- CPCU, Social services officer, labour Officer, Children Officer and NEMA - CDE will provide detailed guidance on mitigation measures as outlined in the *ESMF*; and
- Specific advice is required from CDE¹, Lead Scientist and CPCUs regarding Sub -project specific Assessment (s) and also in the following area(s)

All Subproject applications/proposals MUST include a completed ESMF checklist. The NAVCDP-CPCU will review the subproject applications/proposals and the CDEs will sign off; The input from the NLC, Social Services office, Children's office, labour office and the CSSCO will be sought before the documents are presented to the CPSC.

The proposals will then be submitted to CPSC for clearance for implementation by communities in the proposed Subprojects. *The projects that require SPRs will be forwarded to NPCU for further analysis and CPRs be forwarded to the World bank for approval and finally to NEMA for clearance certificate (License).*

Expert Advice

The Government of Kenya through the Department of Monuments and Sites of the National Museums of Kenya can assist in identifying and, mapping of monuments and archaeological sites;

Expert guidance will also be provided by the land registrar on all issues related to land tenure, The children department on all issues on children, especially child labour, plus department of social services on IPs/vulnerable groups in the community, and

Subproject specific Environmental and Social impact assessments, if recommended, must be carried out by experts registered with NEMA and be followed by monitoring and review. During the process of conducting an ESIA's the proponent shall seek views of persons who may be affected by the Subproject. The ESS10 requires consultation of Subproject affected groups and disclosure of ESIA's conclusions. In seeking views of the public after the approval of the Subproject, the proponent shall avail the draft ESIA report at a public place accessible to project-affected groups and local NGOs/CSO/SAIC/CDDCs.

¹County Director of Environment and the County Technical Team

Completed by: Vincent Kingua

Name: Vincent Kingua

Position / Community: Lead Export

Date: 11/10/2024

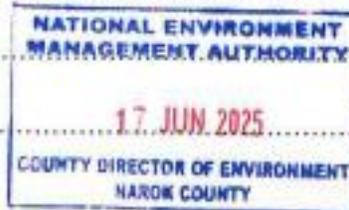
Field Appraisal Officer (NEMA - CDE)

Recommendation SUBMIT A COMPREHENSIVE PROJECT REPORT IN A FORMATS PRESCRIBED IN EIA/EA REGULATIONS 2005

Signature: [Signature]

Stamp

Date



Note:

Project category	Characteristics
High impact	Full and extensive ESIA needed- irreversible environmental impacts; impacts not easy to pick or isolate and mitigation cost expensive; EMP design not easily done; Must have the ESIA done and future annual EAs instituted
Medium impact	Site specific environmental impacts envisaged; mitigation measures are easy to pick, not costly and ESMP needed, design readily done; need an ESIA and future EAs
Low impact	Have minimal or occasionally NO adverse environmental & social impacts; exempted from further environmental processes save environmental audits. Only ESMP required
Land	Land tenure documentation needed and land resolution and consent Form needed with project affected person/community
Loss of income and assets	Income restoration plan needed
Presence of VMG/IP	Additional actions needed
Risk of Child labor/SEAH	Additional actions needed

11.7 Community screening and Entry meeting minutes during public participation

PROCEEDINGS OF THE REHABILITATION AND EXPANSION OF OSUKUNUA EARTH DAM ENVIRONMENTAL AND SOCIAL SCREENING AND LAND ACQUISITION MEETING HELD ON 8th OCTOBER 2024 AT PROPOSED OSUKUNUA EARTH DAM AND IRRIGATION PROJECT SITE.

PRESENT:

S/NO.	NAME	DEPARTMENT/ORGANIZATION	PHONE NO.
1.	Elijah Mututua	NAVCDP	0725135837
2.	Joseph Meriki	DOALF	0712830569
3.	Jamin Rutto	DOALF	0725245481
4.	Mary Marindich	NAVCDP- PoE	0792614408
5.	John Mugo	DOALF	0723014440
6.	David Reson	COOPERATIVE	0703768197
7.	30 community members		

AGENDA:

1. Environmental and Social Screening
2. Land Acquisition
3. Project Sustainability
4. A.O.B

PRELIMINARIES

The meeting began with a word of prayer from the community member Mr. Kone Kironyi and then welcomes Mr. John Mugo the area SCTT who started by welcoming all participants into the baraza and introduced the community members present. He appreciated the proposed project and emphasized that the project would greatly benefit the entire community. Mr. Mugo then welcomed Mr. Elijah Mututua, the County Environmental and Safeguard Compliance Officer (CESCO) to introduce the E&S team.

Mr. Elijah Mututua began by introducing the E&S team and informed the community on the need for the environmental and impact assessment which will enhance project sustainability. He emphasized that it's mandatory for all the projects funded by the World Bank and in addition by the Constitution of Kenya, 2010 and the attendant legislations such as the Environmental

- Pollution
- Insecurity
- Introduction of new habits.

Proposed mitigating Mitigation measures for the anticipated negative impacts

- Putting up road signs to reduce accidents
- Sensitization and awareness
- Adopting proper disposal methods
- Introduction of personal protective equipment
- Presence of a police post/station

Mr. Rutto requested the community members to enumerate some of the potential benefits of the project to the community. To this end, the community members identified the following:-

- Increase milk production
- Increased horticulture production
- Diversification of livelihoods to Chicken and Fish
- Save time used in collecting water
- Save money otherwise used for buying water
- Improve school attendance
- Increase water storage infrastructure
- Enhance employment opportunities
- Increase general household hygiene and sanitation
- Enhance agro-forestry with special interest in temperate fruits

MIN 2/ NAVCDP/ES/2024: LAND ACQUISITION

Mr. Meriki took the meeting through this agenda by beginning inquiring from the community on the nature of land tenure proposed for the project. The community responded that, the nature of land tenure is communal and the transitioning to private ownership is ongoing through adjudication.

After such response from the community, Mr. Meriki then guided the community on the procedure to be followed in land acquisition under such situation.

He indicated that the community should first request a letter from the land adjudication committee confirming the allocation of the land for the proposed development of Osukunua Earth Dam, after acquiring that letter from the land adjudication committee, the community will then seek a non-objection from the District Land adjudication officer to further authenticate such allocation as await the completion of adjudication process and later land titling.

The community appreciated Mr. Meriki for such clear procedure and committed themselves to immediately kick of the process as outlined.

MIN 3/ NAVCDP/ES/2024: PROJECT SUSTAINABILITY

Mrs. Mary Marindich guided the meeting on project sustainability, requirements for a water pan as follows:-

- i. That there should be a water users association to oversee the operations of the project
- ii. That the community should continue to protect the environment, and undertake soil and water conservation in the farms surrounding the water pan
- iii. That the community should continuously repair the fence and other structures associated with the project
- iv. That the community should endeavor to undertake routine meetings to ensure the sustainability of the project and associated enterprises
- v. That the ESMP should be followed to the letter

MIN 4/ NAVCDP/ES/2024: ADJOURNMENT

The E&E team discussed at length with the community members all the areas covered in the ESMMP and emphasized on the important role expected to be undertaken by them to enhance ownership of the project to promote sustainability for the many years the project is expected to serve them. The members thanked the NAVCDP Project for the commendable initiative which would greatly bridge the gap in milk and tomato production through water access.

There being no other business, the meeting was adjourned with a word of prayer

Minutes confirmed by:

Name: Samuel Soki Sign: [Signature] Date: 8/10/2024

Secretary

Name: David Reson Sign: [Signature] Date: 8/10/2024

Chairman



NATIONAL AGRICULTURAL VALUE CHAIN DEVELOPMENT PROJECT (NAVCDDP)
County Project Coordinating Unit

Activity: Environmental Screening for Mkirogi Migration Scheme and O'Somunda Water pan
Venue: O'Sukuma - Laita Ward
Date: 8/10/2024

ATTENDANCE LIST

No.	Name	ID/PP No.	Dep./Org	Desig.	Gender		Age		Contact		Sign
					M	F	<35 Youth	>35 Adult	Phone No.	Email	
1	MWIZITU RESON	41172469			M						
2	Tumpes Mwikuk	87797276			M				079032049	N/A	[Signature]
3	Olsehan Janki	34094787			M				079374462	N/A	[Signature]
4	Simeu Kiara				M				0793367705	N/A	[Signature]
5	SIRE RESON				M				0701534657	N/A	[Signature]
6	JOHNA SEKI	23344889			M				N/A	N/A	[Signature]
7	KONE KIRONYI	23344887			M				0711431810	N/A	[Signature]
8	KIKUM Mwikuk				M				0702573488	N/A	[Signature]
9	OKISANKOI KIROIO				M					N/A	[Signature]
10	Maria Jwili	34135148			M				0725860264	N/A	[Signature]
11	Olau Siloma				M				0710126089	N/A	[Signature]
12	Khustine SEKI	40666060			F				0703263166		[Signature]
13	ITSI RICHARD	88620340			M				071558390		[Signature]
14	Paul KIROIO	21607934			M				072001876		[Signature]
15	DEANIS KOFI	20981233			M				072941785		[Signature]



NATIONAL AGRICULTURAL VALUE CHAIN DEVELOPMENT PROJECT (NAVCDDP)
County Project Coordinating Unit

Activity: Environmental Screening for Mkirogi Migration Scheme & O'Sukuma Water Pan
Venue: O'Sukuma - Laita Ward
Date: 8/10/2024

ATTENDANCE LIST

No.	Name	ID/PP No.	Dep./Org	Desig.	Gender		Age		Contact		Sign
					M	F	<35 Youth	>35 Adult	Phone No.	Email	
1	KONE KIRONYI				M						
2	JOSIAH PAKIRANGI	40576363			M				0702573688	N/A	[Signature]
3	Olmatlak Tumpes				M				0714324753	N/A	[Signature]
4	KARAGA KIRONYI				M					N/A	[Signature]
5	NODONDIKI MUKUK				M				0707764883	N/A	[Signature]
6	Nanyoro KIRONYI	20936141			M				07	N/A	[Signature]
7	NODONDIKI KIRONYI				M				070809132	N/A	[Signature]
8	NODONDIKI KIRONYI				M				070809132	N/A	[Signature]
9	OKTIA KIRONYI	20878587			M				070809132	N/A	[Signature]
10	Olga SIKOTA SIKOTA				M				0710840197	N/A	[Signature]
11	BERSON KIRONYI	41260410			M				0797544237	N/A	[Signature]
12	Godwine Naitani				M				070910010	N/A	[Signature]
13	DAVID RESON	80076673			M				07057688	N/A	[Signature]
14	John MUKUK	50607011			M				07076817	N/A	[Signature]
15	Munk. Joseph	30400660	DOXLE	SKO	M				0702014441		[Signature]

11.8 Community Endorsement and Exit meeting minutes during public participation

PROCEEDINGS FOR THE EXIT MEETING IN THE PROCESS OF THE PREPARATION OF THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) REPORT, FOR THE OSUKUNUA EARTH DAM AND IRRIGATION PROJECT, LOITA WARD, NAROK SOUTH SUB COUNTY, NAROK COUNTY.

Date: 21st January, 2025

Venue: At the proposed project site

Attendance

Community members
(See attached list)

ESIA Team in attendance

1. Joseph Meriki
2. Vincent I. Kinyua

1.0 BACKGROUND

The County government of Narok (Department of Agriculture, Livestock, Fisheries and Irrigation) has received funding from the World Bank under the National Agricultural Value Chain Development Project (NAVCDP), for **proposed** Osukunua Earth Dam and Irrigation Project, **Loita Ward, Narok South Sub County, Narok County.**

The purpose of this baraza was to validate the Environment and Social Management and Monitoring (ESMMP) report, which was developed with the participation of the community. This is a requirement of EMCA, 1999 (Revised in 2016) and the attendant regulations. In Kenya, it is mandatory to involve the community in conceptualization, implementation and operationalization of the project, as dictated by the Constitution of Kenya, 2010.

The main objective of this public participation exercise is to entrench ownership of the project by the community and hence ensure sustainability.

2.0 PROCEEDINGS

This consultative meeting took place on the 21st day of January, 2025 at the project site, from around 10.00 A.M. The aim of the community exit baraza was to validate the Environment and Social Management and Monitoring plan (ESMMP), by the community members.

2.1 Specific Objectives

- 1) To deliberate on the ESMMP, already developed by the ESIA team with the inputs from the community
- 2) To collect and collate further inputs from the community
- 3) To validate the ESMMP plan

- ii. That the community should continue to protect the environment, and undertake soil and water conservation in the farms within the dam catchment
- iii. That the community should continuously repair the fence and other structures associated with the project
- iv. That the community should endeavor to undertake routine meetings to ensure the sustainability of the project and associated enterprises
- v. That the ESMMP should be followed to the letter

9.0. STATUTORY REQUIREMENTS FOR THE PROJECT

Mr. Kinyua, a member of the ESIA committee outlined the following legal requirements for developments in Kenya.

- 1. Article 33 of the Kenya Constitution which states, 'Public participation should respect the freedom of expression of all participants'
- 2. Article 174 (d) of the Kenya Constitution which states, 'Communities have the right to manage their own affairs and to further their development right'
- 3. Article 35 of the Kenya Constitution which states, 'The Constitution guarantees the right to access information by citizens'
- 4. Article 174 (c) of the Kenya Constitution which states, 'Objects of the devolution are to give powers of self-governance to the people and enhance their participation in the exercise of such powers in decision making'
- 5. Chapter 4, Article 42 of the Constitution and Section 3 of EMCA, which states that 'Every Kenyan has a right to a clean and healthy environment'
- 6. Article 69 (2) of the Kenya Constitution which states, 'Every person has a duty to co-operate with state organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources'

10.0 WAY FORWARD/RECOMMENDATIONS

The community members unanimously validated the ESMMP plan for the water project.

Mr. Meriki, a lead expert, confirmed that the community will be furnished with the ESIA once it's completed.

The meeting was closed by a word of prayer from one of the community members at around 12.00 pm.

