NEMA APPLICATION ID: NEMA/EIA/SR/2555

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT PROJECT REPORT

FOR THE PROPOSED IRRIGATION SCHEME PROJECT IN MATA SUB-LOCATION, MATA LOCATION, MATA SUB COUNTY, TAITA TAVETA COUNTY

GPS COORDINATES: 37 M 0361330 m E 9616330 m N

Prepared For	Prepared By
Twiga Foods Limited **3rd Floor – 9 Riverside,** **Riverside Dr – Nairobi** **Tel: 0709 258 000/ 0758712436** **E-mail: info@twiga.com**	ecofix We fix it, you live it **Ecofix Consultancy Limited** **Information (KBC) Building** **P.O. Box 1376-30200 Kitale** **Tel: +254 790 334 886 / 711 850 057** **E-mail: ecofixconsultancy@gmail.com** **Website: www.ecofixconsultancy.com**

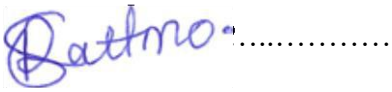
FEBRUARY, 2022

DOCUMENT AUTHENTICATION

This Environment and Social Impact Assessment Report for Twiga Foods Limited has been prepared by Ratemo Sammy Kinara (NEMA Reg. No. 7551) in accordance with the Environmental Management and Coordination Act (EMCA) 1999 and the Environmental Impact Assessment and Audit Regulations 2003 which requires that every development project must have an EIA report prepared for submission to the National Environmental Management Authority (NEMA).

We, the undersigned, wish to certify that the particulars in this report are correct and a truthful representation of all the findings relating to the Twiga Foods Limited Irrigation Project, within Taveta Kisima Farms Limited demised premises in Taita Taveta County.

Environmental Expert	NEMA Reg. No.	Tel:
Ratemo Sammy Kinara	Lead Expert No: 7551	0790334886

Name: …Ratemo Sammy Kinara……..… Signature: ……  ….…….

Designation: ……EIA Lead Expert…… Date: ……24th February, 2022…

Certification by the Proponent

On behalf of Twiga Foods Limited, I hereby confirm that the contents of this Environment and Social Impact Assessment Report is a true reflection of the proposed irrigation project. We shall endeavour to implement the environmental mitigation measures in the report to ensure our facility complies with applicable environmental regulation.
Name: ……Nicholas Ambanya…….....

Designation: ……Chief Officer, Fresh…. Signature: … 

…

Tel No.:0758712436…… Date: ……24th February 2022……

KRA PIN: P051448864U

FACT SHEET

Project Name	Proposed Irrigation Scheme for Twiga Foods Ltd in Taveta Kisima Farms Limited	
Assignment Name	Environmental and Social Impact Assessment (ESIA)	
Location	Mata sub-location, Mata location, Mata sub-county, Taita Taveta County	
Site Coordinates	Office	37 M 0361330 m E 9616330 m S
	Maize Plantation	37 M 0360208 m E 9616384 m S
	Water reservoir	37 M 0360653 m E 9614612 m S
	Pump House	37 M 0360695 m E 9614712 m S
	Inlet to the Water reservoir	37 M 0360660 m E 9614718 m S
	Fish Ponds	37 M 0362276 m E 9610584 m S
	Twiga Foods Limited Stores & warehouse	37 M 0361986 m E 9614769 m S
	Proposed Water retention Pan	37 M 0361305 m E 9615777 m S
Main water source	Njoro Kubwa / Lumi Rivers	
Proponent	Twiga Foods Ltd	
Address of the Proponent	3rd Floor – 9 Riverside, Riverside Dr – Nairobi	
Contact person	Mr. Nicholas Ambanya	
Project Cost	**Kshs 227,619,900**	
Technical Team	Mr. Sammy K. Ratemo – Environmental Expert Eng. Bernard Kasabuli- Civil/ Dam Engineer Dr Oduor Okoth- Hydrologist/ Water Resources Expert Ms. Pauline Ikumi - Socio Economist Mr. Denis Lukato-Ecologist	

EXECUTIVE SUMMARY

The agricultural sector is the backbone of Kenya's economy and the means of livelihood for most of the rural population whilst providing food supplies to the urban population. Agriculture as the mainstay of the Kenyan economy directly contributes 26% of Kenya's GDP annually and another 25% indirectly. Despite the importance of this sector to the economy, climate variability has negatively affected this sector and has had a tremendous impact on the vulnerability of mainly the small-scale farmers as well as the economy. Increased desertification of the country has further exacerbated this problem making rain-fed agriculture rather difficult owing to a reduced amount of water available for plant utilization. The need for irrigation arises if the country has to meet the demand for food commodities as well as meet the millennium development goal of halving the proportion of people who suffer from hunger by the year 2015.

In Kenya, an Environmental Social Impact Assessment must be carried out before any project that is likely to have an impact(s) on the environment and the social and economic well-being of the community involved. The Irrigation and reservoir project construction to be undertaken are among such developments that require the critical and strategic assessment as stipulated in the Environmental Management and coordination (amendment) Act, 2015 and Environmental Impact Assessment and audit regulation (2003). This is done to ensure sustainable environmental management.

Twiga foods Ltd has leased land and intends to start farming in the Kisima farm, Taveta. This will involve the use of overhead sprinkle irrigation in 380 hectares and drip irrigatio105 hectares. The source of water is mainly River Lumi, through a canal that passes by the farm. Also, there is an intention to build a reservoir of capacity 58,313m^3, to store some water and also act as a sump to feed the irrigation pivots directly.

Project Justification

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

Objectives of ESIA Study

The objective of the assignment is to assess the potential environmental and social impacts of the Project's proposed Reservoir construction and development of irrigation infrastructure in the Kisima Taveta farm (±485 ha) in Mata village, Taveta sub-county, Taita Taveta County in Kenya and propose mitigation measures which will effectively address the impacts and inform the project preparation and implementation.

Environmental compliance

Environment Social Impact Assessment (EIA) is required in accordance to EMCA 2015 determining the modalities of protection, conservation, and promotion of the environment in Kenya and World Bank operational policies: Environmental Assessment- OP/BP 4.01, Pest management- OP/B.P 4.09, Natural habitat- OP/B.P 4.04, Safety of dams- OP/B.P 4.37, for

implementation of this kind of infrastructure well as IFC performance standards. Summary of the relevant national laws and international safeguard standards to the proposed project include those indicated in the table below;

Policy, Legal, Regulatory and Institutional Framework:

Policy Framework • National Environment Policy, 2013 • The National Environmental Action Plan • National Gender and Development Policy, 2019 • National Land Policy 2009 • National Water Policy, 2012 **Legal and Regulatory Framework** • Constitution of Kenya • The Environmental Management and Coordination Act (EMCA), 1999 • The Environmental (Impact Assessment and Audit) Regulations 2003 • EMCA (Noise and Excessive Vibrations Pollution Control) Regulations, 2009 • EMCA (Water Quality) Regulations 2006 • EMCA (Waste Management) Regulations 2006 • EMCA (Wetlands, River Banks, Lake Shores and Seashore Management) Regulations 2009 • Agriculture Fisheries and Food Authority Act, 2013 **INTERNATIONAL POLICY FRAMEWORK** • United Nations Framework Convention on Climate Change (UNFCCC) • United Nations Convention to Combat Desertification (UNFCCC) of 1994, • The World Commission on Environmental and Development • International Finance Corporation Performance standards	• Irrigation Act 2019 • The Land Act, 2012 • County Government Act 2012 • Forest Conservation and Management Act, 2016 • Public Health Act (Cap 242) • Pest Control Products Act, 2012 • Occupational Safety and Health Act, 2007 • EMCA (Conservation of Biological Diversity and resources, Access to genetic resources and benefit-sharing) 2006 • Water Act 2016 **Institutional Framework** • Ministry of Water & Sanitation and Irrigation • Water Resources Authority • Ministry of Environment and Mineral Resources • National Environmental Management Authority • The Ministry of Agriculture • Pest Control and Products Board (PCPB) • Kenya Plant Health Inspectorate Services (KEPHIS) • County Government of Taita Taveta • World Bank Safeguard policies **INTERNATIONAL CONVENTIONS** • Ramsar Convention • The Convention of Control of Desertification-UCCD (1992) • EAC protocol on the environment and natural resources Irrigation Act 2019

Approach and Methodology

To meet the objectives of the study, we adopted systematic, integrated, participatory, and collaborative approaches. We gathered information through document reviews, field investigations, focus group discussions, and key informant interviews. We consulted administrators (Chiefs and their Assistants), community leaders among others. The EIA experts examined all legal and regulatory frameworks, socio-economic profiles in the project area, identified environmental impacts and proposed relevant mitigation measures. The report also provides an environmental management framework, monitoring, and evaluation mechanisms. The methodology of the study involved a preliminary assessment of the project, known as the

scoping study; where project literature, preliminary technical studies were reviewed and field visits were done to understand the project, identify its boundaries and relevant stakeholders.

Project Description

The project activities include the proposed irrigation project which will extract water from the canal from River Lumi and also underground water recharge at the reservoir. The proposed infrastructure consists of the following project components: -

- Establishment of the intake canal system,
- Establishment of the Reservoir,
- Center pivot irrigation scheme
- opening up of the 485 Hectares for the 10 Pivot Center irrigation system and drip irrigation system- clearing bush, levelling, and digging of land
- Distribution of water to the Pivotal System and drip system.
- Construction of the warehouses and stores for Twiga Foods, and
- Drainage system for excess water during storms.

Baseline Information

Taita Taveta County is one of the six counties located in the coastal region and is approximately 200km northwest of the coastal city of Mombasa and 360km southeast of Nairobi the Capital city of Kenya. The county covers an area of 17,084.1km^2 with 10,649.9 km2 (62.3 per cent) being within Tsavo East and Tsavo West National Parks The county borders Kitui, Makueni, and Tana River Counties to the north; Kilifi and Kwale Counties to the east; Kajiado County to the north-west and the Republic of Tanzania to the South. The county lies between longitude 37036//east and 300 14// east and latitude 2046// south and 40 10// south. TaitaTaveta County is classified into three major topographical zones, namely:

i. Upper zone – which comprises Mwambirwa, Taita, and Sagalla hills regions with altitudes ranging from 304 meters to 2, 208 meters above sea level. The zone is suitable for horticultural farming.
ii. Lower zone – which includes plains where the national parks, mines, and ranches are found.
iii. Volcanic foothills zone – which covers the Taveta region with underground water and springs sourcing from Mt. Kilimanjaro.

The hydrological analysis has revealed that the River Lumi basin has two major rainy seasons, MAM and OND which contribute to the river flow. A higher flood flow is evident in March to May while the lowest flow values are in June, July, August, and September. The basin has 28 water users who are have been licensed by WRA to abstract water from the Lumi river basin (3J). A total of 19,191.14m^3/day is allocated, most of which is for irrigation use. From the flow duration analysis, Lumi River has fairly high flood flows which could be utilized for irrigation purposes with no negative impacts. From the available records from Water Resources Authority, the river seems to be tending towards water stress levels due to intense abstraction. This project must therefore employ storage to avert negative impact on the downstream users and ecosystem.

Stakeholder consultations were undertaken to ensure that the views of the affected and interested parties especially the immediate community members so that their comments can be incorporated as early as possible in the project design and effect minimizing the potential unexpected opposition

of the development project and potential adverse effects to the environment. Community members welcomed the project, observed the need for the employment of the community members as well as need to ensure the water abstraction does not compromise, other users, on the lower riparian as well as caution in the use of chemicals not to affect the aquatic vegetation specifically in Lake Jipe.

Consideration of Alternatives

The Project site has been under agricultural cultivation, with most of the indigenous ecosystem degraded under cultivation, no endangered plant or animal species identified and no cultural heritage within its perimeters. This coupled with the fact that most of the land had been uncultivated for a while and the project is turning this land to a more productive state through irrigation makes this project more suitable and viable for this land. Several project alternatives were evaluated including the possible alternatives of the inputs and outputs that are to be used throughout the project cycle, alternative sites, activities, products, materials, technology (sprinkling, surface, flood, and drip irrigation), and waste management procedures among others. The "No Project" alternative was examined to help the proponent and various decision-making levels to approximate the impacts of project implementation against the non-implementation thereby making the right decision regarding project implementation.

Environmental and Social Impact assessment

Twiga Foods Limited irrigation scheme is likely to impact the project area and its surroundings either directly or indirectly. Some of the project's impacts highlighted in the study are offering employment opportunities, improved irrigation infrastructure, increased revenue to the county and national government, increased income, improved food security, and availing opportunities for skills acquisition. However, the major negative impacts include Interference with the physical setting, noise pollution, and vibration, dust pollution, occupational health and safety risks, solid waste generation, loss of vegetation cover, cut and fill wastes, soil erosion, soil compaction, pollution of wetlands, increased traffic, the spread of HIV/AIDS, water-Logging, breaking of embankments and flooding, Soil Salinization, poor pesticide, and agrochemical fertilizer management, loss of soil fertility from monoculture and use of inorganic fertilizers, sedimentation of the reservoir, Nutrient Leaching, increased water-borne diseases, human-wildlife conflict, water pollution of receiving water bodies and increased cases of agricultural pests, weeds, and disease. Other impacts were; soil erosion, air and noise pollution, dangerous borrow pits, fire outbreaks, vandalism of irrigation infrastructure, canal siltation, oil spillage resulting in soil and water contamination, among others impacts discussed. *Chapter 7*, in form of a table, gives a summary of negative impacts likely to be caused by proposed development that was anticipated by the locals during stakeholders' and public consultation. Details of the public consultation are addressed in the report. Positive and negative impacts are discussed thoroughly in *chapter 8*; with positive impacts reflected and mitigation measures proposed for every anticipated negative impact.

Environmental management plan (EMP) and monitoring plan

The report has proposed appropriate mitigation measures to address all the negative risks and impacts including but not limited to: ensure proper demarcation and delineation of the project area to be affected by construction works, employ the best available work practices to minimize occupational noise levels, strict measures to be applied for the handling of construction materials in powder form such as cement, lime, concrete additives, establish a Health and Safety Plan

(HASP) for both civil and electromechanical work, contract NEMA registered waste handler to dispose of waste and document all waste destruction certificate and waste transfer notes, plant indigenous trees or other fast growing trees in strategic locations where the vegetation cover was cleared as part of landscaping initiatives; use the excavated materials to balance lands with uneven topography, undertaken soil erosion control measures to avoid erosion in sensitive areas and those prone to erosion, apply sediment control procedures to prevent sediment returning into the rivers including but not limited to the retention ponds, regular watering of dusty roads and maintenance during this construction stage, instituting HIV/AIDS awareness among the project workers and awareness creation for both community members and all project workers on the signs and symptoms of COVID-19, how it spreads, how to protect themselves and the need to be tested if they have symptoms, adherence to the reservoir design to ensure world recommended standards are adhered by use of qualifies workmanship. To minimize Flood effects, a berm embankment of 1m height has been thrown around the pan, with vegetation cover around as well. The ESIA also evaluated the effectiveness of the environmental and social considerations to be undertaken by the project Proponent in safeguarding the environment to ensure sustainability and proposed key recommendations.

In *chapter 8 and 9*, presented in tabular form, an environmental and social management plan (EMP) indicating the mitigation measures, the procedure to be followed, monitoring indicators, the responsible institutions to implement these measures and the likely cost of implementing each of these mitigation measures have all been included in this comprehensive Environmental Social Impact Assessment (ESIA) report. The report ends with Chapter *10*, making conclusions from the study findings and submission of summarized recommendations.

Several recommendations have been proposed which include:

- Monitoring of water abstraction quantities to avoid water resource depletion is necessary.
- Integrated Pest Management (IPM) to guide pesticide application.
- Periodic soil tests to monitor soil, baseline, and progressive water quality tests to manage non-point source water pollution.
- Joining the area Water Resource User's Association (WRUA) for effective management of the catchment.
- Controlled use of agrochemical to control pollution by adopting organic fertilizers,
- Plant *Phytolaca decocandra* to control Bilharzia snails hence eliminate *schistosomiasis.*
- Implement a green belt buffer zone of at least 50m along the reservoir and a 2m buffer zone from the river to prevent encroachment of these water sources,
- Periodic manual removal of aquatic weeds from the reservoir to avoid the possibility of an uncontrollable invasion of the reservoir by weeds rendering it non-navigable and incapable of providing sufficient quantities to effectively irrigate the command area.
- Periodic desilting of reservoir and canal to obtain optimal use of the infrastructure.

In conclusion, given the nature and location of the development, the potential impacts associated with the proposed development are of a nature and extent that can be reduced, limited, and eliminated by the application of appropriate mitigation measures. The adverse impacts on the physical and natural environment will be "in total," not significant, and can be handled through the recommended mitigation measures. With due considerations to sustainable development, it is recommended that the proposed Twiga Foods Limited project be approved by the Authority with strict adherence to the proposed mitigation measures.

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ABBREVIATION

AEZ	Agro-Ecological Zone
AIDS	Acquired Immune Deficiency Syndrome
CAACs	Catchment Area Advisory Committees
CBO	Community-Based Organization
DAO	District Agriculture Officer
DIO	District Irrigation Officer
DLO	District Livestock Officer
DOCS	Directorate of Occupational Safety and Health Services
EMCA	Environmental Management and Coordination Act
ESIA	Environmental and Social Impact Assessment
ESMP	Environment & Social Monitoring Plan
FGD	Focus Group Discussion
HHs	Households
HIV	Human Immunodeficiency Virus
IPM	Integrated Pest Management
IWUA	Irrigation Water Users Association
MSDS	Material Safety Data Sheets
NEC	National Environmental Council
NEMA	National Environment Management Authority
PCPB	Pest Control Products Board
PPE	Personal Protective Equipment
SERC	Standard and Enforcement Review Committee
UMZ	Upper Midland Zone
UTM	Universal Transverse Mercator
WGS	World Geodetic System
WRA	Water Resources Authority

1.0 INTRODUCTION

1.1 Project Background

The project proponent, Twiga Foods Limited of P.O Box 38714-00100, Nairobi is in the process of utilizing River Lumi through a pre-existing canal that passes through their farm for the development of the Taveta Kisima Farm Irrigation Project. The purpose of this report is to evaluate the effects/impacts of the proposed development about the general environmental aspects i.e., physical, biological, and socio-economic environments. It aims at influencing g the protection and coexistence of the development with the surroundings as well as the compatibility of the proposed development to the area; to ensure and enhance sustainable environmental management during implementation and operational phases.

Irrigation in the area will invariably result in many far-reaching ecological changes. Some of these will benefit the human population, while others threaten the long-term productivity of the irrigation project itself as well as the natural resource base. The undesirable changes are not solely restricted to increasing pollution or loss of habitat for native plants and animals; they cover the entire range of environmental components, such as soil, water, air, and the socio-economic system. It is in this regard that Kenya has accepted the principle of environmental screening of development projects at the planning stage and undertaking ESIA for those that are recommended following the screening process, to conform to the requirement spelt out under section 58 of the Environmental Management and Coordination Act, 2015 (EMCA) which stipulates in part that a project proponent must seek a NEMA license notwithstanding any approval, permit or license granted under this Act or any other law in force in Kenya…‖ and the requirement for NEMA license for all projects listed in the Second Schedule of the Act.

1.2 Project Justification

Irrigation is considered a priority by the government in enhancing agricultural productivity and thereby contributing to food security and poverty alleviation. Indeed, the development of this irrigation infrastructure in the County is considered very beneficial and cost-effective given the water resources present. As a result, the local communities are expected to engage in more productive agricultural farming which would lead to food security and reduced poverty. Equally, a significant segment of households in the project areas will benefit from resulting jobs created at on-farm management and income from the sale of agricultural produce.
The purpose of the project is to increase agricultural productivity and profitability in the area by planting tomatoes, Onions, and Melons rotationally. The main agricultural products in the area are maize, therefore, making it surplus to demand which leads to low market price. The over-reliance on maize has enabled some community members to divert their farming efforts to planting soya beans.

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

The objective of the study was to carry out an Environmental and Social Impact Assessment (ESIA) of the project areas by the Environmental Impact and Audit Regulations (Amended) 2019 and The International Finance Corporation Performance Standards for ESIA and submit a report to NEMA for evaluation and approval. This will involve carrying out a systematic examination

of the present environmental situation within the project area to determine whether the proposed project will have adverse environmental, social, cultural, economic, and legal considerations and impacts on the surrounding area. The assessment included collection and analysis of environmental baseline data, identification of impacts (both positive and negative) analyses and evaluation of impacts, formulation of mitigation measures for significant negative impacts, analysis of project alternatives, and development of environmental management and monitoring plans. Specifically, the assessment is aimed at achieving the following specific objectives:

- To establish the baseline environment of the proposed irrigation project
- To determine the compatibility of the proposed development with the neighbouring land uses.
- To identify and evaluate the significant environmental and social impacts of the proposed project
- To assess and analyse the environmental and social costs and benefits associated with the proposed project
- To incorporate environmental and social management plans and monitoring mechanisms during implementation, operation, and decommissioning phases of the project
- To incorporate stakeholder consultations into the environmental and social management process,
- Identifying the impacts of the project and project activities on the environment
- Proposing mitigation measures for the significant negative impacts on the environment
- Generating the baseline data for monitoring and evaluating impacts, including mitigation measures during the project cycle.

1.4 Terms of Reference &Scope of work

Scoping Study was undertaken by the consultant's team to collect enough relevant information to ensure a focused ESIA/ESMP. The purpose of the scoping study for the Twiga foods Ltd irrigation project, Taveta was:

- To consider the main environmental problems to be studied, alternatives and to ensure that the spatial and temporal scopes and extent of the environmental assessment are compatible with the size of the project;
- To determine appropriate EIA methods relevant to the project's potential environmental and socio-economic impacts;
- To provide information to communities in areas affected by the project on the environmental problems and alternatives so that they may take part in identification and assessment of the project's environmental and socio-economic impacts;
- Scoping was a necessary step in the formulation of detailed ToR for impact assessment by the developer.

The scope of this study was restrained to the boundaries of Kisima farm, Taveta, Mata village. This study investigated the influence of the development of the ±485ha of irrigation in Kisima farm on the surrounding areas. This included; the area allocated for construction of the intake works from the canal, reservoir, irrigable command area downstream, neighbouring farms/communities, and any off-shore influence. Cumulative impacts on the nation, region, and international laws and regulations were also reviewed, as a means of understanding the actual impact of the Twiga foods ltd irrigation project on Kisima farm Taveta. Terms of reference (ToR) were developed to outline the conditions and expected output of the impact

study. In brief, ToR included:

- A critical look into project objectives.
- Assessment of the proposed location of the project.
- A concise description of the baseline information, national environmental legislative and regulatory framework, and any other relevant information related to the project.
- Evaluation of the technology, procedures and processes to be used, procedures and processes to be used in the implementation of the project.
- Evaluation of the materials to be used in the construction and implementation of the project and their extended sources.
- Description, evaluation and analysis of the foreseeable potential environmental effects of the project broadly classified into physical, ecological/biological and socio-economic aspects (direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated)
- Evaluation of waste management.
- Evaluation and analysis of alternatives including the proposed project, no project alternative, project site, design and technologies.
- An Environmental Management Plan (EMP), proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment.
- Propose measures to prevent health and safety hazards and to ensure security in the working environment for the employees and the management in case of emergencies.
- This encompasses preventing and managing foreseeable accidents during both the construction and operational phases. Such other matters as NEMA and other international regulations may require.

1.5 Approach and Methodology of ESIA Study

This ESIA study was based on the available baseline information and reports on the proposed irrigation project. Among the sectored issues addressed by the study were: irrigation systems design, technologies and water management; socioeconomic, gender, and socio-cultural issues, Biodiversity, environmental conservation, and occupational health and safety. The latter aspect was considered as cross-cutting and therefore was captured in pertinent sectoral issues. This ESIA study report was prepared by "*The Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2019*" for submission to the National Environmental Management Authority (NEMA).

This study followed procedures stipulated in the World Bank Safeguard Policies, General Guidelines and Procedures for Environment Impact Assessment. The study adopted the following approach: (i) scoping study/ preliminary assessment, (ii) review of secondary data on baseline information (iii) review of policies and regulations, (iv) review of previous meetings and consultations with stakeholders, (v) interviews with key stakeholders, and (vi) field surveys at the project site to gather information and data on various aspects of the project site. Site locations, land cover, proposed infrastructure were described fully with clear maps for a comprehensive understanding of the area and project activities and to make the task of planning and monitoring easier during the implementation of the mitigation measures for the identified impacts.

During the site visits, some comprehensive field survey data on the irrigation project and its environs were collected. The field survey was based on pre-determined parameters and acceptable methodologies used in environmental and social impact assessment. Field surveys included

observations and interviews with informants. The data collected was processed to establish the existing and expected environmental impacts.

The overall objective of the assessment was to get the views and hear the voices of respondents of the local community on the positive and negative impacts of the irrigation project and suggest possible mitigation measures. The key issues which have been addressed during the assessment included economic opportunities, cultural beliefs and practices, irrigation infrastructural development, emerging scenarios with project and community consultation and participation. The methodology followed is hereby outlined: -

1.5.1 Screening and Scoping

The proponent had already identified the project as among those requiring environmental impact assessment as per schedule 2 of EMCA, 2015 for screening. During scooping key issues and potential environmental socio-economic impacts were established, evaluated and their severity determined.

A scoping study was done involving consultation with the client technical staff, Mata village authorities, Water resource user's association leaders for the catchment, sub-region Water resource authority officers, County environment officers and County agricultural officers.

The scoping exercise entailed a preliminary visit to the site area for the following reasons:

- Site reconnaissance to understand the spatial coverage of Kisima farm and the irrigation project.
- Probable positions of the dyke, limits of the reservoir and limits of the command area;
- Identification of the likely stakeholders who will be involved in the public consultation;
- Preliminary findings of the existing environment; (primary, biological and socio-cultural environment)
- Preliminary predictions of likely positive and adverse impacts;
- And finally establishing clear study boundaries and focusing on the relevant issues concerning the study.

The scoping study also involved literature review on; Preliminary technical study of the irrigation scheme, project documentation, Water resources use regulations, Agriculture sector policies and regulations, Government Economic Development for Poverty Reduction Strategy, International Finance Corporation Performance standards, World Bank safeguard policies, and other project-related policies, among others.

1.5.2 Desk Review

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

- Project Preliminary Design

- Feasibility Studies for the project
- Ecological and survey reports (Biodiversity reports)
- Socio-economic reports
- Agricultural reports
- Floods and drainage reports
- Irrigation engineering reports
- Hydrologists reports (WRA)

An intense deskwork was done of existing institutional legislation, policies, plans and programs, which might influence the implementation of the project, maintenance and enhancement of the environmental resources. Institutions reviewed include Taita Taveta County, Ministry of Agriculture, Water Resources Authority, Ministry of Lands, Ministry of Water and Sanitation and irrigation, National Environmental management authority, among others. The literature review for policies involved but was not restricted to the following;

- National Water Resources Management Policy
- Water and Sanitation Policy
- Health Sector Policy
- Land policy
- Wildlife and biodiversity policies

Other than national policies and regulations influencing this project, this review paid considerable attention to regional protocols, International Finance Corporation Performance standard, World Bank safeguard policies and international conventions. World Bank Safeguard Policies included;

- Environmental Assessment (OP4.01, BP 4.01, GP 4.01)
- Natural Habitats (OP 4.04, BP 4.04, GP 4.04),
- Forest Operational Policy 4.36,
- Pest Management Operational Policy 4.09,

The International performance standards include:-

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts
- Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural

International Conventions include

- United Nations Convention on Biological Convention,
- Ramsar Convention on Wetlands among others

1.5.3 Field Data Collection

The consultancy team conducted field visits to the proposed project site to obtain further data and consult with the stakeholders. The consultancy team established the nature of the surroundings including existing infrastructure, economic and social setup of the local communities whose normal daily activities will be and/or likely to be affected by the implementation of the proposed irrigation project. During the field study, the consultancy team collected existing information and administered interviews to predict the potential environmental impacts on day-to-day activities at the site due to the implementation of the proposed irrigation project.

This involved visits to the site earmarked for the project components and activities. The Consultant was accompanied to the sites for the scoping visit, field staff for Kisima farm, and other personnel

that included Water Resources Users Association Secretary and county Agriculture, officer. Subsequent field surveys were done to capture a broad picture of the prevailing situation at the site. Activities included:

i. Appraisal of physical and environmental conditions of the project site and areas that may be impacted by or may have an influence on the proposed irrigation project and its associated facilities and services, namely; Water, climate, topography, soils, drainage/hydrology, flora, fauna, etc.
ii. Appraisal of adjacent land use, alternative sites or technologies for the project and assessment of other relevant socio-economic parameters and biodiversity parameters.
iii. Understanding the detailed project description through comparison of the filed survey and the preliminary technical study.
iv. Opinions of locals on the project, their opinions on likely positive and adverse impacts, proposals on mitigation measures to adverse impacts.

1.5.4 Project Data Synthesis

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

1.5.5 Public Consultation

The consultancy team organized and convened public consultation meetings for the stakeholders. The consultancy team used the local administration leaders (e.g., local chiefs and their assistants, water resource users, youth leaders, and village elders) to reach the communities. During this forum, the consultancy team in close consultation with the client shared the project information in terms of its implementation and predicted impacts.

The study applied different participatory methods, namely interviews, one-to-one discussions, focused group discussions and official meetings with stakeholders as stipulated in the ToR. The consultation was first conducted with Kisima farm staff and the *developer/ proponent*, to get the details of the proposed activities. Stakeholders consulted were informed on the proposed project and asked to raise their concern on the proposed project (See the List of Stakeholder List on Appendix 6)

The stakeholders pointed out several issues and concerns. An issue raised by one individual or a group of people was cross-checked by discussing it over with other individuals or groups. Concerns raised by stakeholders are summarized in Chapter five.

1.5.6 Baseline Data and Information

Information on the physical, biological, socio-economic environment, institutional and legal regimes was collected from a variety of sources, namely project documents and general literature review, visual and inspection, expert opinion, consultations with selected stakeholders and discussions with The Kisima farm staff.

1.5.7 Impacts Assessment

The environmental and social impacts assessment was done by superimposing project elements onto the existing environmental conditions of the project site. Environmental impacts were then

identified, their significance assessed and mitigation/enhancement measures proposed. Simple matrices and the Consultant's expert judgment were used to assess the impacts.

1.6 REPORT STRUCTURE

This report is organized into eleven chapters. Chapter 1 gives a general background of the project; Chapter 2 deals with the project description, Chapter 3 describes pertinent policy, legal and institutional framework within which the project will operate; and Chapter 4 presents the baseline data, environmental, socio-economic and cultural setting of the project site. Chapter 5 presents the findings of the Stakeholders' consultation and public participation. Evaluation of project alternatives is presented in Chapter 6, Impacts identification, evaluation for significance and proposed mitigation measures are elaborated in Chapter 7. An Environment and Social Management Plan is captured in Chapter 8.

Monitoring and Training of the project are presented in Chapter 9, while Chapter 10 provides conclusions and recommendations of the project.

2.0 PROJECT DESCRIPTION

2.1 PROJECT AREA

2.1.1 Project Location

The proposed irrigation scheme is located in Mata sub-location, Mata location, Mata Sub County; Taita Taveta County under GPS coordinates: 37 M 0360208 m E 9616384 m S. The area size to be used for the irrigation project is approximately 485 hectares (see Figure 2-1 to 2-5): It will draw water from Lumi River at coordinates: latitude -3.48494, longitude 37.74589, and altitude 717masl.

Access to the site is by the Voi- Taveta road, branching off at an earth feeder road leading to Mata village The scope of this environmental assessment is restricted to ±485ha of Twiga Foods Ltd Irrigation scheme.

