

ENVIRONMENTAL AND SOCIAL ASSESSMENT REPORT



ENHANCING CLIMATE ADAPTED AGRICULTURAL PRODUCTIVITY THROUGH IMPROVED WATER MANAGEMENT FOR MWAIWATHU IRRIGATION SCHEME PROJECT IN PHALOMBE DISTRICT

Submitted by	Recipient
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ABBREVIATIONS

AFDB	The African Development Bank
AI	Artificial Intelligence
AIDS	Acquired Immunodeficiency Syndrome
CDSS	Community Day Secondary School
CIGs	Common Interest Groups
CMC	Catchment Management Committee
CMCs	Catchment Management Committees
CMCs	Catchment Management Committees
DAES	Department of Agricultural Extension Services
DAES	Department of Agricultural Extension Services
DCCMS	Department of Climate Change and Meteorological Services
DoI	Department of Irrigation Services
EMA	Environment Management Act
EPA	Extension Planning Area
ESAR	Environmental and social assessment reports
FAO	The Food and Agriculture Organization of the United Nations
FIs	Financial Intermediaries
FISP	The Fertilizer and Input Subsidy Programme
FRP	Full Resettlement Plan
GBV	Gender-Based Violence
GBV	Gender based violence
GBV	Gender-Based Violence
GDP	Growth Domestic Product
HIV	Human Immunodeficiency Virus
IFAD	The International Fund for Agricultural Development
ISS	AfDB Integrated Safeguards System
KII	Key Informant Interviews
KII	Key Informant Interviews
MEAL	Monitoring, Evaluation, Accountability and Learning
MEPA	Malawi Environment Protection Authority
MEPA	Malawi Environmental Protection Authority
MMFR	The Mulanje Mountain Forest Reserve
MRDRMP	Malawi Resilience and Disaster Management Project
N	Nitrogen
Na	Sodium
NSO	National Statistical Office of Malawi
OC	Organic Carbon
OM	Organic Matter
OS	Operational Safeguard
P	Phosphorus
PDNA	Post Disaster Needs Assessment
PMP	Pest Management Plan
SEA	Sexual Exploitation and Abuse
T/As	Traditional Authorities
UNOPS	The United Nations Office for Project Services
VECs	Valued Environmental and Social Components
VGGT	Voluntary Guidelines and Governance on Tenure
VNRMC	Village Natural Resource Management Committee
WUA	Water User Association

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EXECUTIVE SUMMARY

Project Overview

The project seeks to build climate resilience and improve the livelihoods of communities affected by Cyclone Freddy in Phalombe district. Through the rehabilitation and enhancement of irrigation infrastructure at Mwaiwathu scheme, restoration of micro-catchments, promotion of climate-smart agriculture, and the strengthening of farmer organizations, the project will address critical challenges posed by climate change. The project targets 80 hectares of damaged irrigation infrastructure. It also introduces digital agricultural solutions and climate advisory services, supports secure land tenure, and fosters inclusive, community-led business development. The intervention is structured around three components: (1) Climate Adapted Production and Productivity, (2) Digital Information and Climate Advisory Ecosystem, and (3) Policy and Institutional Capacity Strengthening for Sustainable Climate Adaptation. The project supported by the African Development Bank under the Climate Action Window, will be implemented by a consortium led by FAO and comprising of IFAD, UNOPS, and the Ministry of Agriculture's Department of Irrigation.

Rationale of the Project

Phalombe District which encompass Mwaiwathu Irrigation Scheme was severely impacted by Cyclone Freddy, which disrupted irrigation systems, degraded land and water resources, and undermined food and income security for thousands of smallholder farmers. The high vulnerability of these communities is exacerbated by limited land holding sizes, poor access to climate-resilient agricultural practices, and weak institutional capacities. There is an urgent need to rehabilitate damaged infrastructure, restore natural ecosystems, and support the adoption of sustainable and climate-smart farming methods. Furthermore, leveraging digital platforms, enhancing market access, and ensuring gender inclusion are critical to building long-term resilience. The project aligns with national climate adaptation priorities and contributes to broader goals of poverty reduction, food security, and sustainable natural resource management.

The scheme, originally covering 65 hectares, was reduced to 25 hectares due to infrastructure damage. The rehabilitation aims to restore full functionality, improve water management, and enhance climate resilience for local communities. The project will benefit 105 irrigation farmers (of which 65 are women) and includes components on climate-adapted production, digital advisory systems, and institutional capacity building.

The report identifies both positive and negative environmental and social impacts across planning, construction, operation, and demobilization phases. Key positive impacts include increased agricultural productivity, improved food security, employment creation, and enhanced livelihoods. Negative impacts such as soil erosion, water contamination, deforestation, and gender-based violence risks are addressed through detailed mitigation measures.

Methodological Approach

The Environmental and Social Assessment (ESA) for the Mwaiwathu Irrigation Scheme was conducted to evaluate the potential environmental and socio-economic impacts both positive and negative associated with the proposed project. The assessment emphasized enhancing beneficial impacts and implementing mitigation measures to manage adverse ones. This report complies with the Terms of Reference provided by the Malawi Environment Protection Authority (MEPA) and aligns with the African Development Bank's Integrated Safeguards

System (ISS, 2023), MEPA's ESIA Guidelines (2011), FAO's Framework for Environmental and Social Management (FESM, 2021), and relevant national legislation including the Environment Management Act (EMA, 2017).

Desk Review and Legal Framework

A comprehensive literature review was undertaken, focusing on project-specific documents, policies, laws, and institutional frameworks relevant to environmental and social management in Malawi. This provided the basis for aligning the assessment methodology with best practices and regulatory expectations.

Field Surveys and Site Visits

The ESA team conducted site visits to capture baseline data on the biophysical and socio-economic conditions of the project area. These visits enabled expert-driven in-situ analysis using direct observation, professional judgment, and participatory techniques. The process provided valuable insights into land use, infrastructure, biodiversity, and social dynamics.

Stakeholder Consultations

Stakeholder engagement was integral to the ESA process, fostering transparency and inclusiveness. Consultations included public meetings, Focus Group Discussions (FGDs) disaggregated by gender, age, and vulnerability, and Key Informant Interviews (KIIs) with traditional authorities and relevant government officials. These engagements helped identify local priorities, social concerns, and opportunities, and contributed to the development of a robust Stakeholder Engagement Plan.

A Grievance Redress Mechanism (GRM), consistent with AfDB and FAO standards, will be established to ensure responsive conflict resolution and promote community trust.

Biophysical Assessments

- *Terrestrial Flora*: A qualified forester conducted a structured assessment of vegetation types using transect walks. Plant species were identified and documented using key botanical references, focusing on ecological significance and conservation concerns.
- *Terrestrial Fauna*: The fauna assessment adopted a qualitative approach, examining species diversity and potential project impacts, particularly on birds and small mammals. It involved field observations and expert consultations across the project's catchment.
- *Soil Sampling*: The assessment of soil quality utilized both disturbed and undisturbed samples. Field indicators such as erosion, vegetation cover, and infiltration capacity were evaluated. Laboratory analyses covered physical (e.g., bulk density, water retention), chemical (e.g., pH, salinity, organic matter), and biological (e.g., microbial biomass) parameters to offer an integrated view of soil health.
- *Water Quality*: Domestic water sources were sampled and tested by Bvumbwe Research Station, Department of Agricultural Research Services under Ministry of Agriculture using Standard Methods (21st Edition). The results were benchmarked against Malawi Standards (MS214:2005) to assess suitability for drinking and domestic use.

Overall, the methodological approach ensured a multi-disciplinary, participatory, and evidence-based assessment. It combined quantitative data, professional expertise, and community inputs to deliver a comprehensive understanding of the existing environmental and social landscape and to inform the proposed project's design and mitigation strategy.

Project Objective

The overarching objective of the project is to enhance climate change adaptation and resilience of cyclone-affected communities of Mwaiwathu Irrigation Scheme in Phalombe District through efficient water management, climate-smart agriculture, institutional strengthening, and inclusive social structures. Specifically, the project aims to:

- Rehabilitate and strengthen irrigation and water management infrastructure (including water sanitation and warehouse facilities).
- Restore and conserve degraded catchment areas using sustainable land management practices.
- Promote the adoption of climate-smart and conservation agriculture.
- Empower farmers and local institutions including WUAs and cooperatives.
- Provide digital extension, early warning, and climate advisory services.
- Promote inclusive access to land and market opportunities for women, youth, and marginalized groups.
- Strengthen community and institutional capacity to integrate climate resilience into development planning and implementation.