Minutes confirmed by:

Name: Samuel Saki Sign: [Signature] Date: 21/01/2025
Secretary

Name: David Rason Sign: [Signature] Date: 21/01/2025
Chairman



NATIONAL AGRICULTURAL VALUE CHAIN DEVELOPMENT PROJECT (NAVCDF)
County Project Coordinating Unit
NAROK

Activity: Osukuma Earth Dam Environmental and Social Impact assessment - Exit Barza
Venue: Osukuma Earth Dam Site
ATTENDANCE LIST Date: 21/01/2025

No.	Name	ID/PP No.	Dep./Org	Desig.	Gender		Age		Phone No.	Contact		sign
					M	F	<35 Youth	>35 Adult		Email		
1	Tumosi Patai	23394751										
2	Danson Patai	29641483										
3	Josphat Kera	2032565										
4	OKetuk Karonyi	24422998										
5	Moras Koroim S chief	5975171										
6	HANE KIRANTI	22294827										
7	TOM PATIAT	28466016										
8	RAKONCHA KIRANTI	25919588										
9	ATEJI RAIRO	28630340										
10	Kemoi RAIRO											
11	Daniel Mlagi Takal	35269145										
12	Musigo Mwangi Kibera	2942268										
13	Kuriam Mwangi											
14	Munyari Mwangi											
15	Mwangi Mwangi											

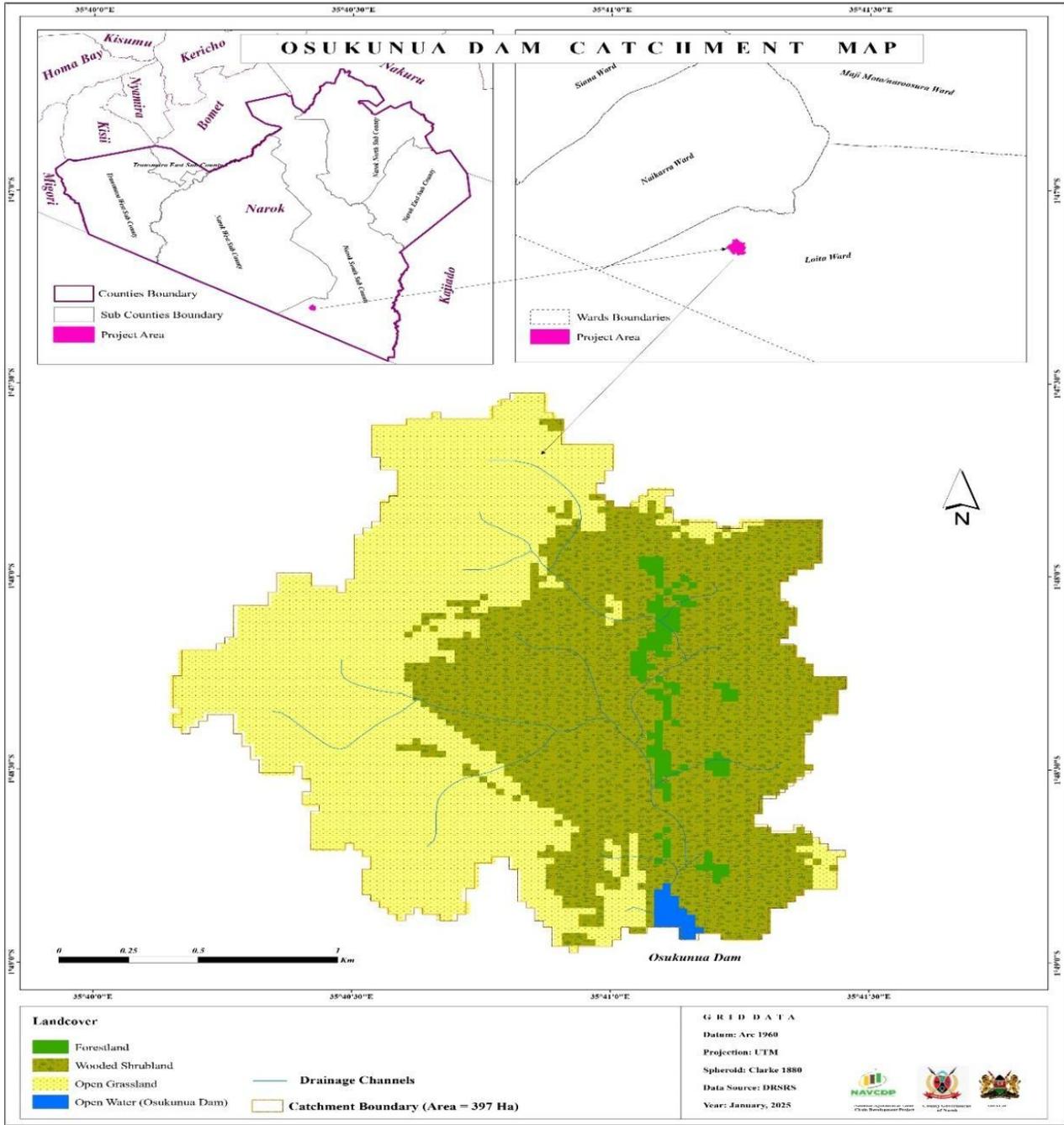


NATIONAL AGRICULTURAL VALUE CHAIN DEVELOPMENT PROJECT (NAVCDF)
County Project Coordinating Unit
NAROK

Activity: Osukuma Earth Dam Environmental and Social Impact assessment - Exit Barza
Venue: Osukuma Earth Dam Site
ATTENDANCE LIST Date: 21/01/2025

No.	Name	ID/PP No.	Dep./Org	Desig.	Gender		Age		Phone No.	Contact		sign
					M	F	<35 Youth	>35 Adult		Email		
1	Juni Mwai	12982235										
2	Dumiles Lesile	822076556										
3	Kamman Kipiro											
4	Sira Rapon	20565210										
5	Karoko Koroim	20565202										
6	James Kari	50980097										
7	MUANIWA N KARA	9775192										
8	Peter Kipiro	2607924										
9	Atumati Kikonyo											
10	Kisim Koi Kikonyo											
11	Siloma Kaitano	21180399										
12	Kuriga Kikonyo	76033951										
13	Manka Joseph	30800262	ACTIF	STC								
14												
15												

11.10 Project Site Map



11.11 Summary of Bills of Quantities

SUB-TOTAL BROUGHT TO SUMMARY					
					6,060,000.00
1	Preliminary and General Items				40,410,920.00
2	Pan Excavation				3,443,835.00
3	Draw off system				1,840,000.00
4	Silt Trap				1,378,790.00
5	spilway				811,940.00
6	2Nos, VIP Latrines				413,000.00
7	Cattle Trough				39,780.00
8	Communal water point				4,485,000.00
9	Fencing				9,610,939.00
10	Pipe works				5,691,980.00
11	Pump house, accessories and pump house				3,948,580.00
12	225M3 masonry tank				78,134,764.00
	Sub Total				3,906,738.20
	5% Contingency				82,041,502.20
	TOTAL				1,599,040.00
	Community contribution				83,640,542.20
	TOTAL COST OF PROJECT				



11.12 Way leave for Pipeline infrastructure to pass in Beneficiaries Parcels of Land

MINUTES OF PUBLIC CONSULTATION MEETING OF OSUKUNUA EARTH DAM AND IRRIGATION PROJECT ON WAYLEAVE HELD ON 11th JUNE 2025 AT PROPOSED OSUKUNUA EARTH DAM AND IRRIGATION PROJECT SITE.

1. ATTENDANCE

The meeting was attended by:

- Area Chief – Ilkerin Location
- Assistant Chief – Ilkerin Sub-location
- Representatives from the County Government of Narok
- Project consultants (Environmental and Social experts)
- Local opinion leaders
- Members of Osukunua Community
- Representatives of the local Irrigation Water Users Association (IWUA)
- Youth representatives

2. OPENING REMARKS

The meeting was officially opened by the Area Chief, who welcomed all participants and emphasized the importance of the Osukunua Earth Dam and Irrigation Project in improving local livelihoods, water security, and food production.

3. PROJECT OVERVIEW

The Project lead expert (Mr. Kinyua) gave an overview of the Osukunua Earth Dam and Irrigation Project. Key points included:

- Project scope and location
- Purpose and benefits of the project (irrigation, livestock watering, domestic water supply)
- Technical components: dam wall, reservoir, canals, intake structures, access roads
- Need for **wayleave acquisition** to allow laying of irrigation infrastructure through community land

4. COMMUNITY ENGAGEMENT

The community members were taken through the concept of **wayleave** and its legal and practical implications. It was clarified that:

- The wayleave will not result in land ownership transfer
- The project team will maintain open communication with affected persons
- Grievance redress mechanisms will be established and operational

5. COMMUNITY FEEDBACK AND DISCUSSIONS

- Members expressed appreciation for the project and recognized its value in enhancing water access and agricultural productivity.
- Concerns were raised about potential displacement, loss of grazing areas. This was clarified by the expert that, the wayleave will not result to any form of displacement and loss of grazing area.
- It was agreed that local youth and artisans should be prioritized in employment opportunities during project implementation.

6. RESOLUTION AND CONSENT

- After detailed deliberations, the community members: **Unanimously accepted the allocation of a wayleave** through Osukunua community and individual land for the implementation of the Earth Dam and Irrigation Project as evince by the wayleave consent signed by the community.
- Requested that the wayleave route be clearly marked and minimal disruption to settlements and grazing areas be ensured.

7. Closing Remarks

The Assistant Chief thanked all members for their constructive participation and reiterated the government's commitment to ensure that the community benefits from the project. The meeting was adjourned at 1:00 PM.

Minutes confirmed by:

Name: Samuel Seki Sign:  Date: 11/06/2020

Secretary

Name: David Reson Sign:  Date: 11/06/2020

Chairman

APPLICATION FOR WAY LEAVE

PARTICULARS OF APPLICANT		DETAILS	
1. Full name of applicant(s) (In Block Letters)		Osukuma Irrigation water user Associa	
2. Category of Applicant - Individual, Group [Association, Society], Company, Institution		Association	
3. ID Number of Applicant (Individual) or Certificate of incorporation or Registration for Groups or Companies		BSD/33/181/01/47122	
4. PIN Number (where available)			
Physical Address where water is to be used		Contact Address of Applicant	
5. Village (s)	Osukuma	10. Box Number	128
6. Sub-location(s)	Ikenin	11. Town	Marok
7. Location(s)	Loita Ikenin	12. Post Code	20500
8. Ward	Loita	15. Telephone Contact(Mobile)	0703768197
9. Sub-County	Marok South	16. Email Contact	daradason@gmail.com

In respect of an easement of aqueduct in connection with the passage of water

Osukuma Earth Dam [Description and name of body of water]

Across the property Osukuma Irrigation Project [Description of property]

And in respect of an easement of work in connection with the water from the

Osukuma Earth Dam [body of water]

1. The applicant named above is the landholder [or agent lawfully authorized by the landholder] of the property Osukuma Irrigation Project [Description of property and L.R. (Nos) of farms (if any)]

2. The following is a description of the work[s] in respect of which [an] easement [s] of work is [are] Required

Irrigation Primary Pipeline development

3. The maximum quantity of water to be conveyed or dealt with by the aqueduct

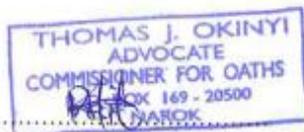
Is..... 179m³cubic meters per day.

4. The easement of aqueduct is required for a period of..... Project duration

AFFIDAVIT

I, David Reson (Chairperson) of
Osakunna Inyaha Water users Association do solemnly and sincerely declare as follows;
I have read the foregoing and the particulars and things set out therein are true and accurate.
I make this declaration conscientiously believing the same to be true, and according to the oath and
Statutory Declarations Act.

Sworn this 17th Day of June 2025



(Magistrate or Commissioner
for Oaths)

SCHEDULE OF LAND HOLDER							
S/NO	Name of Farmer/Landholder	Phone Number	ID Number	Area of Way leave required (area /Km)	Purpose for which way leave is required	Does the person agree to the claim for way leave (Yes/No)	Signature of the Landholder
1	PARTARAKI RESOH	0759753058	37352056	0.18	irrigation pipeline	YES	<i>[Signature]</i>
2	KONE KIROHJI	0701668906	24840371	0.12	irrigation pipeline	YES	<i>[Signature]</i>
3	MWIATAT NAIKUNI	0746672088	20833685	0.13	irrigation pipeline	YES	<i>[Signature]</i>
4	LESILGE TUMPES	0746653979	29210565	0.15	irrigation pipeline	YES	<i>[Signature]</i>
5	Sarah Royoei	0715595091	71166033	0.17	irrigation pipeline	YES	<i>[Signature]</i>
6	Muscya Meingati	0710466453	24262606	0.17	irrigation pipeline	YES	<i>[Signature]</i>
7	DANIEL TIMGIL	0719895182	24893468	0.19	irrigation pipeline	YES	<i>[Signature]</i>
8	JOHNA SEKI	0711827629	26066754	0.14	irrigation pipeline	YES	<i>[Signature]</i>
9	SAMUEL SEKI	0712695750	21672204	0.12	irrigation pipeline	YES	<i>[Signature]</i>
10	MOROGO RESOH	0727709942	21313495	0.15	irrigation pipeline	YES	<i>[Signature]</i>
11	MARIA MEINGATI	0726423814	26185274	0.16	irrigation pipeline	YES	<i>[Signature]</i>
12	MOSIM NAIKUNI	0794177858	29619357	0.17	irrigation pipeline	YES	<i>[Signature]</i>
13	NOOLMESHUKI TEMPES	0701692791	11347936	0.13	irrigation pipeline	YES	<i>[Signature]</i>
14	MALEKU SEKI	0741449513	27781198	0.18	irrigation pipeline	YES	<i>[Signature]</i>
15	PARMUAT KOYOEI	0703856465	20843817	0.12	irrigation pipeline	YES	<i>[Signature]</i>
16	LINET PATIAT	0703856467	2285193	0.19	irrigation pipeline	YES	<i>[Signature]</i>
17	NAISIAHOI SEKI	0714433968	34563783	0.15	irrigation pipeline	YES	<i>[Signature]</i>
18	ANNAH RESOH	0758367529	2467056	0.14	irrigation pipeline	YES	<i>[Signature]</i>
19	MEGWARA RESOH	0745351541	11533452	0.14	irrigation pipeline	YES	<i>[Signature]</i>
20	MELYO KIROHJI	0720221761	34769067	0.12	irrigation pipeline	YES	<i>[Signature]</i>

pg. 3

SCHEDULE OF LAND HOLDER							
S/NO	Name of Farmer/Landholder	Phone Number	ID Number	Area of Way leave required (area /Km)	Purpose for which way leave is required	Does the person agree to the claim for way leave (Yes/No)	Signature of the Landholder
21	JOSPHAT KONO	0712170544	9656797	0.1	irrigation pipeline	YES	<i>[Signature]</i>
22	LEHTANO SILOMA	0714454418	40758451	0.13	irrigation pipeline	YES	<i>[Signature]</i>
23	TATE MAOI	0701605112	24918547	0.19	irrigation pipeline	YES	<i>[Signature]</i>
24	KEREMPE TIMKIL	0724356236	27744935	0.17	irrigation pipeline	YES	<i>[Signature]</i>
25	NALANGU NGABUAL	0720072131	24820568	0.18	irrigation pipeline	YES	<i>[Signature]</i>
26	TUMPES MURKUK	0742871000	4034501	0.16	irrigation pipeline	YES	<i>[Signature]</i>
27	MUSA KIPILO	0729166201	3077874	0.14	irrigation pipeline	YES	<i>[Signature]</i>
28	OLOSERIN KANBIAL	0718648334	20236472	0.15	irrigation pipeline	YES	<i>[Signature]</i>
29	NAISHIRO KIPILO	0799766020	24462261	0.1	irrigation pipeline	YES	<i>[Signature]</i>
30	NAIOLAANG PATIAT	0745821840	24046947	0.12	irrigation pipeline	YES	<i>[Signature]</i>
31	SARUNI MURKUK	0751000757	12506016	0.18	irrigation pipeline	YES	<i>[Signature]</i>
32	MOSES MAOI	0742319173	9657245	0.12	irrigation pipeline	YES	<i>[Signature]</i>
33	DAVID PATIAT	0790027578	29308198	0.1	irrigation pipeline	YES	<i>[Signature]</i>
34	MESHUKO KIPILO	0797583112	34884402	0.1	irrigation pipeline	YES	<i>[Signature]</i>
35	KIPILO KIPILO	0708401828	5699380	0.14	irrigation pipeline	YES	<i>[Signature]</i>
36	SAYANKA KIPILO	0708293107	124797	0.16	irrigation pipeline	YES	<i>[Signature]</i>
37	MALEKO KIPILO	0716033541	34583924	0.17	irrigation pipeline	YES	<i>[Signature]</i>
38	NOOLAREWA MURKUK	0746449032	24246120	0.18	irrigation pipeline	YES	<i>[Signature]</i>
39	CHRISTINE TIMKIL	0710218900	29294602	0.19	irrigation pipeline	YES	<i>[Signature]</i>
40	NAISHIRO RESOH	0743259620	31956098	0.15	irrigation pipeline	YES	<i>[Signature]</i>
41	SETU RESOH	0717525258	36263224	0.14	irrigation pipeline	YES	<i>[Signature]</i>