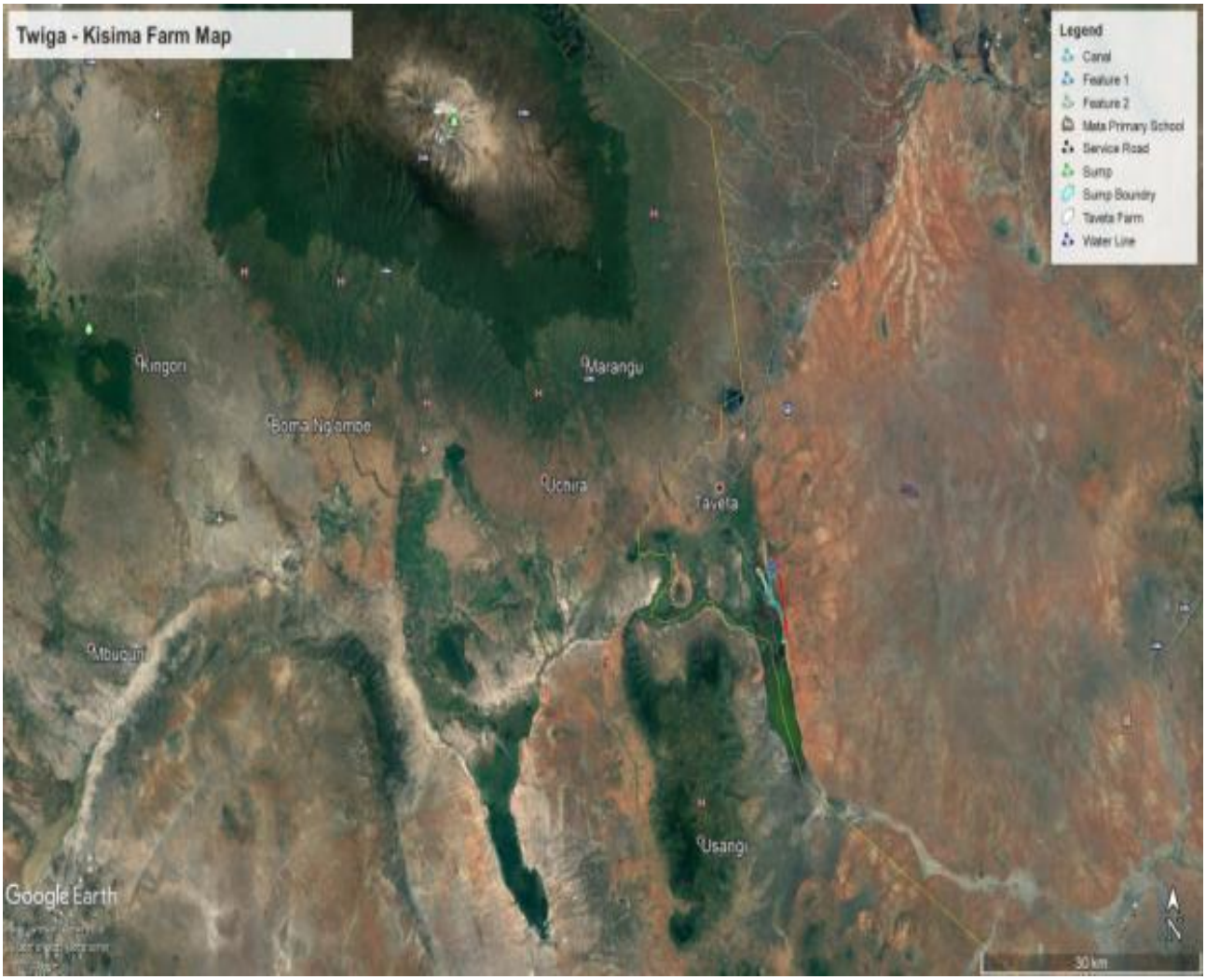

Figure 2-1: General Google Overview of the project area

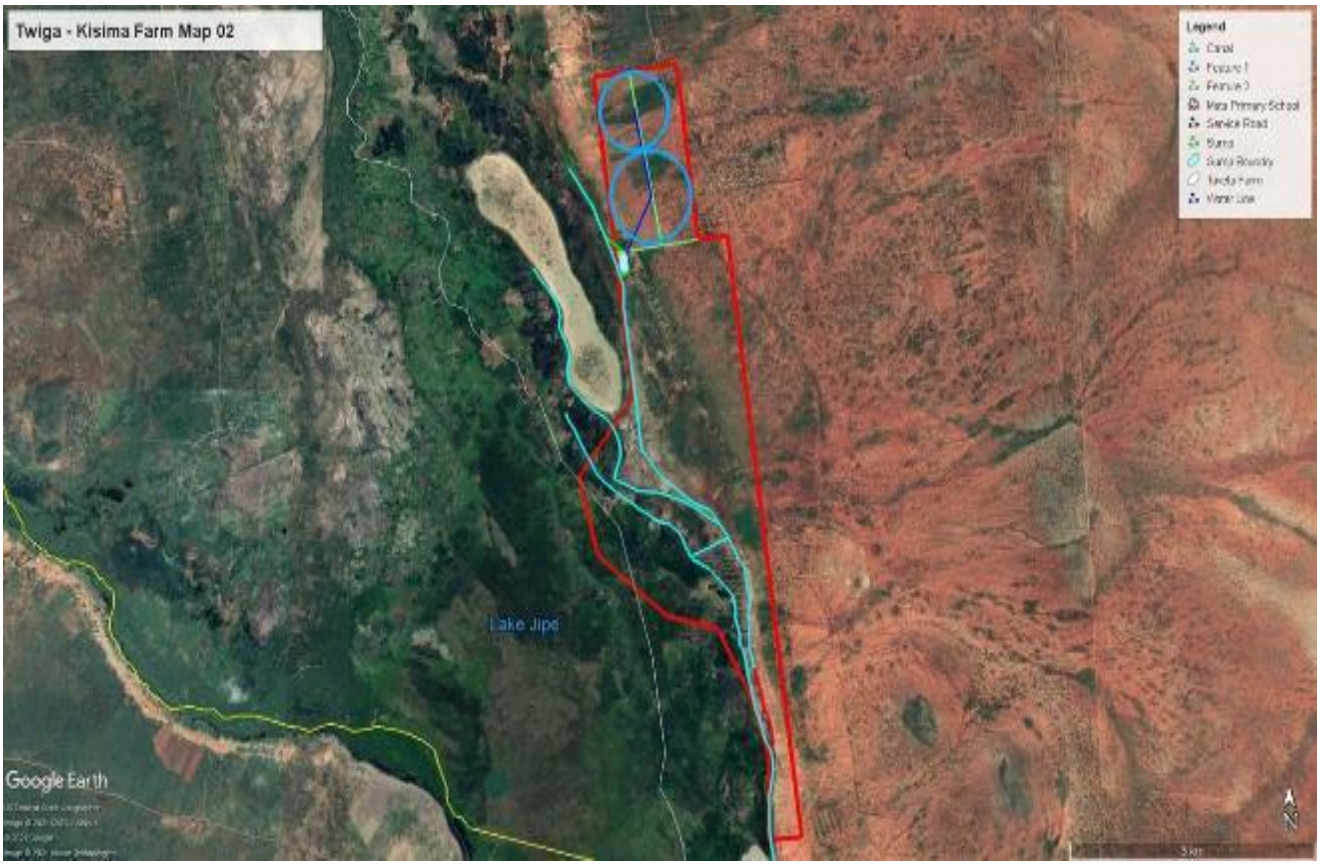

Figure 2-2: Google overview of the project area

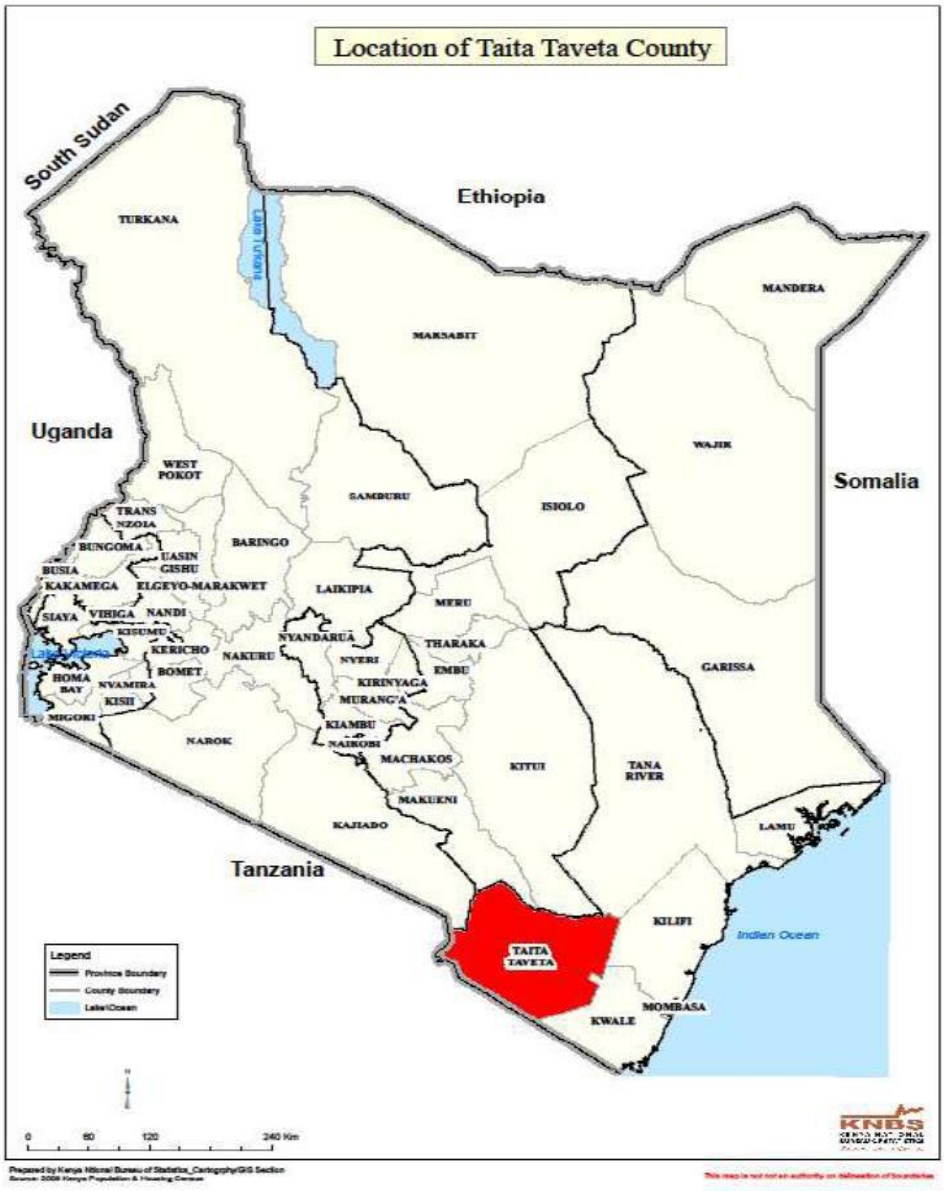

Figure 2-3: Location of Taita Taveta County in Kenya

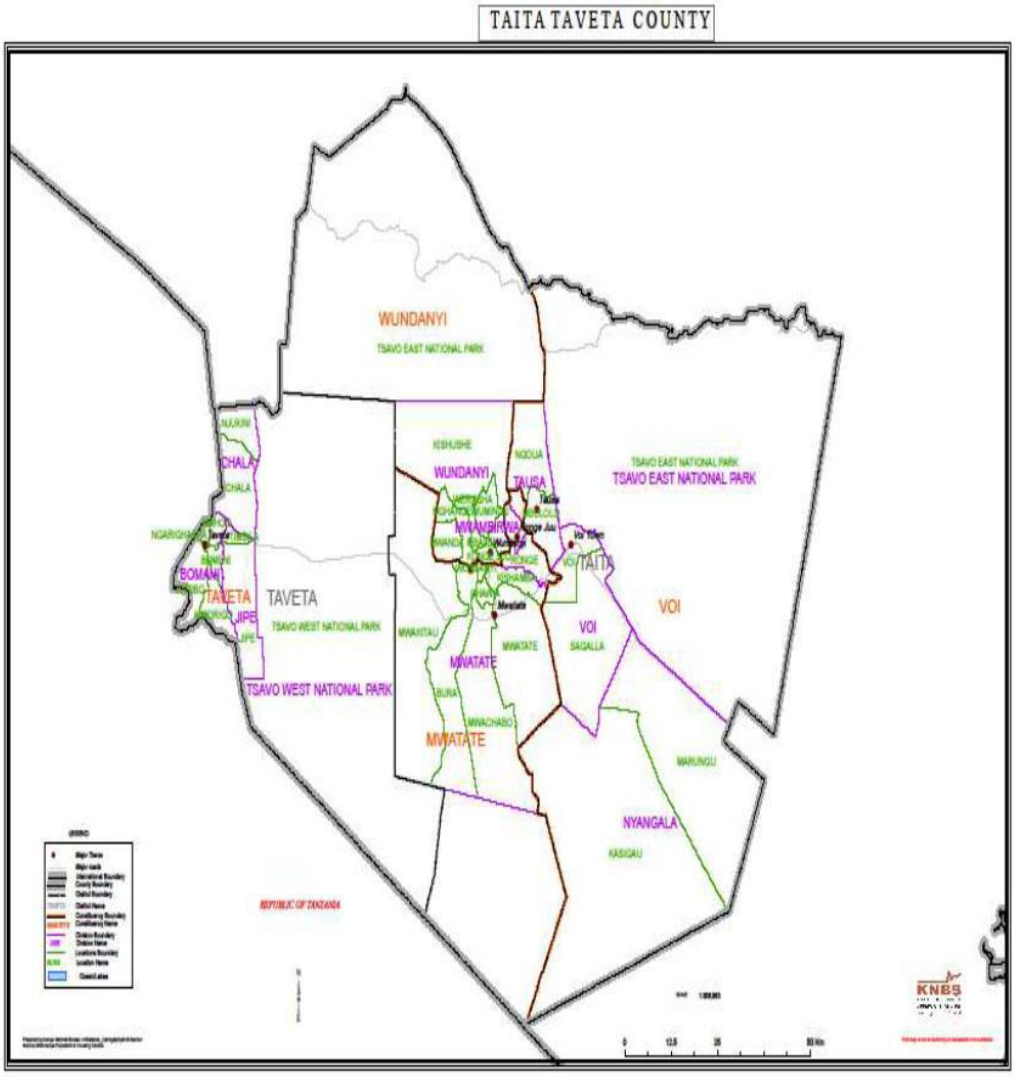

Figure 2-4: Location of Taveta Constituency in Taita Taveta County

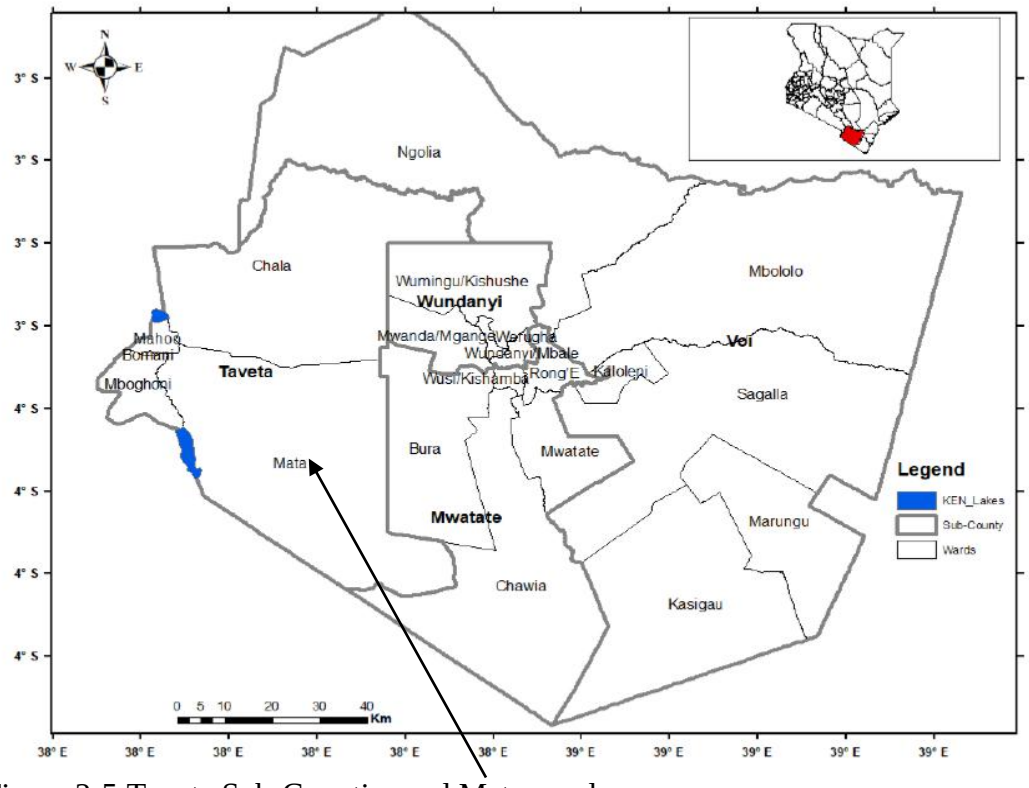

Figure 2-5:Taveta Sub-Counties and Mata ward

2.1.2 Existing features observed

There is an existing canal drawing water from River Lumi that passes by the farm. Water is being drawn to existing fish ponds and reservoirs on the farm. There is also a road passing through the farm for accessibility in the farm. There are maize plantations on part of Kisima farm and Livestock as shown in figures 3-6 and 3-7. The project generally will cover bare land, with no plantation currently on bushes. There are also some existing Pivot irrigation schemes on the farm.

Figure 2-6: Maize plantation at the project site

Figure 2-7: Borana cows and Maize plantation at the project site

2.1.3 Overall Adjacent Developments

The proposed project site is located within private farms in the rural areas of the county; this would mean that there are no major development activities apart from livestock farming or open field grazing and maize plantations.

There are no homesteads in the nearby surroundings. The surrounding area is the village settlement scheme where the villagers have farms that use the same channel for irrigation. The common type of transport means observed in the area are; bicycles, pedestals (by foot) and on a couple of instances motorcycles but hardly any vehicles.

2.2 Land Ownership

The proposed project is located on land reference number 10287/10 (Original Number 10287/5/4). The proponent; Twiga Foods Limited is leasing this piece of land from Taveta Kisima Farms Limited.

2.3 DESCRIPTION OF THE PROJECT ACTIVITIES

2.3.1 Overview of the project

General features of the proposed project Phase one;

- The area to be covered will be 485 Ha
- It will have a total of 10 pivots of area 38Ha and the wetting radius of the pivot is 350m
- The pressure requirement at the inlet of the pivot is 25m
- The flow required for each pivot is 117m^3/hr.
- The application rate is 7.5mm/day
- Designed to operate all pivots at a time

For phase 2 which will be 85 hectares, it will have a drip irrigation system.

The proposed phase one system will consist of the following key components:

- Zymotic 9500P Pivot irrigation system
- Sand traps
- Tower Lights
- Gearboxes and base beam support
- Electric Motors
- Alignment system

- A-frame
- Tower seals

Other components of the project include the reservoir and the drainage structures that are the dykes.

2.3.2 Zimmatic 9500P Pivot irrigation system

Zimmatic 9500P Pivot Irrigation System provides the ideal management tool thereby ensuring optimum production efficiency. They are specifically designed for the extreme conditions encountered in Africa and are built to meet the specific needs of the client. This enables the former to enhance crop production and profit. Update technology is combined with only the highest quality materials to ensure that Zimmatic 9500P Pivot is effective and efficient.

To ensure absolute stability the centre tower is a strong and durable structure, anchored to a reinforced concrete base. The design of the weatherproof control panel focuses on safe and easy operation. The control panel is mounted on the centre tower, which controls all the electrical and water supply functions. It enables the operator to pre-set and control all the various options relative to activation, stopping, reversing, increasing and decreasing travelling speed, as well as cutting out the system. Built-in pressure sensors prevent the pivots from operating if the water pressure is too low. It will have the following characteristics;

- Zimmatic 9500P Centre Pivot
- 3*6-58", 54.5m & 3*5-916", 54.5m Spans 20.1m overhang.

Figure 2-8: Zimmatic 9500P Pivot irrigation system at coordinates 37M 0360888 m E 9615848 m N.

The Zimmatic 9500P Pivot irrigation system is composed of the following structures:

- Pipe strength 11-gauge, 6 5/8" diameter pipeline is more than 10% thicker than the competition's best offering, providing strength, durability and long-lasting integrity.
- Robust pivot point Standard, medium, high and ultra-high clearance options fit virtually every type of field, and hot-dipped galvanized steel legs and heavy-duty cross-members form a rugged foundation.
- Full flow collector ring Exclusive design that's externally mounted to eliminate water flow restrictions—a distinct advantage—and features dual sliding contacts to ensure uninterrupted power.
- Watertight seal Exclusive preformed sprinkler outlets allow for a tight seal to avoid leakage and rusting, which is key for eliminating waste and extending the life of your pivot.

- Advanced controls User-friendly control panels are compatible with FieldNET to offer precise, time-saving management, whether you're in the field or out and about.
- Zimmatic's exclusive V-Jack truss design distributes the span's load evenly, providing superior support and durability. Forged-head truss rods in heavy pocket-type rod anchors add strength and support to each span.
- "X-type" tower bracing links each span with the next tower, absorbing torsional stress caused by uneven terrain
- Zimmatic's exclusive Uni-Knuckle span connection offers full support, stress-free flexibility and external design to eliminate flow restriction.
- Radial tires offered by Zimmatic provide a new high-performance alternative to bias tire options. They are wide, flat profile for improved flotation and tracking, low air pressure for less compaction and rutting, and heavy load rating; even at lower pressures.

2.3.3 Sand Traps

Sand traps are provided on all overhangs to facilities cleaning and to prevent clogging of the spray nozzles.

2.3.4 Tower Light

To indicate the pivot's position and progress. A strong light is mounted on the end tower.

2.3.5 Water Reservoir

The proposed intake canal is to be constructed at coordinates 37M 0360660 m E 9614718 m N to direct water to the water reservoir of capacity 58313m^3 where it will be pumped to the intended irrigation project area.

Figure 2-9: Water Reservoir

2.3.6 Mainline

The mainline will be HDPE Pipes 315mm, 250mm and 200mm of pressure rating PN6. There will be 4 mainlines, out of which two lines connect 3 pivots each and the other 2 lines will connect 2 pivots each making a total of 10 pivots. All necessary fittings to connect the mainline to pivots are included.

2.3.7 Pump

The project will be served by 2 pumps: KBS 125-50/2-55KW-4 POLE motors of Head – 55m, Flow – 175.5m^3/hr. will connect to 3 pivots, and KSB 125/40/55KW – 4 POLE motors of Head – 45m, Flow – 219.8m^3/hr will connect to 7 pivots.

Figure 2-10: Main and Slave Pump at the site

2.3.8 The Generator

The generator will be used to generate electrical power for pumping of water from the dam. The generator will be used in case there is a power shortage in the area to enable continuous work in the proposed project.

Figure 2-11: Powerhouse under construction

2.4 CONSTRUCTION ACTIVITIES AND INPUTS

2.4.1 The project inputs:

Construction raw materials

These will include metal rods, sand, cement, water pipes and impermeable plastic material for laying on the base of the dams. All these will be to the approved standards and shall be obtained from licensed dealers especially those that have complied with the environmental management guidelines and policies.

Construction machinery

Include but not limited to excavators, trucks, concrete mixers and other relevant construction equipment. These will be used for the transportation of materials, and in construction activities. Some of the machinery will use petroleum products to provide propulsion energy.

A construction labour force of both skilled and non-skilled workers will require services such as water supply, washing and sanitation facilities. Water for construction purposes. This will be obtained from the current water supply system within the farm.

Construction activities

- Bush clearing
- Trench excavation and levelling of the land
- Felling trees and uprooting rock outcrops
- Construction of division boxes
- Canal lining culvert construction
- Water conveyance piping system
- Rehabilitation of the existing water reservoir 200 by 100 meters
- Bulk and connection water meters installation.

Figure 2-12 On-Going Clearing of Bush and Levelling of grounds

2.5 Infrastructure

The proposed irrigation project will extract water from River Lumi and Njoro. The proposed infrastructure consists of a Centre Pivot irrigation system. The main components are:

- Establishment of the intake canal system
- Establishment and lining of the canals for conveying water
- Drainages for excess water during irrigation and storms.
- Construction of the reservoir.

2.6 Irrigation Crops

The crops to be grown in the irrigation project include various varieties of tomatoes, onions and melons which are to be sold locally or transported into various major towns in Kenya.

The cropping patterns in the area are largely mixed with food crops grown with the vegetables such as tomatoes and maize which is largely dependent on the farm sizes. An improvement of the infrastructure will promote diversification to match the farmers' preferences to achieve the best yields.

2.7 Project operation

This involves the conveyance and water distribution to the farm in the project area to meet the water need at the farm. The main objective of the conceptualization of the project is to streamline the water supply to the farm to prevent water wastage and thereby manage the little water available.
The objectives of the project operation include:-

i. Ensure the adequacy of the available water to prevent possible depletion of the same,
ii. Ensure there is a reliable water supply of water as per the distribution plans and
iii. To ensure there is efficient use of water to optimize the abstracted water.

2.8 Water Demand Estimation

Kisima Farm has an area of 700 Hectares, Twiga foods intend to irrigate 485ha in the first phase. The estimated water demand is 52,380m^3/day deduced as follows: - 3.0x485x10x60x60; Hence the daily water required =52,380m^3/day.
The adopted water demand is 24,250m^3/day.

2.9 Water Reservoir/ Pan

The proposed dimension of the pan is as per the Google image of Figure 2-13

Figure 2-13: Proposed Pan with the depth of about 3.0 m

2.9.1 DETAILED DESIGN OF 58,313M^3 PAN TO BE CONSTRUCTED IN PHASE 2

The Detailed Design mainly consisted of steps of designing and constructing a pan. Pans are required to be designed, calculated and supervised by an experienced person, and always seek advice or a second opinion from skilled engineers if there are any hesitations. This is because the failure of a valley dam or pan may have disastrous consequences or lead to waste of investments.

A detailed topographical survey and on the map precisely locate the pan and the spillway, to enable us to exactly calculate its storage capacity and the height and length of the wall is a must. Thereafter we will design the foundation, the wall and the spillway. This will give the basis for preparing the bill of quantity (the volume of soil to be moved) and planning for and calculating the costs of the construction phase. Topographical Survey using RTK was undertaken of the area to necessitate design.

2.9.2 DESIGN DRAWINGS

Drawings useful to prepare for the construction are:

- A plan of the pan wall and spillway.

- A cross-section of the pan wall.
- A profile of the pan site (longitudinal drawing of the pan wall including key and crest)

2.9.3 SIZING

The anticipated storage is required to yield 20,000m^3/day with a total storage of 58,313 m^3. A pan of capacity of 58,313m^3 is proposed at site 1 against an estimated requirement of 1,800,000m^3 due to available financial envelop and land.

2.9.4 Catchment Yield

The farm can abstract about 20,000m3/day for the majority of the month.

2.9.5 Shape Dimensioning

Considering the available land, a Rectangle shape is proposed. According to the Ministry of Water and Irrigation Practice Manual for Small Dams, Pans and Other Water Conservation Structures in Kenya dated August, 2015 on pages 14-2 requires pans have a minimum depth of 2.50m and a maximum of 5.0m. According to Agriculture Handbook 590:- Ponds-Planning, Design and Construction by USDA page 10 recommends a minimum depth of 5 feet in wet areas to a maximum of 12 feet in arid areas to ensure a permanent water supply by ensuring deep water to meet the intended use and to offset probable seepage and evaporation losses. Linking Agro-Ecological Zones of U.S.A and Kenya, and considering Kisima Farm is considered to be located in Semi-Arid Zone, a recommended depth of 8–10-foot pond depth (2.44m to 3.05m) is recommended. The Geotechnical Investigation indicates that there is good black cotton soil up to a depth of 1.0m. Beyond it will require lining. To avoid short-circuiting, the length is normally double to triple the width. Arising from above and avoiding wastage, Table 2-1 has the proposed dimensions:-

Table 2-1: Final Proposed Dimensions

Capacity of 2nd Phase Dam	54000	m3							
Let width to be x									
length 2x									
depth	3	m3							
Volume	6x2								
X	94.86833								
Say x-Inside	95	m		Width-Outside		110	m		
Length-Inside	190	m		Length		205	m		
Area	4.5125	Acres		slope		1 to 3	both inside and outside		
Spillway Dimensions	with	2m	depth	1m					
			Note	L+n(D+2F)					
					T.W.L				F
									D/2
	1			L-nD					
									D/2
		n							
					L				
			Source: Waste Stabilisation Ponds-A design Manual for East Africa by DD Mara page 40						
	1st Phase outside Dimensions-15K Dam								

Say x-Inside	50	m		Width-Outside		65	m		
Length-Inside	100	m		Length		115	m		
Area	1.25	Acres		slope		1 to 3	both inside and outside		
	Crest of the Top Embankment should be 3.50m								
The off-take will be near the footbridge									
There will be a flood control wall of about 1m height and 3m thickness surrounding the dam to defend it from flooding									
The off-take is at the footbridge since the speed of water here is highest compared to the reference area									
The spillway will be reduced from 0.50m inside the Excavation and 0.50m in the raised embankment									
The capacity of the 2nd Phase Dam	54000	m3							
Let width be x									
length 2x									
depth	3	m3							
Volume	6x2								
X	94.86833								
Say x-Inside	95	m		Width-Outside		110	m		
Length-Inside	240	m		Length		255	m		
Area	5.7	Acres		slope		1 to 3	both inside and outside		
Spillway Dimensions	with	2m	depth	1m					

2.9.6 ORIENTATION

The pan should face West-East Direction.

2.9.7 PAN AXIS

The survey data produced the contour map of the site. The contours show the area of constriction where the embankment wall required the list fill material. This also could be done without surveying; this could also be done by using software that shows the contours of a place when a map of that place is available.

2.9.8 EMBANKMENT

From the contour map that had been obtained in the pan axis. This helped to find the pan axis and, in a way, it minimized the fill material. The embankment height was also determined by determining the elevation difference between the lowest and the highest contours of the area. This was selected based on the contoured layout to give the shortest crest length and allow for the economical location of the spillway route.

2.9.9 CREST WIDTH AND LENGTH

By use of the embankment height, the width was calculated as; W=Z/5+3 where,

Z=embankment height W=

(Z/5) +3

= (1/5) +3 = 3.20m

4m used because machinery is used in the construction of the pan.

2.9.10 CREST LENGTH

The alignment was selected based on the contoured layout to give the shortest crest length and allow for the economical location of the spillway route. The crest length is taken to be 240m from the dimension of the pan.

2.9.11 EMBANKMENT SLOPE

From the site visit, the soil is black cotton soil. Given embankment height being equal to 1m, hence slope selected from the table below; Upstream slope= 1:3, Downstream slope= 1:3 see Table 2-2 below:

Table 2-2: Embankment slopes

Embankment height	Fill material	Slope	
		Upstream	Downstream
≤5m	Good granular distribution/clay	1/2.5	½
5m to 10m	Good granular distribution	1/2.5	½
	Clay	1/2.5	1/2.5

Source: guidelines for the design, construction and rehabilitation of small dams and pans in Kenya (Kenya- Belgium water development program Nairobi, June 1992)

2.9.12 EMBANKMENT PROTECTION

To protect the embankment against wave action and erosion, grassing of both downstream and upstream slopes is required. Fencing also of the pan helps to prevent the animals from getting into the pan, this is accomplished by building water troughs outside the pan and feeding using delivery pipes of 5cm in diameter. Also protected by planting stabilizers.

2.9.13 PAN CAPACITY

Pan capacity was found using the formula below;

Pan capacity= [Reservoir length * reservoir width * depth of water]/

= (L*W*d

= 58,313m^3

Figure 3-2 has the layout of proposed pan.

2.9.14 Reservoir Dimensions

Say x-Inside	95	m		Width-Outside		110	m		
Length-Inside	240	m		Length		255	m		
Area	5.7	Acres		slope		1 to 3	both inside and outside		
Spillway Dimensions	with	2m	depth	1m					

1) a) Pan

c) Annual Evaporation = 1800mm
d) Fetch = 255m
e) Maximum Depth = 3.0m

Note
Compaction of the bottom will be done to ensure permeability.

2.9.15 Silt Trap

Impounded area 1200m^2
Storage capacity 1200m^3 (30m by 40m by 2m depth)
Maximum depth 2.0m

2.9.16 Spill Way

Assume: - width of spillway = 2m and depth 0.80m Maximum allowable slope = 2%.