Legal and regulatory framework and requirements

The Mwaiwathu Irrigation Scheme must comply with several legal and regulatory frameworks notably Malawi's Environmental Management Act (2017), Land Act (2016), and Water Resources Act (2013), requiring ESMP preparation, secure land tenure, and water use permits. It also adheres to the Forestry Act, Occupational Safety Act, and Gender Equality Act to ensure environmental protection, worker safety, and inclusion. Oversight is by Malawi Environment Protection Authority (MEPA), National Water Resource Authority (NWRA), and local councils, aligning with EIA Guidelines (2002) and international standards such as those of the Green Climate Fund (GCF) and 2023 AfDB's Integrated Safeguards Systems. Indeed, it should be noted that operational safeguards of the ADB apply to the project. These are:

- E&S Operational Safeguard 1: Assessment and Management of Environmental and Social Risks and Impacts
- E&S Operational Safeguard 2: Labour and Working Conditions
- E&S Operational Safeguard 3: Resources Efficiency and Pollution Prevention and Management
- E&S Operational Safeguard 4: Community Health, Safety and Security
- E&S Operational Safeguard 6: Habitat and Biodiversity Conservation & Sustainable Management of Living Natural Resources
- E&S Operational Safeguard 7: Vulnerable Groups
- E&S Operational Safeguard 10: Stakeholder Engagement and Disclosure of Information

From an institutional point of view, several ministries and organisations are involved in the implementation of this project. These Ministries and institutions include Ministry of Agriculture, Ministry of Trade and Industry, Ministry of Water and Sanitation, Ministry of Lands, Ministry of Natural Resources and Climate Change and the Environmental Affairs Department (EAD), Department of Climate Change and Meteorological Services, Ministry of

Gender Community Development and Social Welfare, Ministry of Labour, Ministry of Health through Department of Nutrition, Ministry of Information and Digitalisation, Malawi Environmental Protection Authority (MEPA), National Water Resources Authority, District Councils of Phalombe and Thyolo.

Overview of the existing requirement

The project will be implemented in two prone districts of Phalombe and Thyolo in Southern region of Malawi.

Biophysical environment

The ecological assessment of the Mwaiwathu Irrigation Scheme area revealed a rich variety of wildlife and vegetation, highlighting the site's significant biodiversity. Field observations and community consultations identified several mammal species such as the Rock hyrax, various bats including the Common slit-faced bat and Lander's horseshoe bat, and small mammals like the Dusky elephant shrew and Silvery mole rat. Notably, the area supports bird species of conservation concern, including the Thyolo alethe and White-winged Apalis, which are endemic to the Eastern Afromontane biodiversity hotspot and vulnerable due to habitat loss. Reptiles such as the endemic Mulanje chameleon, alongside amphibians like the Guttural toad and African bullfrog, add to the ecological richness. Various insects from different families were also recorded, reflecting a healthy ecosystem. This biodiversity underscores the need to integrate conservation measures into the project's Environmental and Social Management Framework to protect these species and their habitats.

Vegetation in the project area consists mainly of open grasslands, indigenous trees, and agricultural lands. Fruit trees like mango and pawpaw are common around homesteads, supporting local consumption and trade. The grasslands serve as grazing areas and water recharge zones but face threats from overgrazing, burning, and invasive species. Smallholder farming dominates land use, with key crops including maize, cassava, pigeon peas, and sweet potatoes. Expansion of farmland through clearing natural vegetation is a leading cause of biodiversity loss. To mitigate this, strategies such as community-based forest conservation, agroforestry, invasive species control, and restoration of degraded woodlands are recommended to promote ecosystem resilience and sustain livelihoods.

Water quality assessments indicate that water from intake points, boreholes, and outlets generally meets national standards for safe drinking and household use, showing low mineralization and balanced pH. However, phosphate levels exceed recommended limits, likely due to domestic wastewater, fertilizer runoff, detergents, or sewage. Elevated phosphates pose a risk of eutrophication, which could degrade water quality through algal blooms and oxygen depletion. Ongoing monitoring and management are necessary to prevent such impacts. Soil tests reveal dominant sandy clay loam and sandy clay textures, suitable for crops like maize and beans but requiring frequent watering due to hardness when dry. Soil erosion risk is low due to soil type and gentle terrain. Nutrient application should be targeted within root zones to address limited water movement through the soil.

Overall, these findings emphasize the importance of sustainable resource management in the project design. Protecting biodiversity, maintaining water quality, and managing soils effectively will support long-term productivity and environmental sustainability of the Mwaiwathu Irrigation Scheme.

Socio economic environment

The socio-economic landscape of Mwaiwathu in Phalombe District is primarily shaped by subsistence farming and small-scale trading. With a population growing at approximately 3% per year, landholdings have progressively diminished to around 0.5 hectares per household, increasing the urgency for improved agricultural methods and irrigation. Most land is held under customary tenure, and while the Land Act of 2016 enables landowners to formally register their land—potentially facilitating access to loans—this process may inadvertently raise rental fees and limit land availability for some farmers. National efforts at land consolidation aim to boost productivity and secure tenure, providing a framework for improved agricultural outcomes.

Agriculture in the area relies heavily on rain-fed systems with minimal use of enhanced inputs, resulting in generally low crop yields. Consequently, irrigation emerges as a critical intervention to enable year-round farming, particularly when complemented by farmer training, improved input access, and extension support. Basic social services such as schools, health centers like John Chilembwe Hospital, and police presence are available, although infrastructure development and electrification are still limited, posing challenges for broader socio-economic advancement.

The cultural composition predominantly includes Christian communities from the Ngoni and Lomwe ethnic groups. Women constitute the majority of farmers within the scheme, accounting for 66 out of 105 participants. However, women face significant social challenges, including limited recognition in female-headed households, complexities related to polygamous family structures, and gender-based violence often linked to poverty and economic pressures. Addressing these gender inequalities is essential for the project's success, requiring targeted interventions, community engagement, and the strengthening of local bylaws to promote inclusivity and equity.

The area is well-suited for irrigation development, with basic infrastructure for water, sanitation, and road access in place. Nonetheless, public health concerns persist, particularly regarding waste management and disease outbreaks such as malaria and diarrhoea during rainy seasons. These issues underscore the need for integrated health and environmental strategies alongside agricultural improvements to ensure sustainable socio-economic progress in Mwaiwathu.

Stakeholder engagement

The stakeholder consultation process for the project was designed to ensure inclusive, transparent, and meaningful participation of all interested and affected parties. Conducted from 4th to 6th March 2025, consultations used focus group discussions, interviews, and key informant engagements across the Mwaiwathu scheme and other Extension Planning Areas, ensuring representation by gender and age.

Participants included smallholder farmers, national institutions, NGOs, and local leaders. Stakeholders highlighted key challenges such as crop pests and diseases, limited veterinary services, high input costs, and climate-related shocks. Their inputs emphasized the need for capacity building in irrigation management, pest control, market access, and land tenure support. These insights shaped the project's integrated approach to resilience building, promotion of Good Agricultural Practices, and productivity enhancement for crops and livestock.

Additionally, a Grievance Redress Mechanism (GRM) will be established, aligned with AfDB and FAO guidelines, to enable affected parties to raise concerns through multiple channels, ensuring transparent, timely resolution. The GRM aims to foster trust, mitigate risks, and enhance project responsiveness to stakeholder needs.

Environmental and Social Impacts identified with Mitigation Measures

The project faces environmental risks including soil erosion, siltation, borrow pit hazards, waste generation, dust, noise, and chemical contamination from machinery. Social risks involve child labour, gender-based violence (GBV), sexual exploitation and abuse (SEAH), and increased spread of HIV/AIDS and other STIs. Ecological challenges include hydrological changes, catchment degradation, groundwater contamination, and flooding, while poor irrigation and crop management threaten food security and livelihoods.

To address these risks, the project proposes planting vetiver grass, constructing drop structures, and rehabilitating borrow pits to control erosion and safety hazards. Waste disposal will follow designated sites, with dust controlled by speed limits and water spraying. Codes of conduct and legal enforcement will combat child labour and GBV/SEAH, alongside awareness campaigns and condom distribution to reduce STIs. Hydrological impacts will be managed via water abstraction permits and improved irrigation practices. Conservation measures like tree planting, buffer zones, and organic farming will protect catchments. Training and extension services will support safer, more productive farming, boost employment, and enhance food security.

Environmental and Social Management Plan

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/monitoring			
	<i>Design, Planning and Mobilization Phase</i>	Effect on water quality	• Ensure use of well serviced machinery with no oil leakages. • Ensure disposal of waste in sites designated by the Council. • Limit operations to site designated for the camp.	DoI/DPW/WUA/PMT	District Environmental Sub Committee (DESC)	2026-2027	-No of vehicles serviced -Wastes disposed in designated site.	700,000
	<i>Design, Planning and Mobilization Phase</i>	Loss of trees and vegetation	• Ensure minimal disturbance of vegetation and trees by limiting operations to designated site. • Ensure camp is sited in areas where clearing of vegetation will not be involved.	- DFO//PMT	-	- 2026-2027	- Area conserved Camp properly sited	-
	<i>Design, Planning and Mobilization Phase</i>	Conflicts over land use	• Local leaders/chiefs to identify rightful owners and users of land together with the irrigation committee. • Administer land agreement forms with clear arrangements on how winter cropping will be done to ensure there is common	DLO//PMT		2026-2027	-No of land agreement forms signed	500,000

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/monitoring			
			understanding					
	Construction Phase	Soil erosion and siltation caused by clearing of land for construction works.	Plant vetiver grass on contours and along all canals to stabilise them.	Contractor/WUA/DC	DESC/PMU	2026-2027	Area planted with vetiver in meters	500,000
	Construction Phase		Construct drop structures as per the designed size of the canal and appropriate for steep slopes to minimise water velocity.	Contractor/WUA/DC	DESC/PMU	2026-2027	Number of drop structures constructed	
	Construction Phase		Apply water to stripped soils to reduce erosion.	Contractor/WUA/DC	DESC/PMU	2026-2027	Area applied with water and records of water application	
	Construction Phase		Use soils from stockpiles to rehabilitate stripped and excavated zones.	Contractor/WUA/DC	DESC/PMU	2026-2027	Number of stockpiles or volumes of loose soils used for rehabilitation and backfilling of excavations	
	Construction Phase		Enhance soil and water conservation measures and farming such as mulching, box ridging, agroforestry etc.	Irrigation Committee/Labour/DoI/WUA/DC(DADO)/PMU	DESC	2026-2027	Area under conservation measures	