pg. 4

SCHEDULE OF LAND HOLDER							
S/NO	Name of Farmer/Landholder	Phone Number	ID Number	Area of Way leave required (area /Km)	Purpose for which way leave is required	Does the person agree to the claim for way leave (Yes/No)	Signature of the Landholder
42	MOOLPARAKUP RESON	0796630210	2895688	0.15	Irrigation pipeline	YES	[Signature]
43	JANE MAOI	0765949887	2380500	0.13	Irrigation pipeline	YES	[Signature]
44	EVALYNE SILOMA	0704849611	29186095	0.13	Irrigation pipeline	YES	[Signature]
45	MOOS-PUKI RESON	0722144969	35628377	0.16	Irrigation pipeline	YES	[Signature]
46	NONLAIRETUA RESON	0745501571	8750575	0.19	Irrigation pipeline	YES	[Signature]
47	NAISWAKU KIRONTI	0743849146	35635522	0.17	Irrigation pipeline	YES	[Signature]
48	NAKAYIAN MURKUK	0741887801	248145630	0.19	Irrigation pipeline	YES	[Signature]
49	KAPEEN MURKUK	0700710873	9056801	0.18	Irrigation pipeline	YES	[Signature]
50	KABIKO MURKUK	0741890043	27504975	0.13	Irrigation pipeline	YES	[Signature]
51	NATUMA KIPIRO	0715118841	2582621	0.14	Irrigation pipeline	YES	[Signature]
52	NOONKISHU KIPIRO	0797045754	4192792	0.15	Irrigation pipeline	YES	[Signature]
53	ESUPAT TURUNI	0721167964	11015394	0.17	Irrigation pipeline	YES	[Signature]
54	SIAMANTA TOMDES	0703198528	6156123	0.17	Irrigation pipeline	YES	[Signature]
55	MOOLAMALA KIRONTI	0712932199	11533647	0.15	Irrigation pipeline	YES	[Signature]
56	MOOLAMALA KIRONTI	0712684692	20879850	0.19	Irrigation pipeline	YES	[Signature]
57	NAHTORRI KIRONTI	0706955365	29171355	0.12	Irrigation pipeline	YES	[Signature]
58	SAHICILU KIRONTI	0729577145	28825706	0.18	Irrigation pipeline	YES	[Signature]
59	ESUPAT KIRONTI	0729857145	11219474	0.124	Irrigation pipeline	YES	[Signature]
60	OKOTUK KIRONTI	0702616900	910003	0.11	Irrigation pipeline	YES	[Signature]
61	Patrick MURKUK	0724014345	37641241	0.1	Irrigation pipeline	YES	[Signature]
62	NARIKUNEHINGERA SILOMA	07222155699	36299680	0.12	Irrigation pipeline	YES	[Signature]

pg. 5

SCHEDULE OF LAND HOLDER							
S/NO	Name of Farmer/Landholder	Phone Number	ID Number	Area of Way leave required (area /Km)	Purpose for which way leave is required	Does the person agree to the claim for way leave (Yes/No)	Signature of the Landholder
63	MOOLKILEKU MURKUK	0724647358	26314521	0.1	Irrigation pipeline	YES	[Signature]
64	NANIKAJI SHUMA	0713657288	1274459	0.1	Irrigation pipeline	YES	[Signature]
65	GLADYS MURKUK	0794362724	25475893	0.19	Irrigation pipeline	YES	[Signature]
66	NORETET NKIBINGA	0769364663	36559300	0.18	Irrigation pipeline	YES	[Signature]
67	NALOTUESHA SHUMA	0712348837	236265899	0.16	Irrigation pipeline	YES	[Signature]
68	NELOITA MURKUK	0722544427	2929964	0.17	Irrigation pipeline	YES	[Signature]
69	LANKISA MURKUK	0707535701	32106612	0.14	Irrigation pipeline	YES	[Signature]
70	KITIPAI SILOMA	079773536	3531112	0.1	Irrigation pipeline	YES	[Signature]
71	KISONKAI KIRONTI	0701026736	12807017	0.12	Irrigation pipeline	YES	[Signature]
72	SANTABOR KIRONTI	0723968711	11533449	0.11	Irrigation pipeline	YES	[Signature]
73	MESHUKO KIRONTI	0712911865	12987494	0.1	Irrigation pipeline	YES	[Signature]
74	MUNDET SHUMA	0729013460	23202747	0.11	Irrigation pipeline	YES	[Signature]
75	NOLARI SHUMA	0765585706	23202671	0.12	Irrigation pipeline	YES	[Signature]
76	MASEK SHUMA	0758488784	24700643	0.12	Irrigation pipeline	YES	[Signature]
77	BENSON KIRONTI	0741412856	29255243	0.12	Irrigation pipeline	YES	[Signature]
78	KURSAS MALI	0704280866	147143830	0.13	Irrigation pipeline	YES	[Signature]
79	MOOSUPUKI MURKUK	0725784081	12306605	0.19	Irrigation pipeline	YES	[Signature]
80	MOOHTAWUA KUKUMAD	0708204983	8815971	0.14	Irrigation pipeline	YES	[Signature]
81	MOOHTAWUA RESON	0719720543	12932551	0.18	Irrigation pipeline	YES	[Signature]
82	KIRKAM MURKUK	070711116	26900055	0.1	Irrigation pipeline	YES	[Signature]
83	NAISWAKU MURKUK	0702025284	9174702	0.1	Irrigation pipeline	YES	[Signature]

pg. 6

SCHEDULE OF LAND HOLDER							
S/NO	Name of Farmer/Landholder	Phone Number	ID Number	Area of Way leave required (area /Km)	Purpose for which way leave is required	Does the person agree to the claim for way leave (Yes/No)	Signature of the Landholder
84	NALOTUESHA MURKUK	0710273663	24452075	0.1	Irrigation pipeline	YES	
85	MOKOROI KOTEI	073322415	24047013	0.19	Irrigation pipeline	YES	
86	NAIDOSHI GIEZO	0790057026	12983561	0.17	Irrigation pipeline	YES	
87	PEMBA SEKI	074442956	30489328	0.3	Irrigation pipeline	YES	
88	KELEMPU RESON	011340344	3972848	0.15	Irrigation pipeline	YES	
89	LERONCHO MURKOK	0711186478	32520013	0.1	Irrigation pipeline	YES	
90	NOLOSIO KEKU	0792850646	9174132	0.19	Irrigation pipeline	YES	
91	NARAMAT RESON	0728376735	12421201	0.18	Irrigation pipeline	YES	
92	KAISEYIE SILOMA	0704280866	29292962	0.12	Irrigation pipeline	YES	
93	SELHA KIARA	0725784081	12983551	0.14	Irrigation pipeline	YES	
94	SORDUA KOIN	0711400034	22965945	0.14	Irrigation pipeline	YES	
95	KAIKI KOTOEI	0769825565	39827023	0.17	Irrigation pipeline	YES	
96	KAIKI KOTOEI	0729867965	29200055	0.16	Irrigation pipeline	YES	
97	KAKANJA KIROHTI	0728745678	35158660	0.12	Irrigation pipeline	YES	
98	TODIKA MENGATI	0708299983	20860015	0.15	Irrigation pipeline	YES	
99	NOONTOMOH MENGATI	0722583151	22767513	0.18	Irrigation pipeline	YES	
100	NOONTOMOH KOTOEI	0708034888	28971112	0.12	Irrigation pipeline	YES	
101	TODIRO TUPUNI	0711545013	30286657	0.15	Irrigation pipeline	YES	
102	KIARO TUPUNI	0701104206	28255407	0.16	Irrigation pipeline	YES	
103	SENCHURA NATIA	0717079758	25712528	0.13	Irrigation pipeline	YES	
104	NOULWANTAI NATIA	0757356968	9883738	0.14	Irrigation pipeline	YES	

pg. 7

SCHEDULE OF LAND HOLDER							
S/NO	Name of Farmer/Landholder	Phone Number	ID Number	Area of Way leave required (area /Km)	Purpose for which way leave is required	Does the person agree to the claim for way leave (Yes/No)	Signature of the Landholder
105	TURERE NATIA	0703334980	20533590	0.1	Irrigation pipeline	YES	
106	OLOLEPO MURKUK	0700298137	36807636	0.19	Irrigation pipeline	YES	
107	OLKISONKOI KIPIRO	0742359174	35637545	0.17	Irrigation pipeline	YES	
108	OLOSHIRO KIROHTI	0708934604	29171779	0.18	Irrigation pipeline	YES	
109	KASHAU NAIKUMI	071109335	36822246	0.16	Irrigation pipeline	YES	
110	ATETI RESON	0708373791	29146225	0.1	Irrigation pipeline	YES	
111	MURUMET RESON	0728604477	300886935	0.18	Irrigation pipeline	YES	
112	MITOH RESON	0791013538	40550437	0.1	Irrigation pipeline	YES	
113	NOOLKISHU BURUM	0796365552	30764873	0.15	Irrigation pipeline	YES	
114	KONINI RESON	0745968976	8031909	0.13	Irrigation pipeline	YES	
115	SANINGO MAOI	0758647811	11533405	0.1	Irrigation pipeline	YES	
116	MENGORU RESON	0701924519	2174702	0.1	Irrigation pipeline	YES	
117	LEMPAPA KIROHTI	0740712761	29255243	0.1	Irrigation pipeline	YES	
118	KENTONIAN SILOMA	0719720307	41743830	0.12	Irrigation pipeline	YES	
119	OLEBUKU SILOMA	0791394514	372722091	0.16	Irrigation pipeline	YES	
120	LEMOI RESON	0724519177	37997988	0.16	Irrigation pipeline	YES	
121	LENINGET RESON	0727943669	12306605	0.16	Irrigation pipeline	YES	
122	MOSEKA RESON	0707118153	26986889	0.15	Irrigation pipeline	YES	
123	LEMATIAN MURKUK	0708430392	35540448	0.14	Irrigation pipeline	YES	
124	LEKUTA PATIAT	0798404151	34720777	0.12	Irrigation pipeline	YES	
125	TUMATE PATIAT	24033061	81011142	0.13	Irrigation pipeline	YES	

pg. 8

11.13 Lead Expert certificate



NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

ENVIRONMENT MANAGEMENT AND COORDINATION ACT, Cap 387

Experts License - Associate/Lead Experts

License No.: **NEMA/ENVIS/EL/0347**

Application Reference No: **NEMA/ENVIS/ELA/03352**

M/S VINCENT IRERI KINYUA

(individual or firm) of (address) P.O.BOX 20500, 20500,Narok

is licensed to practice in the capacity of a **Lead Expert** registration number **NEMA/ENVIS/EL/0347** in accordance with the provision of the Environmental Management and Coordination Act cap 387.

Issued Date: **7th January 2026**

Expiry Date: **31st December 2026**

A handwritten signature in black ink, enclosed in a hand-drawn oval.

David Ongare

For DIRECTOR GENERAL

National Environment Management Authority

11.14 Pictorial



11.15 Hydrological Assessment Report



**NATIONAL AGRICULTURAL VALUE CHAIN DEVELOPMENT PROJECT
(NAVCDP)**

COUNTY PROJECT COORDINATING UNIT
PO BOX 898-20500 Narok, Kenya
Off Mau Narok - Nakuru Road, Narok Town

**HYDROLOGICAL ASSESSMENT REPORT
OSUKUNUA EARTH DAM PROJECT**

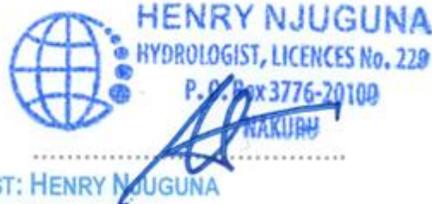
NAROK COUNTY

JANUARY 2025

Client: Osukunua Earth Dam Self Help Group in Loita Narok

Assignment: Develop Hydrological Assessment Report for abstraction and Obstruction of water for storage for a small-scale community irrigation project.

Report Title: Hydrological Assessment Report on Osukunua Earth Dam and Irrigation project in Ilmarai Sub location, Ilkerin Location, Loita Ward. Narok South Sub County in Narok County. The proposed volume for harvesting and storing is about 172,000 cubic metres.



INVESTIGATING HYDROLOGIST: HENRY NJUGUNA

DATE... 17 Jan 2025

Table of Contents

1. Name and details of Applicant	5
2. Location and description of proposed activity	5
3. Details of Climate	7
4. Details of river or water body	10
5. Details of catchment	11
6. Details of Registered and Non registered Abstraction on the resource	13
7. Details of all other permits related to this application	13
8. Hydrological characteristics and analysis	13
Basin Model.....	14
Meteorological Model	14
SCS Curve Number Method.....	14
SCS Hydrologic Soil Groups	15
Model Approach	15
Input Data for the HEC-HMS Basin Model.....	16
Computation of Hydrologic Parameters.....	16
Osukunua Flow.....	17
Analysis of the Reserve	19
Impact of proposed activity.....	20
Recommendations on Proposed Activity.....	20
References.....	21

List of Figures

Figure 1: Group Registration Certificate	5
Figure 2: Osukunua Site Access through C11 from Narok Town.....	6
Figure 3 Osukunua Proposed Dam Statistics.....	6
Figure 4 Annual Rainfall in the catchment upstream of the proposed Dam.....	8
Figure 5 Annual rainfall in and around Osukunua	8
Figure 6 Monthly totals rainfall over the Osukunua catchment.....	9
Figure 7 mean annual rainfall over Osukunua catchment.....	10
Figure 8 Position of Osukunua Sub catchment in relation to Lake Natron.....	11
Figure 9 Osukunua sub catchment falls in vast rangeland with patches of forest.....	12

Figure 10 Elevation classification in the catchment upstream of the proposed Dam.....	12
Figure 11 slope classification in the catchment upstream of the proposed Dam.....	12
Figure 12 Landforms in the catchment upstream of the proposed Dam.....	13
Figure 13 Topographic Wetness Index in the catchment upstream of the proposed Dam.....	13
Figure 14 Stream inflow at the proposed dam site	17
Figure 15 peak annual Flow at the proposed dam fitted to Gumbel Statistical Distribution.	18

List of Tables

Table 1 Osukunua catchment statistics.....	14
Table 2 Osukunua Basin attributes.....	16
Table 3 Flood Magnitudes for return periods of 2,5,10,25,50 and 100 year.....	18
Table 4 harvestable volume in average year, driest years.....	19
Table 5 Classification of Dams.....	19
Table 6 Return Period Criteria for Design Purposes	19
Table 7 inflow Statistics to the proposed Osukunua Dam.....	19

1. Name and details of Applicant

The applicant is Osukunua Earth Dam Self Help Group. The group's certificate of registration issued on 12th February 2025 is under the Community Group Registration Act, No. 30 of 2022 is DSD/33/181/01/69208. The contact person is Mr. Kone Kironyi (Chairperson Osukunua Earth Dam) +254 702 573 688 / +254 707 650 477.