2.9.17 Slope

A slope of 1:3 on either side is proposed as indicated in Figures 2-15 and 2-16.

2.9.18 Flood Control

To minimize Flood effects, a berm embankment of 1m height has been thrown around the pan, with vegetation cover around as well.

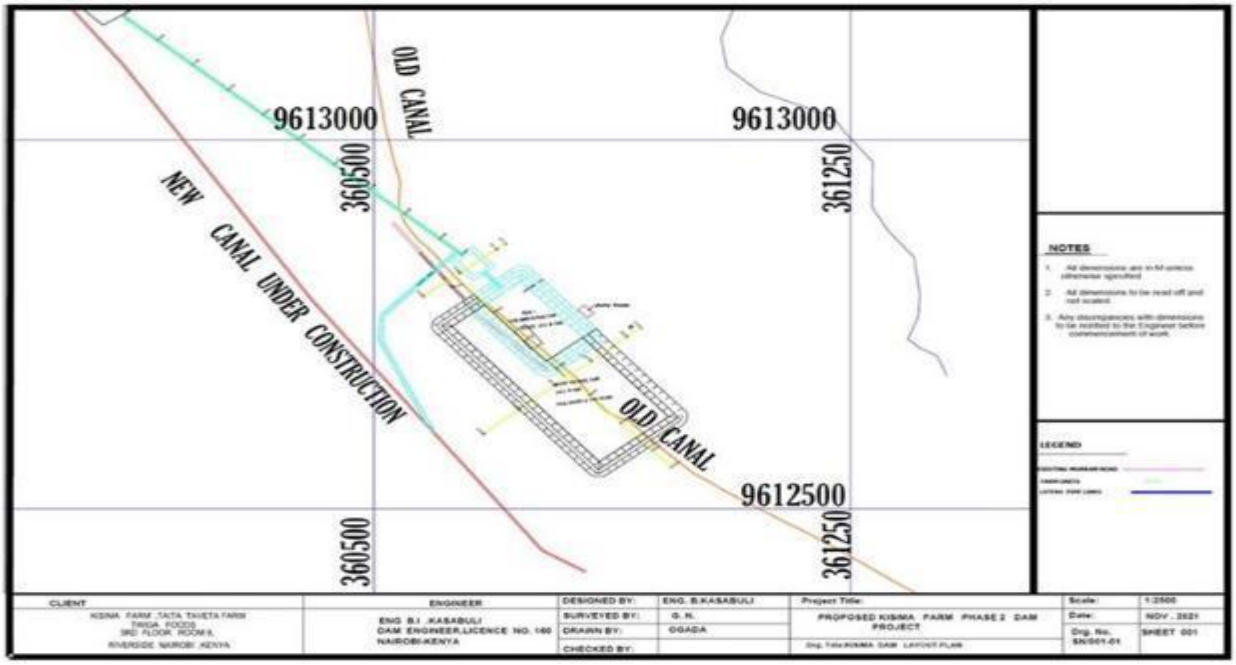

Figure 2-14: Layout of proposed Pan

3.0 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

3.1 GENERAL OVERVIEW

Kenya has a policy, legal and administrative framework for environmental management. Under the framework, the National Environment Management Authority (NEMA) is responsible for ensuring that environmental impact and social assessments (ESIAs) are carried out for new projects and environmental audits on existing facilities as per the Environmental Management and Coordination Act 2015. ESIA studies are carried out to identify potential positive and negative impacts associated with the proposed project to provide effective mitigation measures for the negative effects. The requirements on ESIA are contained in sections 58 to 67 of the Act.

According to section 68 of the environmental management and Coordination Act (EMCA) 2015, the Authority shall be responsible for carrying out environmental audits on all activities that are likely to have a significant effect on the environment.

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

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

3.1 Kenyan Policy Framework

3.1.1 National Environment Policy, 2013

The policy paper emphasizes that the Environmental and Social Impact Assessment must be undertaken by the developer as an integral part of project preparation. A comprehensive Environmental and Social Management Plan was developed to ensure that the impacts identified in the assessment are fully and appropriately mitigated.

3.1.2 The National Environmental Action Plan (NEAP)

The National Environmental Action Plan (NEAP) is provided for by EMCA, 1999 to ensure the preparation of the Environmental Action Plan at different levels. The framework recognizes the intertwined linkages between economic growth and the environment in Kenya. It highlights priority themes and activities for the country towards achieving a sustainable environment. The policy framework among others proposes the integration of environmental concerns into regional and local development plans, promotion of appropriate land uses and enforcement of EMCA, 1999 and its subsidiary and other relevant legislation. The policy framework also advocates for efficient water harvesting, storage and usage. On human settlements and infrastructure, this policy framework recognizes the associated environmental issues. These include waste management, sanitation, diseases, land-use changes in conservation areas, demand for water, energy, construction materials, pollution, land degradation, biodiversity loss etc.

In managing operations of the proposed irrigation project, consideration of the highlighted issues is vital towards contribution to the sustainable development goals (SDGs). Multiple stakeholders'

involvement inclusive of the private sector is advocated for within the implementation of this framework towards achievement on of sustainable development goals.

3.1.3 National Gender and Development Policy, 2019

The National Gender and Development Policy provide a framework for the advancement of women and an approach that would lead to greater efficiency in resource allocation and utilization to ensure the empowerment of women. The National Policy on Gender and Development is consistent with the Government's efforts of spurring economic growth and thereby reducing poverty and unemployment, by considering the needs and aspirations of all Kenyan men, women, boys and girls across economic, social and cultural lines. The overall objective of the Gender and Development Policy is to facilitate the mainstreaming of the needs and concerns of men and women in all areas in the development process in the country.

The project strongly advocates for social and gender inclusivity and has laid down structures that will ensure adherence to this policy in its implementation.

3.1.4 National Land Policy 2009

The National Land Policy has the vision to guide the country towards an efficient, sustainable and equitable use of land for prosperity and posterity. After the enactment of the National Land Policy, Kenya has enacted several Acts of Parliament to help manage the land question including the Land Registration Act Legal Notice No. 3 of 2012, Land Commission Act Legal Notice No. 5 of 2012 and Land Act Legal Notice No. 6 of 2012.

3.1.5 National Water Policy

The National Policy of Water tackles issues on water supply and sanitation facilities development, institutional framework and financing of the sector to ensure a rational and efficient framework for meeting the water needs for national economic development, poverty alleviation, environmental protection and social well-being of the people through sustainable water resource management.

3.2 Legal Framework

3.2.1 Constitution of Kenya

Kenya's constitution was first enacted in 1963 and amended in 1964 to make Kenya a republic with the president as head of state. A new constitution was promulgated on 27th August 2010. The constitution of Kenya is the source of law from which other laws derive their validity. The constitution is the supreme law of the republic and governs both individuals and state organs at different levels. Article 42, chapter four on the bill of rights grants to every person the right to 'a clean and healthy environment which includes the right to have the environment protected for the benefit of present and future generations this is to be done through legislative measures, particularly those in article 69 and to have obligations relating to the environment fulfilled under article 70.

Part 1 of the chapter dwells on land, outlining the principles informing land policy, land classification as well as land use and property. The definition of private land as land within the project area is to be used for irrigation purposes to the benefit of all. The second part of the chapter directs focus to the environment and natural resources. It provides guidelines of the state's obligation concerning the environment.

The proposed project has conformed to the constitution of Kenya 2010 which lays emphasis on activities being undertaken in tandem with the vision of a clean and healthy environment. The

irrigation projects are developments that utilize sensitive components of the physical and natural environment hence the need to develop an elaborate EMMP to contain probable adverse effects.

3.2.2 Environmental Management and Coordination Act (EMCA), 1999

The Environmental Management and Co-ordination Act (EMCA) 1999 Cap 487is an Act of parliament to provide for the establishment of an appropriate legal and institutional framework for the management of the environment and related matters.
The main objective of the Act is to:

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

The Act empowers the National Environment Management Authority (NEMA) to exercise general supervision and coordination over all matters relating to the environment and to be the principal instrument of government in the implementation of all policies related to the environment.
The *Second Schedule* to the Act specifies the projects for which an EIA or environmental audit must be carried out. According to the Act, Section 58, all projects listed in the Second Schedule of the Act must submit a study report to NEMA. The proposed Irrigation Project is classified under Item 8 (e) Irrigation, in the Second Schedule of EMCA 1999.
EMCA and the other national laws that govern environmental, health and safety issues, in relation to agricultural and irrigation activities, are briefly discussed in the following sections. Wherever any of these laws contradict each other, the Act should prevail.

3.2.3 The Environmental (Impact Assessment and Audit) Regulations 2003

On June 13th 2003, the Minister of Environment, Natural Resources and Wildlife promulgated the Environment (Impact Assessment and Audit) regulations 2003 (EIA/EA Regulations) under section 147 of the EMCA. These regulations provide the framework for carrying out EIAs and EAs in Kenya.
Relevance:
Irrigation as an activity listed in section 8 (e) of the second schedule of the main Act, as an activity that requires a full EIA study before commencement. This necessitates the need for the report. An irrigation project re-adjusts major environmental elements including land, water, air, human health and wildlife among many others. There is an apparent need therefore to investigate all the projected impacts to be able to formulate adequate mitigation measures to attain sustainable development.

3.2.4 Environmental Management and Coordination Act (Noise and Excessive Vibrations Pollution Control) Regulations, 2009

The regulations define noise as any undesirable sound that is intrinsically objectionable or that may cause adverse effects on human health or the environment. The regulations prohibit any person from making or causing to be made any loud, unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment.

Article 13 2(d) of the regulations allows for construction work at night for public utility construction, construction of public works, projects exclusively relating to roads, bridges, airports, public schools and sidewalks, provided noise generated is not caused within a residential building or across a residential real property boundary where such noise interferes with the comfort, repose, or safety of the members of the public. The Second Schedule of the Regulations provides for the maximum permissible level of noise at construction sites.

Table 3-1: Maximum permissible noise levels for construction sites

Facility		**Maximum Noise level permitted (leq) in dB (A)**	
		Day (6.01am-6.00pm)	**Night (6.01 pm-6.00am)**
(i)	Health facilities, educational institutions, homes for disabled and residential areas	60	35
(ii)	Residential	60	35
(iii)	Areas other than those prescribed in (i) and (ii)	75	65

It is anticipated that the proposed project will generate very minimal noise during the laying down of main pipelines and transportation of the materials to and from the site. It is recommended that the construction team adheres to the proposed ESMP in line with the above laws.

3.2.5 The Environmental Management and Co-ordination (Water Quality) Regulations 2006

The regulations set stringent controls to protect sources of water for domestic use. Section 4(1&2) states that "Every person shall refrain from any act which directly or indirectly causes, or may cause immediate or subsequent water pollution, and it shall be immaterial whether or not the water resource was polluted before the enactment of these regulations" and 2 states that "No person shall throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such substance in or near it, as to cause pollution". Section 5of the regulation states that: - "All sources of water for domestic uses shall comply with the standards set out in the first schedule to the regulation". The regulations also prohibit abstraction of groundwater or carrying out any activity near any lakes, rivers, streams, springs and wells that is likely to have any adverse impact on the quantity and quality of water, without an environmental impact assessment license issued per the provision of the Act in section 6. The regulations invest in the authority NEMA in consultation with the relevant agency, the powers to maintain water quality monitoring for sources of domestic water at least twice every calendar year and such monitoring records shall be in the prescribed form as set out in the second schedule to these regulations.

Relevance:

The proposed project is meant to abstract water from various sources. It is therefore of great importance to analyse water quality and quantities at the intake points to enhance conformity to the regulations. There is an apparent need to ensure there are regular water quality checks to prevent the discharge of toxic waste waters in conformity to the laid procedures.

3.2.6 The Environmental Management and Co-ordination (Waste Management) Regulations 2006

These regulations are described in legal Notice No. 121 of the Kenya Gazette Supplement No. 69, 2006. They offer legal provisions on the handling of a variety of wastes emanating from various projects and activities. The waste categories covered under regulations are: -

- Industrial Wastes
- Hazardous and toxic substances
- Pesticides and toxic substances
- Biomedical wastes
- Radio-active substances

These regulations outline requirements for handling, storing, transporting and treatment of all waste categories as provided.

Relevance:

The proposed project once operational will involve the use of pesticides and chemical fertilizers. Wastes resulting from the use of these products may contaminate the water bodies in the project areas and there should therefore be the strict observation of these

3.2.7 The Environmental Management and Co-ordination (Wetlands, River Banks, Lake Shores and Sea shore Management) Regulations 2009

This legislation emphasizes management of wetlands resources, river banks, lakeshores and sea shores. The legislations provide guidelines for conservation and sustainable use of the wetlands and to promote their integrity on any project taking place on the environment.

Relevance:

The irrigation project when in operation will abstract water from the rivers and springs resulting in increased demand for water thereby affecting these resources. It is important this legislation is clearly enacted during the planning, construction and operation of the project.

3.2.8 The Environmental Management and Co-ordination (Conservation of Biological Diversity and resources, Access to genetic resources and benefit sharing) 2006

This legislation takes cognizance of the need to promote the integrity of biodiversity so as to promote their integrity. Most of the biological diversity is highly threatened by development in the current world and there is an apparent need to enhance their integrity. Section iv prohibits any activity which may have adverse effects on the ecosystem.

Relevance:

The introduction of irrigation to the area may lead to an introduction of new crops that are not indigenous. There is need to promote these regulations to enhance the integrity of these biological diversity.

3.2.9 Water Act

Part II section 18 of this act provides for the national monitoring and information systems on water resources. Sub-section 3 of this allows the water resources management authority to demand from any person or institution, specified information samples or raw material on water resources. Under these rules, specific records may require to be kept by a site operator and the information made available to the authorities as and when required.

Section 73 of the act allows a person with a license to supply water to make regulations for purposes of protecting against degradation of water resources. Section 75 allows the licensee to construct and maintain drains, sewers and other works for intercepting, treating or disposing of any foul water arising or flowing upon land for preventing pollution of water within their jurisdiction.

The Water Act (2002) of the Laws of Kenya seeks to make better provision for the conservation, control of pollution, apportionment and use of the water resources in Kenya, and for purposes they are incidental thereto and connected therewith. The Act vests ownership and control of water in the government subject to any rights of the user. Under this provision the responsibility to regulate access, use and control of water resources is vested with the WRA.

The water Act protects water bodies and sources from pollution and controls their use by the project. It ensures that the project require amount of water that can be provided for by the existing water system and that the project design will work to conserve the available water resources both during construction and operation phases.

3.2.10 Irrigation Act 2019

This Act of parliament provides for the development, control and improvement of irrigation schemes. Section 3 (i), part ii of the Act grants legal establishment of the NIB with powers to sue and to be sued and capable of purchasing or otherwise, acquiring, holding, managing and disposing of any property movable or immovable, entering into contracts and doing all things necessary for the proper performance of its duties and discharge of its functions under this Act and any subsidiary legislation made. The National Irrigation Schemes Regulations outlines the general manner of the management of gazetted irrigation schemes by the board.

3.2.11 Agriculture Fisheries and Food Authority Act, 2013

Agriculture, Fisheries and Food Authority Act (No.13, 2013) is an Act of Parliament to provide for the consolidation of the laws on the regulation and promotion of agriculture generally, to provide for the establishment of Agriculture, Fisheries and Food Authority. The Act tends to protect Agriculture and fisheries excluding livestock for food security in the country.

The Act addresses these activities:

- Administer the crops Act and the fisheries Act per provision of these Act.
- Promote best practices and regulate, the production, processing and marketing of agricultural and aquatic products.
- Collect, collate data and maintain a database on agricultural and aquatic products.
- Determines the research priorities in agriculture and aquaculture.

3.2.12 The Land Act, 2012

This law "gives effect to Article 68 of the Constitution, to revise, consolidate and rationalize land laws; to provide for the sustainable administration and management of land and land-based resources, and for connected purposes". Section 143 and 144 of the Act provides for the establishment of Right of Way for public projects. The Act also provides for the rights and responsibilities of persons occupying the land for which the right of way is sought or has been provided.

The proponent has decided to utilize this piece of land for agriculture; this is in tandem with the provision above.

3.2.13 Forest Conservation and Management Act, 2016

This Act provides for the establishment, development and sustainable management, including conservation and rational utilization of forest resources for the socio-economic development of the country. Forests may be classified as public, community forests or private forests. A person who owns a private forest, including a forest in the course of establishment, on land owned by the person, may apply to the Service for registration of the forest under this section.

A person who establishes or owns a private forest may apply to the relevant authorities for exemption from payment of all or part of the land rates and such other charges as may be levied in respect of the land on which the forest is established. The proponent shall be encouraged to plant woodlots as well as use the technical advice for the Extension Officers.

3.2.14 Public Health Act (Cap 242)

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

Relevance:

Several issues arise from irrigation projects such as sanitation issues, disease spread, and communal resource sharing among others. The Act provides for the necessary legal guidelines regulating measures aimed at effective control and management of the said issues.

3.2.15 Pest Control Products Act, 2012

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

3.2.16 Occupational Safety and Health Act, 2007

This is an Act of Parliament to provide for the safety, health and welfare of all workers and all persons lawfully present at workplaces, to provide for the establishment of the Directorate of

Occupational Safety and Health Services and its purposes. It applies to all workplaces where any person is at work, whether temporarily or permanently. During the construction phase of the irrigation project, the works contractor must adhere to the requirements of this Act. Farmers should be oriented on safety handling, application and disposal of agrochemical to mitigate any eventuality of wastes from the packaging materials as well inhalation or ingestion of poisonous chemical substance.

3.3 Institutional Framework

Developments can have major impacts on the environment by degrading soils and waterways, altering the landscape and by destroying the habitats and other life supporting systems. There are many challenges associated with development activities including land use conflicts, human-wildlife conflicts, water management problems and environmental pollution. The environment as a result is negatively affected and this could pose an effect to human health.
The government has established several institutions to ensure that there is sufficient and adequate management of these resultant effects of development so as to promote the health of its citizenry. Some of the established institutions that are relevant to this project include; -

3.3.1 Ministry of Water, Sanitation and Irrigation

The mandate of this ministry is the formulation, review and implementation of policy on the water sector, the irrigation and the drainage sector and in the reclamation of land for sustainable development of the nation. The core functions include: -

- Water harvesting and storage infrastructure for water conservation which help in mitigating droughts and famine
- Conservation of catchment areas
- Water resources management policy
- Urban and rural water development and supply
- Wastewater treatment and control
- National water conservation,
- National irrigation policy which aims to sustainably accelerate development and performance improvement of irrigation, drainage and water storage
- Irrigation and dam construction schemes
- Flood preparedness and management to mitigate impacts
- Water quality and pollution control by adopting the ‘polluter pays principle’ to promote water user responsibility

Relevance:
Water is the primary factor in the proposed irrigation project. Abstraction of water has to be regulated to prevent water waste and unnecessary losses. Water abstraction should be guided by WRA.

3.3.2 Water Resources Authority

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

Part III of the Water Act 2012 (Amended 2016) defines the powers and functions of WRA which include:

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

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

- Formulation of a National Water Resources Management Strategy;
- Classification of water resources and resource quality objectives;
- Determination of water reserves;
- Designation of catchment areas;
- Formulation of a catchment management strategy;
- Declaration of protected catchment areas national monitoring of and information on water resource management;
- Definition of state schemes and community projects

3.3.3 Ministry of Environment and Mineral Resources

The mandate of the ministry is to monitor, protect, conserve and manage the environment and natural resources through sustainable exploitation for socio-economic development aimed at eradication of poverty, improving living standards and ensuring that a clean environment is sustained now and in the future. The core functions of the ministry include: -

- Environment and Natural Resources Policy formulation, analysis and review
- Sustainable management of Mineral resources and conservation of environment
- Continuous development of geo-database for integrated natural resources and environmental management systems
- Conduct applied research and dissemination of research findings in land resources and geology
- Carry out geological surveys, mineral exploration and regulation of mining and use of commercial explosives.
- Promote, monitor and coordinate environmental activities and enforce compliance with environmental regulations and guidelines Meteorological services.

Relevance:

The environmental components are the main aspects that promote development in today's world. The proposed project will make utilization of this in a way or another to achieve the objectives of the project. Adherence to the laid down procedures will be required to promote sustainable development from this project.

3.3.4 National Environmental Management Authority

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

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

3.3.5 The Ministry of Agriculture

The mandate of the Ministry of Agriculture is to promote and facilitate production of food and agricultural raw materials for food security and incomes; advance agro-based industries and agricultural exports; and enhance sustainable use of land resources as a basis for agricultural enterprises. The functions of the Ministry include:

- Formulation, implementation and monitoring of agricultural legislation's, regulations and policies.
- Provision of agricultural extension services.
- Supporting agricultural research and promoting delivery.
- Facilitating and representing agricultural state corporations in the Government.
- Development, implementation and coordination of programs in the agriculture sector.
- Regulating and quality control of inputs, produce and products from the agriculture sector.
- Management and control of pests and diseases in crops.
- Promoting management and conservation of the natural resource base for agriculture.
- Collecting, maintaining and managing information on the agriculture sector.

Relevance:

The purpose of the project will entirely focus on boosting agricultural production in the region and the country at large. Several factors will play a key role at this juncture including agricultural extension activities, farm inputs and marketing of the products.

3.3.6 Pest Control and Products Board (PCPB)

The Pest Control Products Board is a Statutory organization of the Kenya Government established under an Act of parliament, the Pest Control Products Act, Cap 346, Laws of Kenya of 1982 to regulate the importation and exportation, manufacture, distribution and use of pest control products. The mission of the Pest Control Products Board is to provide an efficient and effective regulatory service for importation, exportation, manufacture, distribution, transportation, sale, disposal and safe use of pest control products and mitigate potential harmful effects to the environment.

3.3.7 Kenya Plant Health Inspectorate services (KEPHIS)

This is a regulatory agency for quality assurance on agricultural inputs and produces in Kenya. It undertakes plant variety protection, seed certification, an inspection of imports and exports, soil, water and agro-inputs analyses. Some of its functions include the following: -

- Certification of the quality of seeds and fertilizers
- Testing and monitoring the presence of harmful residual agrochemicals on agricultural produce, soils and water systems
- Coordination of the release of superior and well-adapted varieties to the farming community
- Protecting the rights of the breeders/discovers of new plant varieties through a grant of rights to the owners of such varieties and registering them
- Preventing introduction into the country of harmful foreign weeds, pests and diseases through adherence to strict quarantine regulations and procedures
- Inspecting and grading agricultural produce for import and export to ensure that they are of high and acceptable quality

- Implementing the national policy on the introduction and use of genetically modified plant species, insects and micro-organisms in Kenya.

3.3.8 County Government of Taita Taveta

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 Environment & Agriculture Department (Agricultural Officer, Environment Officer, and Forest Officer) among others will take responsibility for guiding the community respondents to guarantee proper implementation of the project including but not limited to: pollution control, biodiversity conservation (planting of woodlots especially indigenous trees, Napier grass), among others.

INTERNATIONAL POLICY FRAMEWORK

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

3.4 INTERNATIONAL FINANCE CORPORATION PERFORMANCE STANDARDS

The IFC implemented the most recent version of the IFC Performance Standards 2012 to address gaps in the previous guidelines, emphasize private-sector considerations and ensure better compatibility with other IFC policies. In the IFC's view, long-term profitability and positive project outcomes are more likely to be attained by borrowers and international lending institutions that manage risk well. The new IFC Performance Standards seek to ensure that projects foster a sustainable economic, social and environmental system and add value to community infrastructure beyond the scope and life of a project. Accordingly, the IFC Performance Standards set forth specific objectives, systems, policies and practices to be followed by project sponsors.

IFC Performance Standard 1 provides information on setting up the management system that will be in place throughout the life of the project and establishes the organizational structure, responsibilities, policies, procedures and practices, and resources essential for successfully implementing the project-specific management program. IFC Performance Standards 2 through 8 deal with discrete topics and may not be relevant for every project. During the initial assessment process, the project sponsor and the international lending institution will determine which of the IFC Performance Standards apply, and incorporate them into the Social and Environmental Assessment and action plan as appropriate.

Fin Fund requires the implementing entity (Twiga Foods Limited) to demonstrate compliance with several relevant IFC Performance Standards, which are summarized in the subsection below:

3.4.1.1 Performance standard 1- Assessment and Management of Environmental and Social Risks and Impacts (2012)

Environmental and social responsibility is critically important in today's global economy. An environmental and social management system (ESMS) helps companies integrate plans and standards into their core operations, so they can anticipate environmental and social risks posed by their business activities and avoid, minimize, and compensate for such impacts as necessary. A good management system provides for consultation with stakeholders and a means for complaints from workers and local communities to be addressed.

Requires the development of an action plan that will establish a management system, which incorporates the following: (i) the social and environmental assessment; (ii) management programs to address identified risks and impacts; (iii) processes for establishing, maintaining, and/or strengthening the organizational structure; (iv) adequate training for responsible employees; (v) building and maintaining a constructive relationship with the impacted community, including disclosure, consultation and an appropriate grievance mechanism; (vi) effective monitoring of the project sponsor's implementation of the management system; and (vii) internal reporting on the effectiveness of the management program and external reporting on the action plan. The development process will include significant stakeholder engagement, particularly engagement with local communities and all other interested parties including the local government authorities.

3.4.1.2 Performance standard 2 - Labour and Working Conditions

Requires the implementation of an appropriate human resources policy, which should include: (i) documenting and communicating working conditions and terms of employment to all employees/workers; (ii) respecting collective bargaining agreements and otherwise providing reasonable working conditions; (iii) complying with national laws regarding labour; (iv) providing for equal opportunities, non-discrimination and fair treatment; (v) adopting a plan to mitigate adverse impacts if there is the possibility of retrenchment; (vi) providing an appropriate and effective grievance mechanism for workers/organizations; (vii) prohibiting exploitative or hazardous child labour; (viii) prohibiting all forced/compulsory labour; (ix) providing a safe and healthy work environment, (x) taking steps to prevent accidents, injury and disease; and (xi) using commercially reasonable efforts to ascertain that contractors are reputable. The project will observe the above requirements from the cradle to the grave of the project.

3.4.1.3 Performance Standard 3 - Resource Efficiency and Pollution Prevention

Performance Standard 3 recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. There is also a growing global consensus that the current and projected atmospheric concentration of greenhouse gases (GHG) threatens the public health and welfare of current and future generations. At the same time, more efficient and effective resource use and pollution prevention2 and GHG emission avoidance and mitigation technologies and practices have become more accessible and achievable in virtually all parts of the world. These are often implemented through continuous improvement methodologies similar to those used to enhance quality or productivity, which are generally well known to most industrial, agricultural, and service sector companies. This

Performance Standard outlines a project-level approach to resource efficiency and pollution prevention and control in line with internationally disseminated technologies and practices. In addition, this Performance Standard promotes the ability of private sector companies to adopt such technologies and practices as far as their use is feasible in the context of a project that relies on commercially available skills and resources. The Objectives of this performance standard include: -

To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities.

- To promote more sustainable use of resources, including energy and water.
- To reduce project-related GHG emissions.

It Outlines the IFC policy on pollution control and mitigation, as described in the Pollution Prevention and Abatement Handbook. Focuses on internationally accepted best practices for pollution prevention, minimization and control, including provisions for: (i) considering ambient conditions (including future land use) and applying pollution prevention and control technologies and practices that are best suited to avoid or minimize adverse impacts on human health and the environment; (ii) tailoring project-specific techniques to unique hazards and risks of the project, consistent with good international industry practise; (iii) avoiding or minimizing pollutant releases, waste generation, and release of hazardous materials; (iv) preparing an emergency preparedness and response plan; (v) promoting the reduction of project-related greenhouse gas (GHG) emissions and monitoring such emissions in accordance with internationally-recognized methodologies; and (vi) formulating and implementing an integrated pest management plan, including selection of pesticides that are low in human toxicity and have minimal environmental effects. Careful consideration will be taken into account given the proximity to the fragile wetland ecosystem that drains to Lake Jipe and Nave National Park.

3.4.1.4 Performance standard 4 - Community Health, Safety and Security

Performance Standard 4 recognizes that project activities, equipment, and infrastructure often bring benefits to communities including employment, services, and opportunities for economic development. However, projects can also increase the potential for community exposure to risks and impacts arising from equipment accidents, structural failures, and releases of hazardous materials. Communities may also be affected by impacts on their natural resources, exposure to diseases, and the use of security personnel. While acknowledging the public authorities' role in promoting the health, safety and security of the public, this Performance Standard addresses the client's responsibility to avoid or minimize the risks and impacts to community health, safety and security that may arise from project activities. The level of risks and impacts described in this Performance Standard may be greater in projects located in conflict and post-conflict areas. The Objectives of this standard are: - To avoid or minimize risks to and impacts on the health and safety of the local community during the project life cycle from both routine and non-routine circumstances and to ensure that the safeguarding of personnel and property is carried out in a legitimate manner that avoids or minimizes risks to the community's safety and security. Requires that the project will be designed to minimize risks to public health and safety during all phases of development. Water and reservoir dams whose failure would have an impact on local communities must be ***reviewed by independent experts during the design phase***.

Requires preparation of a community health and safety plan, which should include provisions for: (i) establishing preventative measures to address risks (favouring prevention/avoidance over

minimization); (ii) disclosing the action plan and other relevant information to the affected community and engaging with the affected community on an ongoing basis consistent with IFC Performance Standard 1; (iii) ensuring that structural elements of the project (design/operation/decommission) in accordance with good international industry practice; (iv) retaining experts when necessary to protect the affected community; (v) preventing accidents and incidents on public roads/infrastructure; (vi) preventing or minimizing community exposure to hazardous materials releases; vii) exercising commercially reasonable efforts to control the safety of deliveries of raw hazardous materials and transportation/disposal of waste; (viii) avoiding or minimizing impacts from land use changes; (ix) preventing or minimizing community exposure to communicable diseases (AIDS and malaria in particular) resulting from project activities (including influx of labour); (x) collaborating with community and local government to prepare an emergency preparedness and response plan; (xi) assessing risks to those within and outside the project posed by (private or governmental) security arrangements; (xii) ensuring that security personnel are not implicated in past abuses and receive adequate training regarding conduct toward workers and the local community; (xiii) establishing a grievance mechanism for the affected community to express concerns about security arrangements; and (xiv) investigating any credible allegations of unlawful or abusive acts by security personnel and reporting such acts to public authorities when appropriate.

3.4.1.5 Performance standard 5 - Land Acquisition and Involuntary Resettlement

Provides that involuntary resettlement pertains to displacement due to losses of both real property and assets (e.g., loss of land or shelter) and economic resources (e.g., loss of income or means of livelihood).

Requires that the project sponsor: (i) consider feasible alternative project designs to avoid or minimize physical and economic displacement; (ii) provide compensation at full value for losses and provide assistance to restore prior standards of living; (iii) devise standards that are transparent and consistent; (iv) provide land-based compensation where livelihoods of displaced people were land based; (v) execute decision-making processes on an ongoing basis that include consultation and informed participation of affected communities throughout the life of the project; (vi) establish a grievance mechanism consistent with IFC Performance Standard 1; (vii) carry out a census to identify people needing compensation if involuntary resettlement is unavoidable; (viii) document all transactions to acquire land rights, as well as compensation and relocation activities; (ix) establish procedures to monitor and evaluate the implementation of resettlement plans; (x) offer displaced persons choices among feasible resettlement options, including adequate housing or cash compensation, where appropriate; (xi) provide replacement property of equal or higher value with equivalent or better characteristics and location, if displaced persons had formal legal rights or recognized claim to land; (xii) provide relocation assistance sufficient for displaced persons to restore standards of living at an adequate alternative site, if displaced persons had no recognized claims to land; (xiii) provide targeted assistance (credit facilities, training, job opportunities, etc.) to those who are economically displaced or whose livelihoods or income levels are adversely affected; (xiv) take additional measures to supplement government action if government action does not satisfy requirements of this IFC Performance Standard.

Twiga Foods Limited has leased the entire land (see Attached Lease Agreement) from the land without encumbrances hence there are no cases of forced displacement nor compensation associated with the project.

3.4.1.6 Performance standard 6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources (2012)

Biodiversity loss can result in critical reductions in the resources provided by the earth's ecosystems, which contribute to economic prosperity and human development. This is especially relevant in developing countries where natural resource-based livelihoods are often prevalent. PS6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and managing living natural resources adequately are fundamental to sustainable development.
Synchronizes with the Convention on Biological Diversity (CBD) in that both conservation and the sustainable use of natural resources are promoted and all ecosystems and all levels of biodiversity are required to be considered, including the introduction of alien and invasive species and changes in GHG emissions due to changes in land use.