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/monitoring			
	Construction Phase	Risk of borrow pits	Barricading of the borrow pit perimeter with orange safety mesh barricade while in use.	Contractor	DESC/PMU	2026-2027	Area/number of pits barricaded or protected	2, 000, 000
	Construction Phase		Backfilling and rehabilitation of all borrow pits after use.	Contractor	DESC/PMU	2026-2027	No of pits rehabilitated or filled	
	Construction Phase		Sensitize communities on risks of the borrow pits	Contractor/WUA/DC	DESC/PMU	2026-2027	No of sensitization meetings conducted	
	Construction Phase	Increased Generation of waste	Dispose wastes in sites designated by the District Council	Contractor/WUA/DC	DESC/PMU	2026-2027	Amount of wastes properly disposed	1, 000, 000
	Construction Phase	from construction activities	Siting and establishing camps at approved sites in consultation with the Supervision Committee	Contractor/WUA/DC	DESC/PMU	2026	Camp properly sited	
	Construction Phase	Loss of trees and vegetation due to infrastructure development	Limiting bush clearance to approved sites.	Contractor/WUA/DC	DESC/PMU	2026-2027	Area cleared	1, 500, 000
	Construction Phase		Prevent clearing of bush for construction works except where necessary – this to be agreed by the supervision committee/WUA.	Contractor/WUA/DC	DESC/PMU	2026-2027	Agreement made	

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/monitoring			
	Construction Phase		Avoid wanton cutting down of trees and enforce penalties for deliberate and unnecessary cutting down of trees.	Contractor/WUA/DC	DESC/PMU	2026-2030	No of people penalized for the malpractice	
	Construction Phase		Planting trees on all bare lands	WUA/DC	DESC/PMU	2026-2030	No of trees planted	
	Construction Phase		Promote use of alternative sources of cooking fuel to migrant workers such as efficient cook stoves such as zipolopolo mbaula, or gas; and avoid use of charcoal or fuelwood.	WUA/DC	DESC/PMU	2027-2030	No of people adopting use of fuel-efficient stoves/gas	
	Construction Phase		Training communities to protect trees and woodlands/forests.		DESC / PMU	2027-2029	No of members trained	
	Construction Phase	Increased dust emission by construction equipment	Control vehicle speed to reduce generation of dust through installation of speed humps and enforcement of speed limits.	Contractor	DESC / PMU	2026-2027	No of speed humps and speed limit signs installed	500,000
	Construction Phase		Regular application of water to civil works and earth roads	Contractor	DESC / PMU	2026-2027	Area applied with water	

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/monitoring			
			to suppress dust.					
	Construction Phase	Increased risk of child labour	Checking of the workforce by the Consulting Engineer and other members of the supervising engineer, as well as the District Council, Committee etc.	Contractor/Labour	DESC / PMU	2026-2028	Records of workers employed	700,000
	Construction Phase		Enforce Code of Conduct for contractors developed under the project (and signed by all contractors and their staff),	Contractor/Labour	DESC / PMU	2026-2027	No of workers signing CoC	
	Construction Phase		Enforce Laws of Malawi including prosecution of those who employ children.	Contractor/Labour	DESC / PMU	2026-2030	Records of law enforcement/No of visits	
	Construction Phase		Checking of the workforce by the Consulting Engineer and other members of the supervising engineer, as well as the District Council, Committee etc.	Contractor	DESC / PMU	2026-2030	No of people checked	
	Construction Phase	Noise pollution	All construction works shall be	Contractor	DESC / PMU	2026-2027	Agreements signed	As in the BoQs

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/ monitoring			
			confined to daylight hours unless permission is obtained from Supervision Committee and consultation with affected communities.					
	Construction Phase		Provide and enforce use of noise cancelling devices for workers working with noisy machines.	Contractor	DESC / PMU	2026-2027	No of workers provided and using noise cancelling devices	
	Construction Phase	Chemical contamination of soil and water by oil leakages and spillage from machinery	This can be mitigated by carrying out regular servicing of machinery.	Contractor	DESC / PMU	2026-2027	No of vehicles serviced	2, 500,000
	Construction Phase		Training of workers on spill prevention and control	Contractor	DESC / PMU	2026-2027	No of workers trained on spill prevention and safety issues	
	Construction Phase		Use of spill response equipment such as drip trays and absorbents to capture and clean up spillages.	Contractor	DESC / PMU	2026-2027	No of spill response equipment available	
	Construction Phase		Construct a storm bund for storage of hazardous substances	Contractor	DESC / PMU	2026-2027	No of storm bund constructed and being used	

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/ monitoring			
	Construction Phase		servicing machinery at a central point and disposing used oil at a site approved by MEPA.	Contractor	DESC / PMU	2026-2027	No of vehicles serviced	
	Construction Phase	Increased incidences of waterborne diseases	All open ditches should be closed or rehabilitated.	Contractor	DESC / PMU	2027	No of open ditches or pits filled	500,000
	Construction Phase		Ensuring absence of stagnant water in the scheme area by empowering the WUA to conduct regular supervisions.	Irrigation Committee / Labour/DoI/WU A/DC(DADO), Health /PMU	DESC	2027-2030	Area free from stagnant water	
	Construction Phase	Increased risk of Spread of HIV AND AIDS and other STIs.	Conduct awareness meetings among workers and communities,	Irrigation Committee / Labour/DoI/WU A/DC(DADO), Health /PMU	DESC	2026-2030	No of awareness meetings conducted/minutes	500, 000
	Construction Phase		Distribute condoms.	Irrigation Committee / Labour/DoI/WU A/DC(DADO), Health /PMU	DESC	2026-2030	No of condoms provided	
	Construction Phase		Development of and strict adherence to Code of Conduct for workers.	Irrigation Committee/ Labour/DoI/WU A/DC(DADO)/PMU	DESC	2026-2027	No of workers who have signed codes of conduct	
	Construction Phase	Increased risk of Gender based violence	Conduct awareness meetings among workers and communities,	Irrigation Committee/ Labour/DoI/WU A/DC(DADO)/PMU	DESC	2026-2030	No of awareness meetings conducted	500, 000

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/monitoring			
	Construction Phase	(GBV) and Sexual Exploitation and Abuse (SEA)	Development of and strict adherence to Code of Conduct for workers	Irrigation Committee/ Labour/DoI/WU A/DC(DADO)/PMU	DESC	2026-2027	No of workers who have signed codes of conduct	
	Construction Phase	Conflict over land use	Local leaders/chiefs to identify rightful owners and users of land together with the irrigation committee.	Irrigation Committee/ Lands/DoI/WU A/DC(DADO)/PMU	DESC	2026-2027	No of land parcels with rightful owners	1, 500, 000
	Construction Phase		Administer land agreement forms with clear arrangements on how winter cropping will be done to ensure there is common understanding.	Irrigation Committee/ Lands/DoI/WU A/DC(DADO)/PMU	DESC	2026-2027	No of land agreement forms signed	
	Construction Phase	Interferences in marriages	Conduct awareness meetings among workers and communities	Irrigation Committee/ Labour/DoI/WU A/DC(DADO)/PMU	DESC	2026-2027	No of awareness meetings conducted	350, 000
	Construction Phase		Development of and strict adherence to Code of Conduct for workers	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DoI PMU	2026-2027	No of workers who have signed codes of conduct	
	Operation phase	Changes in hydrological regimes in the	Ensure that the scheme obtains water right.	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DESC	2026	No of water rights obtained	2,500,000

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/monitoring			
	Operation phase	rivers	Adhere to provisions in water right to, for example, maintain environmental flow requirements of 0.000228906m³/s.	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DoI PMU	2026-2030	Amount of water allowed to flow	
	Operation phase		Improve irrigation and drainage operations to enhance water use efficiency.	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DESC	2026-2030	No of canals that have been improved	
	Operation phase	Increased deforestation	Introduce efficient, accessible, and affordable cook stoves.	DoI DC (DFO) PMU	DESC	2027-2030	No of households using efficient, energy saving stoves	800, 000
	Operation phase		Establish tree nurseries and woodlots	DoI DC (DFO) PMU	DESC	2026-2029	Number of nurseries and woodlots established.	
	Operation phase		Promote tree planting	DoI DC (DFO) PMU	DC (DFO) PMU	2026-2030	No of trees planted and survived	
	Operation phase		Sensitise and train WUA members and staff on catchment management	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DESC	2027-2028	No of members trained and sensitized	
	Operation phase		Establishing 15 metres buffer zones of trees and grasses between the river and irrigated	DoI DC (DFO) PMU	DESC	2026-2030	15 m buffer zone established	

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/monitoring			
			land to assist filter the chemicals before entering the river.					
	Operation phase	Risk of flooding, water logging and salinisation of soils	• Apply of organic matter to improve soil structure.	DoI DC (DLRC) PMU		2026-2030	Area applied with organic fertilizers	1, 000, 000
	Operation phase		• Apply recommended type and amount of chemicals and fertilisers.	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DESC	2026-2030	Area applied with recommended type of chemicals and fertilizers	
	Operation phase		• Regularly maintain irrigation and drainage channels to improve seepage.	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DESC	2026-2030	Number of channels regularly maintained	
	Operation phase		• Drafting of the operation and maintenance manual; and training of operators' weir maintenance and drafting of a Contingency Emergency Response Plan.	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DESC	2027-	Number of O&M developed	
	Operation phase		• Apply of organic matter to improve	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DESC	2026-2030		