Figure 1: Group Registration Certificate

2. Location and description of proposed activity

Osukunua Earth Dam and Irrigation project is located in Ilmarai Sub location, Ilkerin Location, Loita Ward. Narok South Sub County in Narok County (figure 2)

Osukunua Earth Dam was first constructed in the year 1976 with assistance from Norwegian Agency for Development Co-operation (NORAD) and sits in a 4 Ha piece of land. The Dam has served the community well for over 48 years, however, over time silt has accumulated and significantly reduced dam's storage capacity and thus require to be desilted and expanded to increase its capacity from 70,000m³ to 172,000 m³ to supply water for domestic and livestock to an estimated 3,600 direct beneficiaries and also for irrigation of 40ha small scale community irrigation scheme. The beneficiaries are organized into a Water Users Association (WUA) comprising of 125 community members and interim management committee of 15-members comprising of 11 males and 4 females.

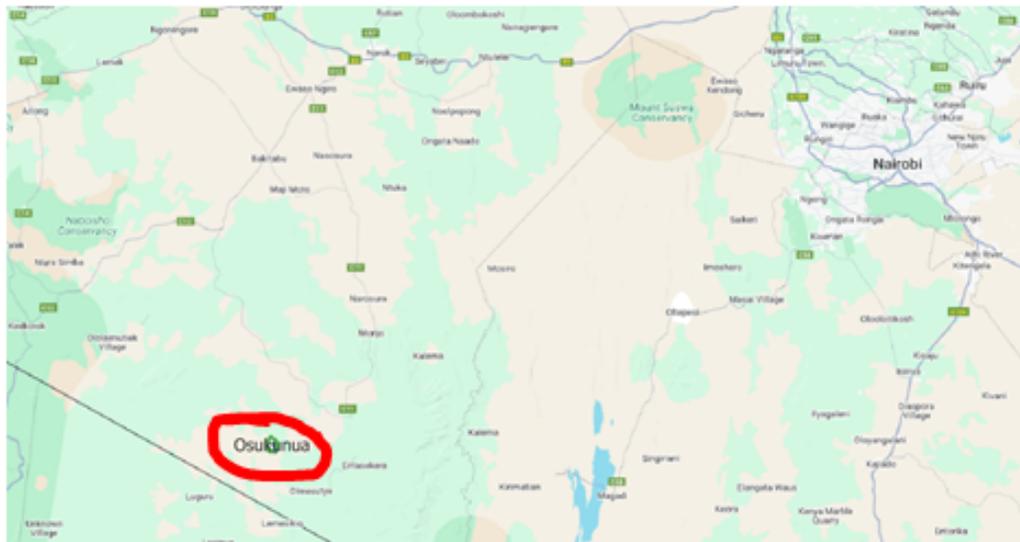


Figure 2: Osukunua Site Access through C11 from Narok Town

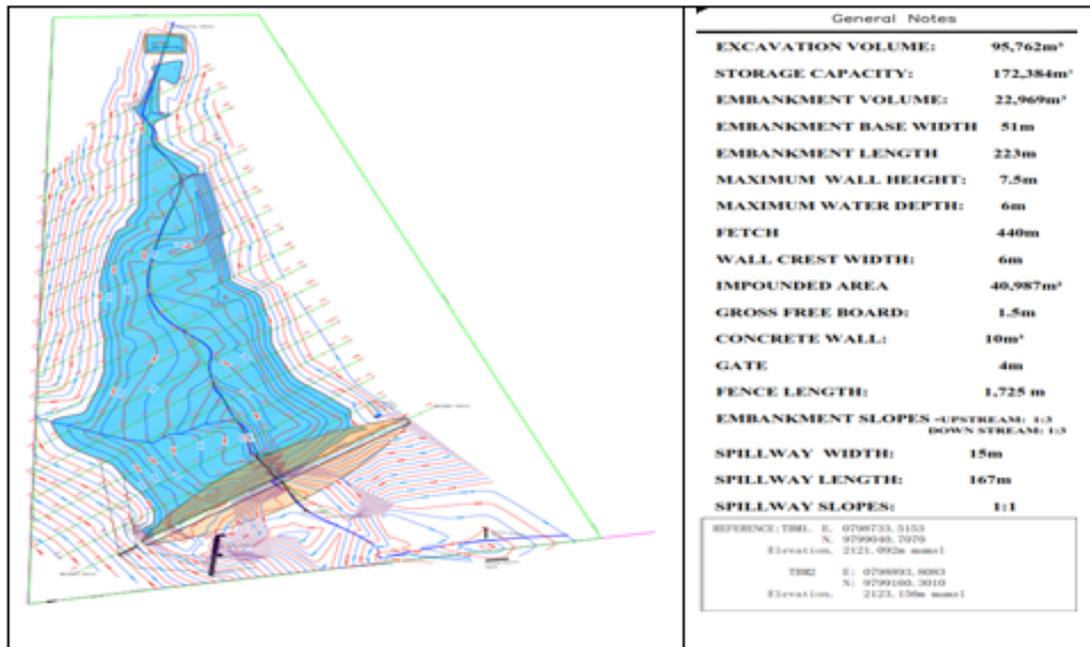


Figure 3 Osukunua Proposed Dam Statistics

3. Details of Climate

The climate experienced in the Osukunua and generally in the upstream of Lake Natron within the Loita Hills is part of the east African climate which has been described by among other Ogallo (1993) who identified rainy seasons namely the long' rains (March to May) and the 'short' rains (October to December) and associated with the northward and southward movement of the Intertropical Convergence Zone (ITCZ), respectively rainfall.

The sub catchment falls within a upslope altitude compared to the surroundings terrain. The area's rainfall is characterized from long term data obtained and downloaded from Climate Hazards Infrared Precipitation with Stations (CHIRPS) web site (<http://chg.geog.ucsb.edu/data/chirps/>). The area mean annual rainfall is 858.69mm (Figure 4) against a 679 mm of the whole of Kenya (The National Water Master Plan 2030). The area rainfall is characteristic of that in east Africa widely reported by Ogallo (1993) and consists of two season, that of March, April and May (MAM) and the 'short' rains October to December (OND). This is associated with the northward and southward movement of the Intertropical Convergence Zone (ITCZ), respectively. However, a third peak season as strong as that of MAM experienced in July and August in all stations in Rift Valley has been observed. Beltrando, (1990) categorized the seasons as: March–May, June–September and October– December. Rainfall over the years shows anomalously high rainfall as falling in the years 1989, 1997, 1998, 2001, 2002, 2006, 2010, 2012, 2013, 2015, 2019, 2020. Spectral analysis by Ogallo (1979) shows a 5–6

years peak. Annual rainfall series in the region indicate an oscillatory characteristic with no significant trend (Figure 4).

In East Africa, the controlling factor for vegetation types is generally accepted to be climate, and in particular, rainfall and temperature and their combined effect on moisture availability. As reported, there is a close correlation between these variables and altitude (Vincens and Casanova, 1987) and some authors have demonstrated clearly the importance to vegetation type of the rainfall/altitude relation (Trapnell and Griffiths, 1960). This phenomenon is well shown in the Natron-Magadi basin where Loita Hills fall, where the limits of the main vegetational boundaries follow hypsometric curves and rainfall isohyets

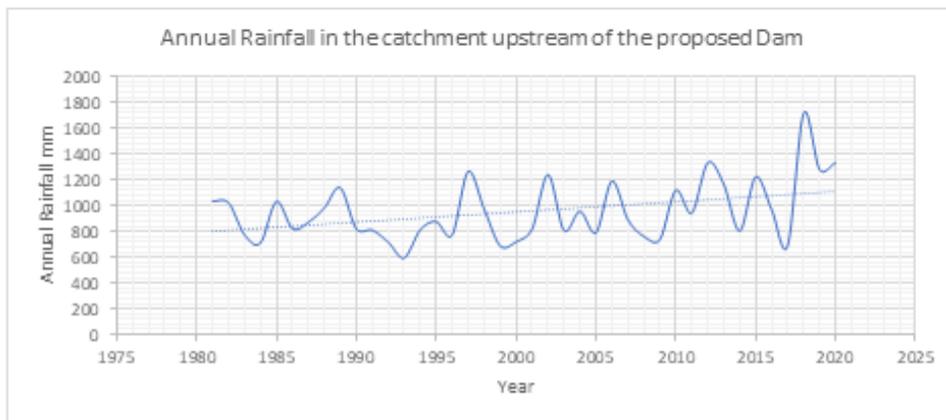


Figure 4 Annual Rainfall in the catchment upstream of the proposed Dam

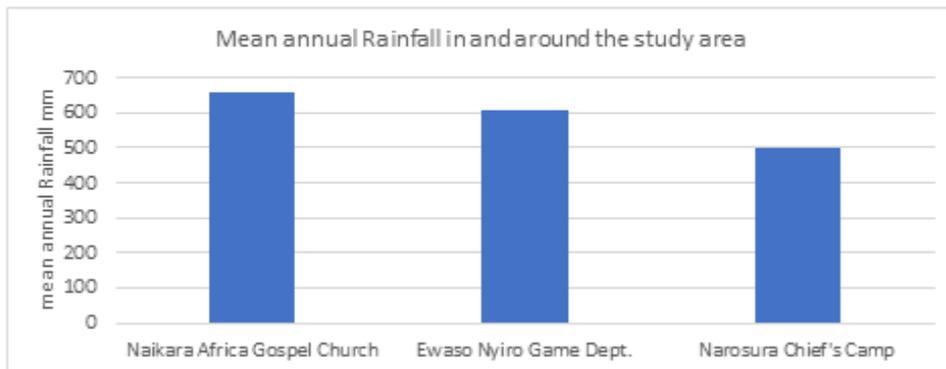


Figure 5 Annual rainfall in and around Osukunua

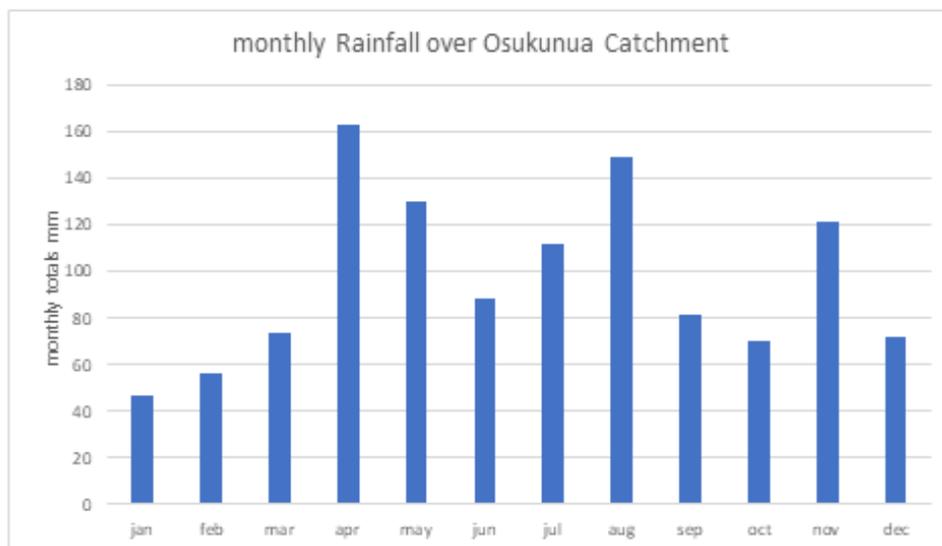


Figure 6 Monthly totals rainfall over the Osukunua catchment

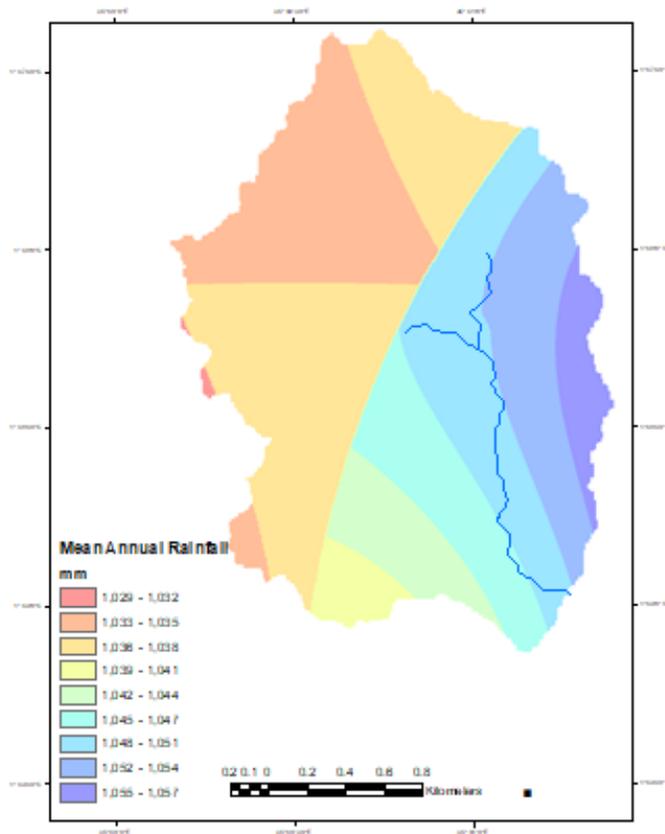


Figure 7 mean annual rainfall over Osukunua catchment

4. Details of river or water body

Osukunua sub catchment of lies furthest upstream of the western catchment of Lake Natron. The proposed dam is at coordinates Projection: UTM, Zone 36M South Map: 798924.00 m E, 9798828.00 m S, LL: 1°49'4.97"S, 35°41'12.15"E Elevation: 2120 m above sea Level. It traverses the Loita plains into Lake Natron (Figure 8). The entire streams here are ungauged.