Requires that the project sponsor: (i) assess the significance of project impacts on all levels of biodiversity as an integral part of the social and environmental assessment process by taking into account different values attached to biodiversity by specific stakeholders, using qualified and experienced external experts where necessary; exercising care to minimize conversion or degradation of modified habitats, and enhancing habitat and protecting biodiversity when possible; (ii) avoid converting or degrading natural habitats, unless there are no technically or financially feasible alternatives, the overall project benefits outweigh the costs, and conversion and degradation is mitigated appropriately; (iii) ensure that mitigation measures achieve no net loss of biodiversity; (iv) avoid project activities in critical habitats, unless there would be no measurable adverse impacts on the habitat, no reduction in population of the endangered species, and lesser impacts are properly mitigated; (v) for areas legally protected for conservation of biodiversity, act in a manner consistent with defined management plans, consult area sponsors and managers, consult local communities, and implement additional programs to promote and enhance the conservation aims of the protected area; (vi) avoid introducing any new alien species and exercise diligence to prevent unintended or accidental introductions; (vii) manage renewable natural resources (including activities involving the harvesting of fish or other aquatic species) in a sustainable manner, preferably demonstrated by independent certification; (viii) ensure that activities involving natural forest harvesting or plantation development do not cause conversion or degradation of critical habitat; and (ix) obtain independent certification required for natural forest and plantation management of lands under control of the project sponsor.

The biodiversity assessment for the project area and zone of influence has been done and the report has been appended on the project ESIA report.

3.4.1.7 Performance standard 7- Indigenous Peoples and Natural Resource Dependent Communities

Defines "natural resource dependent communities" as those having "a close attachment to unique areas or habitats containing resources that cannot be readily replaced or substituted, including land, flora, fauna, or water; and reliance on grazing, hunting, gathering, or artisanal fishing for their livelihood."

Requires that the project sponsor: (i) identify through the social and environmental assessment all communities of indigenous people that may be affected and work to avoid adverse impacts whenever feasible; (ii) minimize, mitigate or compensate for impacts in a culturally appropriate manner where avoidance is not feasible; (iii) develop proposed action with informed participation

of affected people and document such action in a formal, time-bound plan, or as part of a broader community development plan with a separate component focusing on indigenous people; (iv) establish an ongoing relationship with affected communities throughout the life of the project, ensuring their free, prior, and informed participation on matters affecting them directly; (v) ensure that the community engagement process is culturally appropriate and commensurate with the risks and potential impacts to the group, including by involving indigenous people representative bodies (e.g., councils of elders), consulting persons of different age and gender in a culturally appropriate manner, providing indigenous people sufficient time for their collective decision-making processes, facilitating expression of the views and concerns of indigenous people without external influence or coercion, and ensuring that the grievance mechanism established in IFC Performance Standard 1 is culturally appropriate and accessible for indigenous people; (vi) identify areas where development benefits may be used to improve standards of living and livelihoods in a culturally appropriate manner; (vii) retain qualified and experienced external experts when using traditional or customary lands (i.e. does not require legal ownership) to assist in documenting that the affected communities' land is used in a way that does not prejudice their claims, the project sponsor has undertaken efforts to avoid or minimize the size of land proposed for the project, and the affected communities are informed of their rights under national laws regarding their land; (viii) offer compensation and due process to those with full legal title to land, along with culturally appropriate development opportunities; (ix) enter into good faith negotiations with indigenous people and document their informed participation; (x) consider feasible alternatives to avoid relocation of indigenous people from traditional or customary lands; (xi) enter into good faith negotiations and document informed participation before proceeding with a project if relocation is necessary; (xii)if the project uses cultural resources, knowledge, innovations or practices of indigenous people, inform indigenous people (and document such negotiations and information) of their rights under national law, the scope and nature of the proposed development and the potential consequences of development.

There is no group of the community within the project area of influence that meet the requirement of this performance standard.

3.4.1.8 Performance Standard 8- Cultural Heritage (IFC Performance Standard 8):

Provides procedures for inventorying, protecting and removing (only when unavoidable) cultural property. Communities should be engaged to determine the most culturally appropriate means to handle such assets. In areas where cultural heritage is prevalent, monitoring for artefacts should be conducted during land clearing, soil stripping and mining operations.

Requires that the project sponsor: (i) comply with relevant national laws on the protection of cultural heritage; (ii) undertake internationally recognized practices (including the retention of qualified and experienced experts where necessary) for the protection, field-based study and documentation of cultural heritage; (iii) carry out siting and design to avoid significant damage to cultural heritage; (iv) if the project is in an area where cultural heritage is expected to be found, establish chance find procedures through the social and environmental assessment which provide that chance find material shall not be disturbed until assessed by a competent specialist; (v) consult with affected communities and relevant national or local regulatory agencies to identify cultural heritage of importance and incorporate their views into the decision-making process; (vi) refrain from removing any cultural heritage, unless (x) there are no technically or financially feasible alternatives to removal, (y) the overall benefits of the project outweigh the anticipated cultural

heritage loss from removal, and (z) removal is conducted by the best available techniques; (vii) refrain from significantly altering, damaging or removing any critical cultural heritage except that, in exceptional circumstances, the project sponsor may consult with the affected community and conduct good faith negotiations (including documentation) in order to ensure that cultural heritage impacts are appropriately mitigated in conjunction with the informed participation of the affected community; (viii) when the proposed project is located within a legally protected area, ensure that the project sponsor (x) complies with defined national or local cultural heritage regulations, (y) consults with protected area sponsors, managers and local communities and other key stakeholders, and (z) implements additional programs to promote and enhance the conservation aims of the area; and (ix) ensure that any projected use of cultural heritage complies with the requirements for using indigenous people knowledge in IFC Performance Standard 7.

The Performance standards that will be of concern in this project are Performance standards 1,2.3.4 and 6. The land is privately owned so no projected affected persons and also no archaeological site is within the Kisima farm. There are no cultures to be observed during construction, operation and maintenance of the project, only that the baobab tree is never cut down.

3.4.2 World Bank Safeguard policies

3.4.2.1 Environmental Assessment- OP/BP 4.01

It is internationally required that environmental assessment (EA) of projects is proposed for financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision making. It takes into account the natural environment (air, water, and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples, and physical cultural resources); and transboundary and global environmental aspects. Environmental Assessment considers natural and social aspects in an integrated way. Generally, an environmental screening of each proposed project should be undertaken to determine the appropriate extent and type of Environmental Assessment. It involves classification of the proposed project into one of four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts.

(a) *Category A*: A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works. Environmental Assessment for a Category A project examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including the "without project" situation), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. For a Category A project, the proponent is responsible for preparing a report, normally an EIA (or a suitably comprehensive regional or sectoral Environmental Assessment).

(b) *Category B*: A proposed project is classified as Category B if its potentially adverse environmental impacts on human populations or environmentally important areas including wetlands, forests, grasslands, and other natural habitats are less adverse than those of Category a project. These impacts are site-specific; few if any of them are irreversible; and in most cases

mitigatory measures can be designed more readily than for Category A projects. The scope of Environmental Assessment for a Category B project may vary from project to project, but it is narrower than that of Category A Assessment. Like Category A, Environmental Assessment, it examines the project's potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance.

(c) *Category C*: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further Environmental Assessment action is required for a Category C project.

Twiga Foods Ltd project is classified as Category B project and as such requires an ESIA.

3.4.2.2 Pest Management- OP/B.P-4.09

In assisting the proponent to manage pests that affect either agriculture or public health, a strategy that promotes the use of biological or environmental control methods and reduces reliance on synthetic chemical pesticides is necessary. The proponent addresses pest management issues in the context of the project's environmental assessment.

The proponent is required to use various means to assess pest management in the country and support integrated pest management (IPM)and the safe use of agricultural pesticides: economic and sector work, sectoral or project-specific environmental assessments, participatory IPM assessments, and investment projects and components aimed specifically at supporting the adoption and use of IPM. For agriculture projects, pest populations are normally controlled through IPM approaches, such as biological control, cultural practices, and the development and use of crop varieties that are resistant or tolerant to the pest. Concerning the classification of pesticides and their specific formulations, the proponent may refer to the World Health Organization's Recommended *Classification of Pesticides by Hazard and Guidelines to Classification* (Geneva: WHO 1994-95). The following criteria apply to the selection and use of pesticides in such projects: (a) They must have negligible adverse human health effects. (b) They must be shown to be effective against the target species. (c) They must have minimal effect on non-target species and the natural environment. The methods, timing, and frequency of pesticide application are aimed to minimize damage to natural enemies. Pesticides used in public health programs must be demonstrated to be safe for inhabitants and domestic animals in the treated areas, as well as for personnel applying them. (d) Their use must take into account the need to prevent the development of resistance in pests.
Finally, it is required that any pesticides be manufactured, packaged, labelled, handled, stored, disposed of, and applied according to standards acceptable Internationally.

3.4.2.3 Natural habitat- OP/BP- 4.04

The conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long-term sustainable development. The proponent should, therefore, support the protection, maintenance, and rehabilitation of natural habitats and their functions in its economic and sector work, project financing, and policy dialogue. The proponent is expected to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development.
In the areas of project intervention, the proponent should identify; (a) natural habitat issues and

special needs for natural habitat conservation, including the degree of threat to identified natural habitats (particularly critical natural habitats), and (b) measures for protecting such areas in the context of the country's development strategy. As appropriate, Country Assistance Strategies and projects incorporate findings from such economic and sector work.

Under the project design and implementation, the developer may promote and support natural habitat conservation and improved land use by financing projects designed to integrate into national and regional development the conservation of natural habitats and the maintenance of ecological functions. Furthermore, the developer should promote the rehabilitation of degraded natural habitats.

The proponent is not expected to engage a project that involves the significant conversion or degradation of critical natural habitats.

3.4.2.4 Physical Cultural Properties OP/BP 4.11

This policy addresses physical cultural resources, which are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance.

Although project activities do not involve major civil works, historical and cultural properties may be encountered during the laying down of the Primary Pipeline along the public access road. Therefore, Physical Cultural Resources Policy (OP/BP 4.11) is triggered. This ESIA includes a "chance finds" procedure.

3.4.2.5 Disclosure of Information OP 15.50

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

3.4.2.6 Projects on International Waterways- OP/BP- 7.50

This policy applies to the following types of international waterways: (a) any river, canal, lake, or similar body of water that forms a boundary between, or any river or body of surface water that flows through, two or more states; (b) any tributary or other body of surface water that is a component of any waterway described in (a) above; and (c) any bay, gulf, strait, or channel bounded by two or more states or, if within one state, recognized as a necessary channel of communication between the open sea and any river flowing into such waters.

The policy concurrently applies to the following types of projects: (a) hydroelectric, irrigation, flood control, navigation, drainage, water and sewerage, industrial, and similar projects that involve the use or potential pollution of international waterways; and (b) detailed design and engineering studies of projects mentioned above.

Through notification of riparian countries, it is necessary to ensure that the international aspects of a project on an international waterway are dealt with at the earliest possible opportunity. If such a project is proposed, the developer is required, if it has not already done so, to formally notify the other riparian of the proposed project and its Project Details. It should be ascertained

whether the riparian have entered into agreements or arrangements or have established any institutional framework for the international waterway concerned. In the latter case, the responsible authority ascertains the scope of the institution's activities and functions and the status of its involvement in the proposed project, bearing in mind the possible need for notifying the institution.

The Twiga foods irrigation project uses the Lumi River which is shared between Kenya and Tanzania, also Lake Jipe which could imply that the project lies in the Lake Jipe basin and this requires notification to the Water Resource Users in the catchment and the Water Resources Authority.

	Yes	No
Environmental Assessment (OP/BP 4.01) The project will support investments in irrigation schemes, soil and water conservation that in some cases will involve heavy machine construction works. It has been classified under category B as per international categorization.	[X]	[ ]
Natural Habitats (OP/BP 4.04) Though the area of project intervention has been occupied, with land use activities such as agricultural farming and cattle keeping predominant. From field visits and analysis of the project components, there is still riparian fauna in the northern zone of the marshland that is constantly flooded in the wet season that could be affected by the marshland rehabilitation.	[X]	[]
Pest Management (OP 4.09) The project will support Sustainable Land Management (SLM) activities, including improved agricultural practices which may involve the need to control agricultural pests. IPM frameworks will need to be prepared to address the requirements of this policy.	[X]	[ ]
Physical Cultural Resources (OP/BP 4.11) This policy has been triggered due to the possibility of unexpected findings of cultural artifacts during the implementation of works, and chance findings.	[X]	
Projects on International Waterways- OP/BP- 7.50 This being an Irrigation project with its source of water from river Lumi in the lake Jipe basin shared by Kenya and Tanzania. This policy may be triggered by the project.	[X]	[ ]
Disclosure of Information OP 15.50 This Policy details the Banks requirements for making operational information available to the public. The Bank reaffirms its recognition and endorsement of the fundamental importance of transparency and accountability to the development process	[X]	[ ]

3.5 INTERNATIONAL CONVENTIONS

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

3.5.1 Ramsar Convention

In 1971, the international Convention on Wetlands was adopted in Ramsar, Iran. The Ramsar

Convention is an inter-governmental treaty for national action and international cooperation for the conservation and wise use of wetlands and their resources. The convention has been signed by 159 governments (contracting parties) of which Rwanda is part. The Ramsar List of Wetlands of International Importance includes over 1,800 wetland sites, covering all regions of the planet. Ramsar makes grants in support of its objectives:

- Conservation and wise use of wetlands;
- Emergency conservation assistance at Ramsar sites; and
- Education and training in wetlands management.

3.5.2 United Nations Framework Convention on Climate Change (UNFCCC)

UNFCCC provides the basis for global action "to protect the climate system for present and future generations". The Convention has been universally signed by 189 countries. Rwanda is a signatory to this convention.

The main objective of this Convention is to achieve stable greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed sustainably.

The Convention requires a framework for inter-government efforts to tackle the challenge posed by climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases.

At the UNFCC Convention, governments:

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

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

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

3.5.4 The World Commission on Environmental and Development

The commission focuses on the environmental aspects related to development and requires all development projects to be sustainable economically, socially and environmentally. The principle of the organization emphasis that development project should have no permanent negative impact on the biosphere and in particular the ecosystems. It is recommended that the project proponent incorporate mitigation measures to ensure that the project impacts on the ecosystem in reduced. The consultants used participatory methods to involve the target group

and concerned stakeholders in order to inform and enlightened them on the likely negative environment and social impacts for them to prepare mitigation measures so as to ensure the proposed project is sustainable throughout its life span.

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

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

3.6 EAC Protocol on Environment and Natural Resources

This Protocol shall apply to the East Africa Partner States' cooperation in the management of the environment and natural resources within their jurisdiction including trans boundary ecosystems and natural resources. Article 3 of this Protocol states that it is a protocol of general application and shall apply to all activities, matters and areas of management of the environment and natural resources of the Partner States, including the following:

i) Sustainable environment and natural resources management,
ii) Management of trans boundary resources;
iii) Conservation of biological diversity;
iv) Management of forest and tree resources;
v) Management of wildlife resources;
vi) Management of water resources;
vii) M anagement of wetland resources;
viii) M anagement of coastal and marine resources;
ix) Management of fisheries resources;
x) Management and access to genetic resources;
xi) Management of mineral resources
xii) Management of energy resources;
xiii) Management of mountain ecosystems;
xiv) Soil and land use management
xv) Management of rangelands
xvi) Combating desertification and mitigating the effects of drought;
xvii) Protection of the ozone layer;
xviii) Tourism development;
xix) Biosafety and biotechnology;
xx) Management of chemicals
xxi) Management of wastes and hazardous wastes;
xxii) Pollution control and management
xxiii) Environmental impact assessment and environmental audits
xxiv) Environmental standards
xxv) Military and hostile activities
xxvi) Environmental education and capacity building
xxvii) Public participation, access to information and justice
xxviii) Environmental disaster preparedness and management.

The EAC protocol shall be observed due to the project drawing water from the Lake Jipe basin.

4.0 BASELINE INFORMATION

4.1 POSITION AND SIZE

Taita Taveta County is one of the six counties located in the coastal region and is approximately 200km North-West of the coastal city of Mombasa and 360km South-East of Nairobi the capital City of Kenya. The county covers an area of 17,084.1km2 with 10,649.9 km^2 (62.3 per cent) being within Tsavo East and Tsavo West National Parks The county borders Kitui, Makueni and Tana River Counties to the north; Kilifi and Kwale Counties to the east; Kajiado County to the north-west and the Republic of Tanzania to the South. The county lies between longitude $37^0 36^{//}$east and 30^0 $14^{//}$ east and latitude $2^0 46^{//}$ south and 4^0 $10^{//}$ south.

The proposed Taveta Kisima farm irrigation project is located in Mata sub-location, Mata location, Mata Sub County, Taita Taveta County. It will draw water from the Lumi River at coordinates: latitude -3.48494, longitude 37.74589, and altitude 717masl. The area to be used for the irrigation project is approximately 380 hectares acres. Physiographic and Natural Conditions

4.2 PHYSICAL ENVIRONMENT

The physical environmental survey involves understanding the actual status of the area, regarding Climate (temperature, rainfall), relief, topography, hydrology, vegetation, soil, water and air quality. Physical parameters of both sites are discussed hereafter.

4.2.1 Topography

Taita Taveta County is classified into three major topographical zones, namely:

i. Upper zone – which comprises Mamberamo, Taita and Smagala hills regions with altitudes ranging from 304 meters to 2, 208 meters above sea level. The zone is suitable for horticultural farming.
ii. Lower zone – which includes plains where the national parks, mines and ranches are found.
iii. Volcanic foothills zone – which covers the Taveta region with underground water and springs sourcing from Mt. Kilimanjaro.

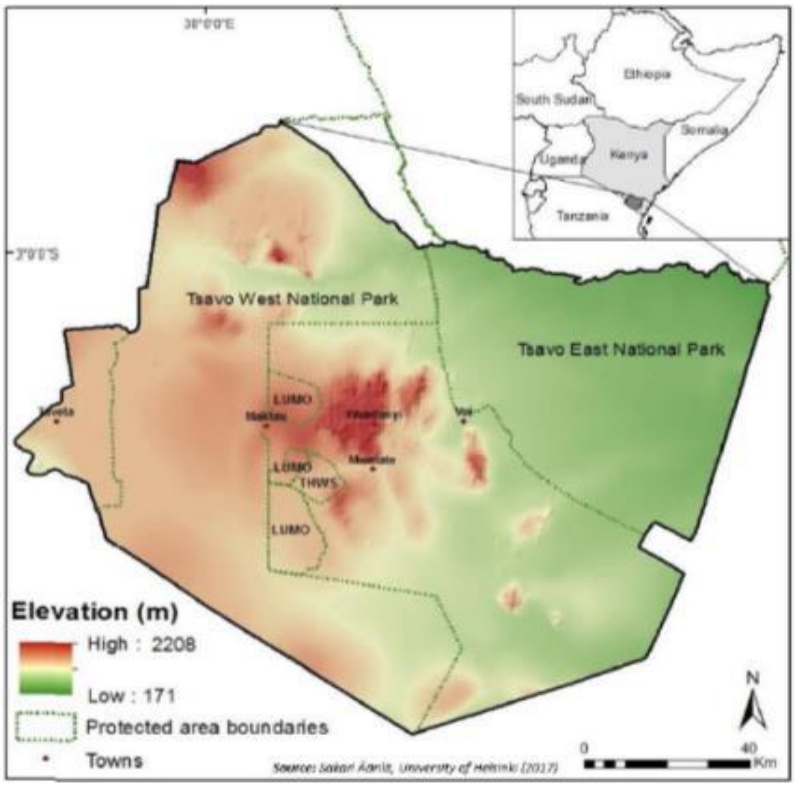

Figure 4-1: County elevated map

4.2.2 Agro-Ecological Zones

Ecological zones in TaitaTaveta County are based on climatic conditions and relief. The Taita Hills which form the highlands cover approximately 1,000 km^2 and rise to a maximum elevation of 2,208 meters above sea level (Vuria Peak). The Taita Hills forests commonly referred to as the "Cloud Mountain Forests", harbour several endemic plant species (>14) and animal taxa (>10) – the most prominent among them being:

- The birds (*Taita thrush, Taita apalis, Taita white-eye*)
- The African violet (*Saintpauli ateitensis*)
- The Sagalla Caecilian (*Boulengeru laniedeni*)
- Endemic coffee (*Coffe afadenii*); and *Milletia oblata, Ceropegi averticillata* and several other plants are also endemic to the eastern arc mountains.

The vast rangeland covering Tsavo National Park (Tsavo East and Tsavo West) is located in the lowlands and transitional zone and occupies about 62% of the entire county area. This forms the Tsavo Ecosystem which is constituted of plains, wildlife, springs, rivers and vegetation. The park is an open savannah and bush woodland supporting the famed 'big five' quintet of lions, elephants, buffaloes, rhinos and leopards as well as antelopes, giraffes, zebras and a host of bird life.

4.2.3 Climatic Conditions: - Annual, monthly and extreme events

Taita Taveta County is mainly dry, except for Taita Hills which are considerably wet. The south-easterly winds influence climate in the area, whereby hilly areas have ideal conditions for moisture condensation which then results in relief rainfall. Rainfall over the Lumi basin was analysed from long-term basin rainfall extracted from the National Water Master Plan (NWMP 2030). Two rainfall seasons are evident, i.e. the March-May (MAM) and October -December (OND). The peak

rainfall months are in March, April and November. Rainfall distribution and occurrence is very important in that it affects the flow characteristics and the dry months when irrigation is needed.

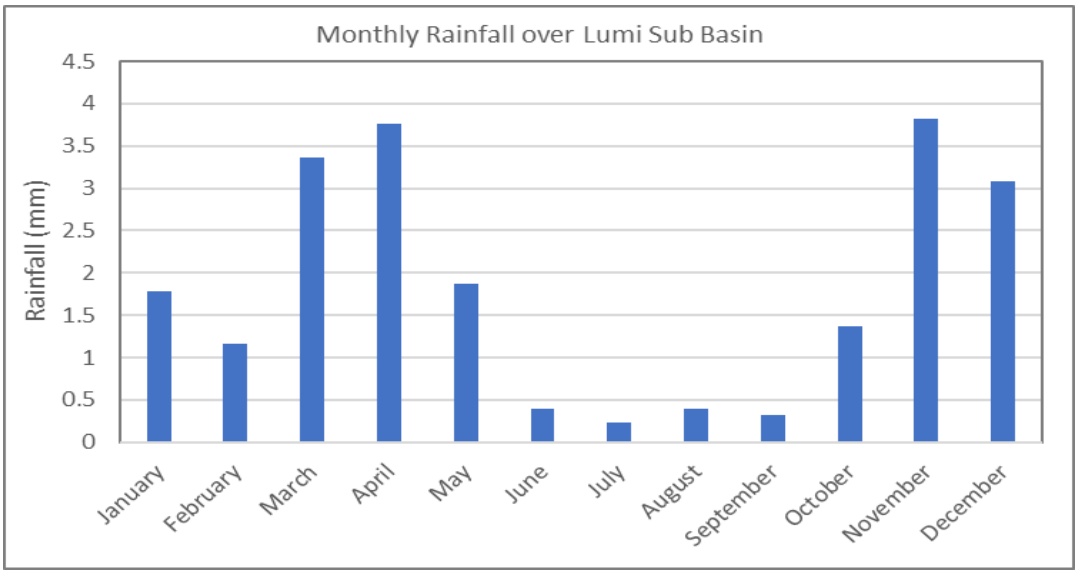

Figure 4-2: Monthly Rainfall over Lumi River basin

Based on the area of study, the RGS 3J15C, which is approximately 10 kilometres upstream of the proposed abstraction point has been used. The discharge data at this station is reliable from 2007 to 2018. Table 6-1 shows the mean, maximum and minimum monthly flows for river Lumi as analysed from records at RGS 3J15C while Figure 6-2 and 6-3 depicts the long-term mean flows and daily flow hydrographs for Lumi River at 3J15C respectively.

Table 4-1: Mean, maximum and minimum flows at RGS 3J15C

	mean	maximum	minimum
January	0.689	13.758	0.012
February	0.590	10.414	0.031
March	0.967	13.758	0.031
April	1.754	14.296	0.000
May	0.895	12.962	0.055
June	0.776	11.667	0.055
July	0.510	1.455	0.055
August	0.553	13.093	0.055
September	0.645	8.499	0.055
October	0.686	8.383	0.031
November	1.153	14.296	0.000
December	1.028	13.226	0.012

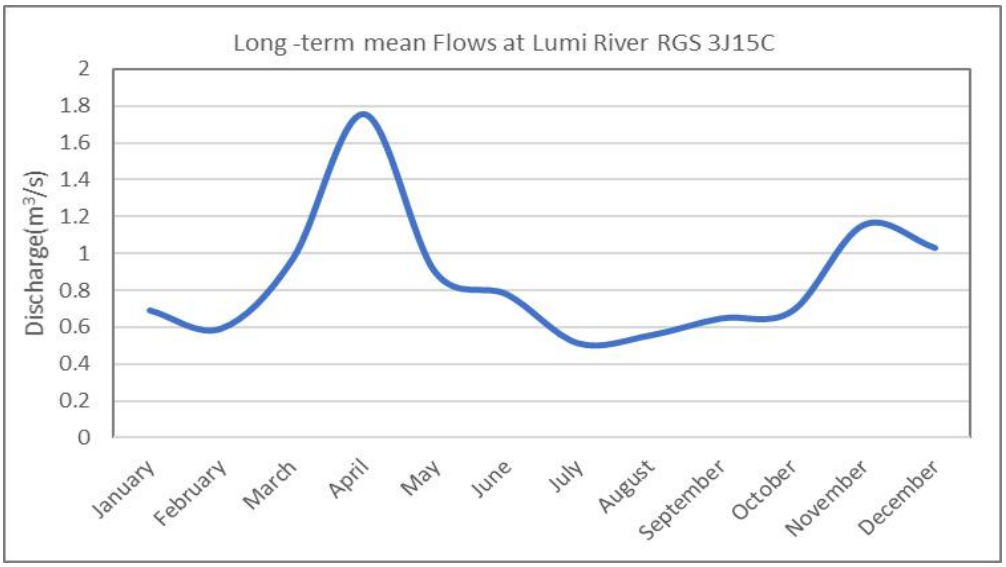

Figure 4-3: Long-term mean flows at Lumi River RGS 3J15C

As observed in the daily hydrograph in Figure 6-3, the magnitude of peak flows has declined with time. This contributes to the reduction in the magnitude of flood waters for the infrastructural developments along the river. This is an indication that the proposed irrigation project is will have to economically utilize the scarce water through appropriate storage.

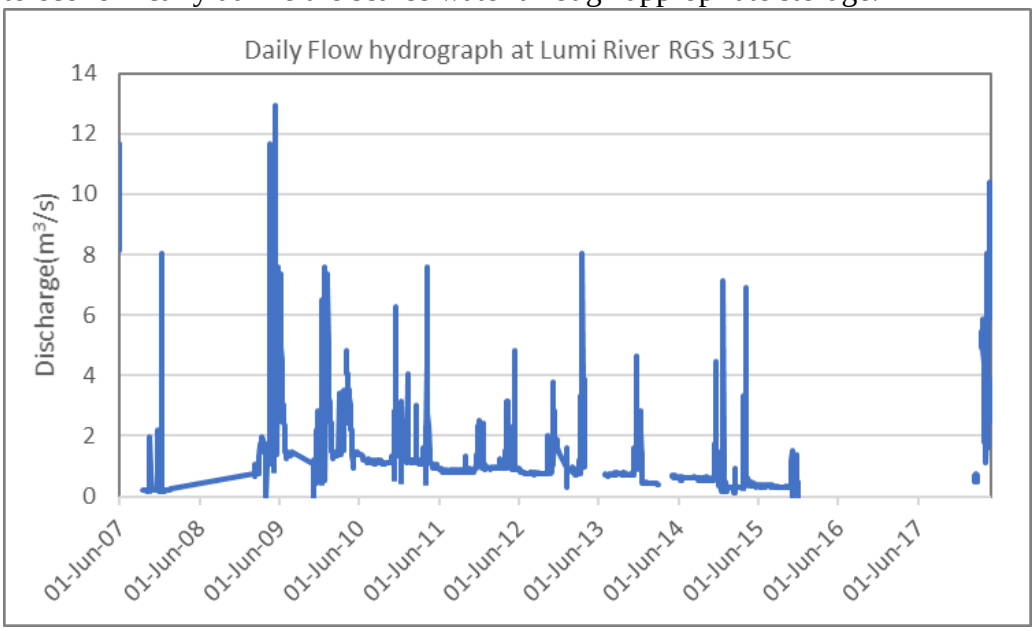

Figure 4-4: Daily flow hydrograph at Lumi River RGS 3J15C

Based on the hydrological analysis conducted, the project is able to abstract up to a maximum of 40,510.46 m^3/day from flood flow. A reserve flow of between 0.114m^3/s (9,849m^3/day) and 0.306m^3/s (26,438.4m^3/day) that constitute Q95 is available at RGS 3J15C while the flood flow, Q50 ranges between 0.997m^3/s (86,140.8m^3/day) and 0.35m^3/s (30,240$m^{3/}$day) and 0.44m^3/s (38,016.0m^3/s). On the other hand, normal (Q80) range between 0.223m^3/s (19,267.2m^3/day) and 0.396m^3/s (34,214m^3/day).

The hydrological analysis has revealed that the Lumi River basin has two major rainy seasons, MAM and OND which contribute to the river flow. A higher flood flow is evident in March to May while the lowest flow values are in June, July, August and September. The basin has 28 water users who are have been licensed by WRA to abstract water from the Lumi River basin (3J). A total of 19,191.14m^3/day is allocated, most of which is for irrigation use. From the flow duration analysis, Lumi River has fairly high flood flows which could be utilized for irrigation purposes with no negative impacts. From the available records from Water Resources Authority, the river seems to be tending towards water stress levels due to intense abstraction. This project must therefore employ storage to avert negative impact on the downstream users and ecosystem.

4.2.4 Geology and Soils

Figure 4-2 shows the soil distribution in the Lumi River basin. Sandy soils manifest around the inflow areas of Lake Jipe and the river mouths. This means that the lake and other hydraulic infrastructure within the basin are susceptible to siltation. According to the National Water Conservation and Pipeline Corporation (NWCPC), the floods within the system is caused by clayey sediment and silt deposited in the river channels.

Mountainous and hilly areas are covered with moderately thick and breakable clayey loam and the land is fertile and well-drained. Therefore, the area is suitable for agriculture. In the inclined or low land, the soils comprise sandy and clayey soil which are also suitable for agriculture. The floodplains comprise a wetland of clayey soil containing sodium and natrium which is also good for agriculture.