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/monitoring			
			soil structure					
	Operation phase		• Clear clogged channels to allow water to flow.	Irrigation Committee/Dol/WUA/DC(DADO)/PMU	DESC	2026-2030	Length of channels cleared	
	Operation phase	Increased occurrences of waterborne diseases	• Ensure an absence of stagnant water at the site by constructing proper drainage around the scheme and clearing blocked areas by the committee/WUA.	Irrigation Committee/Dol/WUA/DC(DADO)/PMU	DESC	2026-2030	Length of channels cleared	850,000
	Operation phase		• Promote good sanitation, hygiene, and use of mosquito nets in the camps and surrounding communities.	Irrigation Committee/Dol/WUA/DC(DADO)/PMU	DESC	2026-2030	No of awareness meetings	
	Operation phase	Use of unregistered pesticides in the scheme	• Training and awareness for farmers on harmful/banned and unregistered pesticides.	Irrigation Committee/Dol/WUA/DC(DADO)/PMU	DESC	2026-2029	No of farmers trained approved pesticides	550,000
	Operation phase		• Encourage farmers to buy approved pesticides and from registered suppliers.	Irrigation Committee/WUA/DC(DADO)/PMU	DESC	2026-2-30	No of awareness meetings	

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/ monitoring			
	Operation phase	Risk of high sediment loads from flooding impacting on the irrigation scheme	- Constructing flood protection structures such as dykes, check dams and infiltration ponds to trap excess water during flooding. - Planting vegetation to trap sediments and improve seepage.	DoF/PMU/DoI/DC	DESC	2027	No of structures constructed. Area planted with vegetation	600,000
	Operation phase	Aquifer depletion	- Improve irrigation and drainage operations to enhance water use efficiency. - Enhance catchment conservation practices to increase percolation, reduce run off and enhance recharge	PMU/DoI/LRCO	DESC	2026-2030	-Number of structures improved. -Area under catchment conservation	500,000
	Operation phase	Diminished land and soil fertility / productivity	- Enhance soil and water conservation measures and farming such as mulching, box ridging, agroforestry etc. - Promote use of organic manure. - Develop and implement the Integrated Pest Management Plan.	DLRC/DoF/ WUA/DC	DESC/PMU	2026-2030	- Area under conservation -IPMP developed & implemented	500,000

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/ monitoring			
			Plant vetiver grass on contours and along all canals to stabilize them.					
	Demobilization phase	Loss of employment	- Timely sensitization and awareness to workers on the end of construction works - Pay terminal benefits to the workers	DC/Labour/PMU/DoI	DESC	2026	-No of meetings conducted/No of workers sensitized. -No of workers given terminal benefits	500,000
	Demobilization phase	Loss of business opportunities	Timely sensitization and awareness to workers & community members on the end of construction works	DC/Trade/ABO/PMU	DESC	2026	-No of meetings conducted. -No of workers sensitized.	500,000
	Demobilization phase	Risk of accidents	- Provision of PPE to workers - Conduct safety and health awareness	DC/WUAPMU	DESC	2026	-No of workers provided with PPEs.	1,500,000
	Demobilization phase	Increased generation of construction rubble/waste	Designate specific places for the disposal of waste in consultation with the district council.	DC/EDO/PMU	DESC	2026	Amount of wastes disposed in designated places	500,000

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/monitoring			
			Development and implementation of a Waste Management Plan					
TOTAL								76, 169, 675.17 (USD 43,500.67)

Environmental and Social Monitoring Plan

NO	IMPACT IDENTIFIED	RECOMMENDED ENHANCEMENT/MITIGATION/MANAGEMENT MEASURE	MONITORING INDICATOR	FREQUENCY	RESPONSIBLE INSTITUTION	ESTIMATED COST (MK)
<i>Design, Planning and Mobilization Phase</i>						
1	Reduced water quality	• Ensure use of well serviced machinery with no oil leakages. • Ensure disposal of waste in sites designated by the Council. • Limit operations to site designated for the camp.	-No of vehicles serviced -Wastes disposed in designated site.	Quarterly	DoI/DPW/WUA	700, 000
2	Loss of trees and vegetation	• Ensure minimal disturbance of vegetation and trees by limiting operations to designated site. • Ensure camp is sited in areas where clearing of vegetation will not be involved.	- Area conserved - Camp properly sited	Quarterly	DFO/PMU	-
3	Increased conflicts over land use	• Local leaders/chiefs to identify rightful owners and users of land together with the irrigation committee. • Administer land agreement forms with clear arrangements on how winter cropping will be done to ensure there is common understanding	-No of land agreement forms signed	Quarterly	DLO/PMU	500, 000
<i>Construction and operation Phases</i>						
1	Increased erosion and siltation	• Plant vetiver grass on contours and along all canals to stabilise them.	Area planted with vetiver in meters	Biannually	Agriculture/DoI/PMU	500, 000
		• Construct drop structures as per the designed size of the canal and appropriate for steep slopes to minimise water velocity.	Number of drop structures constructed	Quarterly		
		• Apply water to stripped soils to reduce erosion.	Area applied with water and records of water application	Quarterly		

NO	IMPACT IDENTIFIED	RECOMMENDED ENHANCEMENT/MITIGATION/MANAGEMENT MEASURE	MONITORING INDICATOR	FREQUENCY	RESPONSIBLE INSTITUTION	ESTIMATED COST (MK)
		Use soils from stockpiles to rehabilitate stripped and excavated zones.	Number of stockpiles or volumes of loose soils used for rehabilitation and backfilling of excavations	Quarterly		
		Enhance soil and water conservation measures and farming such as mulching, box ridging, agroforestry etc.	Area under conservation measures	Biannually		
2	Increased risk of borrow pits	Barricading of the borrow pit perimeter with orange safety mesh barricade while in use.	Area/number of pits barricaded or protected	Regularly	Contractor / Supervision Committee/Council/PMU	2, 000, 000
		Backfilling and rehabilitation of all borrow pits after use.	No of pits rehabilitated or filled	Quarterly		
		Sensitize communities on risks of the borrow pits	No of sensitization meetings conducted	Regularly		
3	Increased Generation of waste from construction activities	Dispose wastes in sites designated by the District Council	Amount of wastes properly disposed	Weekly	Contractor / DoI / DC/Committee/PMU	1, 000, 000
		Siting and establishing camps at approved sites in consultation with the Supervision Committee	Camp properly sited	Biannual		
4	Loss of trees and vegetation due to infrastructure development	Limiting bush clearance to approved sites.	Area cleared	Weekly	Community/ Supervision Committee/District Council (DFO)/PMU	1, 500, 000
		Prevent clearing of bush for construction works except where necessary – this to be agreed by the supervision committee/WUA.	Agreement made	Fortnightly		
		Avoid wanton cutting down of trees and enforce penalties for deliberate and unnecessary cutting down of trees.	No of people penalized for the malpractice	Fortnightly		

NO	IMPACT IDENTIFIED	RECOMMENDED ENHANCEMENT/MITIGATION/MANAGEMENT MEASURE	MONITORING INDICATOR	FREQUENCY	RESPONSIBLE INSTITUTION	ESTIMATED COST (MK)
		• Planting trees on all bare lands	No of trees planted	Annually		
		• Promote use of alternative sources of cooking fuel to migrant workers such as efficient cook stoves such as zipolopolo mbaula, or gas; and avoid use of charcoal or fuelwood.	No of people adopting use of fuel-efficient stoves/gas	Quarterly		
		• Training communities to protect trees and woodlands/forests.	No of members trained	Once-		
5	Increased dust emission by construction equipment	• Control vehicle speed to reduce generation of dust through installation of speed humps and enforcement of speed limits.	No of speed humps and speed limit signs installed	Monthly	Contractor/Engineer/PMU	500, 000
		• Regular application of water to civil works and earth roads to suppress dust.	Area applied with water	Weekly		
6	Increased risk of child labour	• Checking of the workforce by the Consulting Engineer and other members of the supervising engineer, as well as the District Council, Committee etc.	Records of workers employed	Weekly	Labour Office/WUA/PMU	700, 000
		• Enforce Code of Conduct for contractors developed under the project (and signed by all contractors and their staff),	No of workers signing CoC	Weekly		
		• Enforce Laws of Malawi including prosecution of those who employ children.	Records of law enforcement/No of visits	Weekly		
		• Checking of the workforce by the Consulting Engineer and other members of the supervising engineer, as well as the District Council, Committee etc.	No of people checked	Weekly		
7	Increased Noise pollution	• All construction works shall be confined to daylight hours unless permission is obtained	Agreements signed	Weekly	DC/PMU/ DHO/DoI	As in the BoQs