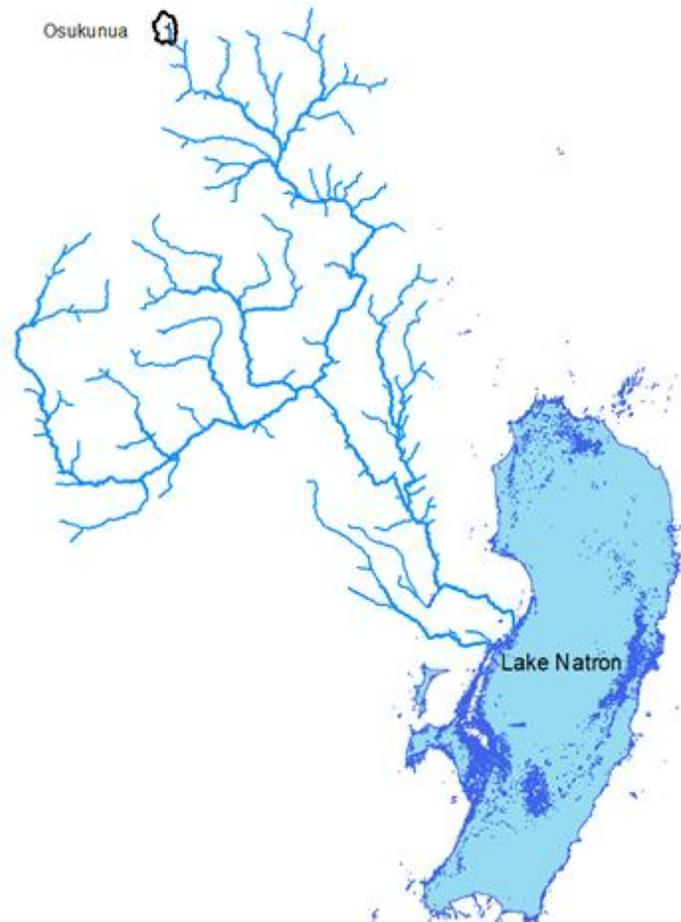


Figure 8 Position of Osukunua Sub catchment in relation to Lake Natron

5. Details of catchment

The Dam's catchment is within agropastoral livelihood zone, where livestock is the dominant economic activity (Figure 9). Along the riparian, forest dominated vegetation is intact thus acting to prevent riverine and bed erosion and the roughness in there being helpful in sediment trapping. It is one of the ways of checking dam siltation. Elevation varies from a high of 2120 to a low of 2100 m above sea level (Figure 10) and slope varies from a high of 16 degrees to a low of <1 degree (Figure 11)

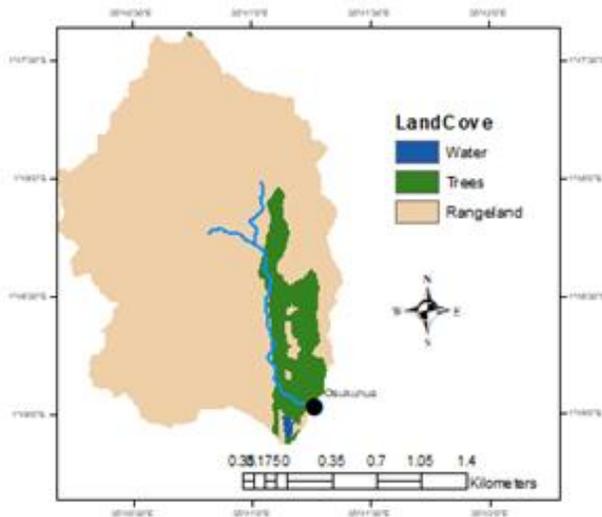


Figure 9 Osukunua sub catchment falls in vast rangeland with patches of forest

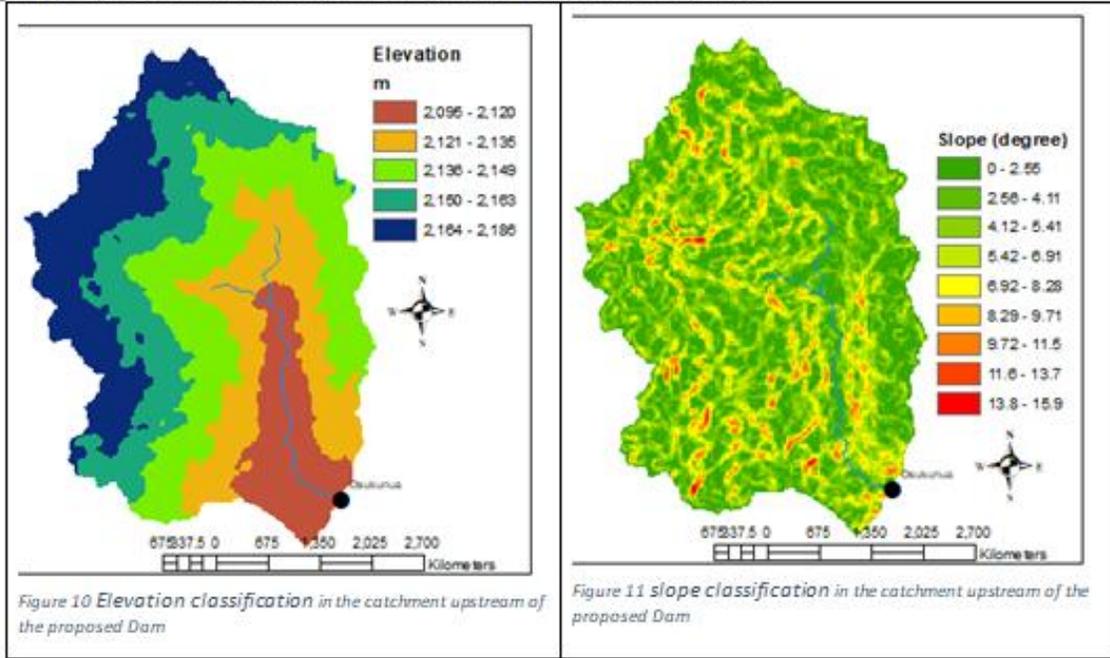
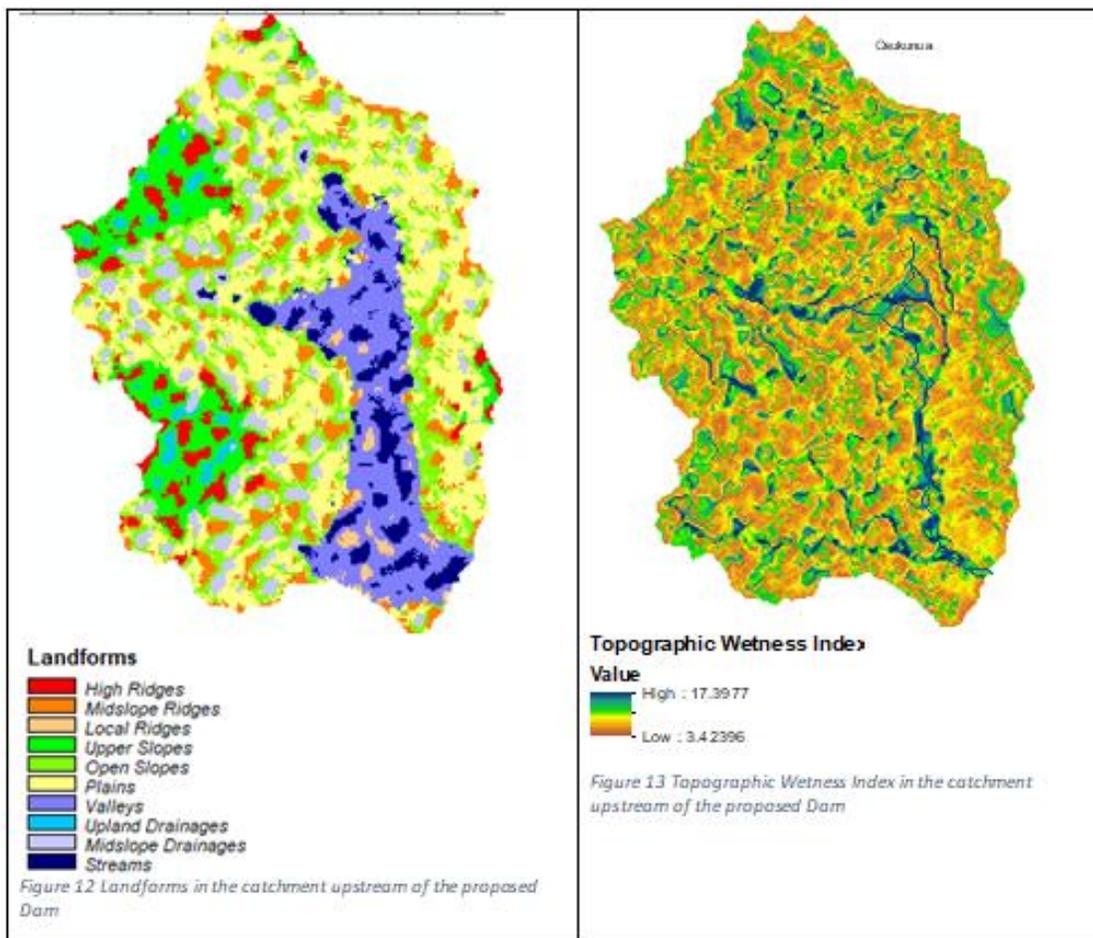


Figure 10 Elevation classification in the catchment upstream of the proposed Dam

Figure 11 slope classification in the catchment upstream of the proposed Dam



6. Details of Registered and Non registered Abstraction on the resource

There are no Registered and Non registered Abstraction on the resource

7. Details of all other permits related to this application

There are no Details of all other permits related to this application

8. Hydrological characteristics and analysis

The following aspects have been considered in deriving the hydrological characteristics of this river at station the proposed intake site: annual, monthly, extreme events, flow duration or probability of events occurring. Because Osukunua sub catchment is ungauged and the sub catchment occupies a tiny area of 4.94 km² (494 Ha), flow was simulated using the HEC-HMS hydrological model. HEC-HMS is a hydrologic modelling software developed by US Army Corps of Engineers Hydrologic Engineering Center. It includes many of the well-known and well

applicable hydrologic methods used in simulating rainfall-runoff processes in river basins (USACE-HEC, 2006).

Table 1 Osukunua catchment statistics

Catchment area km ²	Catchment slope	Max flow distance km	Max stream distance km	Shape Factor	Sinuosity	Mean Elevation m
4.94	7%	4.33	2.29	2.03	0.72	2,144.58

In this case, HEC-HMS model is preferred to the rational method as it will produce more accurate results as it incorporates the actual soil, land-use and topography conditions in the simulation process as described below.

Basin Model

Basin model in HEC-HMS is set up for the Osukunua basin; using two hydrologic elements: basin and junction. The basin element handles the infiltration loss and baseflow computations, and rainfall runoff transformation process. Junction element handles the observed flow data and is mainly used for the comparison of the observed flow hydrographs with the simulated flow hydrographs. Among the available hydrologic methods [USACE-HEC, 2006] SCS loss method is used to handle infiltration loss and constant monthly method is used to handle baseflow. For the rainfall-runoff transformation process, unit hydrograph of Osukunua Basin is obtained from simulation of flow at proposed storage site.

Meteorological Model

Meteorological model in HEC-HMS is the major component that is responsible for the definition of the meteorologic boundary conditions for the sub-basins. It includes precipitation, evapotranspiration and snowmelt methods to be used in simulations. In this case, the Specified hyetograph method was adopted, where from each 24-hour rainfall the model cumulatively calculates the daily run-off corresponding to the rainfall subject to the land-cover and soil-type of the catchment.

SCS Curve Number Method

The SCS curve number method is a simple, widely used and efficient method for determining the approximate amount of runoff from a rainfall event in a particular area. The Soil Conservation Service Curve Number (SCS-CN) method was originally developed by the SCS (US Department of Agriculture), to predict direct runoff volumes for given rainfall events and it is documented in the National Engineering Handbook, Section 4: Hydrology (NEH-4) (SCS, 1956, 1964, 1971, 1985, 1993, 2004). In the present case, the method was applied for a single storm event, though it can be scaled to find average annual runoff values. Requirements for this method include rainfall amount and curve number. The curve number is based on the area's hydrologic soil group, land use, treatment and hydrologic condition. The soil group was obtained from FAO soil classification (IUSS Working Group WRB, 2007). The SCS curve number was obtained from the classification of Hawkins et al., (2008).

SCS Hydrologic Soil Groups

Definition of SCS Hydrologic Soil Groups include Group A soils which have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission (greater than 7.62 mm /hr.). Group B soils have moderate infiltration rates when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (3.81 to 7.62 mm/hr.). Group C soils have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately coarse textures. These soils have a moderate rate of water transmission (1.27-3.81 mm/hr.). Group D soils have high runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a clay pan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low rate of water transmission (0.00 to 1.27 mm/hr.).

Model Approach

The model approach used to determine the runoff volume was the SCS-CN method (SCS, 1972). With this method, the precipitation excess is a function of cumulative precipitation, soil type, land use/cover and antecedent moisture. Considering the initial loss and the potential maximum retention, the precipitation excess can be calculated; the maximum retention and the basin characteristics are related through the curve number. The standard SCS curve number method is based on the following relationship between rainfall depth, P , and runoff depth, Q (USDA, 1986; Schulze *et al.*, 1992):

$$Q = \frac{(P-0.25)^2}{(P+0.85)} \text{ for } P > 0.25; \text{ otherwise } Q = 0 \dots\dots\dots(1)$$

$$S = \frac{25400}{CN} - 254 \dots\dots\dots(2)$$

$$I_s = 0.2S \dots\dots\dots(3)$$

Where: Q is the surface runoff (mm), P is the precipitation (mm), S is the soil retention (mm), I_s is the initial loss (mm), and CN is the curve number.

To obtain volumes, P and Q (in millimeters) must be multiplied by the basin area. The potential maximum retention (S) represents an upper limit for the amount of water that can enter the basin through surface storage, infiltration, and other hydrologic losses. For convenience, S is expressed in terms of a CN , which is a dimensionless basin parameter ranging from 0 to 100. A CN of 100 represents a limit condition for a perfectly impermeable basin with zero retention, where all the rainfall becomes runoff. A CN of zero conceptually represents the other extreme, with the basin trapping all the rainfall with no runoff regardless of the rainfall amount. Composite parameter CN was determined from a combination of the 3 inputs; land use, soil type and slope. The CN report is presented in table 3. To determine how the runoff is distributed over time we must introduce a time-dependent factor. The time-of concentration (t_c) is used in the SCS methods. The t_c is most often defined as the time required for a particle of water to travel from the most hydrological remote point in the basin to the point of collection. There are several methods available for calculating t_c , one of them is the SCS Lag Method:

$$t_L = \frac{L^{0.8}[(1000/CN) - 9]^{0.7}}{1900S^{0.5}} \dots\dots\dots(4)$$

$$t_c = 1.67t_L \dots\dots\dots(5)$$

where t_c is the time of concentration (minutes); t_L is the watershed lag time (minutes); L is the length of longest watercourse (m); S is the mean slope of the basin (%); and CN is the curve number.