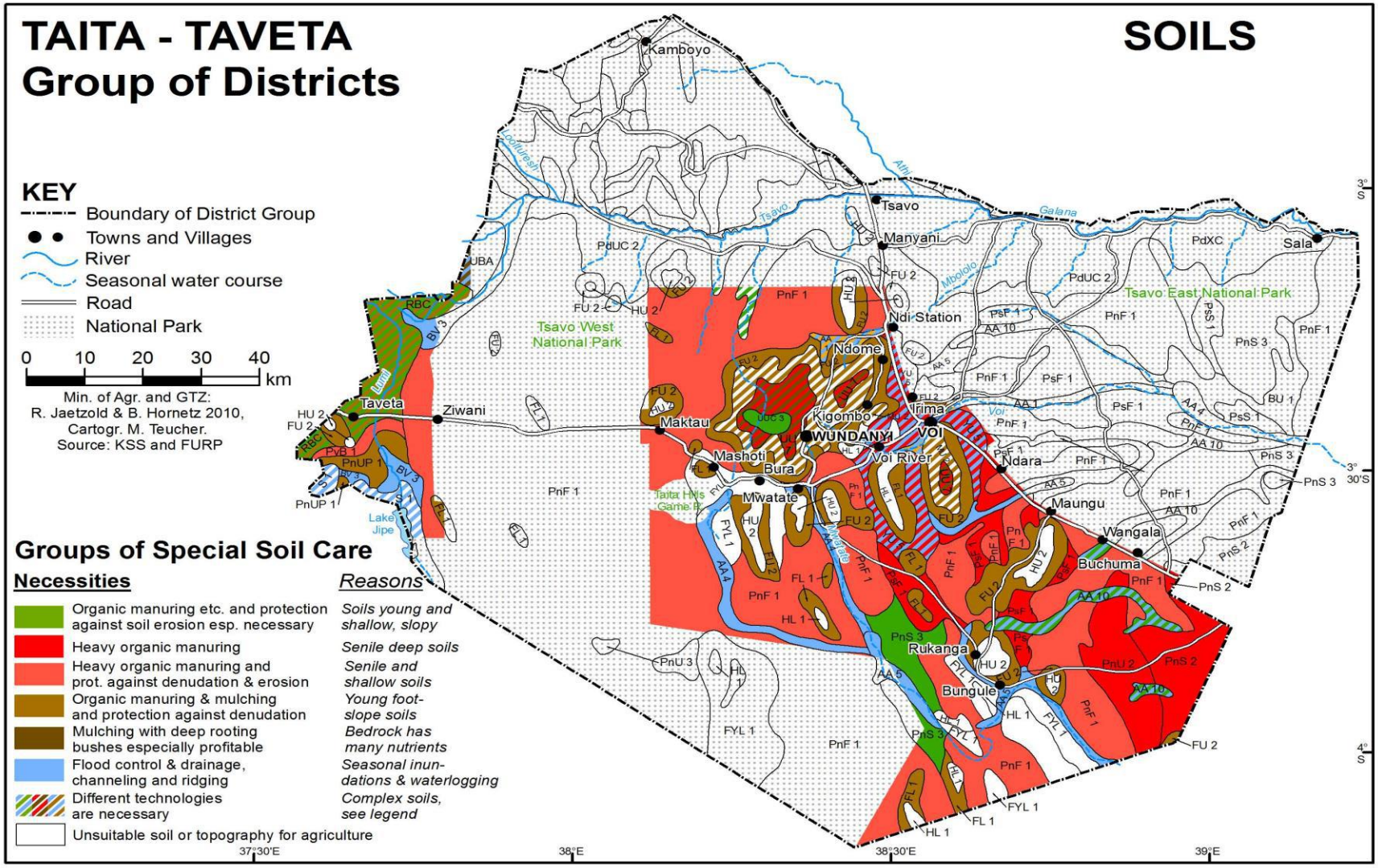

Figure 4-5: Soil distribution in Lumi River Basin (Source: JICA, 1992)

4.3 Biological Environment

Kenya having a tropical climate along the coast to temperate inland to arid in the Northern areas, boosts of different species of flora and fauna. Its climatic conditions are favourable for vegetation growth and animal habitat. The areas of intervention all in the coastal regions may be classified under Tropical Savannah Grassland. It was therefore evident that the type of flora and fauna identified in the region was of similar grassland areas.

Twiga Foods Ltd irrigation project in Taveta is located in existing farmland that has been farmed for the last decade, it was part of the Grogan Farming estates under sisal plantations. Currently part of the land is under farming while the rest is bushy. The surrounding land is also small-scale privately-owned farms by the villagers. There is a wetland nearby the farm that farming activities might impact.

4.3.1 Flora

The project area is located in an arid and semi-arid area of the country, characterized by brush and thicket characteristic of a lowland dry forest. Common trees around the dam area include acacias; *Mzwaule- Acacia lahai; Mwagari-Commiphora Africana,* iti- *Acacia melifera/ Faidherbia albidia, Chariso- Bosciacoriacea* and *Ndomoko- Grewiaplagiophylla.* Other acacias include *Acacia Senegal, Acacia aldida, Acacia tortilis* among others. Very little if not agro-forestry is being practiced in the area. Also found in the area are perennial woody plant species of *Boscia senegalensis* commonly known as Mbambara tree. Common low shrubs observed in the ecosystem include *Solanumin canum shrubs* commonly known as sodom apple. Some parts of the area are covered with fodder grass-*Panicum maximum, Cynodonera grostisrhodes grass,* star grass, red oat grass, lemon grass suitable for livestock keeping. The shrubs and bushes provide habitat for small wild animals such as Dikdiks, porcupines among others. The grasslands are periodically grazed and disturbance due to the activities of cattle and goats is evident. There is rampant felling of trees for timber, firewood and charcoal burning that has contributed to environmental degradation. However, the project area is not within or near any environmentally sensitive area thus no adverse effects are expected or indigenous biodiversity is affected. See the detailed Biodiversity Assessment report in the Appendixes.

a. Maize Plantation at Taveta Kisima Farms Limited

b. Mathenge Shrub near the Reservoir

c.Acacia Tree species with the land being cleared

d. Baobab and acacia trees

Figure 4-6: Maize Plantation within Taveta Kisima Farms Limited

4.3.2 Fauna

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

Monkeys inhabiting within the nearby areas

Goats and Sheep grazing in the background

Figure 4-7: Fauna within the Project Zone of Influence

In conclusion regarding the ecosystem of the area, one could say that the establishment of the irrigation infrastructure and Reservoir is not likely to cause a significant threat to the current biodiversity of this area. From the assessment of the project area and interviews with the locals, there is no protected plant or endangered species of animals on site.

4.4 SOCIO ECONOMIC ENVIRONMENT

4.4.1 Location of the project

The project is located in Mata Village, Mata location, Mata Sub County; Taita Taveta County under GPS coordinates: 37 M 0360208 m E 9616384 m S. It is surrounded by the following villages: Orukung, Mokocheni, Mata Chini, Groga and Njoro Villages. The villages are characterized by scattered settlements with approximately 5 persons per household. The major social-economic activity is the burning of charcoal and the rearing of goats. Several community members are associated with the small scale cultivation of rice and seasonal crops within the wetland.

4.4.2 Community Accessibility

The project has opened up the area with the access road to Kisima Farm being used by the community members as well. This access road is periodically maintained especially during the flooding period where the community there exist flash floods that usually carry away the culverts. Kisima Farm usually takes the initiative to maintain the road, thus enhancing access to the community members as well.

4.4.3 Population Size and Composition

The projected 2019 population of the county stands at 347,909 with a gender split of 50.2% being male and 49.8% being female. The population density per km^2 in the county ranges from 3 persons in rural areas to more than 800 persons in urban areas. The population distribution in the county is influenced by cultural heritage, rainfall and terrain. The main ethnic groups in the county include Taita, Taveta, Kamba, Maasai, Luo, Kikuyu and Somali.

The f special population comprises of Under-5: Pre-school going age, 6-13: Primary school-going age, 14-17: Secondary school-going age, 15-35: Youth Population, 15-49: Female reproductive age, 15-64: Labour force, 65+:

4.5 Solid Waste Management Facilities

The County's major urban centres of Voi town, Mwatate, Wundanyi, Taveta with several others have dump sites that only provide basic Solid waste collection and management services despite the amount of wastes collected per day ranging between 10-20 tones. Currently, the county has three waste disposal sites namely: Chakaleri dumpsite serving Mwatate, Voi and Wundanyi, Riata dumpsite in Taveta and Maungu dumpsite. As a result of a shortage of receptacles, long illegal dumpsites are coming up the Wundanyi stage in Mwatate and Taveta. Waste transportation in the county is done by 2 garbage trucks and one tractor which currently do not meet the guidelines stated Waste Management Regulation, 2006.

4.6 Health Facilities

The County has five public Level-4 hospitals. These include Moi County Referral hospital in Voi, Wesu district hospital in Wundanyi and Taveta district hospital. These have bed capacities of 112, 60 and 108 respectively. The other two are Mwatate and Wundanyi sub-district hospitals which have a bed capacity of 19 and 18 respectively. The total bed capacity for Level-4 facilities is 317. In addition, there are 16 public health centres that fall under the Level-3 category, with eight of these having a combined bed/cots capacity of 81. In this category are the four model health centres constructed in the four constituencies under the Economic Stimulus Programme (ESP). These are Maungu Model Health Centre (MHC) in Voi, Bura MHC in Mwatate, Mgange MHC in Wundanyi

and Rekeke MHC in Taveta. The nearest health facility to the project is Mata Dispensary which is less than 1 kilometre away from the Farm Office.

4.7 Infrastructure Development

4.7.1 Roads

TaitaTaveta County has a total road network of 1832.29km of which 283.2km are of bitumen standards, 168.09km of murram, and 1381km earth road. Key roads in the county include Mombasa-Nairobi highway, which covers approximately 270km, Voi-Taveta Road (110km) Mwatate –Wundanyi Roads, Voi-Salaita gate Road, Maungu-Kasigau road. The road network has greatly improved in recent times following the upgrading of Mwatate-Taveta road to bitumen standards and rehabilitation of Mwatate –Wundanyi road. The county has also seen regular maintenance of both classified and unclassified roads which has greatly improved increased accessibility and agricultural productivity.

The conditions of most roads however remain a major challenge especially during the rainy seasons and the roads maintenance Players County Government, KURA, KERRA, KENHA and KWS will be required to put more resources to make the roads motorable.

4.7.2 Railway

In the past, the County of TaitaTaveta had two railway networks namely:

i. The Voi – Taveta Railway line and
ii. The Mombasa – Voi – Nairobi railway line.

While the Voi-Taveta railway line is now defunct having been in operation for several years, the Mombasa – Voi - Nairobi railway line has since been upgraded to a Standard Gauge Railway (SGR). The SGR line runs both passenger and cargo trains with the latter commencing operations in 2018. The county hosts two of the SGR Terminus Stations at Miasenyi and Voi, with a total of 170km of railway track running through the county. The SGR has greatly enhanced access to the county for both trade and tourism purposes.

4.7.3 Lorry Parks

A modern lorry park is situated in Maungu, Voi Sub-County. This Lorry Park was among the national flagship projects under Vision 2030 and was handed over to the County Government in 2015. The park while operational is not yet running at full capacity with a lot of potential for increased tenancy within the restaurant, accommodation and trade facilities as well as the basic parking area. Parking of Lorries and trailers in other urban centres in the county remains a challenge as it is uncontrolled.

4.7.4 Bus parks

The Voi Central Business District hosts the main transport terminus. The terminus accommodates vehicles plying both counties, national and international routes including Buses and 14-Seater vehicles (Manaus) from areas such as Nairobi, Mombasa, Tanzania and from within the county. Mwatate and Wundanyi Centres accommodate public vehicles such as Probox and matatus that are transiting to Taveta and/or Tanzania and traversing the more rural areas of the county. Taveta Centre accommodates buses moving through the Holili Border and other local public service vehicles.

4.7.5 Airstrip

TaitaTaveta County has a total of 17 public airstrips most of which are underutilized or undeveloped. The airstrips are located in Taveta (6), Voi (5) and Mwatate (6). The main airstrips are Ikanga, Taveta and KWS. Plans are underway to have Ikanga airstrip handle chartered airlines which will greatly boost tourism and trade in the county. There are also two private airstrips one in Taveta and one Mwatate and 4 airstrips in Tsavo National Park.

4.8 Information, Communication Technology

4.8.1 Mobile Telephone

Mobile penetration has been improving over the years, it is estimated over 80% of the county is covered by telecommunication network service providers. Most of the national mobile phone operators have a presence in the County including the main ones Safaricom, Airtel and Telkom.

4.8.2 Fibre Optics and related Infrastructure

The National Government has laid down fibre optic cables in the main urban areas, through the National Optic Fibre Backbone (NOFBI) Network, a Ministry of Information, Communications and Technology programme. The main connection terminates at the Wundanyi County Headquarters. This connectivity in conjunction with the planned county ICT infrastructure installations will greatly enhance communication services when fully operationalized within the county government offices and in the main urban areas. Private Service providers and the county government have made significant progress in the provision of internet services. Several cyber cafes can be found in major towns greatly contributing to an increased usage of internet services. With youth using their mobile phones to access the internet for social media and other digital utilities, farmers accessing information online, the level of penetration can be assumed to be on the rise.

The county government has also initiated the establishment of Community Resources Centres to complement what is currently available through various other players in the public and private sector. These Community Resource Centres are in areas such as Mghange and Kasigau.

Local radio stations, national television and radio stations and digital satellite services have well-distributed coverage across the county with a majority of the county population having access to at least radio services.

4.9 Housing Types

The 2009 population and Housing census report indicated that the distribution of housing concerning main walling materials is 51.1%, 42.5%, 2.4% and 2.1% for brick/block, mud/wood, mud/cement and stone respectively.

On the other hand, housing distribution by main floor materials is 64.7% and 35.3% for earth and cement respectively, while housing distribution by main roofing material is 80.2%, 14%, 1.9% and 1.7% for corrugated iron sheets, grass, makuti and asbestos sheets respectively. This has however changed due to multiplier effects of urban expansion and other exceptional factors such as landowner compensation for large infrastructures such as SGR and Road construction. Most of the proceeds from compensation have gone towards the improvement of the household environment.

4.10 Land and Land Use

4.10.1 Land Ownership Categories/ Classification

The total land area in TaitaTaveta County is 17,084.1 km^2. The two National Parks (Tsavo East and Tsavo West) cover an approximate area of 10,650 Km^2, which translates to about 62% of the total land area. Water bodies in the county account for approximately 16 Km^2 of the land area, leaving about 22% of County land for settlement and agricultural activities.

Land available for household farming activities is further reduced drastically due to the presence of a total of 28 ranches which combined, cover an approximate area of 773.5 Km^2. Eight of these belong to the Kenya government, nine to group ranches and 11 are privately owned. The average size of the ranches is 2,762.5 Ha. Large scale sisal farming for fibre production further reduces the land available for settlement and household farming activities. Three companies produce sisal for both domestic and export markets. Rain-fed agriculture is the dominant activity by most households as subsistence and/or economic undertaking. The land in the County is communally owned with approximately 35% having title deeds. Land adjudication is currently ongoing, to ensure all landowners are issued with title deeds.

4.10.2 Mean Holding Size

The total acreage under food crops is 18,125 Ha while the total acreage under horticulture (excluding sisal estates) is 3,296 Ha. The total acreage under food crops is 18,125 Ha while the total acreage under horticulture (excluding sisal estates) is 3,296 Ha. The average farm holding in the areas that have agricultural potential ranges between 0.5 ha to 30ha, while that of rain-fed ranges between 2ha - 20ha. The average farm size for small scale farmers is about 0.4 Ha in the highlands, 1.3 Ha in the midlands, and 4.8 Ha in the lowlands. This however rapidly changing due to population pressure which has led to land sub-division. The county also has large scale farms (mostly sisal estates) in Mwatate, Voi and Taveta whose average farm size is 7,400 Ha.

4.10.3 Percentage of Land with Title Deeds

TaitaTaveta County land is public, private and communal owned, with the public covering about 63% leaving around 37% to the community to own. The land in the County is communally owned with approximately 35% having title deeds. In the county, 55.2% of residents own land but do not have title deeds or any formal document while 5.8% of the land is under lease. Disaggregated by gender, the majority of male-headed households (57.5%) and female-headed households (55.6%) own land but do not have title deeds or any formal document whereas, 38.5% of youth headed households have allotment letters which show they own land but do not have title deeds. Only 31.3% and 40.7% of male and female-headed households, respectively, have land with title deed/ allotment letters.

This situation is expected to change with the conclusion of the land adjudication process that is currently going on in all the sub-counties.

4.10.4 Incidence of Landlessness

Landlessness is on the increase as a result of poverty, illegal land evictions, internal displacement of persons, natural disasters. Unresolved land tenure issues continue to be a thorny issue in the county in all the sub-counties.

A huge chunk of the county is occupied by private farms and ranches, contributing to the high rate of landlessness. Moreover, the long process of land adjudication and settlement in schemes such as

Jipe (Taveta), Mwachabo and Mwananchi (Mwatate) as well as Maungu and Buguta (Voi) have also contributed to this increase.

4.10.5 Settlement Patterns (Urban Centres, Informal Settlement, Etc.)

Settlement patterns in the county have mixed variations. There is a scattered form of settlement majorly in the rural areas with medium and high cluster settlement patterns more prevalent in minor and major towns within the county. Most of the county's urban centres have not been well planned and subdivided for allocation purposes leaving them to poor and unplanned urban developments.
In recent times, the county has witnessed a growth of key urban centres of Voi, Mwatate and Taveta. The rapid growth of population has seen the emergence of peri-urban settlements and the expansion of informal and unplanned settlements. Other than the key urban areas, the county has witnessed an increase of unplanned trading centres along the Mombasa–Nairobi highways and on the Voi-Taveta Road.

4.11 Irrigation Infrastructure and Schemes

4.11.1 Irrigation Potential

The established irrigation potential in the county stands at 11470 ha with only 47% of the irrigable land being utilized. Taveta Sub-County accounts for 84.6% of the irrigation potential, mainly because of the presence of a regular water supply from Njoro springs and Lake Chala. With food security being both a national and county priority development of both large scale and smallholder irrigation schemes, this will require a concerted effort by all development stakeholders.

4.11.2 Irrigation Schemes

The county has 57 smallholder irrigation and drainage schemes of which 40 are operational as seen below.

Table 4-2: Number of Irrigation Schemes in Taita Taveta

Sub-county	No of schemes	Operational	Non-operational
Mwatate	6	5	1
Wundanyi	17	14	3
Voi	9	4	5
Taveta	25	17	8
Total	57	40	17

4.12 Crop, Livestock, Fish Production and Value addition

4.12.1 Main Crops Produced

The main crops grown are in the county are cereals (Maize, sorghum, rice), pulses (beans, cowpeas, green grams, pigeon peas), root crops (cassava, and sweet potatoes), horticultural crops (kales, tomatoes, cabbages, French beans, snow peas, capsicum, Asian vegetables), fruit crops (bananas, mangoes, oranges, passion fruit, guavas), nuts and oil crops (macadamia, groundnuts, sunflower, coconut, cashew nut) fibre crops (cotton, sisal), emerging crops (jojoba, moringa, mushroom, aloe vera, jatropha).

4.12.2 Acreage under Food and Cash Crops

The county has 2,909.9 Km2 of total arable land, whereby 74% is used for low potential agriculture as it receives an annual mean rainfall of 440mm. The hectarage under food and cash crop production in the County is approximately 18,125 ha and 3,296 ha respectively.

4.12.3 Average Farm Sizes

The average farm size in the highlands is 0.4 Ha, translating into low yield per unit area for most farming households. For small scale farming in the midlands and lowlands, the average farm size is 1.5 Ha and 4.8 Ha respectively.

4.12.4 Main Storage Facilities

Though the county has National Cereal and Produce Board stores in Voi and Taveta, the main storage facilities used by most households are improved granaries, traditional stores and living houses.

4.12.5 Main Livestock Breeds and Facilities

The County is a major livestock rearing zone, with the main types of livestock being beef cattle, dairy cattle, goats, sheep, camels, donkeys, poultry, beekeeping, rabbit and pigs. Chicken is the main poultry reared, although guinea fowl quills, turkeys, geese, ducks, peacock, pigeons are emerging poultry. Other emerging livestock enterprises that are yet to be exploited include ostrich farming, crocodile farming, tortoise farming, snakes, silkworm farming, snail farming and butterfly farming in select parts of the County.

4.13 Water and Sanitation

4.13.1 Water Resources

The County has a total of 71,090 households, of which 41,390 households, representing 58% of the total households have access to potable water and 35% (24,882) have access to piped water. The number of households with roof catchment systems stands at 13,400 representing 19% of the total number of households. With the erratic rainfall, efforts should be made to increase the number of households with roof catchments to tap rainwater. The water quality (% of cleanliness) is 80%. In terms of water resources, there are six main rivers, 95 shallow wells, 92 protected springs, 25 water pans, five dams, 25 boreholes and 57 Water supply schemes in the County.

The main rivers in the county are Lumi, Tsavo and Voi. Mzima Springs forms the main water supply for Voi town and Mombasa City. Smaller springs augment this supply and include Njoro Kubwa, Sanite, Njukini, Maji Wandeni, Lemony, Kitobo and Humans Springs. Additionally, Lake Challa and Jipe found in the Taveta area are served by springs emanating from Mt. Kilimanjaro.

4.13.2 Water Supply Schemes

The County has the biggest water supply scheme in the coastal region. This is the Mzima Water Project, which supplies water to Voi town and its environs through a number of major projects including Voi water supply, Mbololo water supply, Irima, Kimwa and Kaloleni water projects, Miasenyi water project, Manyani water supply, and Maungu-Bughuta water project. This scheme is also among the major suppliers of water in the coastal city of Mombasa. The source of the water is Mzima springs, situated in the Tsavo West National Park.

Other major water schemes are found in Taveta and Wundanyi areas. In Taveta, there are four schemes. These are Taveta Lumi water supply, Challa Water Project, Chumvini water project, and Kitobo water project.
The County is home to both surface and underground water sources. The surface water sources include Mzima springs, Lakes Challa and Jipe, and some rivers like Mwatate, Kishenyi, Ziwani, Lumi, Sanga, Wanganga and Voi, Challa, Kighombo and Kishushe. Underground water resources include two springs, Homer's and Lemonya, and several streams including Njukini, Sanite Njoro Kubwa, Kitobo, and MajiyaWaleni.

4.13.3 Water Sources and Access

The average distance to the nearest water point is 1.25 Km. In the County, an estimated 13% of households take between 1-4 minutes one way to fetch drinking water. Likewise, 27.2% take between 5-14 minutes and 35% take between 15-29 minutes. About 24.8% of households take 30 minutes and above one way to fetch water.

4.13.4 Sanitation

The majority of households in the County use pit latrines, which are 75.8% of total number of toilet facilities. 67.4% of these are covered pit latrines. The Ventilated Improved Pit (VIP) latrines form 4.5% of total toilet facilities. The other main type of facility is flush toilets, which accounts for 5.8%. An estimated 63,981 (about 86%) of the total households in the County have access to toilet facilities while about 14% of households do not have any kind of toilet facility.
The farm/garden accounts for the largest garbage/waste disposal type at 44.1%, followed by garbage pits at 23.7%, burning at 22.1%, public garbage heaps at 6.4%, collection by county government at 2.4%, and collection by private firms at 0.3%. The county government is playing a more active role in garbage collection to make the environment more habitable.

5.0 STAKEHOLDER ENGAGEMENT

5.1 Introduction

The EMCA 1999 calls for effective stakeholder participation and public consultation in the EIA process, this case an ESIA. Public consultations and participation ensure that the views of the affected and interested parties are incorporated as early as possible in the project design and effect minimizing the potential unexpected opposition of the development project and potential adverse effects to the environment. It is also very beneficial in incorporating the views of the public into the design process for the adoption of the best workable models and systems since the local people know best what suits them.

Public consultations took off from the scoping stage once the EIA process was commenced with the main objective of involving the public in the design of the project to identify and mitigate the likely negative project effects and promote the positive ones. The key stakeholders consulted included:-

i. Line ministries officials
ii. The Local area administration
iii. Local community members
iv. Water Resource Users for River Lumi and the Canal
v. Youth Leaders

vi. Village elders
vii. Women leaders in the community
viii. County Agricultural officer.

5.2 Goals of Consultations

The primary goals of the consultation process are to:

- Ensure transparency and involvement of stakeholders in assessing and managing the potential environmental and socioeconomic impacts of the project;
- Help manage risks, concerns and public expectations through ongoing dialogue with stakeholders;
- Improve decision-making and build understanding by actively involving key project stakeholders and PAPs in two-way communication. Through this process, the implementing agencies will better understand the concerns and expectations of stakeholders, beneficiaries and PAPs, and the opportunities to increase project value to the local community.

Stakeholder consultation aimed at:
The consultations with stakeholders and communities were carried out to specifically achieve the following objectives:

- To provide information about the project and to tap stakeholder information on key environmental and social baseline information in the project area;
- To provide opportunities to stakeholders and communities to discuss their opinions and concerns respectively and get a full appreciation of their expectations
- To solicit the stakeholders' views on the project and discuss their involvement in the various project activities;
- To discern the attitudes of the community and their leaders towards the project so that their views and proposals are taken into consideration in the formulation of mitigation and benefit enhancement measures;
- To identify specific interests of and to enhance the participation of the poor and vulnerable groups; and
- To inform the process of developing appropriate mitigation measures as well as institutional arrangements for effective implementation of the project.

5.3 Approaches to Stakeholder consultation

Techniques used during consultation included the following:

- Face-to-face or interviews through use of checklists and questionnaires with relevant stakeholders,
- Community consultations,
- Focus Group Discussion and
- Key Informant Interview

Figure 5-1 below shows some of the stakeholders who were engaged

Figure 5-1: community leaders meeting with the team for a discussion on project impacts.

5.4 Stakeholder consultation Comments

Stakeholder consultation was done on 22nd October 2021 under the headship of the Chief and the Assistant Chief of Mata Ward.

Table 5-1: Stakeholders' Consultation Comments

Item No	Description	Remarks
1.	Minute 01: Prayer The meeting started with a prayer from Mrs. Gladys Ocharo at 10:30 AM.	
2.	Minutes 02: Introduction. This was followed by self-introduction under the leadership of the Area Chief.	
3.	Minutes 03: Remarks from the Chief: The meeting was opened by the Chief who emphasized the need to adhere to COVID 19 protocols. Due to this only the representatives of the youth, women, men, elders and opinion leaders were invited for the meeting. The members present are supposed to update the community about all the reached deliberations. We are seeing progress in the area, Taveta Kisima Farms Limited has progressed with the following milestone: 1. Fencing of the project that was done by community members, 2. Start of the Borana animal rearing, the project buys animals from the community for fattening and selling, 3. Maize Farming project, and now 4. Tomatoes, Onions and Vegetable project by Twiga Farm. We request for the Investor to outsource the market for the farmers near the project to benefit from the project.	ESIA report shall document COVID19 protocol for the project. Need for more collaboration between the community and the developer in near future.
4.	Minutes 04: Remarks from the Village Elder: The elder welcomed the visitors and the community to the meeting and appreciated, their sacrifice to create time and attend the meeting. He opened the meeting officially. He clarified that the project is located in Mata Sub-location, Mata Location. Mata Ward, Jipe Division, in TaitaTaveta. Stakeholders/Community members were told to air out all the comments regarding the project.	Project location noted and shall be documented in the project.
5.	Minutes 05: Project Description The farm Manager briefed the stakeholders about the project. Twiga Foods Limited is leasing the land from Kisima to undertake the growing of Tomatoes, onions and other vegetables. The company is already undertaking the rehabilitation of the Canal to ensure that community members who have been negatively affected by the excessive water in their land that has become unproductive can start farming again.	Twiga Foods Limited has leased land from Taveta Kisima Farms Limited

Item No	Description	Remarks
	Taveta Kisima Farms Limited is reopening up the World vision Channel (Miliki) to help the upstream community do cultivation on their farm. The project will provide the sale of the farm products to the community members.	
6.	Minutes 06: Remarks from Engineer Damaris Kerubo The investor is complying with the requirements for the Kenya Laws as well as the funder (IFC/World Bank) operation policies. Community / Stakeholder consultation is an integral part of establishing new development in any area. This platform provides the avenue to include the community input to the planning and design of the project as well as informing the community over the proposed project components. All views gathered here shall be documented in the ESIA report and also key output communicated to the client.	All views gathered here shall be documented in the ESIA report and also key output communicated to the client.
7.	Minutes 07: Remarks from Environment and Social Safeguards The Environmental and Social Impact Assessment (ESIA) Project Report for the proposed Irrigation Scheme is being undertaken in line with the requirement of Environmental Management and Coordination Act Cap. 387 of the Laws of Kenya. The law emphasizes the need for information sharing and disclosure to all affected stakeholders and the community members are key stakeholders for such a project. This is the reason behind ensuring the community is aware of the proposed project as well as enhancing project acceptability and possibly evaluating the opportunities for community participation in the project.	Community Input will be documented in the ESIA report
8.	Minutes 08: Comments from the Community Members. There is a need for clarification whether the project is covering the entire section of the land or a specific area leased by Twiga Farm? The immediate community members should be given priority in employment when the activities commence.	Twiga Foods Limited has leased land from Taveta Kisima Farms Limited
	The community would like to be informed if the farming process will involve the use of chemicals? If chemicals will be used when there is a potential risk of contaminating Lake Jipe as well as the community members downstream who use this water for domestic purposes as well.	The project will use agrochemical inputs under the supervision of an agronomist to ensure no pollution to the environment

Item No	Description	Remarks
	The community is happy with the project, already they have seen the benefit of such project coming within our environs; many youths have been employed in Taveta Kisima Farms Limited. However, we take note that the average wage paid at the site is very lay and many at a times it delays being received.	Need to pay the workers at the prevailing market rates. County Labour Officer should inspect this during project implementation
	The community leaders should come up with one major community need and discuss it with the Twiga Foods Limited Management to ensure it is incorporated in the Corporate Social Responsibility. We are already aware the number one need for the community is clean and safe water for domestic use, this can be done by the investor to connect the community with the clean water from the borehole at the farm.	The developer should consider providing clean water to the community as part of the Corporate Social Responsibility.
9.	We appreciate the project has employed many youths thus they are busy working and no loitering and idleness among youths. However, the biggest challenge is the community access to the land for cultivation that is along with River Lumi and Njoro. The community members have to go round the fenced Taveta Kisima Farms Limited thus reaching the farm late and when they are tired. We used to access our land direct across Kisima Land before it was fenced. Another challenge is the accessibility of our road especially when it rains, the road is in a deplorable state, and the project may improve the access road as well.	
10.	The initiate project had one supervisor (who was a white man), the community sort audience of the community access to the wetland where we do cultivation but up to now, the community has never listened.	
11.	There is a need to cater for the employees' welfare for example if one is sick, one should be paid for as well as catering of the medical bills as this may be an occupational hazard. As community members, we may come together and be out-growers and possibly seek to sell our products to the ready market identified by the investor, is this possible.	Need for the project abide by the labour laws with periodic supervision from the county Labour Officer.
12.	There is a need for the investor or government to seek a market for our bananas, community members have a lot of bananas rioting in their garden because there is no market for it.	
13.	We would like to know the relationship between Taveta Kisima Farms Limited and Twiga Foods Limited so that	Twiga Foods Limited has leased land from Taveta Kisima Farms Limited

Item No	Description	Remarks
	we can know as a community how to engage with these two entities? There was no public participation in the initial land opening; this is a good gesture that the new investor has done, we hope community issues will be considered. The community access to the wetland has been fenced off and we have to go round the entire farm. There is need to improve the communication channels between the main Farm (Taveta Kisima Farms Limited) and the community; many community issues have never been attended to by the management. Taveta Kisima Farms Limited Management promised to build a waste dumping site for the community, however, this was not a priority to the community. The community needs clean domestic water. The community had dug a borehole but it is salty, we request the farm to make a borehole for the community.	
14.	We understand that the investor is restoring the water reservoir by having an intake channel and there is an outlet that leads to Lake Jibe. We are wondering won't the community downstream be affected if the farm will use agricultural chemicals at the farm? This may also affect the aquatic biodiversity, especially in Lake Jibe.	The project will use agrochemical inputs under the supervision of an agronomist to ensure no pollution to the environment.
15.	We hope that the channelling of the intake will not compromise the ability of community members in the upstream to cultivate in their land as well. This is the second time we are having community engagement; we hope all community aspirations will be considered and be implemented soon.	Taveta Kisima Farms Limited Management is already opening up the upstream drainage channel to help the community farm on their land.
16.	There is a need for the developer to ensure appropriate and fit for work Personal Protective Equipment are given to the workers. This equipment may include Gumboots, Gloves, Reflector jackets/coveralls among others.	PPEs use will be mandatory for all workers
17.	The community is happy as the current Farm Manager is a son of this soil and we have been having fruitful engagements through him, the communication has improved. The new project should have a realistic minimum wage for the workers, currently, the workers are given 300 shillings per day, and this amount is very less to meet the economic need for an individual today.	The project emphasized the local content, more community members will be employed at the site. The issue of fair wage will be considered.