NO	IMPACT IDENTIFIED	RECOMMENDED ENHANCEMENT/MITIGATION/MANAGEMENT MEASURE	MONITORING INDICATOR	FREQUENCY	RESPONSIBLE INSTITUTION	ESTIMATED COST (MK)
		from Supervision Committee and consultation with affected communities.				
		• Provide and enforce use of noise cancelling devices for workers working with noisy machines.	No of workers provided and using noise cancelling devices	Weekly		
8	Increased Chemical contamination of soil and water by oil leakages and spillage from machinery	• This can be mitigated by carrying out regular servicing of machinery. • Training of workers on spill prevention and control • Use of spill response equipment such as drip trays and absorbents to capture and clean up spillages. • Construct a storm bund for storage of hazardous substances • servicing machinery at a central point and disposing used oil at a site approved by MEPA.	No of vehicles serviced No of workers trained on spill prevention and safety issues No of spill response equipment available No of storm bund constructed and being used No of vehicles serviced	Fortnightly Fortnightly Monthly Monthly Quarterly	Contractor/Ministry of Lands/ Department of Irrigation/DC/PMU	2, 500,000
9	Increased incidences of waterborne diseases	• All open ditches should be closed or rehabilitated. • Ensuring absence of stagnant water in the scheme area by empowering the WUA to conduct regular supervisions.	No of open ditches or pits filled Area free from stagnant water	Weekly Weekly	Contractor/ Department of Irrigation/DC/PMU	500,000
10	Increased risk of Spread of HIV AND AIDS and other STIs.	• Conduct awareness meetings among workers and communities,	No of awareness meetings conducted/minutes	Monthly	Irrigation Committee DoI/WUA/PMU	500, 000
		• Distribute condoms.	No of condoms provided	Monthly		

NO	IMPACT IDENTIFIED	RECOMMENDED ENHANCEMENT/MITIGATION/MANAGEMENT MEASURE	MONITORING INDICATOR	FREQUENCY	RESPONSIBLE INSTITUTION	ESTIMATED COST (MK)
		Development of and strict adherence to Code of Conduct for workers.	No of workers who have signed codes of conduct	Weekly		
11	Increased risk of Gender based violence (GBV) and Sexual Exploitation and Abuse (SEA)	Conduct awareness meetings among workers and communities,	No of awareness meetings conducted	Monthly	Irrigation Committee WUA DoC/PMU	500, 000
		Development of and strict adherence to Code of Conduct for workers	No of workers who have signed codes of conduct	Weekly		
12	Increased Conflict over land use	Local leaders/chiefs to identify rightful owners and users of land together with the irrigation committee.	No of land parcels with rightful owners		Irrigation Committee/WUA/Do I/DC/PMU	1, 500, 000
		Administer land agreement forms with clear arrangements on how winter cropping will be done to ensure there is common understanding.	No of land agreement forms signed	Monthly		
13	Increase interferences in marriages	Conduct awareness meetings among workers and communities	No of awareness meetings conducted	Monthly	Irrigation Committee WUA DoI PMU	350, 000
		Development of and strict adherence to Code of Conduct for workers	No of workers who have signed codes of conduct	Weekly		
14	Increased Changes in hydrological regimes in the rivers	Ensure that the scheme obtains water right.	No of water rights obtained	Monthly	Irrigation Committee WUA DoI PMU	2,500,000
		Adhere to provisions in water right to, for example, maintain environmental flow requirements of 0.000228906m³/s.	Amount of water allowed to flow	Weekly		
		Improve irrigation and drainage operations to enhance water use efficiency.	No of canals that have been improved	Monthly		
15	Increased deforestation	Introduce efficient, accessible, and affordable cook stoves.	No of households using efficient	Monthly	Irrigation Committee WUA	800, 000
			energy saving stoves		DoI	

NO	IMPACT IDENTIFIED	RECOMMENDED ENHANCEMENT/MITIGATION/MANAGEMENT MEASURE	MONITORING INDICATOR	FREQUENCY	RESPONSIBLE INSTITUTION	ESTIMATED COST (MK)
		Establish tree nurseries and woodlots	Number of nurseries and woodlots established.	Quarterly	DC (DFO) PMU	
		Promote tree planting	No of trees planted and survived	Monthly		
		Sensitise and train WUA members and staff on catchment management	No of members trained and sensitized			
		Establishing 15 metres buffer zones of trees and grasses between the river and irrigated land to assist filter the chemicals before entering the river.	15 m buffer zone established			
16	Increased risk of flooding, water logging and salinisation of soils	Apply of organic matter to improve soil structure.	Area applied with organic fertilizers	Fortnightly	Irrigation Committee/DoI/WUA/DC(DADO)/PMU	1,000,000
		Apply recommended type and amount of chemicals and fertilisers.	Area applied with recommended type of chemicals and fertilizers	Fortnightly		
		Regularly maintain irrigation and drainage channels to improve seepage.	Number of channels regularly maintained	Weekly		
		Drafting of the operation and maintenance manual; and training of operators' weir maintenance and drafting of a Contingency Emergency Response Plan.	Number of O&M developed			
		Apply of organic matter to improve soil structure				
		Clear clogged channels to allow water to flow.	Length of channels cleared	Weekly		
17	Increased occurrences of waterborne diseases	Ensure an absence of stagnant water at the site by constructing proper drainage around the scheme and clearing blocked areas by the committee/WUA.	Length of channels cleared	Weekly	Irrigation Committee/WUA/DC (DEHO)/PMU	850,000

NO	IMPACT IDENTIFIED	RECOMMENDED ENHANCEMENT/MITIGATION/MANAGEMENT MEASURE	MONITORING INDICATOR	FREQUENCY	RESPONSIBLE INSTITUTION	ESTIMATED COST (MK)
		Promote good sanitation, hygiene, and use of mosquito nets in the camps and surrounding communities.	No of awareness meetings	Monthly		
18	Increased use of unregistered pesticides in the scheme	Training and awareness for farmers on harmful/banned and unregistered pesticides.	No of farmers trained approved pesticides	Monthly	Irrigation Committee/WUA/DC (DADO)/ PMU	550, 000
		Encourage farmers to buy approved pesticides and from registered suppliers.	No of awareness meetings	Weekly		
19	Increased risk of high sediment loads from flooding impacting on the irrigation scheme	- Constructing flood protection structures such as dykes, check dams and infiltration ponds to trap excess water during flooding. - Planting vegetation to trap sediments and improve seepage.	No of structures constructed. Area planted with vegetation	Biannual	DoF/PMU/DoI/DC	600, 000
20	Increased aquifer depletion	- Improve irrigation and drainage operations to enhance water use efficiency. - Enhance catchment conservation practices to increase percolation, reduce run off and enhance recharge	-Number of structures improved. -Area under catchment conservation	Quarterly	PMU/DoI/LRCO	500, 000
21	Diminished land and soil fertility / productivity	- Enhance soil and water conservation measures and farming such as mulching, box ridging, agroforestry etc. - Promote use of organic manure. - Develop and implement the Integrated Pest Management Plan. - Plant vetiver grass on contours and along all canals to stabilize them.	- Area under conservation -IPMP developed & implemented	Quarterly	LRCO/PMU/WUA	500, 000
<i>During demobilization phase</i>						
1	Loss of employment	- Timely sensitization and awareness to workers on the end of construction works - Pay terminal benefits to the workers	-No of meetings conducted/No of workers sensitized. -No of workers given terminal benefits	Quarterly	DC/Labour/PMU/DoI	500,000

NO	IMPACT IDENTIFIED	RECOMMENDED ENHANCEMENT/MITIGATION/MANAGEMENT MEASURE	MONITORING INDICATOR	FREQUENCY	RESPONSIBLE INSTITUTION	ESTIMATED COST (MK)
2	Loss of business opportunities	Timely sensitization and awareness to workers & community members on the end of construction works	-No of meetings conducted. -No of workers sensitized.	Once	DC/Trade/ABO/PMU	500,000
3	Increased risk of accidents	- Provision of PPE to workers - Conduct safety and health awareness	-No of workers provided with PPEs.	Regularly/ weekly	DC/WUAPMU	1,500,000
4	Increased generation of construction rubble/waste	- Designate specific places for the disposal of waste in consultation with the district council. - Development and implementation of a Waste Management Plan	Amount of wastes disposed in designated places	Weekly	DC/EDO/PMU	500,000
TOTAL						28, 028, 764.79 (USD 16,007.29)

Capacity Building Plan

The project integrates a comprehensive capacity-building strategy across both the construction and operation phases to ensure environmental, social, health, safety, and emergency preparedness among all workers and farmers. During the **construction phase**, the contractor is responsible for providing training on workplace induction, health awareness, emergency preparedness, and job-specific safety, including drills and simulations for fire, earthquakes, and other emergencies. Emergency response training includes induction, task-specific training (e.g., excavation safety), and the establishment of emergency teams. Real incidents such as near-misses or hazardous events are documented and used to improve future trainings.

In the **operation phase**, training continues on environment, health, and safety, covering fire safety, first aid, natural disaster response, hazardous material handling, and communication protocols. Drills and simulations are carried out regularly, and training content is updated based on lessons learned. All emergency exercises—including fire, evacuation, spill response, and accident drills—are conducted at least once a year, and outcomes are documented in formal reports (e.g., Exercise Minutes). These records inform corrective actions, improve response procedures, and guide revisions to emergency plans.

Capacity building in **crop pest management** focuses on integrated pest management (IPM), safe pesticide use, pest identification, and community surveillance systems. Training is delivered through farmer field schools and demonstration plots, with support from extension and digital advisory services to enhance resilience and timely response to pest outbreaks.