Input Data for the HEC-HMS Basin Model

Digital Elevation Model (DEM) of 10 m was obtained from USGS and were used as input for delineation of catchment and stream network. Other parameters necessary in the model input derived from the DEM were slope, aspect, and elevation above sea level. Rainfall of 24-hour was obtained from Bomet Forest Station that is within and upstream of the catchment. Soil data were obtained from shape files of IUSS Working Group WRB, 2007. World Reference Base for Soil Resources 2006, World Soil Resources Reports No 103, FAO, Rome. Land cover shape files were obtained from Directorate of Resources Survey and Remote Sensing (DRSRS, 2010) from the report of Assessment of Land Cover changes in Kenya 1990-2010

Computation of Hydrologic Parameters

HecGeoHMS Watershed Modeling System were used to compute sub-basin parameters (area, lag-time and average curve number). Other parameters, needed for estimating the lag-time, such as length and slope of the longest flow path, were also calculated and stored in the sub-basin attribute table. These files, when opened in HEC-HMS, automatically create a topologically correct schematic network of sub-basins and reaches with hydrologic parameters. Table 2 shows the attribute table for the sub-basins with the calculated hydrologic parameters.

Table 2 Osukunua Basin attributes

Catchment area km ²	Catchment slope	Max flow distance km	Max stream distance km	Shape Factor	Sinuosity	Mean Elevation m
4.94	7%	4.33	2.29	2.03	0.72	2,144.58

The following procedure was adopted to construct the rainfall-runoff model for the Osukunua River basin. A schematic representation of Osukunua River network was created by dragging and dropping icons that represent hydrological elements, and connections between them were established. The hydrologic parameters for each sub-basin were entered using HEC-HMS sub-basin editor; required data consist of sub-basin area, loss rate method (SCS-CN method was used), transform method (SCS Unit Hydrograph method was used), and baseflow method (baseflow was set to zero for Osukunua River Basin). Considering that the time span of the storm event was short, it was reasonably assumed that evapotranspiration was zero.

A precipitation model is the next component of the HEC-HMS model. The specified hyetograph was adopted where a time series rainfall downloaded from app.climateengine.org for the period of 1981 to 2024.

Osukunua Flow

In figure 14, the simulated flow for the period of 1981 to 2024 from Osukunua catchment is shown, and the maximum flow observed is 2.92 m³/s. The other statistics include; a minimum of 0.0 m³/s, mean of 0.135. Q80 is 0 m³/s.

To assess what flood flow can be obtained, a Flood frequency analysis was done thus, plotting the graph shown in figure 15. It was noted that the probability of 1.93 m³/s flood occurring in a 5-year return period, and for the 10 year, 25year, 50 years and 50 years, the floods estimated are 2.19 m³/s, 2.50 m³/s, 2.74 m³/s and 2.98 m³/s respectively.

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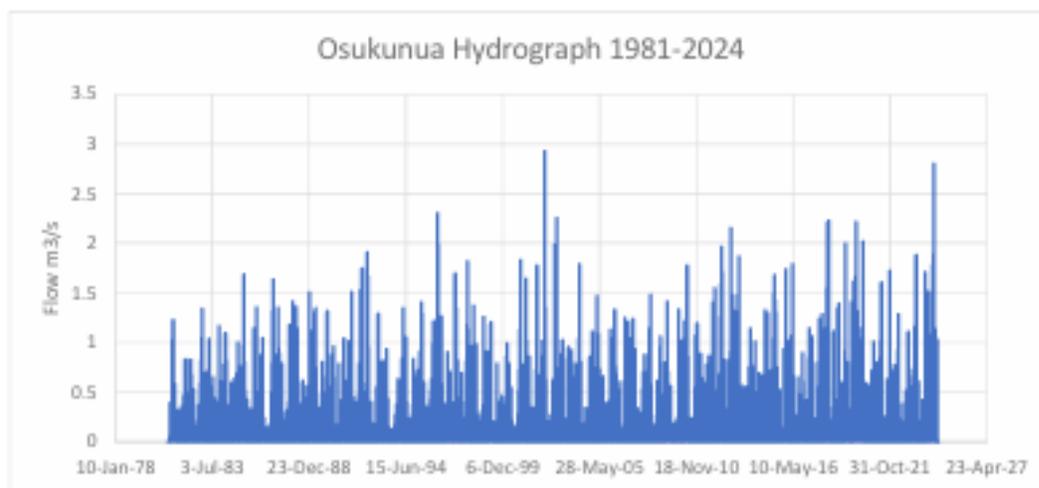


Figure 14 Stream inflow at the proposed dam site

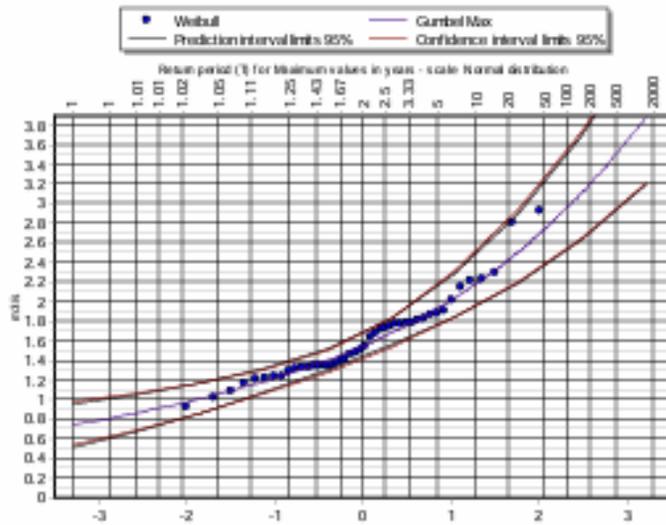


Figure 15 peak annual flow at the proposed dam fitted to Gumbel Statistical Distribution.

Table 3 Flood Magnitudes for return periods of 2,5,10,25,50 and 100 year

Kolmogorov-Smirnov test: for goodness of fit	a=1%	a=5%	a=10%	Attained a	DfMax	2 year peak flow m³/s	5 year peak flow m³/s	10 year peak flow m³/s	25 year peak flow m³/s	50 peak flow m³/s	100 peak flow m³/s
Gamma	accept	accept	accept	93.92%	0.078	1.55	1.93	2.19	2.50	2.74	2.98

The demand is 872 m³/day. Rule No 47. (1) of the Water Resources Regulations, 2021 states that, in allocating water for irrigation, consideration shall be made to;

- I. give priority to irrigation for subsistence purposes;
- II. be guided by crop water requirements in the area and the efficiency of water use;
- III. limit the permit holder to abstract, impound or divert only flood flow for purposes of irrigation; and
- IV. require the applicant, to the extent practicable, to make provision for not less ninety days' storage of flood flow for use during the dry season unless the abstraction of water is to be from a regulated watercourse or river.

Figures presented in Table 4 shows amounts harvestable in average year, direct years in 1984 and year 2000. It also shows volume harvestable in the period 1981-2024 (44 years). It is apparent that on average an amount of 4,173,819.81 may be available for use by the community every year. This compares to amount 4,380,702 m³ on an average year.

For the purposes of sizing the embankment and the spillway, the Figures presented in Table 6 may be used e.g. for dam size of this, a return period of 1 in 50 year (Table 3) with a probability of 2.74 m³/s peak flow is hereby recommended.

Table 4 harvestable volume in average year, driest years

Year	peak flow m ³ /s	Volume m ³
2013	1.8013	4,380,702
2000	1.7858	2,859,698
1984	0.9689	2,355,439
1981-2023	2.9255	179,4742,52

Table 5 Classification of Dams

Class of Dam	Maximum Depth of Water at NWL (m)	Impoundment at NWL (m ³)	Catchment Area (km ²)
A (Low Risk)	0 – 4.99	< 100,000	< 100
B (Medium Risk)	5.00 – 14.99	100,000 to 1,000,000	100 to 1,000
C (High Risk)	> 15.00	> 1,000,000	> 1,000

Source: WRMA 2009. Guidelines for Determination of Permit Classification for Water Storage Structures

Table 6 Return Period Criteria for Design Purposes

Class of Dam	Minimum Return Period for Design of Spillway	Recommended Minimum Return Period for Design of Spillway	Recommended Minimum Return Period for Design of Diversion Works
A (Low Risk)	1 in 50 years	1 in 100 years	1 in 5 years
B (Medium Risk)	1 in 100 years	1 in 100 – 500 years	1 in 10 years
C (High Risk)	1 in 500 years	1 in 1000 years	1 in 15 years

(Source: WRM Regulations 2021)

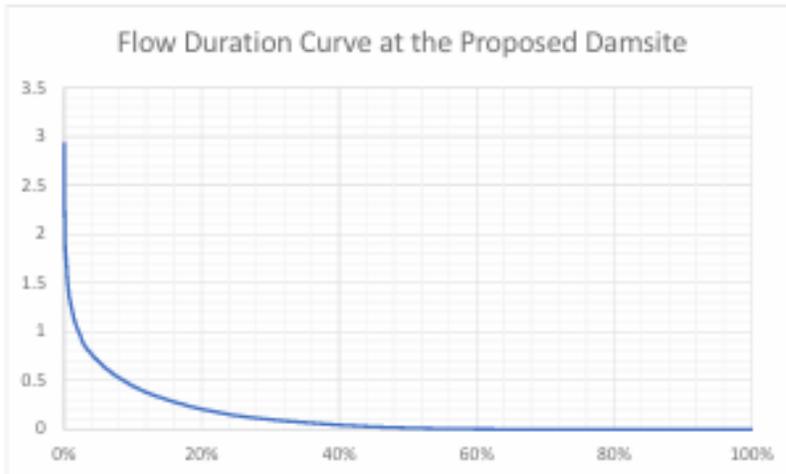
Analysis of the Reserve

Low-flow percentiles from the FDC are often used as key indices of low-flow. Water Resources Management Rule No 128. (1) require that in all instances where water resource records are available, the Authority shall establish the Reserve and shall be guided by the quantity not being less than the flow value that is exceeded 95% of the time as measured by a naturalized flow duration curve at any point along the water course. The 95-percentile flow 0 m³/s.

In accordance to Water Resources Management Rules No 49 on Normal Flow and Flood Flow, Rule No 49. (1) states that for the purposes of these Rules, “flood flow” is defined as any flow that exceeds the Q80 flow value and “normal flow” is defined as any flow that is less than the Q80 flow value. Rule No 49. (2) states that the Q80 flow value is the flow value that is equalled or exceeded eighty percent of the time. Q80 is 0 m³/s

Table 7 inflow Statistics to the proposed Osukunua Dam

Statistic	Q50	Q80	Q95	QMax	Qmean
Q m3/s	0.12				0.13



Impact of proposed activity

The contribution of flow from the micro catchment of Osukunua to Ewaso River is insignificant. The catchment size is 5 km² and the flow during flood flow will exceed the dam capacity and shall overflow downstream to contribute to Ewaso recharge. Because there is no flow 99% of the time, there is no ecological, environmental, or morphological status to be upset as a result of impoundment of 172,000 m³ of water on average every month.

Recommendations on Proposed Activity

Regulation No 48. (1) of The Water Harvesting and storage Regulations, 2021 require that an agricultural establishment using water resources for irrigation purposes shall implement water harvesting and storage measures capable of storing flood water sufficient to meet three months water demand. This report has been written in compliance of Regulation No 14. (1) of the Water Resources Regulations, 2021 that require that an application for a permit for a proposed water use activity and for this case falling within Category C specified in Part III of the First Schedule. It has stated the intended purpose of water use and that this report is a site hydrological assessment report which demonstrates the strategy and plan. It is hereby recommended that the applicant be issued with authorization to construct Dam works of in the position shown to store streamflow within the riparian in Osukunua sub catchment. It is observed that all measures to protect and keep the riparian intact will be implemented with a purpose of maintaining the flow reserve.

References

1. Probable Maximum Precipitation (PMP) in East Africa for durations up to 24 hours (Lumb, 1971), F.E. East African Meteorological Department, Technical 41 Memorandum No 16, 1971
2. DRSRS, 2010. Assessment of Land Cover changes in Kenya 1990-2010. Unpublished
3. Ogallo L. A. 1993. Dynamics of the East African climate. *Journal of Earth System Science* 102 (1) page 203-217
4. Ogallo, L.J., Okoola, R.E. and Wanjohi, D.N. 1994. 'Characteristics of Quasi-Biennial Oscillation over Kenya and their predictability potential for seasonal rainfall', *Mausam*, 45(1), 57–62.
5. Beltrando, G. (1990) Space-time variability in April and October-November over East Africa during the period 1932-1983. *International Journal of Climatology*, 10, 691-702
6. Rainfall Frequency Atlas of Kenya; Ministry of Water Development, 1978
7. Patton, P. C. and Baker, V. R. (1976) Morphometry and floods in small drainage basins subject to diverse hydrogeomorphic controls. *At. Resour. Res.* 12, 941-952
8. K. M. Rowntree Storm rainfall on the Njemps flats, baringo district, Kenya *Journal of Climatology* Volume 8, Issue 3, pages 297–309, May/June 1988
9. Bradfield Lyon and David G. DeWitt. A recent and abrupt decline in the East African long rains *Geophysical Research Letters*, Vol. 39, L02702, doi:10.1029/2011GL050337, 2012
10. Jaetzold R, Schimdt H, Hornetz B and Shisanya C. Farm Management Handbook of Kenya. Natural Conditions and Farm Management Information. Volume IIA. Nairobi Kenya. 2007 ;pp319.
11. Sombroek, W.G., Braun, H.M.H. and van der Pouw, B.J.A., 1982: Exploratory soil map and Agroclimatic zone map of Kenya; Scale 1:1 Million. Report E1. Kenya Soil Survey, Nairobi
12. <http://www.fao.org/soils-portal/soil-survey/en/>
13. <https://www.samsamwater.com/maps.php>.