Item No	Description	Remarks
	We insist that the community should be given priority in getting jobs at the farm to a tune of 75% of the possible employment available.	
18.	There is a need for all employees to have formal employment during project implementation. We have concerns when the employees are casual labourers and when one is sick, they are not paid for the days they are away from work but under medication. We appreciate the existing medical care arrangements given to the sick workers which include catering for the medical bills, we hope the new project will emulate this good gesture.	All workers will have a formal running contract that will be signed by both parties.
19.	Remarks from the Assistant Chief: We acknowledge the positive gesture of having this consultative meeting with the community member and larger stakeholders. We hope the community submission will be factored into the project during the implementation process. Within the community we have learned youth with a technical expert in irrigation as well as agronomy, we hope they will be considered as well. The community biggest challenge is access to potable water for domestic use. Mr Dumber had promised the community with a waste recycling project for the plastic waste, glass among others? This project is long overdue we hope it is still in the pipeline. We are seeing the use of machines in developing channels, the previous work by World Vision was using community Members as a form of earning (Cash for Work), can't the current management use community members as well and not all-time use of machines. There is a need to open up the "Miliki" channel to ensure the upstream farmers go back to their farms and cultivate them. Currently, there is a great challenge that community members are not farming at all. If no comments, we request we close the consultation to allow our Muslim brother to go for "Friday Duwa"	More community members will be employed. The communication has improved between the community and the management of Taveta Kisima Farms Limited after the appointment of the new manager who is from within this community.
20.	Vote of thanks We appreciate the initiative to meet the community to listen to their views concerning the proposed irrigation project, we hope community request and consideration will be factored in. We hope for better things ahead as the community commit to fully support the project, we see	

Item No	Description	Remarks
	there is light at the end of the channel. The key output of the consultations include: • Community members to get priority in employment, • Better employment welfare at the farm, • Need to look for the Banana market for the community members, • Consideration for community Access, and • Implementation of the Social Corporate Responsibility especially the major community needs for clean domestic water. We wish the investor the best in the investment, the success of the investor will be a success to the community members as well. The meeting was closed by Prayer from Ms Gladys Charo at 12:50 PM.	

5.5 Summary Findings of Community Consultation

- The respondents said that the proposed irrigation will not interfere with their public health and the safety of the area there will be few waste products that will be well-taken care of.
- The noise produced from the machines will be monitored so that it doesn't go past the regulated limit.
- Some knew the effects of irrigation on the soil while others did not. Some said that the project will not interfere with the ecosystem but if it does it will interfere in the following ways. Firstly, it will reduce forest cover then reduce then possibly affect the animals living in the forest.
- The Community respondents were aware of the benefits of the irrigation project and would increase income, farming knowledge and technique. It further revealed that they did not know of other benefits on social, educational and development which needs to be highlighted to them.
- The potential for chemical pollutants getting into the aquatic resources as the agricultural activities intensify
- Deforestation through vegetation clearance and establishment of more agricultural land and the expansion of the current land sizes. This would be addressed through reforestation programs as is ongoing in the area and the protection of indigenous plant species through the sparing of indigenous trees during the clearing process.
- Increased dust during the excavation and site clearance; the contractor should ensure there is fast completion of the project to ensure a reduction in exposure period for people and livestock,
- Noise emission from the machinery in use at the construction phase,

- An increase in mosquito prevalence and therefore increased incidence of malaria and other water-borne diseases due to increased breeding sites would be addressed by Educating the community on preventive and control measures such as spraying and use of treated nets boiling of drinking water and avoiding stagnant water. It would be important to improve the existing health facilities in the project areas and also to ensure the availability of medicines closer to the population or in worst case scenario establish more health facilities
- Inadequate water for target users at the downstream, the project maintenance should ensure minimal siltation to have a regular water flow to all the locations, and
- Increased wildlife-human conflict due to increased irrigation leads to more greenery at the farms than at the parks.

5.6 Conclusion

The proposed irrigation project has very minimal socio-economic issues to be interfered with. The land size will not be altered. The project will benefit positively 24 the respondents of the project or even more who will be indirectly involved or connected to the project. The community members have not fore-seen any alarming negative impact. All potential impacts are localized and can be mitigated. The project will enhance the living conditions and standards and there will be no interference with the human settlement or displacement, there will be very little interference with the land as piping is being done through pivot mechanism system of irrigation which most of the respondents say they will not require compensation. The rules and regulations are being followed to ensure proper legislation and no conflicts occur during the implementation process.

The Irrigation project is a good project with a very minimal socio-economic negative impact which if addressed, will create very positive socio-economic change to the community where it's being implemented and it will enhance development in the area, TaitaTaveta County and the Country at large. The produce from the project can be exported to the neighbouring countries, therefore, boosting our international and regional trade.

- There is a need to provide knowledge on issues to do with the impact of irrigation on soil fertility and how to grow healthy soil under intensive farming.
- There is a need to enforce water source protection and conservation.
- Need to provide knowledge on the ecosystem and the effects of human activities on it plus how to protect it.
- There is a need to provide policies on irrigation to the respondents and community
- There is a need to provide knowledge on waste disposal and recycling methods

6.0 PROJECT ALTERNATIVES

6.1 Introduction

The ESIA study should seek to consider possible alternatives of the inputs and outputs that are to be used throughout the project cycle. These inputs include alternative sites, activities, products, technology and waste management procedures among others. The project report seeks to give a detailed description of the project area, technology, resources and other inputs that are to be put in place to promote the best working models that could be adopted to prevent injurious activities to the supporting resources.

This study has therefore sought to identify and assess alternatives to the proposed developments to have the best working models that may not have adverse effects or those that have the least minimal effects. The best alternative is to be selected based on minimal negative impacts and through a cost-benefit analysis.

The "No Project" alternative model helps the proponent and various decision-making levels to approximate the impacts of project implementation against the non-implementation thereby making the right decision regarding project implementation. The following alternatives are probable in the project area.

6.2 No Project Alternative

This model helps the proponent measure impacts from the project baseline information and helps in the assessment of impacts concerning the project's activities. This alternative implies the project does not proceed thereby enhancing the status quo.
The status of the environmental resources neither improves nor worsens since the state of the resources is not interfered with at all. However, project implementation could improve food security, increase household incomes and help to provide employment as well as upgrade the regional economy. The 'No Alternative' has various negative and possibly long-term impacts to the region which include; -

i. The local populations will continue to suffer from food scarcity due to a lack of adequate harvests pushed by insufficient water for agricultural use.
ii. There is projected to be reduced productivity and poverty.

Some of the consequences of adopting this option include: -

- Increased water losses and wastage in the existing irrigation schemes thereby bringing about water scarcity
- Loss in productivity of the land
- Increased economic activities that are detrimental to the environment such as charcoal burning
- Reduced capital gains from the land, and
- Increased demand for agricultural inputs such as fertilizer and pesticides to promote outputs.

The effects of adopting this model largely show there will be huge losses to the residents and the nation at large since the areas especially around Mata provide the local markets and other nearby towns with much-needed fruits and vegetables.

The economic level of the project area is low and need to be improved to promote the fiscal outputs of the area. The 'No Project Alternative' is the least preferred option since the costs far much outweigh the benefits to be accrued.

6.3 Alternative Irrigation Methods

Several irrigation methods can be used in the project area. There is an apparent need to choose the most appropriate method that will promote the effectiveness of the water conservation measures. There was a consideration of various methods that would be used in the areas to ensure water conservation measures are promoted. Some of the methods include: -

6.3.1 Sprinkler Irrigation

There are limiting factors to implementing this kind of method. Firstly, the amount of water required would be limited due to water wastage. The capital investment to this method would be prohibitive to the projects' implementation thereby making the initial costs high. The method is rather prohibitive in terms of costs and capital investments. In addition, some of the project areas have heavy clay soils with low infiltration rates and therefore are unsuitable for this irrigation method.

6.3.2 Surface Irrigation

In this method, water flows to the land by gravity, the irrigation water must be available at higher grounds/ levels than the recommended fields. Water is diverted from the main source by the headworks and supplied to the field through a network of conveyance and distribution canals or pipes. Water can be supplied directly to the fields using canals, sprinklers or indirectly from a storage reservoir. Storing water in a reservoir or dam allows for more area to be covered but it is more expensive due to the high construction cost of the reservoir. This method is rather convenient to the project area since the water intakes can be seen to be of higher gravity to the areas water is needed.

6.3.3 Flood Irrigation

This is a form of gravity irrigation from a river without the need for an intake structure to divert the water. Seasonal rains raise the streams and rivers courses and the flow waters can be used by the farmers to irrigate their fields. Channels can be constructed to maintain the water in the fields for as long as possible, and as the flood recede the residual moisture, is used by the crop. Once the floods and residual moisture have been exhausted the farmer can make use of the shallow water table and construct shallow wells to lift the water by the bucket for watering/ irrigating the crops. However, the method could be prohibitive since it requires a significant amount of water to sustain thereby making it rather impracticable in these areas especially bearing in mind these areas are ASALs.

6.3.4 Drip Irrigation

This kind of method is largely sustainable though prohibitive in terms of capital investments especially when the project is large and diverse. The method saves water and fertilizer by allowing water to drip slowly to the roots of plants, either onto the soil surface or directly onto the root zone, through a network of valves, pipes, tubing, and emitters. It is done through narrow tubes that deliver water directly to the base of the plant thereby avoiding all potential water losses. This method is

very sustainable and water-conserving though the capital investment and the distance becoming rather prohibitive. The main advantages are that Water application efficiency is high thereby heavily reducing water losses and that soil erosion is minimized. However, the disadvantages that may hinder its implementation include;

- It is highly expensive; the initial cost can be more than overhead systems,
- Harsh weather conditions e.g., the sun can affect the tubes used for drip irrigation, shortening their usable life.
- If the water is not properly filtered and the equipment is not properly maintained, it can result in clogging.
- Drip irrigation might be unsatisfactory if herbicides or top-dressed fertilizers need sprinkler irrigation for activation thereby making them less effective.

From the above analysis, it is apparent that drip irrigation is the most effective method when it comes to saving water. However, with the initial project costs that are estimated, it may become largely prohibitive thereby making the best alternative to be surface irrigation.

6.4 Alternative Location

This project can be considered to be more or less site-specific. From the initial feasibility study report for the intake of the proposed canals, the intake sites are appropriate as they are located on higher levels from the land to be irrigated. Some of the factors that influenced the choice of the locations include the agro-climatic conditions of the area, the soils, water availability and the drainage system in the areas. These can be seen to be the most appropriate site locations for the activities because of their proximity to the sources of water to be used for these activities and the convenience of water sustainability and regeneration.

6.5 The Comparison of Alternatives

Under the proposed development alternative, the project would enhance the expansion of irrigation infrastructure and would provide employment both directly and indirectly to the Kenyan population in all phases. Once implemented, this project will not only ensure food sufficiency in the project area but to the whole country and also earn Kenya forex revenue from the export of surplus harvest. The design has been chosen after a careful cost-benefit analysis (CBA) and about the available budget and targeted irrigation area. It has also been made practical and aesthetically pleasing hence will improve the general outlook in the area.

Under the No Action alternative, there would be no development at all, no impacts on the environment and serious losses to the project proponent being the farmers, NIB and the government of Kenya and income, food sufficiency and employment losses to the general population including loss of forex income to the government. An alternative location is currently not viable as the project is site-specific and this piece of land is ideal for this kind of investment due to spring water availability and land fertility. Provided that the Environmental Impact mitigation measures are implemented and sound construction measures adopted, negative effects on water, soil, air, and water systems will be avoided.

7.0 POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

This chapter identifies and discusses both positive and negative impacts associated with the proposed Irrigation Project. The anticipated impacts are discussed in three phases namely: construction, operational and decommissioning phases. Impacts associated with the construction are short term of low magnitude and localized to the project area of implementation.

7.1 Positive Impacts during Construction Phase

7.1.1 Employment Opportunities

There is anticipated to be an increase in the recruitment of labour to be involved in the project works. Employment opportunities are seen to be both directly and indirectly to the service providers of the persons to be involved in the construction works. An increase in the population of the workers will lead to an increase in the demand for consequent services such as food demand and other services e.g., housing, health care and transport among others. These are set to be provided by the local communities thereby creating new opportunities.

7.1.2 Improved Infrastructure

The expansion of the access roads into the villages will ultimately lead to opening up to the markets. There have been many challenges that arise out of the undeveloped roads especially in the transportation of farm products during the rainy seasons and now with the opening up of these areas, accessibility shall be made easy. Consequently, the improved revenue growth will precipitate the development of other social amenities which is highly desirable in solving prevalent social issues.

7.1.3 Injection of money into the local economy

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

7.1.4 Creation of a market for construction materials

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

7.1.5 Improved Food Security

The Irrigation Scheme is expected to produce a variety of diverse crops ranging from Tomato, Onions, and Maize and rearing of Borana cows for meat. The irrigation scheme will employ improved agricultural technologies such as drip and sprinkler irrigation, minimum tillage and crop rotation. This will lead to high yields of crops per year (with two planting seasons) thus leading to improved food security situation unlike the current situation under rain-fed agriculture.

7.2 Negative impacts and their mitigations measures

7.2.1 Interference with the physical setting

Impact

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

Mitigation

- Ensure proper demarcation and delineation of the project area to be affected by construction works
- Passing of relevant information to each of the affected parties

7.2.2 Noise Pollution and Vibrations

Impact

Construction of the proposed project store and warehouses will most likely result in noise emissions as a result of the machines that will be used (excavation equipment etc.) and construction vehicles delivering materials to the site. Noise could impact negatively on the workers during the construction phase. Noise can also be a nuisance to the local community if construction works begin too early in the day and continue into the night. Noise levels from construction activities exceeding 60 dB (A) at the construction campsite have a negative impact on the environment.

Mitigation

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

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

7.2.3 Dust Emissions

Impact

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

Mitigation

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

- Strict measures are to be applied for the handling of construction materials in powder forms such as cement, lime, concrete additives, etc. and the disposal of the packaging

- Excavation, handling and transport of erodible materials shall be avoided under high wind conditions or when a visible dust plume is present and or covered by tarpaulin while on transit.
- Minimizing the number of motorized vehicles in use;
- Wet all active construction areas as and when necessary to lay dust;
- Vehicle speeds are limited to a maximum of 30Km/h.
- Above all, a monitoring and evaluation programme for air quality shall be implemented and reported on throughout the construction phase cycle.

7.2.4 Occupational health and safety risk

Main pipes will be composed of the pipes that deliver water from the pumping station directly to irrigation systems called centre pivot and drip from the pumping station water centre tanks in the logistic centre. In total there will be twelve (12) main lines of PVC pipes of varying diameters and classes to deliver water from the reservoir to the Farm. The main lines will be operating under high pressures of up to 10 bars. The project works may expose workers to occupational risks due to handling of heavy machinery, construction noise, electro-mechanical works etc. Other construction activities including bush clearing, materials delivery, and construction traffic will generate a lot of dust and this may affect the respiratory system.

Mitigation:

- Ensure that all construction machines and equipment are in good working conditions to prevent occupational hazards.
- Establish a Health and Safety Plan (HASP) for both civil and electromechanical work.
- Appoint a trained health and safety team for the duration of the construction work. Use of dust masks while working in the dusty environment to avoid respiratory-related sicknesses, and
- Provide workers with appropriate personal protective equipment (PPE).

Should an accident occur?

- The injured person should be given first aid and immediately taken to the hospital
- An investigation should be initiated immediately to ascertain the cause of the accident and preliminary findings released within 24 hours.

7.2.5 Solid Waste Generation

Impact

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

Mitigation

- It is recommended that construction waste be recycled or reused as much as possible to ensure that materials that would otherwise be disposed of as waste is diverted for productive

uses. In this regard, the contractor will ensure that construction materials left over at the end of construction will be used in other projects rather than being disposed of.

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

7.2.6 Loss of Vegetation Cover and Biodiversity

Clearing of part of the existing vegetation cover will be done to pave way for the scheme. Direct impact from such disturbance may cause changes in the natural community ecosystem or lead to invasion by non-native plant species. Loss of plant communities may also result in soil erosion and/or compaction. The loose soil material may also be washed down into the lower areas (streams and valleys).

Mitigation

- It is recommended that indigenous trees or other fast-growing trees be planted in strategic locations where the vegetation cover will be cleared as part of landscaping initiatives;
- Project implementation plans will be developed such that sections excavated are worked on and completed before moving to other areas;
- Re-vegetation of exposed areas around the site will be carried out rapidly to mitigate against the erosion of soil through surface water runoff and wind erosion; and
- Identify and restrict movement of vehicles to areas of disturbance

7.2.7 Accumulation of soil stockpiles

Construction of water tunnels through the excavation of the soil will result in the accumulation of soil within the project area.

Mitigation

- The excavated soils will be reused for other activities such as backfilling field roads during construction
- Excavated materials will also be used to balance lands with uneven topography

7.2.8 Soil Erosion

There could be an increase in soil erosion in the area due to construction activities that involves excavation and vegetation clearing. This will remove the ground cover resulting in bare land. Vegetation will be cleared along the canal conveyance route leaving the soil exposed to agents of soil erosion. In addition, some of the loose soils accumulated in the area will be swept away by winds and rainwater leading to siltation and affecting aquatic life.

Mitigation

- Soil erosion control measures should be undertaken to avoid erosion in sensitive areas and those prone to erosion
- The topsoil should not be utilized during the construction activities

- Rehabilitation of degraded environment should be undertaken to stabilize the soil and therefore reduce rate of soil erosion and siltation.
- Soil conservation measures should be constructed especially at stockpiled areas
- The excavation works should be compacted

7.2.9 Soil Compaction

The high traffic especially of machinery and the construction workforce within the project area is likely to lead to compaction of the soil structure further leading to reduced capacity of the water to infiltrate into the soil thereby affecting the soil-water balance and the hydrological cycle largely.

Mitigation

- Machinery needs to be operated on the existing roads or tracks as much as possible
- Unnecessary vehicle movement should be avoided
- Compaction during stockpiling should be avoided by working the soil in its dry state
- Re-vegetation should be enhanced to reduce runoff.

7.2.10 Pollution of Wetlands

The construction of the intake canals and water conveyance systems if not well controlled could deposit resultant construction wastes such as sediments from the earthworks and surface run-offs especially in the rainy season, into the reservoir thereafter to the river, wetland and Lake Jipe and also through. This may ultimately lead to potential degradation of the water quality especially for downstream users and adversely affect aquatic life.

Mitigation

- Apply sediment control procedures to prevent sediment returning into the rivers including but not limited to the retention ponds, among others appropriate to the site,
- Plant vegetation cover, the grass around the reservoir and all affected areas not under cultivation.

7.2.11 Increased Traffic

There is meant to be an increased traffic flow into the project area varying from heavy to light and fast vehicles for the movement of the construction materials as well as during the production period. The access roads largely made of earthen roads could result in increased dust and consequently increased traffic especially at the daily onset and offset of the construction works. This is likely to affect the health of the residents and the aesthetic value of the areas.

Mitigation

- The contractor should ensure there is regular watering of dusty roads and maintenance during this stage,
- Damaged roads as a result of heavy vehicles should be repaired adequately and without delay
- After the construction works, the temporary access roads should be rehabilitated to their former state and closed.

7.2.12 Increased HIV/ AIDs prevalence to the community and Construction workforce

The prevalence of HIV/AIDS in the area could increase at the construction due to the influx of people into the project areas thereby increasing the infection rates. This could be pushed up by traders and worker's interactions due to the availability of money to spend. Some workers could

use this money to look for women and engage in illicit sex thereby creating avenues for the spread of the pandemic both to the community members and to the construction workforce.

Mitigation

- Education and sensitization of workers and the local communities on the dangers and prevalence of the disease
- Regular sensitization campaigns and monitoring of the disease spread
- Instituting HIV/AIDS awareness among the project workers
- There should be adequate and regular passage of information regarding the spread and risk of contracting the disease
- There should be a provision of adequate prevention measures such as condoms.

7.2.13 Spread of Infectious Disease – COVID-19

Possible spread of infectious diseases as a result of failure to adhere to COVID-19 prevention measures issued by Ministry of Health, WHO and the World Bank. Possible infection routes include weak compliance with the precaution measures for infection prevention and control on COVID-19 including handwashing hygiene, respiratory / cough etiquettes, contact with an infected mask; among others for both community members and project workers especially those at the civil work areas.

Mitigation

- Awareness creation for both community members and all project workers on the signs and symptoms of COVID-19, how it spreads, how to protect themselves and the need to be tested if they have symptoms;
- Use existing grievance procedures to encourage reporting of co-workers if they show outward symptoms, such as ongoing and severe coughing with fever, and do not voluntarily submit to testing;
- All workers shall be subjected to rapid Covid-19 screening which may include temperature check and/or other vital signs;
- Mandatory provision and use of appropriate Personal Protective Equipment (PPE) shall be required for all project personnel including workers and visitors;
- Keep records of all persons (including phone contacts) involved in project implementation;
- Workers are to limit face to face working and work facing away from each other when possible.
- Consider introducing an enhanced monitoring process for activities where less than 2 m distance may be required.
- Single-use PPE should be disposed of so that it cannot be reused and to control potential contamination.

7.3 Positive Impacts during Operational Phase

7.3.1 Food Security

There is set to be an increase in the quantity of food produced once the project is operationalized. Food security will be achieved both at an individual household level and the national level due to the increase in food production. Increased farming of the various crops will ultimately lead to improved nutrition for the local populations thereby leading to improved health in the long run. These areas are ASALs and have been experiencing drought and famine thereby leading to overdependence on food relief from the government. There is meant to be a boost in the amount of food available for consumption to the residents thereby reducing dependence levels.

7.3.2 Increased Agricultural Activities

The proposed irrigation project is meant to bring about land reclamation through the supply of water to lands previously not well served. The land acreage under crop farming and the number of livestock reared is meant to increase due to the availability of water to these areas. This improvement will be a result of the availability of irrigation water thereby leading to an increase in the pasture and crop production land.

In addition, there are meant to be crop value addition measures to improve the crop yields levels thereby leading to a greater production capacity. This has the overall net effect of boosting the national economy.

7.3.3 Economic Growth

The development of the irrigated land is meant to ensure there are increased yields and reduction of crop loss due to famine. Irrigation is also meant to bring about more land under agriculture and to promote products all year round. This will boost the economic gains through the sale of farm products. The availability of more farm outputs and inputs that can be sold in markets available will lead to a reduction in the poverty levels of many households.

The increase in agricultural production will lead to a subsequent increase in the revenue for farmers within the project area and there are meant to be several positive results such as the growth and expansion of the local markets, reduction of the poverty levels in the area, improved food security and a significant rise of the living standards of the people in project areas.

7.3.4 Employment Creation

The project will directly create employment for a large number of people to the farmers and an even larger number indirectly in the construction and operational phases through the sale of the products. The living standards of a significant number of people will improve due to the availability of income. During the construction phase, there will be a significant increase in the people working in the area and this will promote the economy of the country both directly and indirectly.

7.3.5 Improved Infrastructure

The expansion of the irrigation project is meant to bring about other infrastructural developments such as the expansion of the roads, markets expansion and others such as recreational facilities. The availability of water both for domestic and livestock purposes during the wet and dry seasons will also play a key role in the development of the project area. The canal will ensure a reduction in the distance between the various households and the water collection points as compared to the long distances initially covered from the homesteads to the river thereby saving time used to ferry water

and doing other productive work. The produce will also attract more businessmen to the centres who will end up requiring accommodation and recreational facilities.

7.3.6 Opportunities for Skills Acquisition

The implementation of the project activities will require several trainings to the farmers by extension officers e.g., on-farm water management and various aspects of crop husbandry to promote productivity. There is meant to be capacity building for the farmers to pass knowledge across the board. Qualified personnel shall be hired and further training is enhanced to sharpen the farmers' skills in the delivery of the extension information. This is highly desirable since the farmers will be provided with the requisite information.

7.4 Negative Impacts during Operational Phase

7.4.1 Water-Logging, Soil Salinization and sedimentation and Nutrient Leaching

The uncontrolled use of additives in irrigated agriculture can lead to a build-up of salts through the soil profile from the excess agrochemicals. The introduction of large volumes of water into the soil continuously through irrigation is likely to change both the soil physical and chemical attributes. Inappropriate management of the water e.g., through excessive irrigation and inadequate drainage, will lead to waterlogging and leaching of water-soluble nutrients to levels where they are no longer available for use by plants. Waterlogged conditions will adversely affect the growth and development of many plants including crops; it may also encourage change in the natural composition of vegetation by suppressing and encouraging the development of various plants respectively. If proper land drainage is not practised irrigation has the potential of increasing soil salinity through raised water table and accumulation of soluble salts from the water.

Cultivation along the river banks may lead to the loss of the riparian ecosystems thereby leading to a vulnerability of the soils surrounding the rivers and thereby leading to collapse and eventual sedimentation into the rivers. This is probable as farmers seek ways to expand their farmland and put more land into cultivation.

Mitigation Measures

- The use of fertilizer should be regulated and should be as is recommended by the DAO,
- The promotion of organic manure in place of fertilizers should be intensified
- Project to incorporate a component on irrigation water management training, coupled with installation of water use control and regulation meters to curtail over-irrigation
- Control of the amount of water abstracted from the river through appropriate design of the intake to include facilities for regulating canal discharge
- Installation of appropriate drainage channels to drain any excess water from the farms and to carry away excess agro-chemicals
- There should be adequate and frequent monitoring of soil salinity through analysis of soil carried out before project implementation and with every annual audit
- Afforestation and vegetation growth should be encouraged especially along the riverbanks
- The intakes and canals should be desilted.
- The maintenance and operation of the irrigation infrastructure should be maintained regularly to ensure that localized irrigation does not occur
- Cultivation limits to the river systems should be identified and adhered to strictly, and
- Train the staff on Use of Fertilizer, Pesticides & Training in Agrochemical usage.

7.4.2 Waterborne Diseases

The proposed project has the probability of increasing water-borne diseases such as malaria, amoeba, bilharzia, typhoid and cholera. The prevalence of malaria cases has been on the increase due to the high presence of mosquitoes in the project area. The availability of more water may highly predispose the residents to more cases of malaria owing to the increase in inbreeding sites for mosquitoes.

Water retained in the fields and canals will create a breeding environment for mosquitoes and snails. This situation can lead to an increase in mosquito prevalence and therefore increased incidence of malaria and other water-borne diseases due to the prolonged presence of stagnant water.

Mitigation Measures

- The members of the community need to be educated on preventive and control measures such as spraying and use of treated nets and boiling of drinking water and
- The Ministry of public health should ensure there is regular spraying of homes and houses within the project area to rid them of mosquitoes
- There should be adequate provision of mosquito nets at affordable costs
- There should be regular flushing of stagnated water to destroy breeding grounds for disease-causing vectors in the areas.

7.4.3 Human –Livestock- Wildlife Conflict

The irrigation scheme is within the vicinity of Tsavo National Park, wildlife may easily stray into the farm at night. Crops grown on farms may attract wild animals such as gazelles, elephants, monkeys which will lead to human-wildlife conflict and farmers-wildlife conflict. Also, if livestock is left unattended, they may stray into the farms and damage the crops.

Mitigation Measures

- To avoid this, proper sensitization to herders and the general community must be done.
- The sensitization should involve all community members in the area and should be holistic.
- To minimize the conflicts between man- livestock and wildlife, the farms should be adequately fenced off with the use of the appropriate materials.

7.4.4 Pests and Crop Diseases

Increased acreage of irrigated land may create a more conducive environment that is favourable for the increase of agricultural pests and plant diseases. Change to a more uniform environment in the project areas will favour vigorous species adapted to a wide variety of conditions. Diseases and weeds may spread quickly via the re-use of wastewater and drainage water or by the application of fertilizers. An increase in pests and plant diseases may affect the farm harvest thereby leading to food insecurity. Increased pests and crop diseases will trigger increased use of pesticides leading to water contamination and the degradation of resources.

Mitigation Measures

- Workers should be trained on pest and disease control and management, especially integrated pest management that combines chemical and cultural methods. This will include the integration of appropriate crop rotation plans in the development of cropping patterns.
- There should be increased pest and disease surveillance to monitor the prevalence of existing pests and diseases, as well as the emergence of new ones, consequently, regular

information needs to be disseminated to the farmers adequately to identify emerging pests and diseases.

7.4.5 Health and Safety Risks

Large scale production of tomatoes, onions and other vegetables may expose workers on-site to agrochemicals (Pesticides & Herbicides) that are dangerous to their health if not handled with utmost care.

Mitigation Measures

- All workers shall be provided with the fit for work Personal protective equipment,
- Keep agrochemical (pesticide and herbicide among others) in their original package away from reach by children and mature people as well,
- Health and safety risks should be minimized by conducting farmers training on the safe and effective use and storage of chemicals and basic first aid procedures;
- Maintain Material Safety Data Sheets (MSDS) from manufacturers of agrochemicals;
- Store chemicals as recommended in the MSDS.

7.4.6 Spread of Infectious Disease – COVID-19

Possible spread of infectious diseases as a result of failure to adhere to COVID-19 prevention measures issued by Ministry of Health, WHO and the World Bank. Possible infection routes include weak compliance with the precaution measures for infection prevention and control on COVID-19 including handwashing hygiene, respiratory / cough etiquettes, contact with infected masks; among others for both community members and project workers especially those at the civil work areas.

Mitigation

- Awareness creation for both community members and all project workers on the signs and symptoms of COVID-19, how it spreads, how to protect themselves and the need to be tested if they have symptoms;
- Use existing grievance procedures to encourage reporting of co-workers if they show outward symptoms, such as ongoing and severe coughing with fever, and do not voluntarily submit to testing;
- All workers shall be subjected to rapid Covid-19 screening which may include temperature check and/or other vital signs;
- Mandatory provision and use of appropriate Personal Protective Equipment (PPE) shall be required for all project personnel including workers and visitors;
- Keep records of all persons (including phone contacts) involved in project implementation;
- Workers are to limit face to face working and work facing away from each other when possible.
- Consider introducing an enhanced monitoring process for activities where less than 2 m distance may be required.
- Single-use PPE should be disposed of so that it cannot be reused and to control potential contamination.

7.4.7 Increased Generation of Wastes

The packaging Materials for the Pesticides and Herbicides will be some of the waste generated from the project. Some of this waste is hazardous thus dangerous to the public of not being stored and disposed of in an environmentally sound manner as prescribed by the EMCA act.

Mitigation Measures

- All wastes should be stored away from reach by children and returned to agro-dealers for safe disposal,
- Waste disposal from the scheme should comply with existing waste management practice that is acceptable under EMCA;
- The scheme management should conduct periodic training for respondents on the safe disposal of wastes.
- All wastes should be stored away from reach by children and returned to agro-dealers for safe disposal.

7.4.8 Unsafe Produce for Human Consumption

The need for the quick economic return as well as the availability of farm produce; Twiga Farms Limited may be tempted to harvest the produce for sale before the allowable time for harvest after spraying chemical reaches. This may lead to unsafe produce accessed by farmers at the household level for workers onsite as well as market.

Mitigation

- Proper extension service should be availed to farmers
- Observe the pre-harvest timeline required after spraying produce with agrochemical.

7.4.9 Rapture of the Water reservoir

Water reservoir may rapture due to poor construction techniques and poor workmanship used to construct the reservoir as well as poor maintenance during the operation period.

Mitigation

- Design to ensure world recommended standards are adhered to
- Select competent and qualified contractors
- Proper supervision of construction works and
- Provision of adequate overflow/outlet channels to limit the accumulation of water beyond the maximum capacity of the water reservoir.

7.5 Impacts during Decommissioning

7.5.1 Negative Impacts

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

- Loss of livelihood due to the closure of irrigation activities is considered a significant impact;
- Soil erosion will occur as a result of opening up previously firm ground to remove buried pipelines;
- Generation of waste material comprising concrete rubble, steel and disused pipes and fittings;
- Risk of accidents and Noise pollution.

Mitigation Measures

- Soil conservation works should be maintained until the site stabilizes;
- Alternative uses of excess water should be sought;
- Propose alternative livelihood activities;
- Landscaping should be done to rehabilitate the open trenches;
- Visual impact as a result of decommissioning the pipeline and concrete structures should be mitigated by planting grass and other native vegetation in the restored trenches;
- Waste from decommissioning of the pipeline and concrete structures should be carted away by NEMA Licensed firm and disposed of in a manner that is acceptable under EMCA;
- Fence off all unsafe and potentially dangerous areas.
- Workers should be provided with appropriate PPE, and
- Availability of First Aid Kit at the demolition site.