Conclusion and Recommendations

Conclusion

The Mwaiwathu Irrigation Scheme presents significant potential to enhance crop production, strengthen food security, and improve the socio-economic well-being of the target communities and surrounding areas. Potential positive impacts and their enhancement measures during both construction and operational phases are outlined in Figure 6.3, while anticipated negative impacts and corresponding mitigation measures are also detailed in the same figure.

An Environmental and Social Management Plan (ESMP) has been developed to address these impacts. The ESMP specifies potential impacts, recommended mitigation measures, implementation timelines, responsible institutions or individuals, and cost estimates. To ensure effective implementation, an Environmental and Social Monitoring Plan has also been prepared. This plan outlines the negative impacts, mitigation measures, monitoring indicators, frequency of monitoring, cost estimates, and responsible parties.

Successful project implementation will depend on strict adherence to the proposed enhancement and mitigation measures, as detailed in the ESMP and Monitoring Plan. By doing so, the project can maximise agricultural productivity, strengthen livelihoods, and deliver long-term socio-economic and environmental benefits to the community in a sustainable manner.

Recommendations

The following are the recommendations made from the environmental assessment.

- This safeguard instrument should be implemented in accordance with the established schedules and targets, and applied consistently throughout all phases of the project.

- Adequate resources must be allocated to facilitate the effective implementation of the measures outlined in this report.
- All recommended mitigation measures should be fully executed to avoid or minimise predicted negative impacts to the lowest possible level.
- A Supervision Committee should be formed, comprising representatives from the Phalombe District Council, Mwaiwathu Irrigation Scheme Irrigation Committee, and Project Implementation Committees. This committee will be responsible for ensuring that the provisions of this report are strictly adhered to by the contractor and all relevant institutions or individuals.

1. INTRODUCTION

1.1 The Project Background

This is an Environmental and Social Assessment Report for rehabilitation of Mwaiwathu Irrigation Scheme. The scheme is situated in Group Village Headman Nalingula, Traditional Authority Kaduya in Phalombe District. The scheme is surrounded by the following villages: Mpoto, Kamwala, Mitambo, Bakari, and Tayimu. Mwaiwathu Irrigation scheme is one of the schemes that were damaged by 2023 Tropical Cyclone Freddy. The project is being supported by the Africa Development Bank (AfDB) under the Climate Action Window. The project will be implemented by consortium led by Food and Agriculture Organization (FAO) with other members comprising of International Fund for Agricultural Development (IFAD) , United Nations Office for Project Services (UNOPS), and Ministry of Agriculture's Department of Irrigation (DoI). The implementation approach will leverage on consortium members' extensive expertise in irrigation infrastructure, national and local level transformative structures, integrated catchment management and extensive capacity building on the subject matter is envisaged to strengthen the collaboration.

The development objective of the project is to enhance climate change adaptation and resilience of at-risk communities impacted by Cyclone Freddy in Phalombe, through efficient water management, enhanced agricultural productivity, strengthened business models and inclusive social structures. The specific project objectives seek to rehabilitate and enhance irrigation management facilities; restore the micro catchment areas that perennially supply water to the irrigation schemes; support the uptake of climate smart and conservation agriculture practices, empower the farmers and their institutions; provide improved digital extension and climate advisory services; enhance gender equality; strengthen market models; and support wider communities members (especially women and youth) in environmentally sustainable complementary business ventures. The operation is envisioned to contribute to improved food and income security of the target end-beneficiaries and their adaptation to climate change.

This scheme experienced damage to its headworks and conveyance system (which mainly composed of delivery pipeline) and in-field water structures. The irrigation infrastructure damage reduced irrigable land from 65 hectares to 25 hectares. The initial assessment conducted by project consortium members in December 2024 and follow-up assessments and consultations in February through July 2025, noted that the delivery polyvinyl chloride (PVC) pipes were swept away and the remaining one were exposed to sun and as such were susceptible to damage. The assessment team also noted that there is high interest of people looking to take part in the irrigation farming even though the scheme is partially functional.

1.2 Rationale of the Project

1.2.1 Justification of the Environmental and Social Assessment Report

This environmental and social assessment report was developed in accordance with the requirements of the Environment Management Act (2017), Guidelines for Environmental Impact Assessment for Malawi of 1997 and AfDB's ISS 2023. The screening exercise established that the construction of the scheme would result into several positive and negative impacts. The screening exercise recommended for the development of the report. This report has identified and assessed the environmental and social impacts of the proposed rehabilitation of Mwaiwathu Irrigation Scheme project and proposed measures to manage the impacts during planning and design, construction and operation phase of the project.

In addition, this report was developed to integrate environmental, safety and social issues in the planning and implementation of the activities for the proposed project. It is also a requirement by the AfDB for proponents of projects such as irrigation scheme construction to prepare an Environmental and social assessment report before the actual final designing and actual construction works. Extensive social consultations with communities were undertaken to ensure that the alignments of structures agree with the various communities' wishes wherever is possible, while still providing protection. Adjustments to the designs will be necessary prior to tender stage considering any requirements emanating from consultations and social processes and from additional developments that might inevitably have occurred on the floodplains between when these designs were prepared and when they will be constructed.

1.2.2 Aim and Objective of the report

The African Development Bank (AfDB) classifies the project as Category 1, requiring a comprehensive Environmental and Social Impact Assessment (ESIA) along with key implementation documents: Environmental and Social Management Plan (ESMP), Stakeholder Engagement Plan (SEP), Emergency Preparedness and Recovery Plan (EPRP), and Pest Management Plan (PMP). These documents support project disclosure and implementation.

The main objectives of the report are to:

- Describe the nature and location of the proposed project, including details of the proponent, site spatial location with topographical maps, project costs, land size, and workforce demographics (gender and locality).
- Summarize key project activities during planning, construction, demobilization, and operation phases, covering rehabilitated facilities, machinery and construction materials (with sources), land tenure, waste generation estimates, and waste management approaches emphasizing waste reduction, reuse, recycling, and proper disposal.
- Present a brief description of the existing biophysical environment and socio-economic status of the project area.
- Review relevant legal and policy frameworks affecting the project, referencing key legislation such as the Environment Management Act, Energy Policy, Gender Policy, Land Acts, Water Resources Act, Public Health Act, Occupational Safety and Health Act, and agricultural policies.
- Identify and analyze environmental, social, and climate change impacts—both positive and negative—including potential grievances and conflicts, and assess existing grievance redress mechanisms at the local level.
- Propose an ESMP in tabular form specifying predicted impacts, mitigation/enhancement measures, budgets, and implementation schedules.
- Develop an Environmental and Social Monitoring Plan detailing monitoring activities, frequency, indicators, required resources, and responsible authorities.
- Conduct stakeholder consultations to involve key interested and affected parties in developing the ESMP, incorporate their views in the report, and provide a gender-disaggregated list of consulted individuals in the appendices.

1.3 Project Proponent

The project name is rehabilitation of Mwaiwathu Irrigation Scheme in Phalombe district. The project will be implemented by consortium led by FAO comprising IFAD, UNOPS, and Ministry of Agriculture's Department of Irrigation. The contact details of the project proponent are as follows:

Proponent Address	Name and	George Mvula Assistant FAO Representative - Programmes Food and Agriculture Organization of the United Nations Evelyn Court, Area 13/31 P. O. Box 30750, Lilongwe 3, Malawi Tel: +265 1 773 255 Cell: +265 998093589 Email: George.Mvula@fao.org
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1.4 Scope

This assessment report is being prepared specifically to address the environmental and social impacts of the project and to outline the necessary mitigation measures in accordance with the requirements of MEPA, AfDB and FAO.

1.5 Methodology for preparation of assessment report

The assessment was conducted to evaluate the potential environmental, socio-economic, cultural, and human health impacts both positive and negative of the proposed project. For beneficial impacts, enhancement measures were identified, while for adverse impacts, appropriate mitigation strategies were proposed to minimize harm. The Environmental and Social Assessment Report presented in this document was prepared in full compliance with the Terms of Reference (ToRs) issued by the Malawi Environment Protection Authority (MEPA).

The study was carried out in December 2024 and June 2025, using a combination of methodologies, including:

- Site visits to observe and document environmental and social conditions.
- Collection and laboratory analysis of soil and water samples at Bvumbwe Research Station.
- Professional judgment based on expert experience and technical standards.
- Stakeholder consultations with local communities, authorities, and relevant institutions.

These methods ensured a comprehensive and participatory approach to understanding the project's potential impacts. Figure 1 illustrates the assessment team collecting water samples during fieldwork. Figure 1 shows assessment team collecting water samples.

1.5.1 Literature Review

Literature review involved acquisition and review of related project documents, reports, maps, relevant drawings, policies and legislation. Literature review also involved reviewed of institutional arrangements for social and environmental management in Malawi to establish the optimal management of impacts caused by the project. The notable documents reviewed included African Development Bank's Integrated Safeguards System (ISS) 2023, MEPA's ESIA Guidelines (2011), FAO's Framework for Environmental and Social Management (FESM) 2021, project documents and EMA (2017).

The Environmental and Social Impact Assessment (ESIA) process in Malawi is governed by the Environment Management Act (1996, amended 2017) and operationalized through the Environment Management (Environmental Impact Assessment) Regulations, 1998. These regulations outline the legal procedures for conducting EIAs, including project screening, scoping, stakeholder engagement, report preparation, review, and approval. Projects such as

irrigation schemes are listed under Schedule I, requiring mandatory EIAs. The MEPA ESIA Guidelines (2011) complement these regulations by offering detailed technical guidance on report structure, sector-specific risks, cumulative impacts, and best practices for public consultation, ensuring compliance with national standards.