11.16 Free Prior and Informed Consent Report



NATIONAL AGRICULTURAL VALUE CHAIN DEVELOPMENT PROJECT (NAVCDP)

County Project Coordinating Unit
P.O. Box 898- 20500
NAROK

FREE, PRIOR AND INFORMED CONSENT REPORT

© MAY, 2024

Executive Summary

The National Agricultural Value Chain Development Project (NAVCDP) is a Government of Kenya initiative, co-financed by the World Bank, national and county governments, and local communities. It builds on the achievements of the NARIGP and KCSAP projects to enhance productivity, market access, and value addition among smallholder farmers across 33 counties, including Narok. The Project Development Objective (PDO) is to increase market participation and value addition for farmers within selected value chains, particularly those transitioning from subsistence to commercial farming. As part of its commitment to inclusivity and social sustainability, the NAVCDP integrated a Free, Prior and Informed Consent (FPIC) process in Narok County to engage Indigenous Peoples (IPs), particularly the Ogiek and Ndorobo communities in decision-making. These groups, characterized by unique cultural identities, historical marginalization, and strong attachment to traditional lands, are located in at least 11 of Narok's 30 wards. The FPIC process involved stakeholder mapping, culturally sensitive consultations, and accessible communication to ensure that IPs were adequately informed and empowered to participate in shaping project outcomes. This included identifying community elders, youth and women's groups, CBOs, and spiritual leaders as key stakeholders. The process emphasized transparency, respect for cultural values, and integration of traditional governance structures to build trust and ensure broad community support. Key concerns rose during consultations included inadequate awareness of the project, fears of land dispossession, underrepresentation in governance, marginalization, cultural disruption, and environmental impacts especially regarding settlements near the Mau Forest. IPs also called for improved access to agricultural inputs, support for traditional livelihoods like beekeeping, and inclusive representation of women and youth. To address these concerns, a culturally appropriate grievance redress mechanism was recommended, emphasizing community-level resolution, transparency, and protection of complainants. Observations from the process revealed that over 90% of IPs are integrated into local communities, with 70% aware of the project and participating in Community Development Plans (CDPs). Some IPs has taken on local administrative roles despite limited political representation. Key recommendations include strengthening ongoing community engagement, honoring traditional leadership, ensuring timely information sharing, documenting consent, and promoting equitable participation. The project must also recognize the community's right to withhold or withdraw consent at any time and

invest in capacity building to empower Indigenous communities in development dialogues. This FPIC report reinforces NAVCDP's commitment to inclusive, culturally respectful development and ensures Indigenous Peoples in Narok County have a meaningful voice in agricultural transformation.

Table of Contents

Executive Summary	ii
INTRODUCTION	1
1.1 Background and objectives of the project.....	1
1.2 Purpose of the FPIC process	1
1.3 Definition of IPs.....	1
2.0 Profile of the Indigenous People in Narok County	2
2.1 Settlement of IPs in Narok County	2
2.2 FPIC PROCESS.....	3
2.2.1 Settlement and distribution of IPs in Narok County	3
2.2.2 Stakeholder Identification	4
2.2.3 Cultural Sensitivity and Trust Building	4
2.2.4 Information Sharing	5
3.0 Key Principles throughout the Process	5
4.0 Key Issues and Concerns Raised	5
5.0 Grievance and Redress Mechanisms.....	7
5.1 Objective	7
5.2 Key Principles.....	7
5.3 Grievance Mechanism Structure.....	7
6.0 Observation and Recommendations.....	7
6.1 Observation.....	7
6.2 Recommendations.....	8

INTRODUCTION

1.1 Background and objectives of the project

The National Agricultural Value Chain Development Project (NAVCDP) is a Government of Kenya project funded by the World Bank, the National Government, County Governments and benefiting communities. The project builds on the strong foundation laid by National Agricultural Rural Inclusive Growth Project (NARIGP) and Kenya Climate Smart Agriculture Project (KCSAP) and works with farmers that are part of the agreed value chains across 33 counties. The counties were selected based on various factors including potential for production of NAVCDP value chains, potential to contribute to climate change adaptation and mitigation, vulnerability to climate change risks, fragile ecosystems and socio-economic development indicators. Narok County is one of the counties implementing the project across all its 30 wards. The Project Development Objective (PDO) is to increase market participation and value addition for targeted farmers in select value chains in project areas. The project builds on NARIGP/KCSAP productivity enhancement efforts and the foundation laid to enable market access and value addition for profitability. The project focuses on smallholder farmers either “in transition” or have “transitioned” from subsistence to market and commercial farming.

1.2 Purpose of the FPIC process

The **Free, Prior and Informed Consent (FPIC)** process is a rights-based approach aimed at ensuring that Indigenous Peoples and local communities are meaningfully engaged in decisions that affect their lands, territories, resources, and cultural heritage. The key purpose of this FPIC report is to uphold the rights of these communities to self-determination and participation in development processes. It ensures that any external intervention, such as development projects, conservation initiatives, or land use changes is carried out with their **voluntary agreement**, based on full and transparent information, and before any activities begins.

1.3 Definition of IPs

ESS7 on Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities outlines IP as people who are distinctly different from other groups within a state, have a special attachment to and use of their traditional land, and who experience subjugation, marginalization, dispossession, exclusion or discrimination because of their cultures, ways of life or modes of production different from those of the dominant society. ESS7 concludes that these types of discrimination and marginalization threaten the continuation of Indigenous Peoples’

cultures and ways of life and prevents them from being able to genuinely participate in decisions regarding their own future and forms of development

2.0 Profile of the Indigenous People in Narok County

The targeted IPs are socially characterized as outlined below

- Their cultures and ways of life differ considerably from the dominant society
- Their cultures are under threat, in some cases to the point of extinction
- The survival of their particular way of life depends on access and rights to their lands and the natural resources thereon
- They suffer from discrimination as they are regarded as less developed and less advanced than other more dominant sectors of society
- They often live in inaccessible regions, often geographically isolated
- They suffer from various forms of marginalization, both politically and socially.
- An indigenous language, often different from the official language of the country or region.

2.1 Settlement of IPs in Narok County

In Narok County, the IPs are found in small pockets in about 11 wards that includes Sogoo, Melelo, Ilmotiok, Melili, Kapsasian, Ololmasani and Kimintet. Others are Olposimoru, Oloropil, Keekonyokie, Loita and Mara.

SOGOO WARD: The IPs in Sogoo belong to the Ogiek community. Originally they lived alone owning farm sizes of upto 200acres. But from as early 1940s and 1950s, other settler communities started to arrive in area in small groups. These settlers' communities bought land from the Ogiek and/or benefited from group land allocation during land subdivision in the area. The settler communities mainly the Kalenjin have since increased in numbers by far out numbering the Ogiek community.

MELILI WARD: The IPs in Melili ward belong to the Ndorobo community. They are found in the Ndorobo village bordering Eastern Mau Forest. They live together in this village with the Maasais, but Ndorobos are the most dominant community in the village whereas the Maasai dominates the surrounding areas towards the plains.

KAPSASIAN WARD: The IPs in Siomingin members of the Ogiek. They originally lived in Tinnet Rongai-Nakuru before they were forced out by the colonial government and moved first to

Chepalungu (Sigor), then Kaboson, Chemamit, Njipship and Enosaen. However they were evicted from Enosaen by the dominant Maasai, before finally settling at Siomingin. Other settled in Ololmasani, Ndamama, Boson and Kapsasian.

The Ogiek community is surrounded by the dominant Kalenjin community. They have also continued to be in touch with their relatives in Tinet where their children occasionally move to graze their cattle. They also graze cattle in Chepalungu forest with permission of KFS officials.

OLOLMASANI WARD: The IPs belongs to the Ogiek community. They live in Kabweria-Kapchumbe centre. Just like the Ogiek in Siomingin, they also came from Nakuru after they were forcibly removed from there by the colonial government.

LOITA WARD: The IPs in Loita ward belong to the Ndorobo community. They are found in the Osukunua village bordering West Naimina Enkiyio Forest in Loita. They live together in this village with the Maasais, but the Maasai are the most dominant community in the village.

2.2 FPIC PROCESS

in order to involve the IPs (Ndorobo/Ogiek) found in Narok county to be part of the community development supported by the NAVCDP the CPCU applied the FPIC tool i.e Free, prior, informed and accessible consultation (FPI-Consultation), which refers to a process whereby affected vulnerable and marginalized communities, freely have the choice, based on sufficient information concerning the benefits and disadvantages of the project and how these activities occur.

Projects affecting the vulnerable and marginalized groups, whether adversely or positively, therefore, need to be prepared with care and with the participation of targeted communities. The requirements include social analysis to improve the understanding of the local context and affected communities; a process of free, prior, and informed consultation with the affected vulnerable and marginalized communities to expressed their views on preferred project design considerations that would lead to broad community support to the project; and development of project-specific measures to avoid adverse impacts and enhance culturally appropriate benefits.

2.2.1 Settlement and distribution of IPs in Narok County

Ward	Distribution	Village(s)
Keekonyokie	Integrated	Sintakara
Olorropil	localised	Topoti,Olokirikirai and Empatipat

Melili	localised	Ndorobo village
Mara	localised	Kineti, Leila and Musereji
Melelo	integrated	Olmekenyu
Kapsasian	localised	Siomingin
Ololmasani	localised	Kabweria/Kapchumba centre
Kimintet	integrated	Kirindon,Lokwaya,Ntolish and Esoit
Lolgorian	integrated	scattered
Sogoo	localized	Sogoo, Nkaroni
Loita	integrated	Nkidongi, Osukunua, Moriyo
Ilmotiok	integrated	Nkorkori
Olposimoru	Localized	Mau forest

2.2.2 Stakeholder Identification

During the FPIC Process the following stakeholders were identified.

- i. Community members, including elders, women, youth, pastoralists, farmers, etc
- ii. Traditional authorities and elders
- iii. Clan or family heads
- iv. Community-based organizations (CBOs)
- v. Spiritual/cultural leaders
- vi. Community representatives
- vii. Women's and youth groups to ensure gender and generational inclusion

2.2.3 Cultural Sensitivity and Trust Building

Cultural sensitivity and trust-building are essential elements in the successful implementation of the Free, Prior, and Informed Consent (FPIC) process. This report highlights the significance of these components in ensuring that Indigenous Peoples and local communities are respected, heard, and empowered in decision-making.

Importance of Cultural Sensitivity

Cultural sensitivity involved recognizing and respecting the diverse cultural practices, beliefs, and values of Indigenous Peoples and local communities. Cultural sensitivity was crucial since it

ensured; effective Communication, respect for Traditions, and inclusive Participation during the FPIC process.

Trust-Building Strategy

Building trust was vital for a successful FPIC process. Trust was cultivated through; transparency by openly sharing information about project and its potential impacts which helped established credibility.

2.2.4 Information Sharing

During the FPIC Process clear, accurate and culturally appropriate information on the nature and scope of the proposed activity, Potential impacts (social, environmental, and economic), Benefits, risks, and mitigation measures and Legal rights of the community were presented.

3.0 Key Principles throughout the Process

- **Free:** No coercion, intimidation, or manipulation.
- **Prior:** Before any authorization or commencement of activities.
- **Informed:** All relevant information is shared in an understandable format.
- **Consent:** Given or withheld through community-approved decision-making processes.

4.0 Key Issues and Concerns Raised by IPs Community

i. Limited Awareness and Understanding of the Project

- Some community members lacked clear information about the project's objectives, benefits, and potential impacts.
- Inadequate translation of project materials into local languages limited effective participation.

ii. Inadequate Representation in Decision-Making

- Indigenous Peoples expressed concern over their limited involvement in planning and decision-making processes.

iii. Fear of Loss of Land and Resources

- Communities raised concerns about possible displacement or loss of access to ancestral lands and natural resources.
- There were fears that project implementation might lead to restrictions on traditional livelihoods (e.g., beekeeping, grazing, hunting).

iv. Marginalization and Discrimination

- The IP community reported feelings of social exclusion and discrimination in local governance structures.
- Concerns were raised over the lack of political representation due to their minority status.

v. Disruption of Cultural Practices

- Some feared that development activities could interfere with sacred sites, cultural heritage areas, and traditional knowledge systems.

vi. Environmental Concerns

- IPs expressed worry about the environmental impacts of certain project activities, particularly those affecting forests and water sources.
- Specific concerns were raised about the implications of Ogiek settlement within the Mau Forest.

vii. Grievance Redress and Conflict Resolution

- There was a lack of trust in formal grievance redress mechanisms.
- Community members requested the integration of traditional dispute resolution practices into grievance systems.

viii. Livelihood Sustainability

- While many had shifted to farming, concerns were raised about lack of access to inputs, markets, and extension services.
- Continued support for traditional economic activities such as beekeeping was requested.

ix. Youth and Women Inclusion

- Both youth and women felt underrepresented in consultations and decision-making processes.
- Requests were made for more inclusive approaches to ensure their views are heard.

5.0 Grievance and Redress Mechanisms

5.1 Objective

To provide Indigenous Peoples and local communities with a trusted, transparent, and culturally appropriate system for addressing concerns, complaints, or disputes arising during or after the FPIC process and implementation of the proposed project.

5.2 Key Principles

The grievance and redress mechanism was designed in accordance with the following principles:

- i. **Accessibility:** Open to all community members, including marginalized groups such as women, youth, and persons with disabilities.
- ii. **Cultural Appropriateness:** Aligned with local norms, traditions, and dispute resolution methods (through community elders or councils).
- iii. **Transparency:** All grievances are recorded, tracked, and resolved in a transparent manner, with regular updates to the complainants.
- iv. **Timeliness:** Complaints are addressed promptly to prevent escalation of conflict.
- v. **Non-retaliation:** Complainants are protected from any form of punishment, discrimination, or harassment.

5.3 Grievance Mechanism Structure

Community-Level Resolution (Primary Level)

Indigenous communities often have their own conflict resolution traditions, so a well-designed grievance mechanism must respect and integrate these while ensuring accountability, equity, and compliance with national and international human rights standards. Grievances are always raised and resolved through recognized local mechanisms, such as village elders and traditional councils

6.0 Observation and Recommendations

6.1 Observation

- Over 90% of the targeted Indigenous Peoples (IPs) have been integrated into local communities and actively participate in farming.
- The IPs continues to uphold traditional livelihoods such as beekeeping.
- Around 70% of the targeted IPs were aware of the NAVCDP project, and their priorities were reflected in the Community Development Plans (CDPs) for their respective wards.

- Due to their relatively small population, IPs does not hold political positions, however, as a result of their integration, some have been appointed to local administrative roles, such as chiefs.
- A portion of the IP community (specifically the Ogiek) has settled within the Mau Forest area.

6.2 Recommendations

Strengthen Continuous Community Engagement

- Maintain open, respectful, and ongoing dialogue with Indigenous Peoples before, during, and after project implementation.
- Use culturally appropriate communication channels (e.g., community meetings, local language, visual aids).

Respect Traditional Governance and Decision-Making Structures

- Engage with legitimate traditional leaders and elders recognized by the community.
- Align FPIC processes with customary laws and social structures.

Ensure Full and Timely Disclosure of Information

- Provide accessible and comprehensive information about the project, including potential impacts and benefits.
- Allow sufficient time for communities to understand and deliberate before making decisions.

Document Consent Clearly and Transparently

- Clearly record how consent was given, who was involved, and the process followed.
- Include signed agreements, meeting minutes, and testimonies where possible.

Promote Inclusion and Equity

- Ensure participation of all segments of the community, including women, youth, persons with disabilities, and marginalized groups.
- Avoid elite capture or exclusion of minority clans or families.

Establish a Robust Grievance Redress Mechanism

- Develop accessible and culturally appropriate channels for Indigenous communities to raise concerns.
- Ensure the mechanism respects traditional conflict resolution systems and protects complainants.