8.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

8.1 Background

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

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

Environmental monitoring is an applied research and analysis activity to support cost-effective and timely assessment of the status and trends in environmental and social conditions in response to different project activities. Also, it is necessary to assess the project performance against the desired mitigation measures, and compliance with the regulations and standards to protect people's health and safety, and environmental health and performance. Monitoring activities should be applied to direct monitoring indicators whenever applicable.
Indirect indicators can be monitored instead of direct ones whenever it would provide an acceptable indication of the occurrence of specific impacts and/or compliance with provisions of the ESMP.

Table 8-1: Environment and Social Impact Management Plan

Potential Impacts	Relevant IFC PS	Proposed Mitigation Measures	Responsibility for Mitigation	Means for Monitoring	Frequency for Monitoring	Estimated Cost (KES)
During Construction						
Noise and vibration by construction activities.	PS 1: Assessment and Management of Environmental and Social Risks and Impacts	•All construction equipment will be regularly inspected and maintained in good working condition. •Provision of earmuffs for those working with noise-producing equipment.	•Contractor •Public Health Officer •NEMA inspectors	Routine Activities	Periodic and surprise checks	Embedded in the project cost
Dust Emission	PS 1: Assessment and Management of Environmental and Social Risks and Impacts	•Excavation, handling and transport of erodible materials shall be avoided under high wind conditions or when a visible dust plume is present and or covered by tarpaulin while on transit. •Wet all active construction areas as and when necessary to lay dust; •Vehicle speeds are limited to a maximum of 30Km/h.	•Contractor •Ministry of Health •NEMA inspectors	Periodic Activities	Periodic and surprise checks	Embedded in the project cost
Occupational health and safety risk	PS 4: Community Health, Safety, and Security	•Establish a Health and Safety Plan (HASP) for both civil and electromechanical work. •Appoint a trained health and safety team for the duration of the construction work. •Provide workers with appropriate personal protective equipment (PPE). •Keep agrochemical (pesticide and herbicide among others) in their original package away from reach by children and mature people as well, •Store chemicals as recommended in the MSDS.	•Contractor •Public health officer. •Workers •NEMA inspectors.	Routine activities	Periodic checks	Embedded in the project cost
Labour Influx	PS 2: Labour and Working Conditions	•Develop and implement the Labour management Plan, •Hire labour from the local community unless otherwise, •Use local leaders to vet the workers according to before hiring, •All staff should sign the labour code.	•Contractor •Project Engineer	Periodic inspection	Periodic and surprise checks	Embedded in the project cost
Solid waste generation	PS 1: Assessment and Management of Environmental and Social Risks and Impacts	•Contract registered waste handler to dispose of waste and have waste destruction certificate and waste transfer notes. •Use of durable, long-lasting materials that will not need to be replaced often.	•Proponent •Contractor •Project Engineer	Periodic inspection	Periodic and surprise checks	Embedded in the project cost
Loss of vegetation	PS 6: Biodiversity Conservation and Sustainable mgmt. of Living Natural Resources	•Avoid cutting mature tree stand, and or relocate all mature Mabuyu (Baobab) trees, •Re-vegetation of exposed areas around the site to mitigate against the erosion of soil through surface water runoff and wind erosion,	•Contractor •Project Engineer	Periodic inspection	Periodic and surprise checks	Embedded in the project cost
Accumulation of soil stockpiles	PS 1: Assessment and Management of Environmental and Social Risks and Impacts	•The excavated soils will be reused for other activities such as backfilling to level the land to allow the pivotal movement, •Excavated materials will also be used to balance lands with uneven topography	•The Contractor •Project Engineer	Periodic inspection	Periodic checks	Embedded in the project cost
Soil erosion	PS 3: Resource Efficiency and Pollution Prevention	•Soil erosion control measures (retention ponds) should be undertaken to avoid erosion in sensitive areas and those prone to erosion •The levelling and disturbance of the soil should be limited to the designated cultivation site,	•Contractor •Project Engineer	Periodic inspection	Periodic checks	Embedded in the project cost
Soil compaction	PS 1: Assessment and Management of Environmental and Social Risks and Impacts	•Machinery needs to be operated on the existing roads or tracks, •Unnecessary vehicle movement should be avoided •Re-vegetation should be enhanced to reduce runoff	•Contractor •Project Engineer	Periodic inspection	Periodic and surprise checks	Embedded in the project cost

Potential Impacts	Relevant IFC PS	Proposed Mitigation Measures	Responsibility for Mitigation	Means for Monitoring	Frequency for Monitoring	Estimated Cost (KES)
Pollution of rivers and wetlands	PS 3: Resource Efficiency and Pollution Prevention	•Apply sediment control procedures to prevent sediment returning into the rivers including but not limited to the retention ponds, among others appropriate to the site, •Plant vegetation cover, the grass around the reservoir and all affected areas not under cultivation.	•WRA •Contractor	Voluntary periodic random screening	Periodic and surprise checks	Embedded in the project cost
Increased traffic		•The contractor should ensure there is regular watering of dusty roads and maintenance during this stage, •Damaged roads as a result of heavy vehicles should be repaired adequately and without delay.	•Contractor	Periodic Activities	Periodic checks	Embedded in the project cost
Spread of HIV / AIDs among workers & community members	PS 4: Community Health, Safety, and Security	•Education and sensitization of workers and the local communities on the dangers and prevalence of the disease •Instituting HIV/AIDS awareness among the project workers •There should be a provision of adequate prevention measures such as condoms.	•Contractor •Ministry of Health	Periodic inspection	Periodic and surprise checks	Embedded in the project cost
Spread of Infectious Disease – COVID-19	PS 4: Community Health, Safety, and Security	•Awareness creation for both community members and all project workers on the signs and symptoms of COVID-19, how it spreads, how to protect themselves and the need to be tested if they have symptoms; •Use existing grievance procedures to encourage reporting of co-workers if they show outward symptoms, such as ongoing and severe coughing with fever, and do not voluntarily submit to testing; •All workers shall be subjected to rapid Covid-19 screening which may include temperature check and/or other vital signs; •Mandatory provision and use of appropriate Personal Protective Equipment (PPE) shall be required for all project personnel including workers and visitors; •Keep records of all persons (including phone contacts) involved in project implementation; •Workers are to limit face to face working and work facing away from each other when possible. • Consider introducing an enhanced monitoring process for activities where less than 2 m distance may be required. •Single-use PPE should be disposed of so that it cannot be reused and to control potential contamination.	•Contractor •Social Expert, •County Public Health officer	Periodic inspection	Daily checks	Embedded in the project cost
Occurrence of chance finds and artefacts	PS 8: Cultural Heritage	•Implement the requirements of the chance find procedure including: •Stop the construction activities in the area of the chance find; delineate the discovered site or area; secure the site to prevent any damage or loss of removable objects and contact the Director of Monuments and Antiquities team	•Directorate of Antiquities Sites and Monuments	Construction	Periodic checks	Embedded in the project cost
		Operation phase				
Water quality degradation	PS 3: Resource Efficiency and Pollution Prevention	•Work with the local DAO services so that the staff can be trained on the safe use of agrochemicals to ensure that they apply the right amounts, and prevent pollution water sources. •The right amounts of fertilizer application should be used to prevent potential for excess quantities getting washed into the surface waters and from infiltrating into the groundwater resources •Waste management should be adequately streamlined to prevent the release of effluents into the environment	•Proponent •Ministry of Agriculture	periodic activities	Periodic checks	Embedded in the project cost

Potential Impacts	Relevant IFC PS	Proposed Mitigation Measures	Responsibility for Mitigation	Means for Monitoring	Frequency for Monitoring	Estimated Cost (KES)
Water-Logging, Soil Salinization and sedimentation and Nutrient Leaching	PS 3: Resource Efficiency and Pollution Prevention	• The use of fertilizer should be regulated and should be as is recommended by the DAO, • The promotion of organic manure in place of fertilizers should be intensified, • Control of the amount of water abstracted from the river through appropriate design of the intake to include facilities for regulating canal discharge, • Installation of appropriate drainage channels to drain any excess water from the farms and to carry away excess agro-chemicals, • Periodic monitoring of soil salinity before project implementation and with every annual audit, • Afforestation and vegetation growth should be encouraged especially along the river banks, • The intakes and canals should periodically be de-silted, • Cultivation limits near river systems should be identified and adhered to.	•NEMA Inspectors •Proponent •Ministry of Agriculture	Periodic activities	Periodic surprise checks and Audits	Embedded in the project cost
Labour Influx	PS 2: Labour and Working Conditions	•Develop and implement the Labour Management Plan, •Hire labour from the local community unless otherwise, •Use local leaders to vet the workers according to before hiring, • All staff should sign the labour code.	•Contractor •Project Engineer	Periodic	Periodic and surprise checks	Embedded in the project cost
Waterborne diseases	PS 4: Community Health, Safety, and Security	•The Ministry of public health should ensure there is regular spraying of homes and houses within the project area to rid them of mosquitoes •There should be adequate provision of mosquito nets at affordable costs •There should be regular flushing of stagnated water to destroy breeding grounds for disease-causing vectors in the areas.	•Proponent •NEMA inspectors •Public Health Officers	periodic activities	Periodic surprise checks	Embedded in the project cost
Human –Livestock-Wildlife Conflict	PS 4: Community Health, Safety, and Security	•The sensitization should involve all community members in the area and should be holistic. •To minimize the conflicts between man- livestock and wildlife, the farms should be adequately fenced off with the use of the appropriate materials	•Proponent •KWS •Ministry of Livestock & Agriculture •NEMA inspectors	periodic activities	Periodic surprise checks	Embedded in the project cost
Pests and crop diseases	PS 3: Resource Efficiency and Pollution Prevention	•Workers should be trained on pest and disease control and management, especially integrated pest management, •There should be increased pest and disease surveillance to monitor the prevalence of existing pests and diseases.	•Proponent •Ministry of Agriculture	periodic activities	Periodic surprise checks	Embedded in the project cost
Increased generation of wastes	PS 1: Assessment and Management of Environmental and Social Risks and Impacts	•All wastes should be stored away from reach by children and returned to agro-dealers for safe disposal, •Waste disposal from the scheme should comply with existing waste management practice that is acceptable under EMCA; •The scheme management should conduct periodic training for respondents on the safe disposal of wastes. •All wastes should be stored away from reach by children and returned to agro-dealers for safe disposal.	•NEMA inspectors	periodic activities	Periodic surprise checks	Embedded in the project cost
Unsafe products for human consumption	PS 4: Community Health, Safety, and Security	•Proper extension service should be availed to farmers •Observe the pre-harvest timeline required after spraying produce with agrochemical	•Public health •Ministry of Agriculture	periodic activities	Periodic surprise checks	Embedded in the project cost

Potential Impacts	Relevant IFC PS	Proposed Mitigation Measures	Responsibility for Mitigation	Means for Monitoring	Frequency for Monitoring	Estimated Cost (KES)
		Decommissioning				
Loss of livelihood	PS 1: Assessment and Management of Environmental and Social Risks and Impacts	• Develop alternative livelihood activities. • Community sensitization	•Proponent	Periodic activities	Periodic checks	Embedded in the project cost
Soil erosion	PS 3: Resource Efficiency and Pollution Prevention	• Plant grass and other native vegetation along soil-filled trenches; • Maintain soil conservation works until the site stabilizes.	•Proponent	Periodic activities	Periodic checks Periodic checks	Embedded in the project cost
Visual impacts	PS 1: Assessment and Management of Environmental and Social Risks and Impacts	• Carry out landscaping works and plant vegetation (trees) along with the cleared land areas;	•Farmers	Periodic activities	Periodic checks	Embedded in the project cost
Noise pollution by disassembly activities	PS 1: Assessment and Management of Environmental and Social Risks and Impacts	•Portable barriers will be installed to shield the community from elevated noise, •The use of equipment designed with noise control elements will be adopted where necessary. •Trucks used during demolition exercise on-site shall be routed away from noise-sensitive areas in the neighbourhood, where feasible.	•NEMA inspectors •Contractors	Periodic activities	Periodic checks	Embedded in the project cost
Demolition debris and related wastes	PS 1: Assessment and Management of Environmental and Social Risks and Impacts	•NEMA Licensed Firm will be engaged to collect demolition debris/wastes •All debris/wastes to be collected regularly to limit stockpiling, •Waste Destruction certificates will be required to avoid illegal final dumping at unauthorized sites. •All persons involved in refuse collection shall be in full protective attire.	•NEMA inspectors •Contractor	Periodic activities	Periodic checks	Embedded in the project cost
Workers accidents during the demolition process	PS 2: labour and Working Conditions	•All workers will be sensitized before the exercise begins, on how to control accidents related to the demolition exercise. •A comprehensive contingency plan will be prepared before demolition begins, on accident response. •Adherence to safety procedures will be enforced at all stages of the exercise •All workers, according to labour laws, shall be accordingly insured against accidents. •All workers will be provided and instructed to wear protective attire during demolition, including helmets.	•Public Health Officer •NEMA inspectors	Periodic activities	Periodic checks	Embedded in the project cost
Water reservoir rapture due to poor construction techniques	PS 4: Community Health, Safety, and Security	•Design to ensure world recommended standards are adhered to •Select competent and qualified contractors •Proper supervision of construction works •Provision of adequate overflow/outlet channels to limit the accumulation of water beyond the maximum capacity of the water reservoir.	•Project Engineer •Project management	Operation	Periodic checks	Embedded in the project cost
Spread of Infectious Disease – COVID-19	PS 4: Community Health, Safety, and Security	•Awareness creation for both community members and all project workers on the signs and symptoms of COVID-19, how it spreads, how to protect themselves and the need to be tested if they have symptoms;	•Contractor •Social Expert, •County Public Health officer	Periodic activities	Daily checks	Embedded in the project cost

Potential Impacts	Relevant IFC PS	Proposed Mitigation Measures	Responsibility for Mitigation	Means for Monitoring	Frequency for Monitoring	Estimated Cost (KES)
		•Use existing grievance procedures to encourage reporting of co-workers if they show outward symptoms, such as ongoing and severe coughing with fever, and do not voluntarily submit to testing; •All workers shall be subjected to rapid Covid-19 screening which may include temperature check and/or other vital signs; •Mandatory provision and use of appropriate Personal Protective Equipment (PPE) shall be required for all project personnel including workers and visitors; •Keep records of all persons (including phone contacts) involved in project implementation; •Workers are to limit face to face working and work facing away from each other when possible. • Consider introducing an enhanced monitoring process for activities where less than 2 m distance may be required. •Single-use PPE should be disposed of so that it cannot be reused and to control potential contamination.				
Introduction of invasive/alien flora to the site	PS 6: Biodiversity Conservation and Sustainable mgmt. of Living Natural Resources	•Re-vegetate affected areas with the vegetation from the site, •No introduction of invasive/alien vegetation to the site, •Continuous monitoring of the vegetation within the proposed project site to ensure no incidences of alien species spreading, •Hire a biodiversity expert to periodically monitor the vegetation growth at the site	•Project Engineer •Project management	Periodic activities	Periodic checks	Embedded in the project cost

9.0 MONITORING AND TRAINING

9.1 Monitoring

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

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

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

Monitoring should be undertaken at many levels. Firstly, it should be undertaken by the Contractor at work sites during construction, under the direction and guidance of the Supervision Consultant who is responsible for reporting the monitoring to the proponent. It is recommended that the Contractor employ local full time qualified environmental inspectors for the duration of the Contract. The Supervision Consultant should include the services of an international environmental and monitoring specialist on a part-time basis as part of their team. Environmental monitoring is also an essential component of project implementation. It facilitates and ensures the follow-up of the implementation of the proposed mitigation measure, as they are required. It helps to anticipate possible environmental hazards and/or detect unpredicted impacts over time. Monitoring includes:

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

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

9.2 Internal Monitoring

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

The objective of internal monitoring and audit will be:

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

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

9.2.1 Noise Levels Monitoring

Although noise during construction is expected to be a problem, periodic sampling of Contractor equipment and at worksites should be undertaken to confirm that it is not an issue.
Noise level monitoring could be supplemented by consulting with Project Affected People in the first instance to identify the level of monitoring required.

9.2.2 Soil Erosion Monitoring

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

9.2.3 Monitoring of Accidents/Health

The Contractor's safety and health officer must make sure that appropriate signs are posted at appropriate locations/positions to minimize/eliminate risk. The proponent will have the overall responsibility to oversee that all environmental measures are put in place and that regulations are enforced. The construction supervision consultant should assist the proponent in this process to make sure that contractors fulfil the environmental requirements.
The following parameters could be used as indicators:

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

9.2.4 Waste Management Monitoring

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

- All stored waste shall be contained within construction sites;
- Solid waste: all site waste is to be collected and disposed of at an approved site. Where possible segregation of waste (paper, glass, metal) should be undertaken and recycling opportunities identified.
- Extension / County staff will monitor the handling management and safe disposal of agrochemical wastes.

9.3 Workforce Training

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

9.4 External Monitoring and Evaluation

The Consultant recommends that a dedicated agriculture extension officer should be hired to carry out on-farm support to farmers. Annual Environmental Audits should be done in line with NEMA requirements as well. NEMA has the overall responsibility for issuing approval for the Project and ensuring that their environmental guidelines are followed during Project implementation. Its role, therefore, is to review environmental monitoring and environmental compliance documentation submitted by the implementing authorities and they would not normally be directly involved in monitoring the Project unless some specific major environmental issue arises. NEMA will perform annual environmental reviews in which environmental concerns raised by the project will be reviewed alongside project implementation. Detailed Environment Monitoring Plan has been developed (see Table 9-1):

Table 9-1: Monitoring Plan

Environmental Component	Parameter	Standard	Location	Frequency	Area of interest/Time	Supervision
Construction phase						
Noise levels	Noise levels on dB (A) scale	NEMA guidelines on Noise (LN 25) <75dB	Construction site and the surrounding	As directed by the supervision consultant	Peak Day hours	Supervision Consultant/ contractor
Soil Erosion	Turbidity in stormy water	NEMA guidelines	Construction site	During and after the rainy seasons	Steep areas	Supervision Consultant / contractor
Rehabilitation of work sites	Monitoring to ensure all work sites are progressively rehabilitated	ESMP	Construction site	As required	Affected areas	Supervision Consultant/contractor
Accidents	Safety training for workers, accident reports,	ESMP	Construction site	continuous	Need arise	Contractor
Health and safety	Signs, posters displayed, health awareness lectures,	ESMP	Construction site	continuous	Need arise	Contractor
Operation phase						
Conflicts with downstream	Community cohesion	ESMP	Operation site	continuous	Affected area	Proponent
Water borne / related diseases	Recorded cases of diseases	ESMP	Operation site	continuous	Affected area /Case by Case	Proponent
Water Pollution	Water Quality Test	ESMP	Operation site	continuous	Annually	Proponent
Soil erosion	Soil stabilized	ESMP	Operation site	continuous		Proponent

Environmental Component	Parameter	Standard	Location	Frequency	Area of interest/Time	Supervision
Accidents	Safety training for workers, accident logs / records,	ESMP	Om farm own record	continuous	Affected area /Case by Case	Contractor/ Proponent
Health and safety Risks	Recorded cases	ESMP	Operation site	continuous	Affected area /Case by Case	County Gov't Public Health Officer/ Proponent
Waste Generation	Clean tidy farms and homesteads	ESMP	Operation site	continuous	-	County Gov't Env't Officer/ Proponent
Social Risks & Spread of STIs	Recorded cases of STIs	ESMP	Operation site	continuous	Affected area /Case by Case	County Gov't Public Health Officer/ Proponent
Unsafe Produce for Human Consumption	Recorded cases	ESMP	Operation site	continuous	Case by Case	County Gov't Public Health / Agric' Officer, Proponent
Decommissioning phase						
Rehabilitation of project site	Vegetation	ESMP	Site	End of Project Life	On site	Contractor / Proponent
Noise pollution	Noise levels on dB (A) scale	NEMA guidelines on Noise	Decommissioning site and the surrounding	End of Project Life	On-site	Contractor / Proponent
Dust emissions,	Visual inspection	ESMP	Decommissioning site		On-site	Contractor / Proponent
Occupational health and safety hazards	Visual inspection	ESMP	Decommissioning site		Case by Case	Contractor / Proponent

10.0 CONCLUSION AND RECOMMENDATION

Construction and operation of the proposed irrigation project will result in overall economic growth and development as a result there is improvement in the availability of water for agricultural use within the project area. As is indicated in chapter five, the potential negative impacts can be easily mitigated without any major effect on the environment. These impacts vary from temporary to short term and localized impacts. These impacts can be mitigated as indicated in the ESMP discussed in chapter 8 of this report.

10.1 Recommendations

10.1.1 Minimal vegetation destruction

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

10.1.2 Afforestation within intake canal works area and along wetland

Replant bare areas within the vicinity of the intake canal with vegetation cover to prevent soil erosion. This should also be done along the wetland to help in ensuring that siltation of watercourses from the anticipated increased agricultural activities is mitigated.

10.1.3 Occupational Safety and Health (OSH) management

Ensure that both construction and agricultural workers' occupational health and safety standards are maintained through capacity building, proper training on protection, clothing and managing their temporal residential camps up to the required health standards. The proponent, project beneficiaries and the contractor, therefore, need to ensure all the workers/ Farmers' wear safety gear/clothing like gas masks coveralls, gumboots.

10.1.4 Environmental audits and monitoring

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

10.1.5 Water for Irrigation

The project managers should apply for the Water Abstraction Permit from the Water Resource Authority before the commencement of work; this shall be preceded by carrying out of hydrological Report.

11.0 REFERENCES

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12.0 APPENDICES

12.1 Appendix I: Filled Stakeholder Consultations ESIA Questionnaire

KISIMA FARM PROJECT PUBLIC PARTICIPATION QUESTIONNAIRE

Environmental and Social Impact Assessment for the Proposed Irrigation Scheme for Kisima Farm, in Mata village, Mata Sublocation, Kimala location, Jipe division, Taveta subcounty, Taita Taveta county. The proposed project aims at constructing an Irrigation scheme with a reservoir for Kisima farm for Agricultural Activities that will improve livelihood through job creation and increased food supply among other benefits. This questionnaire is an Environmental and social tool for collecting information. We request you contribute any information that will provide a proper guideline in the project. This information will help in preparing the ESIA report from an informed perspective pf the projects' environment, social, health and safety requirements. All information given will be treated as **CONFIDENTIAL**.

NAME: JAFARY HAJI [illegible]
DATE: 22/10/21
MOBILE NUMBER: 0713599585
GENDER (M/F): MALE
OCCUPATION: FARMER
ID NUMBER: 46543446

1. How long have you been a neighbour to the proposed project site? SIX YEARS
2. What is the estimated distance from your workplace or residence to the proposed project site? 3.4KM
3. Do you foresee the project having any positive impacts (Yes/No) ✓
4. If Yes. Give a reason JOB CREATION AND OUR PRODUCTS MARKET.
5. Do you foresee the proposed project having any Negative Impacts (During, Construction, Operation and Decommission Phases) ?(Yes/No)
6. If yes, please give reason WE NEED ACCESS POLLUTION TO L. JIPE SOIL EROSION
7. If any Negative Impact identified in 6 above, how can it be solved? COMMUNITY ENGAGEMENT USE LESS CHEMICALS IF A MUST PLANT VEGETATION
8. What other Views / comments /opinions do you have for the proposed project? NEED FOR CONTINUOUS COMMUNITY ENGAGEMENT

Signature: [signature] Official Stamp if any

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KISIMA FARM PROJECT PUBLIC PARTICIPATION QUESTIONNAIRE

Environmental and Social Impact Assessment for the Proposed Irrigation Scheme for Kisima Farm, in Mata village, Mata Sublocation, Kimala location, Jipe division, Taveta subcounty, Taita Taveta county. The proposed project aims at constructing an Irrigation scheme with a reservoir for Kisima farm for Agricultural Activities that will improve livelihood through job creation and increased food supply among other benefits. This questionnaire is an Environmental and social tool for collecting information. We request you contribute any information that will provide a proper guideline in the project. This information will help in preparing the ESIA report from an informed perspective pf the projects' environment, social, health and safety requirements. All information given will be treated as **CONFIDENTIAL**.

NAME SEWERA FUNDI MAINA
DATE 22/10/2021
MOBILE NUMBER 0722796513
GENDER (M/F) MALE
OCCUPATION FARMER
ID NUMBER 5386869

1. How long have you been a neighbour to the proposed project site? Approx 6yrs -
2. What is the estimated distance from your workplace or residence to the proposed project site? 1KM
3. Do you foresee the project having any positive impacts (Yes/No) Yes
4. If Yes. Give a reason - Employment, - Our Children will be employed, We will get Market for our farm product

5. Do you foresee the proposed project having any Negative Impacts (During, Construction, Operation and Decommission Phases) ?(Yes/No) Yes
6. If yes, please give reason Air pulution

7. If any Negative Impact identified in 6 above, how can it be solved? SUPPRESS DUST BY Using water

8. What other, Views / comments /opinions do you have for the proposed project? Employees to be given enough cash as payment

Signature

Official Stamp if any

KISIMA FARM PROJECT PUBLIC PARTICIPATION QUESTIONNAIRE

Environmental and Social Impact Assessment for the Proposed Irrigation Scheme for Kisima Farm, in Mata village, Mata Sublocation, Kimala location, Jipe division, Taveta subcounty, Taita Taveta county. The proposed project aims at constructing an Irrigation scheme with a reservoir for Kisima farm for Agricultural Activities that will improve livelihood through job creation and increased food supply among other benefits. This questionnaire is an Environmental and social tool for collecting information. We request you contribute any information that will provide a proper guideline in the project. This information will help in preparing the ESIA report from an informed perspective pf the projects' environment, social, health and safety requirements. All information given will be treated as **CONFIDENTIAL.**

NAME JUMANNE RULE
DATE 22/10/2021
MOBILE NUMBER 0713829066
GENDER (M/F) MALE
OCCUPATION FARMER
ID NUMBER 07308820

1. How long have you been a neighbour to the proposed project site? OVER 60 YRS
2. What is the estimated distance from your workplace or residence to the proposed project site? 2 KLM
3. Do you foresee the project having any positive impacts (Yes/No) YES
4. If Yes. Give a reason
AJIRA ZA VIJANA
5. Do you foresee the proposed project having any Negative Impacts (During, Construction, Operation and Decommission Phases) ?(Yes/No) YES
6. If yes, please give reason
TUTAFAIDIKA NA AJIRA ZA VIJANA
PIA UCHUMI WETU UTAINUKA.
7. If any Negative Impact identified in 6 above, how can it be solved?
WANAKIJIJI KUPEWE KAZI
8. What other, Views / comments /opinions do you have for the proposed project?
UCHUMI WETU UTAINUKA

Signature
Official Stamp if any

KISIMA FARM PROJECT PUBLIC PARTICIPATION QUESTIONNAIRE

Environmental and Social Impact Assessment for the Proposed Irrigation Scheme for Kisima Farm, in Mata village, Mata Sublocation, Kimala location, Jipe division, Taveta subcounty, Taita Taveta county. The proposed project aims at constructing an Irrigation scheme with a reservoir for Kisima farm for Agricultural Activities that will improve livelihood through job creation and increased food supply among other benefits. This questionnaire is an Environmental and social tool for collecting information. We request you contribute any information that will provide a proper guideline in the project. This information will help in preparing the ESIA report from an informed perspective pf the projects' environment, social, health and safety requirements. All information given will be treated as **CONFIDENTIAL.**

NAME JOHN MOHAMED
DATE 22/10/21
MOBILE NUMBER 0743294809
GENDER (M/F) MALE
OCCUPATION MATA
ID NUMBER 25248234

1. How long have you been a neighbour to the proposed project site? 1Km
2. What is the estimated distance from your workplace or residence to the proposed project site?.....
3. Do you foresee the project having any positive impacts (Yes/No) ... NO
4. If Yes. Give a reason.....
5. Do you foresee the proposed project having any Negative Impacts (During, Construction, Operation and Decommission Phases) ?(Yes/No)..... NO
6. If yes, please give reason .....
7. If any Negative Impact identified in 6 above, how can it be solved?.....
8. What other, Views / comments /opinions do you have for the proposed project?.....
   Its a good Project but you Should the consider the Villagers for work opportunities first

Signature.....
Official Stamp if any.....

KISIMA FARM PROJECT PUBLIC PARTICIPATION QUESTIONNAIRE

Environmental and Social Impact Assessment for the Proposed Irrigation Scheme for Kisima Farm, in Mata village, Mata Sublocation, Kimala location, Jipe division, Taveta subcounty, Taita Taveta county. The proposed project aims at constructing an Irrigation scheme with a reservoir for Kisima farm for Agricultural Activities that will improve livelihood through job creation and increased food supply among other benefits. This questionnaire is an Environmental and social tool for collecting information. We request you contribute any information that will provide a proper guideline in the project. This information will help in preparing the ESIA report from an informed perspective pf the projects' environment, social, health and safety requirements. All information given will be treated as **CONFIDENTIAL.**

NAME ALVINE . M . JUMA DATE 22-10-2021

MOBILE NUMBER 0703127500 GENDER (M/F) MALE

OCCUPATION ..... ID NUMBER 26486216

1. How long have you been a neighbour to the proposed project site? 4 YRS
2. What is the estimated distance from your workplace or residence to the proposed project site? 300 MTRS
3. Do you foresee the project having any positive impacts (Yes/No) YES
4. If Yes. Give a reason ..... IT WILL OFFER EMPLOYMENT TO COMMUNITY .....
5. Do you foresee the proposed project having any Negative Impacts (During, Construction, Operation and Decommission Phases) ?(Yes/No) NO
6. If yes, please give reason .....
7. If any Negative Impact identified in 6 above, how can it be solved? .....
8. What other, Views / comments /opinions do you have for the proposed project? .....

Signature ..... Official Stamp if any .....