1.5.2 Site visits

The objectives of site visits were to observe and capture baseline data on the existing biophysical and socio-economic environment of the proposed project area. In addition, the visits provided an opportunity to consult stakeholders and senior government officials on their views regarding the proposed project and its potential impacts. The site visits which occurred in December 2024 and March 2025 also establish potential environmental and social impacts associated with the project through the analysis of the proposed project activities. The influence of these impacts on the baseline environmental and social characteristics of the proposed project area were determined. The environmental characteristics of the project area include biophysical (topography, geology, soils, climate, rainfall, water resources, flora and fauna) and social characteristics (demography, settlement, land administration and tenure, economic activities, infrastructures and services, water supply and sanitation, healthy and HIV and AIDS).

1.5.3 Professional judgement

The experts carried out in-situ analysis and assessments through direct observations of the prevailing environmental and social-economic conditions present in the project site.

Professional judgement was employed in the following:

- Identifying socio-economic impacts: This was undertaken by compiling a list of key impacts such as loss of land, settlement pattern, urban trees, social and cultural systems, water resources etc.
- Predicting environmental and social economic impacts: The environmental and social economic impacts were identified and their magnitude, probability of occurrence and duration was predicted.
- Determining impacts significance: The key activity was to evaluate the significance of impacts, that is, judgment about which impacts identified in the study are considered important and therefore need to be mitigated.
- Identifying mitigation and management options: This basically involved analyzing and making decision on what mitigation measures to be taken against the identified and predicted impacts. Wide ranges of measures have been proposed to prevent, reduce, remedy or compensate for each of the adverse impacts evaluated as significant.
- Socio-economic evaluation: Examination of the environmental and economic implications of social and environmental impacts and their solutions is a fundamental aspect of environmental and social impact study since it helps in formulating recommendations that are realistic and practical.
- Impact evaluation: The impacts on the environmental and social components were evaluated (using a scoring matrix) in terms of the following attributes: significance, duration, probability of occurrence, magnitude/extent and reversibility. Additional details regarding impact evaluation are provided in Section 7.3.

1.5.4 Stakeholder consultation and engagement time frame

Stakeholder consultations were a critical component of the ESMP, aimed at ensuring inclusive participation and transparency in the planning of the proposed project. Conducted between 4th

and 6th March 2025, the consultations provided a platform for stakeholders—particularly community members around the project area to express their views, raise concerns, and contribute to the project’s design and impact mitigation strategies.

The methodology included public meetings to share general project information and facilitate open Q&A sessions; focus group discussions with potentially affected individuals, disaggregated by gender, age, and social status; and key informant interviews with traditional leaders and other influential figures. A total of 50 participants were engaged, comprising 30 farmers (18 women and 12 men) and 20 government officials. These meetings were held within the project area to ensure accessibility and relevance.

The consultations served multiple purposes: informing stakeholders about the project, managing expectations, verifying environmental and social impacts, gathering input on compensation issues, and fostering a sense of ownership. The feedback collected was instrumental in shaping appropriate and locally accepted mitigation measures, reinforcing the project's commitment to participatory development.

1.6 Potential Users of the assessment report

This assessment report has been prepared for use by key stakeholders to be involved in the planning, implementation, management and monitoring and beneficiaries of the construction works of the Mwaiwathu Irrigation Scheme. The assessment report contains useful information on policies and legal framework to be adhered to, analysis of potential environmental and social impacts and suggested mitigation measures at various stages of the project activities. The potential users include:

- The Ministry of Agriculture
- Malawi Environment Protection Authority (MEPA);
- Phalombe District Council;
- National Water Resources Authority;
- Ministry of Labour;
- Ministry of Gender and Community Development.
- National Construction Industry Council.
- Contractors; and Local communities

1.7 Organization of the assessment report

The assessment report is organized in the following sections:

- Executive Summary;
- Chapter 1 - Introduction;
- Chapter 2 - Project Description;
- Chapter 3 - Legal and Policy Framework;
- Chapter 4 - Biophysical and Socio-economic Environment of the project area;
- Chapter 5 – Stakeholder engagement and grievance redress mechanism,
- Chapter 6 -Impact Identification and their management measures;
- Chapter 7- Risk and hazard Assessment
- Chapter 8-Environmental and Social Management and Monitoring Plan;
- Chapter 9- Capacity Building Plan;
- Chapter 10 - Conclusion and Recommendations
- References and Appendices
- Annexes

2 PROJECT DESCRIPTION

2.1 Introduction

The development objective of the project is to enhance climate change adaptation and resilience of at-risk communities impacted by Cyclone Freddy in Phalombe and Thyolo districts, through efficient water management, enhanced agricultural productivity, strengthened business models and inclusive social structures. The specific project objectives seek to rehabilitate and enhance irrigation management facilities; restore the micro catchment areas that perennially supply water to the irrigation schemes; support the uptake of climate smart and conservation agriculture practices, empower the farmers and their institutions; provide improved digital extension and climate advisory services; enhance gender equality; strengthen market models; and support wider communities members (especially women and youth) in environmentally sustainable complementary business ventures. The operation is envisioned to contribute to improved food and income security of the target end-beneficiaries and their adaptation to climate change.

2.1.1 Component 1: Climate Adapted Production and Productivity

The component aims at supporting the at-risk communities and farmers working on the targeted irrigation schemes to cultivate high value crops throughout the year using climate smart, environmentally friendly structures, and methods under secure land tenure.

Sub-component 1.1: Rehabilitate water management structures to restore functionality, enhance resilience and restore livelihoods. A total of 80 hectares irrigable area damaged during the Tropical Cyclone Freddy will be targeted for rehabilitation (as shown in figure 2.1),

- *Sub-component 1.2:* Restore and conserve 200 ha through interventions that deliver landscape restoration, decarbonization through agroforestry and regeneration, and sustainable land and water management.
- *Sub-component 1.3:* Improve farmers capacity and utilization of knowledge in high value crops production, productivity, and environmental management through precision agriculture including climate smart agriculture.
- *Sub-component 1.4:* Strengthen Mwaiwathu Water User Associations (WUAs) and a Catchment Management Committee (CMC) management structures to efficiently and sustainably maintain the irrigation facilities without the need for external investment.
- *Sub-component 1.5:* Promote secure land tenure for men, women and the youth, and persons with disability around irrigation schemes through awareness raising and land registration in line with the VGGT.

2.1.2 Component 2: Enabled digital information and climate advisory eco-system

The component focuses on deliverables related to enhancing access to information, extension, and early warning advisory services to the farmers to support real-time evidence-based decision making and facilitate adoption of climate adapted production and productivity.

- *Sub-component 2.1:* Build capacity of farmers and farmer organizations on the adoption of extension module under the Department of Agricultural Extension Services (DAES) Digital Application along the viable value chains and promotion of the use of Artificial Intelligence (AI) supervised and trained chatbots by the extension workers to deliver climate adapted advisories.
- *Sub-component 2.2:* Setup and operationalize Climate Change Adaptation and Agricultural Production Digital Information Hubs (CAP-DIH) at Naminjiwa EPA in Phalombe district
- *Sub-component 2.3:* Roll out a robust digital geospatial monitoring, evaluation, accountability and learning (MEAL) information system, including harnessing earth

observation remote sensing and drone systems for landscape restoration impact assessment.

2.1.3 Component 3: Conducive policy environment and strengthened community-based institutional capacity to sustainably adapt to effects of climate change

The component aims at creating a conducive policy environment and strengthened community-based institutional capacity to sustainably adapt to effects of climate change of the national, districts institutions, and farmer organizations in the catchment areas to adopt to innovative and modern business models and linkages to markets to attain economic, social, and environmental sustainability. The *component targets* 50 government extension workers, 150 community-based facilitators, 15 national and district irrigation officers, 15 farmer organizations and 3 WUAs.

- *Sub-component 3.1:* Strengthen capacity of national and district institutions in integrating climate change adaptation interventions in broader development strategies aimed at reducing poverty, strengthening social protection, enhancing food security and building climate resilience.
- *Sub-component 3.2:* Strengthen Farmer Organizations (1 cooperative, and 1 association) capacity to streamline their business models and effectively engage along the viable value chains through the establishment of strategic alliances, market linkages and development of bankable business and strategic plans
- *Sub-component 3.3:* Build capacity of the Mwaiwathu WUA in financial management and guiding them in setting up of contributory maintenance and repairs fund.
- *Sub-component 3.4:* Facilitate community-led Gender Transformative and Household Approaches for promotion of gender equality and inclusion in climate adaptation actions.

2.2 Project activities

The 2023 Post-Disaster Needs Assessment (PDNA) reported that Cyclone Freddy caused unprecedented destruction to Malawi's irrigation sector, with estimated damages of \$45.46 million across twelve districts, including Phalombe. Among the hardest-hit was the Mwaiwathu Irrigation Scheme, a vital agricultural facility whose infrastructure was almost completely destroyed. The cyclone drastically reduced the scheme's functional irrigable land after breaching key systems that previously enabled year-round production.