Build Local Capacity

- Support training and awareness programs on Indigenous rights, project details, and negotiation skills.
- Empower IP communities to effectively participate and negotiate in FPIC processes.
- Conduct regular feedback sessions with communities to adapt and respond to emerging issues.

Respect the Right to Say No

- Recognize and honor the community's right to withhold or withdraw consent at any stage of the project lifecycle.

Photos during the FPIC process



The CPCU with IPs during FPIC process at Topoti in Olorropil Ward



The CPCU with IPs during FPIC process at Sogoo chief's office grounds in Sogoo Ward



The CPCU/SCTTs with IPs during FPIC process at kapweria in Ololmasani Ward



The CPCU/SCTTs with IPs during FPIC process at Ndorobo village in Melili Ward



The CPCU/SCTTs with IPs during FPIC process at Osukunua village in Loita Ward

11.17 Resource Use plan Between Pastoralists and Osukunua IWUA

RESOURCE USE PLAN BETWEEN PASTORALISTS AND OSUKUNUA IWUA

KEY ISSUE THAT TRIGGER CONFLICT	RECOMMENDED ACTIONS	RESPONSIBLE
Shared Water Access Schedule	<ul style="list-style-type: none"> • Develop a rotational schedule for water access between pastoralists and IWUA members (alternate days or specific hours). • Designate separate watering points for livestock and irrigation to avoid contamination. 	<ul style="list-style-type: none"> • IWUA • Area Chief • SCTT • Project Manager
Water Conservation & Infrastructure	<ul style="list-style-type: none"> • Improve water storage (Dam) to reduce scarcity. • Promote water-saving techniques (drip irrigation for farmers, troughs for livestock). 	<ul style="list-style-type: none"> • IWUA • SCTT • Project Manager
Dry Season Contingency Plan	<ul style="list-style-type: none"> • Reserve emergency water sources for pastoralists during droughts. • IWUA to allow controlled livestock access to canals/reservoirs under supervision. 	<ul style="list-style-type: none"> • IWUA • Area Chief
Grazing Corridors & Buffer Zones	<ul style="list-style-type: none"> • Establish designated livestock routes to prevent crop damage. • Maintain buffer zones between farms and grazing areas. 	<ul style="list-style-type: none"> • Pastoralists leaders • Area Chief • Sub- County livestock production officer

Seasonal Grazing Agreements	<ul style="list-style-type: none"> • Allow pastoralists to graze on fallow or harvested fields under agreed terms. • Restrict grazing near active farms during planting/harvest seasons 	<ul style="list-style-type: none"> • IWUA • Area Chief • SCTT
Community Grazing Reserves	<ul style="list-style-type: none"> • Identify and protect communal grazing lands to reduce encroachment 	<ul style="list-style-type: none"> • Pastoralists leaders • Area Chief • Sub- County livestock production officer

11.18 MOUs Between land owners and 5 CIGs for irrigation purposes



MEMORANDUM OF UNDERSTANDING (MOU) FOR LAND DONATION

ITEM	DESCRIPTION
Name of Sub-Project	OSUKUNJA EARTH DAM & IRRIGATION PROJECT.
Project Physical Location:	LOITA WARD, ILKERIN
GPS coordinates	798912.794E 7798309.01ND 2M

I, NAISWAKU ENJE KIRONJI at ILKERIN Location
in LOITA Ward

Being the owner/beneficiary of the land parcel of No. 2000 at NAROK SOUTH Sub-county do hereby declare and sign that I have agreed without alteration to donate approximately 5 acres/hectares of the aforesaid land to ENWANG'AN SHK CIG for 12 months/years.

Land owner (Farmer) NAISWA ENJE KIRONJI ID No. 26022382 Signature and date 31/05/2025

CIG Chairperson NAKOTIAN MUNKUK ID No. 28480185 Signature and date 31/05/2025

Term and Conditions

1. The involved parties, being of sound mind and legal age, willingly and without any external influence, entered into this Memorandum of Understanding.
2. Upon signing this Memorandum of Understanding, the farmer committed not to take any action that could obstruct or interfere with the effective management of the specified parcel of land.
3. I acknowledge that the land designated for irrigation is free from any encumbrances or encroachments, is not subject to claims by any individual or group, and its ownership is undisputed.

4. I understand the potential impacts of the proposed activities on the donated land.
5. I have consented to this investment and land donation voluntarily, without coercion, manipulation, or any undue pressure from public or traditional authorities.
6. I confirm that I do not expect or require any financial or non-financial benefits or incentives as a condition for the donation.
7. The donation of this land will not reduce the remaining land area to a level that jeopardizes the livelihoods of its occupants and users, nor will it necessitate the relocation of any household.

Farmer's Witnesses

S/No	Name	ID/No.	Date	Signature
1	Patrick MURKUK	30984279	31/05/25	
2	NALOTUESHU SHUNA	21380077	31/05/25	
3	Saitabon KIKONYA	24622203	31/05/25	

CIG's Witnesses

S/No	Name	ID/No.	Date	Signature
1	Nelota MURKUK	22732708	31/05/25	
2	MESHUKO KIKONYA	25969550	31/05/25	
3	Woonkuta Reson	25860627	31/05/25	

Dated this 31 day of 05 2025

Area Chief

Name	Location	Signature & R/Stamp
Milon KARKAR	ILKERIN	



MEMORANDUM OF UNDERSTANDING (MOU) FOR LAND DONATION

ITEM	DESCRIPTION
Name of Sub-Project	OSUKUNUA EARTH DAM & IRRIGATION PROJECT
Project Physical Location:	LOITA WARD, ILKERIN
GPS coordinates	795912.394E 798372.013W 36M

I, KONE OLE KIRONJI at ILKERIN Location
 in LOITA Ward

Being the owner/beneficiary of the land parcel of No. NAROK 2001 at NAROK SOUTH Sub-county do hereby declare and sign that I have agreed without alteration to donate approximately 3acres/hectares of the aforesaid land to METONI SHCCIG for 12months/years.

Land owner (Farmer) KONE OLE KIRONJI ID No. 23394857Signature and date 31/05/2023 KONE

CIG Chairperson PAPIRAKVI RESON ID No. 30096675Signature and date 31/05/2023 [Signature]

Term and Conditions

1. The involved parties, being of sound mind and legal age, willingly and without any external influence, entered into this **Memorandum of Understanding**.
2. Upon signing this **Memorandum of Understanding**, the farmer committed not to take any action that could obstruct or interfere with the effective management of the specified parcel of land.
3. I acknowledge that the land designated for irrigation is free from any encumbrances or encroachments, is not subject to claims by any individual or group, and its ownership is undisputed.

4. I understand the potential impacts of the proposed activities on the donated land.
5. I have consented to this investment and land donation voluntarily, without coercion, manipulation, or any undue pressure from public or traditional authorities.
6. I confirm that I do not expect or require any financial or non-financial benefits or incentives as a condition for the donation.
7. The donation of this land will not reduce the remaining land area to a level that jeopardizes the livelihoods of its occupants and users, nor will it necessitate the relocation of any household.

Farmer's Witnesses

S/No	Name	ID/No.	Date	Signature
1	MUSAYO Mellingati	29482098	31/05/25	
2	David Patriot	31053162	31/05/25	
3	Tumpes Murkuk	187991315	31/05/25	

CIG's Witnesses

S/No	Name	ID/No.	Date	Signature
1	Meliyio Kivanyi	35876855	31/05/25	
2	NOSIM Naikum	40772629	31/05/25	
3	Movogo Reson	40579048	31/05/25	

Dated this.....31.....day of.....05.....2025.....

Area Chief

Name	Location	Signature & R/Stamp
MITON KARKAR	ILKERIN	



MEMORANDUM OF UNDERSTANDING (MOU) FOR LAND DONATION

ITEM	DESCRIPTION
Name of Sub-Project	OSUKUNUK EARTH DAM & IRRIGATION PROJECT
Project Physical Location:	LOITA WARD, ILKERIN
GPS coordinates	795909.396E 9798274.014N 36M

I, NAKOYIAN MURKUK at ILKERIN Location
in LOITA Ward

Being the owner/beneficiary of the land parcel of No. 1984 at NAROK SOUTH Sub-county do hereby declare and sign that I have agreed without alteration to donate approximately 3 acres/hectares of the aforesaid land to NABOISHO WOMEN GROUP CIG for 12 months/years.

Land owner (Farmer) NAKOYIAN MURKUK ID No. 28480128 Signature and date 31/05/2023

CIG Chairperson NAISHURO RESON ID No. 35630747 Signature and date 31/05/2023

Term and Conditions

1. The involved parties, being of sound mind and legal age, willingly and without any external influence, entered into this Memorandum of Understanding.
2. Upon signing this Memorandum of Understanding, the farmer committed not to take any action that could obstruct or interfere with the effective management of the specified parcel of land.
3. I acknowledge that the land designated for irrigation is free from any encumbrances or encroachments, is not subject to claims by any individual or group, and its ownership is undisputed.

4. I understand the potential impacts of the proposed activities on the donated land.
5. I have consented to this investment and land donation voluntarily, without coercion, manipulation, or any undue pressure from public or traditional authorities.
6. I confirm that I do not expect or require any financial or non-financial benefits or incentives as a condition for the donation.
7. The donation of this land will not reduce the remaining land area to a level that jeopardizes the livelihoods of its occupants and users, nor will it necessitate the relocation of any household.

Farmer's Witnesses

S/No	Name	ID/No.	Date	Signature
1	NHAWAKU KIRONYI	26022382	31/05/25	
2	EVALYNE SIKOMA	23931656	31/05/25	
3	SETU RESON	9784459	31/05/25	

CIG's Witnesses

S/No	Name	ID/No.	Date	Signature
1	LESILE TUMPES	30783791	31/05/25	
2	KONE KIRONYI	23394887	31/05/25	
3	Daniel Nakum	29894019	31/05/25	

Dated this 31/5 day of 05 2025

Area Chief

Name	Location	Signature & R/Stamp
MURION KARKAR	ILKERIN	



MEMORANDUM OF UNDERSTANDING (MOU) FOR LAND DONATION

ITEM	DESCRIPTION
Name of Sub-Project	OSUKOMWA ENTE DAM & IRRIGATION PROJECT
Project Physical Location:	LOITA WARD, ILKERIN
GPS coordinates	-1-82240S, 76-56610E - 76912.39E 9798374.46N

I, SALGILU KIRONYO at ILKERIN Location
in LOITA Ward

Being the owner/beneficiary of the land parcel of No. 1982 at WABEK SOUTH Sub-county do hereby declare and sign that I have agreed without alteration to donate approximately 11 acres/hectares of the aforesaid land to ILAMUWAK CHE CIG for 12 months/years.

Land owner (Farmer) SALGILU KIRONYO ID No. 209603133 Signature and date 31/05/2023

CIG Chairperson OLASERIAN NGABUAL ID No. 08085726 Signature and date 31/05/2023

Term and Conditions

1. The involved parties, being of sound mind and legal age, willingly and without any external influence, entered into this Memorandum of Understanding.
2. Upon signing this Memorandum of Understanding, the farmer committed not to take any action that could obstruct or interfere with the effective management of the specified parcel of land.
3. I acknowledge that the land designated for irrigation is free from any encumbrances or encroachments, is not subject to claims by any individual or group, and its ownership is undisputed.



MEMORANDUM OF UNDERSTANDING (MOU) FOR LAND DONATION

ITEM	DESCRIPTION
Name of Sub-Project	OSUKUNUA EARTH DAM & IRRIGATION PROJECT
Project Physical Location:	LOITA WARD, ILKERIN
GPS coordinates	1.022103, 26.6966101 - 778902 2986 9718.371. 03M

I, NANYORRI KIRONJI at ILKERIN Location
in LOITA Ward

Being the owner/beneficiary of the land parcel of No. 1923 at NAROK SOUTH Sub-county do hereby declare and sign that I have agreed without alteration to donate approximately 1/2 acres/hectares of the aforesaid land to DARANA WOMEN GROUP CIG for 12 months/years.

Land owner (Farmer) NANYORRI KIRONJI ID No. 20096679 Signature and date 31/05/2023 *[Signature]*

CIG Chairperson NAUSHIRO KIPIRO ID No. 26027513 Signature and date 31/05/2023 *[Signature]*

Term and Conditions

1. The involved parties, being of sound mind and legal age, willingly and without any external influence, entered into this Memorandum of Understanding.
2. Upon signing this Memorandum of Understanding, the farmer committed not to take any action that could obstruct or interfere with the effective management of the specified parcel of land.
3. I acknowledge that the land designated for irrigation is free from any encumbrances or encroachments, is not subject to claims by any individual or group, and its ownership is undisputed.

4. I understand the potential impacts of the proposed activities on the donated land.
5. I have consented to this investment and land donation voluntarily, without coercion, manipulation, or any undue pressure from public or traditional authorities.
6. I confirm that I do not expect or require any financial or non-financial benefits or incentives as a condition for the donation.
7. The donation of this land will not reduce the remaining land area to a level that jeopardizes the livelihoods of its occupants and users, nor will it necessitate the relocation of any household.

Farmer's Witnesses

S/No	Name	ID/No.	Date	Signature
1	Tumpes murkuk	187991315	31/05/25	
2	Nidanga Ngabuan	29487965	31/05/25	
3	Kyolun Kupin	9174205	31/05/25	

CIG's Witnesses

S/No	Name	ID/No.	Date	Signature
1	Nalepo Kupin	24620623	31/05/25	
2	SAYIANKA KUPIN	26079341	31/05/25	
3	Nidalareta Muruk	28394797	31/05/25	

Dated this 31 day of 05 2025

Area Chief

Name	Location	Signature & R/Stamp
MION KARKAR	INKERIN	

11.19 Approval for Primary Pipeline Easement



NAROK COUNTY GOVERNMENT DEPARTMENT OF ROADS, TRANSPORT & PUBLIC WORKS

County Headquarters
Mau-Narok Road, Narok Town
P.O. Box 898 - 20500
Narok, Kenya.

Tel: 020 - 268 8929/03
Email: infrastructure@narok.go.ke
Website: www.narok.go.ke

When Replying Quote:

THE COUNTY PROJECT COORDINATOR,

NATIONAL AGRICULTURAL VALUE CHAIN DEVELOPMENT PROJECT

(NAVCDP)

P.O BOX 898-20500

NAROK.

13th June ,2025

RE: APPROVAL FOR PRIMARY PIPELINE EASEMENT

NCG /DOALFI/NAVCDP/ESS/VOLI. /003

I hereby approval to install a primary pipeline easement crossing the roads located at coordinates (35.6866104,1.822105) and (35.6865323, -1.8222046) with the osokunua irrigation scheme area, this office hereby grants you permission to lay the irrigation pipes across the mentioned road

Kindly ensure that the pipes are deeply buried to project against any potential damage

Regards,

WELDON ROP
CHIEF OFFICER -ROADS
NAROK COUNTY GOVERNMENT
DEPARTMENT OF ROADS