12.2 Appendix 2: List of Stakeholder Consultations

KISIMA FARM PROJECT PUBLIC CONSULTATION MEETING HELD ON 22/10/2021

ATTENDANCE LIST

NO	NAME	POSITION IN COMMUNITY	CONTACTS	SIGNATURE
1	GLADNESS M MCHARO	Church (Acki) Leader	0706725091	Gmcharo
2	ZAITUNI SIMON	Leader	0791194994	
3	BAHATI JUMA	Leader	0702102535	
4	MARGARET KADEGHE	Leader	0727507641	
5	HALIMA M. KUTSELA	C.H.V MKULIMA	0724812482	
6	SIMON MAKORE	MKULIMA	0733990334	

CHIEF LOCATION 22/10/2021

KISIMA FARM PROJECT PUBLIC CONSULTATION MEETING HELD ON 22/10/2021

ATTENDANCE LIST

NO	NAME	POSITION IN COMMUNITY	CONTACTS	SIGNATURE
7	JOHN MOHAMAD	RESIDENT	0743294809	
8	SENIRA FUNDI MAINA	V/Chairman Mata Land committee Chairman-Mata Dispensary.	0722796513	
9	JAFARI HAJI BAKARI	OPINION LEADER	0713E79588	
10	THOMAS K HUSSEIN	VILLAGE ELDER MAIA	0717775448	
11	BAKARI SALIM.	IMAM MAIA.	0716619720	
12	JUMANNE BULE	CHAIRMAN MOTA LAND COMMITTEE	0713829066	

CHIEF MAIA LOCATION 22/10/2021

KISIMA FARM PROJECT PUBLIC CONSULTATION MEETING HELD ON 22/10/2021

ATTENDANCE LIST

NO	NAME	POSITION IN COMMUNITY	CONTACTS	SIGNATURE
13	Josphat. K Kibanga	Chief Kata	0713849434	Kibanga
14	VIOLET. M. LUKINDO	SENIOR ASSI- CHIEF	0725413732	
15	ALVIHE. M- JUMA		0703127500	

12.3 Appendix 3: Pictorials


2021/10/22 09:58 AM


2021/10/22 10:01 AM


2021/10/22 10:03 AM


2021/10/22 10:04 AM


2021/10/22 10:04 AM


2021/10/22 10:05 AM


2021/10/22 10:12 AM


2021/10/22 10:13 AM

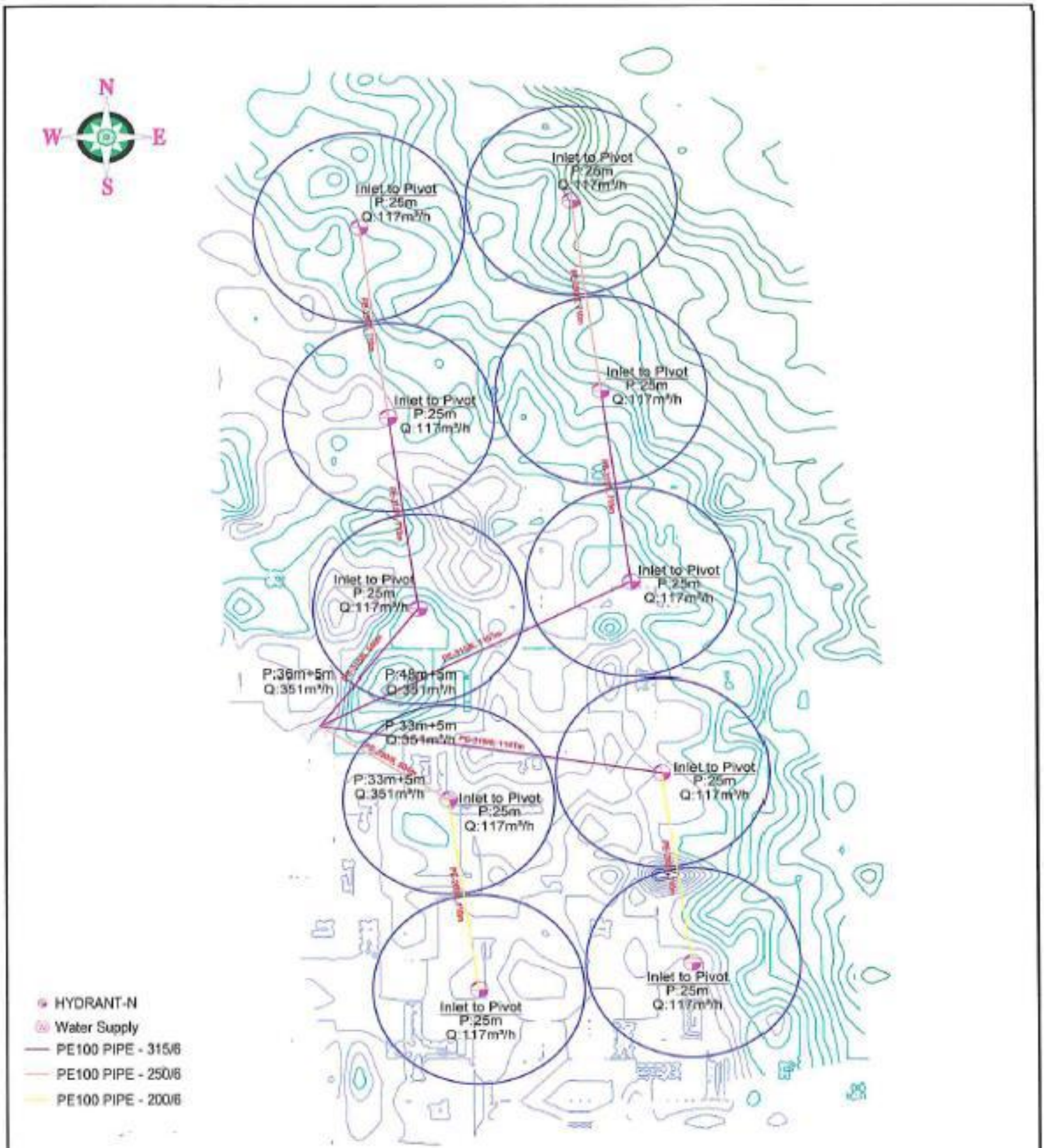

2021/10/22 10:15 AM


2021/10/22 10:16 AM


2021/10/22 11:12 AM


2021/10/22 10:19 AM

12.4 Appendix 4: Approved Design and Layout Plan



Amiran — Our Knowledge, Your Success	Design by : Kumudini	Sign :	Farm : Twiga Foods	Date: 02/11/2021
	Approved by : Mark Hill	Sign :	Location : Taveta	Scale: 1 : 12000
			Area: 380 Ha	File: Twigga Foods1

12.5 Appendix 5: Detailed Biodiversity Report for the project area

TWIGA FOODS LIMITED
IRRIGATION SCHEME PROJECT IN MATA SUB-LOCATION, IN TAITA TAVETA COUNTY

BIODIVERSITY REPORT

DECEMBER 2021

TABLE OF CONTENTS

1.0 INTRODUCTION TO BIODIVERSITY BASELINE

Biodiversity is the variety of living organisms on the Earth. The diversity of life is considered at several levels, for example, the genes, species, and ecological levels. Biodiversity incorporates the evolutionary, environmental, and social processes that sustain life. The terrestrial and aquatic biodiversity is affected by internal factors such as nutrients and external factors such as climate. Consequently, biodiversity is not distributed consistently on Earth, areas with favourable factors have more biodiversity. Biodiversity is a measure of the integrity of an ecosystem, high biodiversity is acknowledged as identical with good ecosystem health. Such ecosystems are believed to be very stable, have high productivity, and have high ecosystem resistance and resilience.

Biodiversity and non-living environments interact to form complex and dynamic networks of ecosystems that increase the delivery of important products called ecosystem services. The Ecosystem services include provisioning, regulating, supporting and cultural ecosystem services. Provisioning ecosystems are tangible products obtained from the ecosystems and include food, water, fibre, wood fuel, and medicine from plants. The regulatory ecosystem service encompasses the processes that control natural occurrences such as floods, air and water cleansing, climate change and soil erosion. The supporting ecosystem services are critical for the production of all other ecosystem services. They include important ecological processes such as photosynthesis which produces food and oxygen, soil formation, organic matter decomposition and water cycling. The cultural ecosystem services non-material benefits from the ecosystems. They include mental and spiritual nourishment that promotes good human health. Human being dependent on all the ecosystem services for their economic activities and their wellbeing.

1.1 Larger Tsavo Ecosystem

Tsavo East and West National Parks, Amboseli national park and Lumo Wildlife Conservancy are traditionally considered to be from one large continuous ecosystem. The ecosystem is made up of a blend of semi-arid grasslands, bushlands and woodlands- mostly along rivers/streams or in the drainage basins. Lake Jipe and Lake Amboseli are aquatic ecosystems found within this large ecosystem. Bordering Tsavo West national park.

1.2 General vegetation description of the area

Much of the surrounding area is, open grassland, with scattered rocky outcrops. The Yatter Plateau, along, a flat-topped lava ridge, runs along the western boundary, and beneath it flows the Athi River; this joins the Tsavo River to become the Galana River, a permanent stream that cuts right across the Tsavo National Park. Along the rivers is a narrow fringe of riverine forest and thicket, dominated by *Acacia elatior*, the Doum Palm *Hyphaene compressa* and the shrub *Suaeda monoica*. The northern part of the irrigation scheme is predominantly *Acacia-Commiphora* woodland. Common shrubs here include species of Premna, Bauhinia and Sericocomopsis, and scattered trees such as Delonix elata and Melia volkensii. This area also has a cover of dense bushland, with stands of Baobab (*Adansonia digitata*). There are scattered seasonal pools, swamps and dams, but relatively few sources of permanent water.

2.0 METHOD OF SURVEY OF FLORA

Literature about the flora of the project area was reviewed, and their conservation status was reviewed in reference to the International Union for Conservation of Nature (IUCN). This was

aimed at identifying beforehand species of conservation concern and sensitive habitats known to occur in the vicinity of the areas of concern.
Floristic sampling and ecological studies have relied on demarcated plots to inventory plant species (Poulsen, 1997). To study vegetation structure and composition in the project area a stratified systematic approach was employed. A stratified vegetation sample is comprised of different distinct plant communities/habitat categories that can then be sub-sampled accordingly.

2.1 Sampling strategy

The circular shape of the plots was adopted for this study as it captures more species than square or round plots of equal area (Cox, 1990). The method captures significant numbers of individuals and it allows for plants to be separated, counted and measured without duplication or omission of individuals. Time constraints for data to be gathered and the number of persons to carry out the enumeration also informed the plot size choice.
Woody species were assessed in circular plots of radius 3m established randomly within the project. The plots were established using a 50 m tape. This was aimed at capturing the most vegetation variation within the area of interest. A total of 12 plots were established in the project footprint (Appendix 1).

2.1.1 Opportunistic species enumeration

The plot method used here may not capture the entire species richness within the area of interest. To increase the species, list a time constraint method was employed at all sample plots. A 3-minute visual scan of the areas outside the plot was used to identify new species that were not recorded from the plot method. The species generated by this method were recorded as opportunistic species. These records are used to supplement the species lists from plots data thus reducing the bias of plot data.

2.1.2 Species data enumeration and capture

Within the plots, all species of plants present were identified and life forms recorded. GPS points and elevation were taken at the centre of each plot using (the GPS-Garmin 64 model). Vegetation types were also recorded. Climbers were recorded by the presence-absence approach due to the difficulty of identifying the point of rooting.

2.1.3 Opportunistic species enumeration

Species around the footprint and outside the plots were recorded as opportunistic species. These records are used to supplement the species lists data from plots.

2.1.4 Voucher specimens

While all effort was taken to identify as many species in the field as possible, some species could not be easily identified with certainty. Such species that could not be identified in the field were collected using secateurs and placed in a collection bag, pressed in a plant press and taken to Makerere University Herbarium for correct identification and deposition. Floras were used to aid the identification of species at the herbarium (FTEA-Polhill et al., 1954. Other materials were used in the identification e.g., trees of Uganda (Hamilton, 1991) and field guides such as 115 Ugandan types of grass (Phillip et al., 2001).

2.2 Terrestrials Flora of the site

A total of 60 species belonging to 19 families were recorded in plots sampled (Appendix 1). Most of the species belonged to the families *Poaceae, Acanthaceaa, Rubiaceae* and *Fabaceae*. The least common families included *Apocynaceae, Ebenaceae, Asclepiadaceae, Burseraceae* and *Flacourtiaceae* each represented by one species. *Acacia sieberiana, A. drepanolobium A. hockii, Balanites aegyptica, Hyperrhenia filipendula, H. rufa, Brachiaria decumbens, Sporobolus africanus* and *Commiphora africana* define the various habitat and vegetation types in the sampled areas.

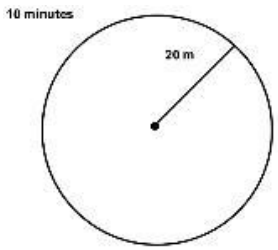
Generally, Taveta region is dominated by the savanna type vegetation communities with expansive Acacia–Commiphora bushland, open grasslands and riverine woodlands. The common trees includes the Adansonia *digitate*, Dobera *glabra, Newtonia hildebrandtii Kigelia Africana, Albizia glaberrima Ficus. Sycamores, Tamarinds indicia, Terminally kilimandscharica. Acacia elatior Cassia abbreviate, Melia volkensii,Acacia tortilis, Combretum aculeatum. and Delonix elata.* Shrubs include *Salvadora persica Azima tetracantha, Combretum ukambensis, Capparis sepiaria, Ziziphus mucronata* and *Meyna tetraphylla. The grasses are dominated by grass species such as Cenchrus ciliaris, Digitaria macroblephara, Panicum maximum, Eragrostis superba, and Cynodon dactylon*

2.3 Terrestrial Fauna of the site

The general landscape (a mixture of hilly and flat land) of the area around the irrigation scheme and the associated vegetation patterns create an environment that attracts several fauna species since these can easily find, create or adapt to habitats here. The indicator taxa for fauna to be discussed for purposes of this Environmental Impact Assessment (EIA) study shall be limited to avifauna (birds) and mammals.

2.3.1 Method of the survey of avifauna (Birds)

Point Counts: A point count consists of standing in a specific location and counting birds. This required counting the number of individual birds (of each species) within a circle of a radius of 20m. The 20m radius was chosen because it is large enough to maximize information gathering, but not so large that birds cannot be seen or heard throughout the survey area. Birds in each sample plot/point were recorded for fifteen (15) minutes before moving onto the next plot.



A typical 20 m (m=meter) radius point count where one person counts all the birds seen or heard within 10 minutes.

2.3.2 Findings on Avifauna along with the road project

The road largely stretches through farmland and fallows and since grains such as sorghum are common, this mainly attracts seed-eating birds such as Swallows, Doves and Guinea fowls. The diversity of birds was seen to increase in areas along rivers and those close to Tsavo National Park where even birds of prey such as the Snake Eagle and Auguar Bazzard are found.

The most common species of birds recorded were: Crowned Lapwing (*Vanellus coronatus*), Ring-necked Dove (*Streptopelia capicola),* Red-rumped Swallow (*Cecropis daurica*), Egret (*Ardea alba*) and Dark-capped Bulbul (*Pycnonotus tricolor*) among others. However, it is important to note that all the bird species recorded in the irrigation scheme site also range from the surrounding areas.


Royal sterling (*Lamprotornis regius*)


*A Pied crow (*Corvus albus*) on the project site*


Augur Buzzard (*Buteo augur*)


Snake Eagle (*Circaetus cinereus*)

Northern shrike (*Lanius borealis*)

Fan-tailed Raven (*Corvus rhipidurus*)

Ring-necked Dove (*Streptopelia capicola) and* Egret (*Ardea alba*) resting within the Water Reservoir Environns

Figure 1: Common birds encountered on the Irrigation scheme site

The Taveta region boasts of an enormous diversity of terrestrial birdlife ranging from grassland to bushland and woodland birds. The diverse habitats attract a reasonably special community of Palearctic migrants that includes species such as Common Whitethroat (*Curruca communis*), Willow Warbler (*Phylloscopus trochilus*), Rufus Scrub Robin (*Cercotrichas galactotes*), Upcher's Warbler (*Hippolais languida*), Basra Reed Warbler (*Acrocephalus griseldis*), Barred Warbler (*Curruca nisoria*), and Isabelline Shrike (*Lanius isabellinus*).

Regionally threatened species in the region include African darter (*Anhinga rufa*), White-headed vulture (*Trigonoceps occipitalis*), African blue quail (*Synoicus adansonii*), Martial eagle

(*Polemaetus bellicosus*), African finfoot (*Podica senegalensis*), Yellow-billed oxpecker (*Buphagus africanus*), Violet wood hoopoe (*Phoeniculus damarensis*), and Great egret (*Casmerodius albus*). Other important bird species in the region includes the Helmeted Guineafowl Numida, Vulturine Guineafowl, Crested Guineafowl, Common Ostrich, Yellow-necked Francolin, Crested Francolin, Shelley's Francolin, Namaqua Dove, Speckled Pigeon, Red-eyed Dove. Black-faced Sandgrouse, Chestnut-bellied Sandgrouse, Kori Bustard, Buff-crested Bustard, White-bellied Go-away-bird, and African Fish-Eagle.

2.3.3 Terrestrial Mammals Assessment Method

Multiple methods were used to identify and record the distribution and abundance of mammals. A review of documents on biodiversity in the region was undertaken to give general insight into the distribution of mammals in the sub-region and hence an appreciation of expected species.
Other methods included;

- Observation
- Identification through footprints and dung
- Study of animal trails and presence of soil mounds

Due to time and financial constraints, the study team did not lay traps but relied on footprints, dung and information from the Kenya Wildlife Service (KWS), Local Leaders and Community members to document the mammals within the study area.

Findings

There were a few species of large mammals encountered on-site and these included; Olive baboon (*Papio Anubis*), antelopes, dik, and Monkeys. The area is generally diverse in terms of small mammals with the most common ones being the rodents such as mice and rats. There are also a few monkeys in the nearby *Phoenix reclined* swamp off the site.

Table 2-1: A list of the small mammals around the site

S/N	Species	Common name
1	*Aethomys kaiseri*	Kaiser's rock rat
2	*Mus triton*	Grey bellied pygmy mouse
3	*Crocidura gracilipes*	Peter's musk shrew
4	*Lophuromys flavopunctatus*	Yellow spotted brush – furred rat

Large Mamals in the Large Tsavo Ecosystem as documented include the diverse habitats appeals for large carnivore community with animals such as Lion, Spotted hyena, Leopard, African wild dog, Stripped hyena and Cheetah. Some of the carnivores face different levels of threats for example, Lion (*Panthera leo*), Cheetah (*Acinonyx jubatus*) and Leopard (*Panthera pardus*), are

classified as Vulnerable and their populations sizes are decreasing. The African wild dog is endangered and its population is decreasing.

Similarly the large herbivore community quite varied and is represented by animals such as Cape buffalo, Common zebra, African savanna elephant, Impala, Blac rhino, Masai giraffe, Cokes hartebeest, Defassa waterbuck, Thomson's gazelle, Lesser kudu, Kirks dik-dik. The large mammals are an important product for many tourists visiting the area. The African savanna elephant (*Loxodonta africana*) is endangered and its population is decreasing while the population of the critically endangered Black rhino (*Diceros bicornis*) is improving.

2.3.4 Herpeto fauna Study Method

Time-constrained searches were used in the study of herpetofauna.

This involved searching study areas for amphibians and reptiles (Bury and Raphael 1983, Campbelland Christman 1982). To ensure Equal effort per study plot, the time spent on each plot was constant. Thus, each search had a specific time limit of 15minutes. Time-constrained searches were applied with the aim of determining presence or absence of species. The local community was also interviewed on the presence or absence of some species.

2.3.5 Amphibians Study Method

One amphibian species was recorded in the areas sampled in the project area. Both species of amphibians belonged to toads. The toads are more adaptable to dry conditions and can thrive where seasonal water sources exist and this explains why the amphibians were only recorded in a seasonal river bed. Based on the IUCN Red List none of the species recorded is of conservation concern. A full list of species recorded is shown in Table 12-1.

Family Name	Scientific Name	Common Name	IUCN Conservation Status
Bufonidae	*Sclerophyrs regularis*	Square-marked Toad	LC

2.3.6 Reptiles Study Method

During the field survey, Five (5) reptile species were recorded along in the study area. The species included. Amphibians and reptiles are elusive creatures some of which require a lot of time to find within their habitats. Secondly, the field survey was conducted when the dry spell was still on and this limits the activity of some herpetofauna species, as they hide to avoid desiccation. A full list of species recorded is shown in Table 12-1:

Table 12-1: Some herpetofauna species

Family Name	Scientific Name	Common Name	IUCN Status	Conservation
Agamidae	*Agama*	Red-Headed Rock Agama	LC	
Agamidae	*Acanthocercus atricollis*	Blue-Headed Tree Agama	LC	
Scincidae	*Trachylepis maculilabris*	Speckled-lipped Skink	LC	
Gekkonidae	*Hemidactylus mabouia*	Tropical House Gecko	LC	
Varanidae	*Varanus niloticus*	Nile Monitor	CITES Appendix II	

2.4.3 Herpetofauna species of Conservation Concern

From the results of the field survey, most herpetofauna species encountered are common species that are widely distributed in Kenya and some on the African continent. All are of Least Concern according to the IUCN Red List of Threatened species. The Nile Monitor (*Varanus niloticusis*) is listed under the Endangered Species Decree of 1985, which means that international trade of the species is prohibited. The species is listed under CITES Appendix II

2.4 Aquatic biodiversity

An aquatic ecosystem is surrounded by water during part of the year or all year round. About 8 % of Kenya's land area is aquatic ecosystem. Plant and animal communities in this ecosystem have developed adaptations that enable them to survive in water. Aquatic ecosystems have important functions such as provision of habitats for wildlife clean water, control flooding, recharge ground water systems and recreation for humans as well as provision of food such as fish. The major aquatic ecosystems in the Taveta region includes Lake Jipe and Tsavoe river.

2.4.1 Reptiles and Fishes

The common species of fish found here include the Lake Jipe Tilapia, common Catfish, and many species of barbs. The Jipe Tilapia a (*Oreochromis jipe*), Taveta Barb (*Barbus Pangani*) are endemic to this region and are not found anywhere else in the world. The Nile crocodiles is a common in rivers and lakes in this region.

2.4.2 Aquatic Birdlife

The region is rich in waterfowl including species such as Egyptian geese, Spur-winged lapwing, African jacana, African skimmers Purple swamp-hen African darter, Yellow-billed stork, Yellow-billed duck, cattle egret pink backed pelicans, African pigmy goose, Madagascar heron and

Squacco heron. The African pygmy goose (*Nettapus auritus*) is a rare species occurring in this regions. The waterfowl migrates from one water body to another in the region in search of suitable habitat.

2.4.3 Aquatic plants

The Typha Spp. Cyperus spp. and Papyrus spp. naturally occur in the regions aquatic ecosystems. Common species includes *Marsilea minuta Cyperus immensus*, *Cyperus distans*, *Panicum sp Nymphaea capensis*, and dominant *Najas graminea*, *Echinochloa haploclada* and *Conyza aegyptiaca*. The vegetation provides dry season browsing and grazing materials for large herbivorous community in the region.

3.0 ANTICIPATED IMPACTS OF THE PROPOSED PROJECT ON FLORA AND FAUNA

Table 12-2 below gives an anticipated impact of the proposed project on flora and fauna

Table 12-2: Anticipated Impacts of the proposed project on flora and fauna

Construction phase	Operation phase
Loss of vegetation and fauna habitat associated with Site clearance, road construction, building and PV array support construction etc.	Damage to natural vegetation through the movement of vehicles and maintenance activities.
Potential of disturbance resulting in an invasion of alien species.	Increased disturbance to fauna associated with the operation of the road and movement of vehicles.
Disturbance of fauna associated with site clearance, road construction, building construction etc.	Collision and/or electrocution of avifauna with project infrastructure.
Disturbance/displacement of avifauna and mammals such as antelopes, dikdik, monkey, etc. associated with noise and movement of construction equipment and personnel.	Loss of avifauna habitat to space occupied by project facilities and associated infrastructure, and disturbance/displacement associated with routine maintenance work.

4.0 REFERENCES

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5.0 LIST OF PLANT SPECIES RECORDED IN THE SAMPLED PLOTS ON SITE

Table 12-3 below enlists the plant species recorded in the sampled plots on site.
Table Key: 1 = presence; 0 – absence of species from stand/locality

Table 12-3: List of plant species recorded in the sampled plots on site

Species	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Plot 12
Abutilon mauritianum	0	0	0	0	0	0	0	0	0	1	0	0
Acacia elatior	1	1	1	1	1	0	0	1	0	0	1	1
Acacia hockii	1	1	1	1	1	1	1	1	0	1	1	1
Acacia sieberiana	1	1	1	1	1	0	1	1	1	1	0	1
Adansonia digitata	1	1	0	0	1	0	1	1	0	1	0	0
Ageratum conyzoides	0	0	1	0	0	0	0	0	0	0	0	0
Allophylus africanus	0	0	0	0	0	0	0	0	0	0	1	0
Asparagus africanus	1	0	0	0	0	0	0	0	1	1	1	0
Asystasia gangetica	1	0	1	0	0	1	0	1	0	0	0	0
Bidens pilosa	1	1	1	0	1	0	1	0	0	1	0	0
Brachiaria decumbens	1	1	1	1	1	0	1	1	0	0	1	1
Cassia mimosoides	0	0	0	1	0	0	1	1	1	0	0	0
Commelina africana	0	1	1	0	0	1	0	0	0	1	1	1
Commiphora africana	1	1	1	0	0	1	0	1	1	0	0	0
Cyanotis lanata	1	0	0	0	0	1	1	1	1	1	0	1
Cynodon nlemfuensis	0	0	0	0	1	0	0	0	0	0	0	0
Cyphostemma adenocaule	1	0	0	0	0	1	1	1	0	0	0	0
Cyphostemma mildbraedii	1	0	0	0	0	0	0	0	0	0	0	0
Delonix elata	0	0	1	0	0	0	0	1	0	0	1	1
Eragrostis racemosa	0	0	0	0	0	0	0	1	0	0	0	0
Erythrina abyssinica	1	0	0	0	0	0	1	0	0	0	0	1
Grewia similis	1	1	0	0	0	0	0	0	0	0	0	0
Hibiscus fuscus	0	0	0	0	0	1	1	0	0	1	0	0
Kyllinga bulbosa	0	0	0	1	1	0	0	0	0	0	0	0
Loudetia flavida	0	0	0	1	0	0	0	0	0	0	0	0
Ocimum gratissimum	1	1	1	1	1	1	1	0	1	1	0	1
Panicum maximum	1	1	1	1	0	1	1	1	0	1	0	0
Phytolacca dodecandra	0	0	0	0	0	0	0	0	1	0	1	1
Rhus natalensis	1	1	0	1	1	1	0	1	1	1	1	1
Sida acuta	0	1	1	0	1	0	0	0	0	0	0	0
Solanecio angulatus	0	0	1	0	0	0	0	0	0	0	0	0
Solanum incanum	0	0	0	0	1	0	0	0	0	1	0	1
Solanum macrocarpon	0	0	0	0	1	0	0	0	0	0	0	1
Solenostemon shirensis	0	0	0	0	0	1	0	1	0	0	0	0

Species	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Plot 12
Sporobolus africanus	0	0	0	1	1	1	1	1	1	1	0	0
Sporobolus pyramidalis	1	0	0	0	0	0	0	0	0	0	0	0
Tagetes minuta	0	0	1	0	1	0	0	0	0	1	0	0
Tarenna graveolens	0	0	0	0	0	0	0	0	0	0	0	1
Teclea nobilis	1	0	0	0	0	1	1	1	1	0	0	1
Ziziphus mucronata	1	1	0	1	0	1	0	0	0	0	0	0
Zornia apiculata	0	0	0	0	0	0	0	1	0	0	0	0

6.0 SPECIES OF BIRDS RECORDED ON THE PROPOSED PROJECT SITE.

Table 12-4 below give the species of birds recorded on the proposed project site

Table 12-4: Species of birds recorded on the proposed project site

Common name	Species name	Abundancy	IUCN Status
African Black-headed Oriole	*Oriolus larvatus*	1	Least Concern
African Fire finch	*Lagonosticta rubricata*	2	Least Concern
African Thrush	*Turdus pelios*	2	Least Concern
Angola Swallow	*Hirundo angolensis*	5	Least Concern
Banded Martin	*Riparia cincta*	7	Least Concern
Bearded Woodpecker	*Dendropicos namaquus*	1	Least Concern
Blue-naped Mouse bird	*Urocolius macrourus*	3	Least Concern
Brown Babbler	*Turdoides plebejus*	9	Least Concern
Brown parrot	*Poicephalus cryptoxanthus*	1	Least Concern
Brown Snake-Eagle	*Circaetus cinereus*	2	Least Concern
Brown-backed Scrub-Robin	*Erythropygia hartlaubi*	1	Least Concern
Brubru	*Nilaus afer*	1	Least Concern
Cardinal Woodpecker	*Dendropicos fuscescens*	3	Least Concern
Cattle Egret	*Bubulcus ibis*	7	Least Concern
Chubb's Cisticola	*Cisticola chubbi*	2	Least Concern
Crowned Lapwing	*Vanellus coronatus*	9	Least Concern
Dark-capped Bulbul	*Pycnonotus tricolor*	1	Least Concern
Fork-tailed Drongo	*Dicrurus adsimilis*	3	Least Concern
Greater Blue-eared Starling	*Lamprotornis chalybaeus*	5	Least Concern
Green Wood-hoopoe	*Phoeniculus purpureus*	7	Least Concern
Green-backed Camaroptera	*Camaroptera brachyura*	3	Least Concern
Grey-backed Fiscal	*Lanius excubitoroides*	2	Least Concern
Grey-headed Woodpecker	*Picus canus*	4	Least Concern
Hadada Ibis	*Bostrychia hagedash*	6	Least Concern
Laughing Dove	*Spilopelia senegalensis*	5	Least Concern
Lilac-breasted Roller	*Coracias caudatus*	2	Least Concern
Little Swift	*Apus affinis*	4	Least Concern
Lizzard Buzzard	*Kaupifalco monogrammicus*	1	Least Concern
Marabou Stork	*Leptoptilos crumenifer*	5	Least Concern
Northern Black Flycatcher	*Melaenornis edolioides*	5	Least Concern
Northern Grey-headed Sparrow	*Passer griseus*	7	Least Concern
Northern Puffback	*Dryoscopus gambensis*	1	Least Concern
Nubian Woodpecker	*Campethera nubica*	5	Least Concern
Plain-backed Pipit	*Anthus leucophrys*	2	Least Concern
Purple-banded Sunbird	*Cinnyris bifasciatus*	3	Least Concern
Red-chested Sunbird	*Cinnyris erythrocercus*	2	Least Concern
Red-eyed Dove	*Streptopelia semitorquata*	2	Least Concern
Red-faced Cisticola	*Cisticola erythrops*	5	Least Concern
Red-headed Cordon-bleu	*Uraeginthus cyanocephalus*	4	Least Concern
Red-headed Weaver	*Anaplectes rubriceps*	2	Least Concern
Red-rumped Swallow	*Cecropis daurica*	6	Least Concern
Ring-necked Dove	*Streptopelia capicola*	3	Least Concern
Rufous Sparrow	*Zonotrichia capensis*	2	Least Concern

Common name	Species name	Abundancy	IUCN Status
Rufous-naped Lark	*Mirafra africana*	1	Least Concern
Ruppell's Starling	*Lamprotornis purpuroptera*	20+	Least Concern
Senegal Lapwing	*Vanellus lugubris*	19	Least Concern
Tawny-flanked Prinia	*Prinia subflava*	6	Least Concern
Trilling Cisticola	*Cisticola woosnami*	8	Least Concern
Tropical Boubou	*Laniarius aethiopicus*	2	Least Concern
Vitelline Masked Weaver	*Ploceus vitellinus*	2	Least Concern
Wahlberg's Eagle	*Hieraaetus wahlbergi*	1	Least Concern
Wattled Lapwing	*Vanellus senegallus*	2	Least Concern
Yellow-billed Kite	*Milvus aegyptius*	2	Least Concern
Yellow-fronted Canary	*Serinus mozambicus*	2	Least Concern
Yellow-throated Longclaw	*Macronyx croceus*	4	Least Concern

12.6 Appendix 6: Chance Find Procedure

Chance find procedures will be used as follows:

a. Encounter or detection of a PCR
b. Stop the construction activities in the area of the chance find;
c. Delineate the discovered site or area;
d. 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 present until the responsible local authorities and the Directorate of Antiquities Sites and Monuments take over;
e. Notify the supervisory Engineer who in turn will notify the responsible local authorities and the Directorate of Antiquities Sites and Monuments (within 24 hours or less);
f. The Directorate of Antiquities Sites and Monuments would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archaeologists of the Directorate of Antiquities Sites and Monuments (within 24 hours). The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historic, scientific or research, social and economic values;
g. Decisions on how to handle the finding shall be taken by the Directorate of Antiquities Sites and Monuments. This could include changes in the layout (such as when finding an irremovable remain of cultural or archaeological importance) conservation, preservation, restoration and salvage;
h. Implementation for the authority decision concerning the management of the finding shall be communicated in writing by the Directorate of Antiquities Sites and Monuments; and
i. These procedures must be referred to as standard provisions in construction contracts, when applicable. During project supervision, the Site Engineer shall monitor the above regulations relating to the treatment of any chance find encountered are observed;
j. Construction work will resume only after authorization is given by the responsible local authorities and the National Museum concerning the safeguard of the heritage; and
k. Relevant findings will be recorded in World Bank Implementation Supervision Reports (ISRs), and Implementation Completion Reports (ICRs) will assess the overall effectiveness of the project's cultural property mitigation, management, and activities, as appropriate.

12.7 Appendix 7: NEMA PRACTICING LICENSES

FORM 7 (r.15(2))

nema
mazingira yetu | uhai wetu | wajibu wetu

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)
THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/15059
Application Reference No: NEMA/EIA/EL/19802

M/S **ECOFIX CONSULTANCY LIMITED**
(individual or firm) of address

P.O. Box 1376-30200, Kitale

is licensed to practice in the capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Firm of Experts** registration number **7912**

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

Issued Date: **5/17/2021** Expiry Date: **12/31/2021**

Signature…..

(Seal)
Director General
The National Environment Management Authority

P.T.O.

FORM 7 (r.15(2))

nema

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/14433

Application Reference No: NEMA/EIA/EL/18642

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

Issued Date: **3/22/2021** Expiry Date: **12/31/2021**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

ENVIRONMENT & SOCIAL IMPACT ASSESSMENT REPORT FOR TWIGA FOODS LIMITED IN TAITA TAVETA COUNTY 2021