Located in Chibwana Village under Traditional Authority Mkhumba, approximately 5 km from Phalombe Boma along the Phalombe–Chitakale Road, the scheme has a potential irrigable area of 200 hectares. Of this, 140 hectares were initially developed, though only 42 hectares are currently in use due to damage. Mwaiwathu operates as a gravity-fed irrigation system, abstracting water from the Phalombe River through an intake shared with the Southern Region Water Board and Phalombe Rural Water Supply Scheme. The scheme supports 203 farmers—93 women and 110 men from Chibwana, Chingwalu, and Mwaleya villages. Established under the Agricultural Input Subsidy Programme (AISP), it once provided consistent water for crop irrigation but suffered the loss of its weir, a 36 m galvanized pipe section, a de-silting chamber, 130 distribution boxes, 120 hydrants, and 1,800 m of secondary uPVC pipeline during the cyclone. Despite these setbacks, farmers have implemented temporary repairs to sustain partial irrigation, underscoring the scheme's indispensable role in local food security, livelihoods, and market supply. Full rehabilitation is urgently needed to restore its capacity, secure agricultural productivity, and build resilience against future climate-induced disasters. Restoration efforts are now focused on catchment management and infrastructure rehabilitation, as illustrated in Figures 2.1 which include topographic maps at a 1:50,000 scale showing the affected areas and planned restoration zones. These maps are critical for guiding recovery interventions and ensuring sustainable rebuilding of the scheme.

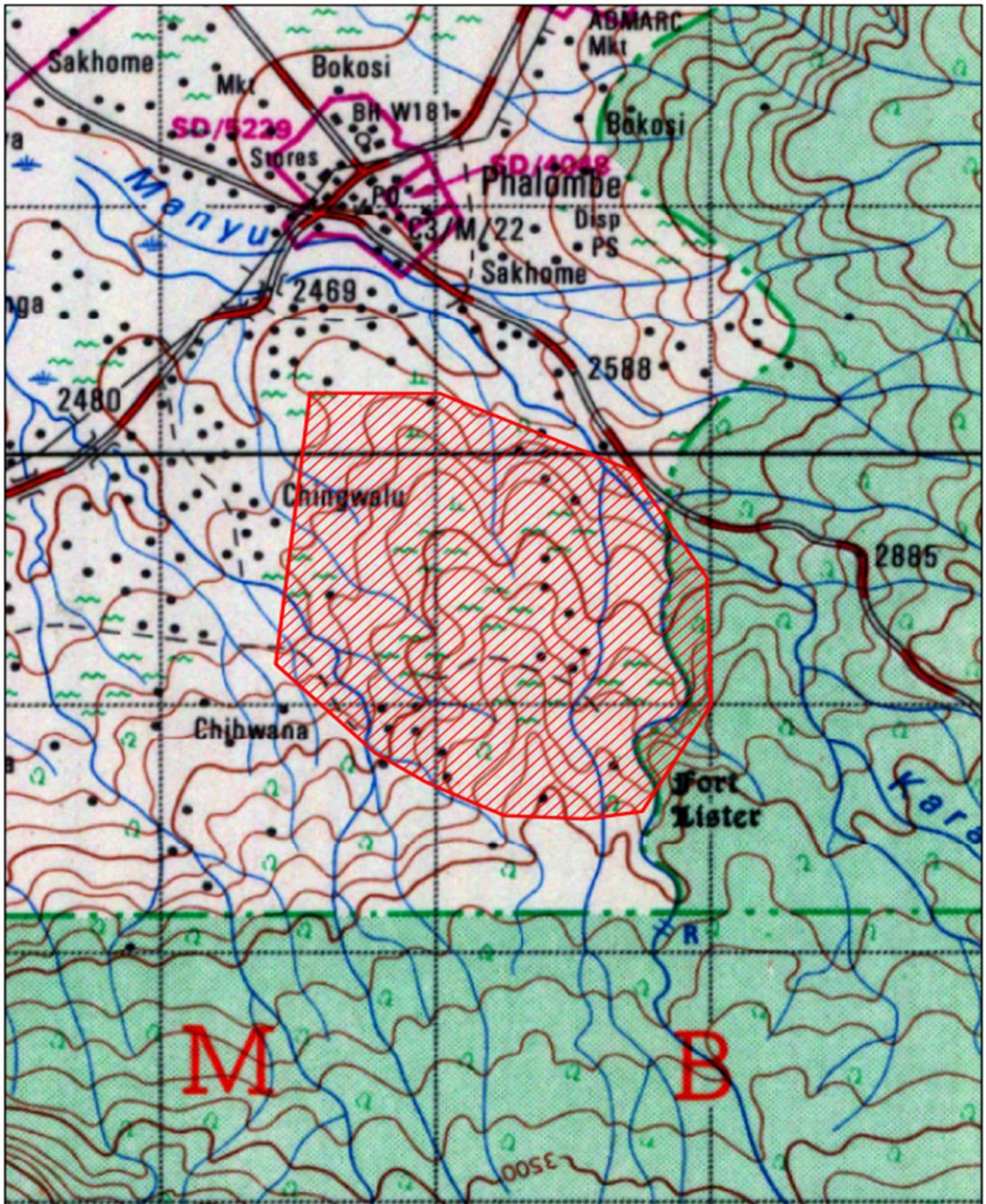


Figure 2.1.: Area (200 ha) surrounding the scheme where catchment activities will be concentrated

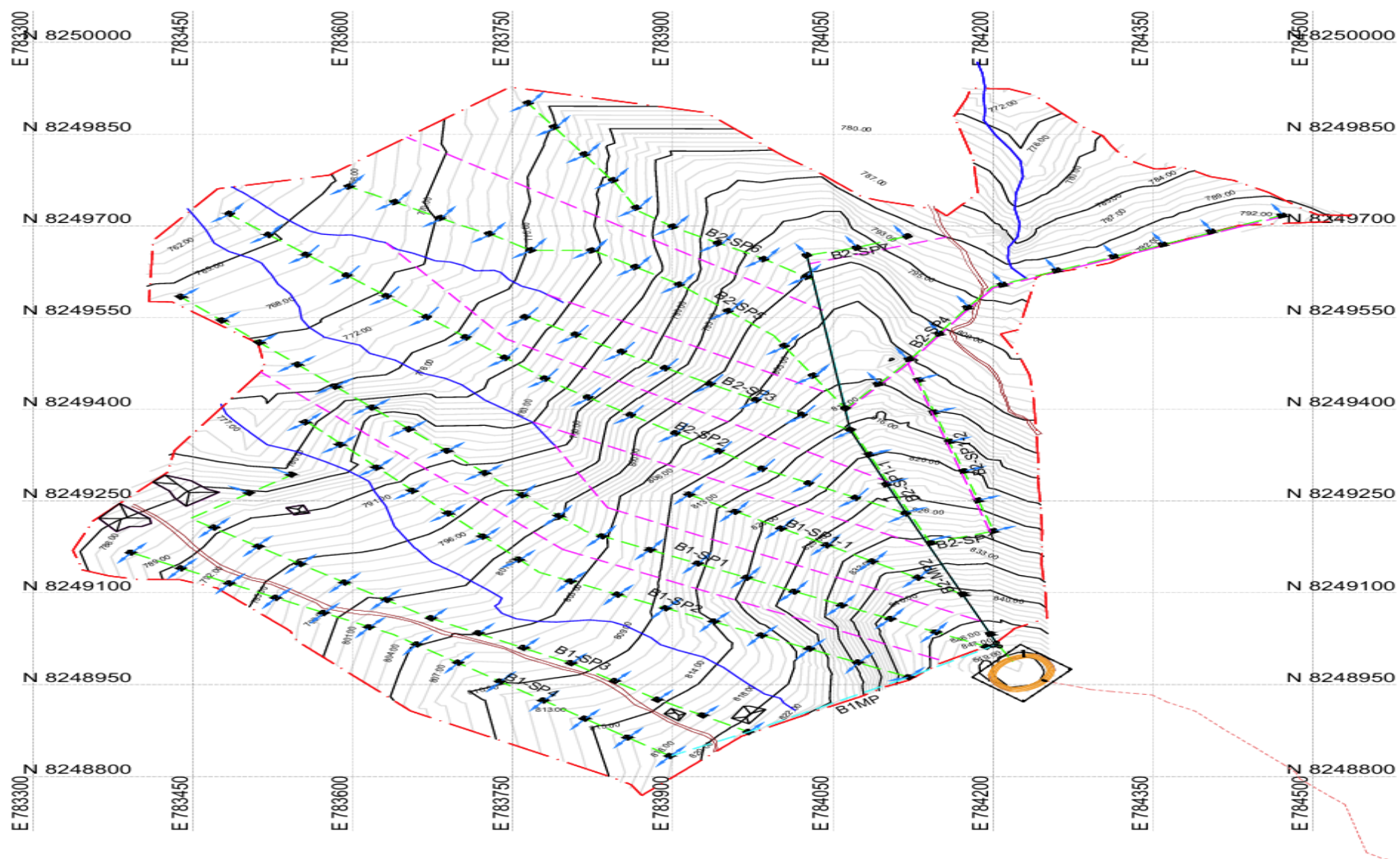


Figure 2.2: Mwaiwathu Scheme Layout

2.2.1 Design stage

Under this section, the irrigation infrastructure encompassing Headworks, water conveyance system, in-field water distribution structures and other structures such as gender-responsive water and sanitation facilities and warehouses for storing agricultural produce. Figure 2.3 and Figure 2.4 shows Mwaiwathu scheme layout.

2.2.1.1 Scheme components

Facilities for the irrigation system comprise the headworks in form of a weir, conveyance pipeline, irrigation distribution network and drainage system. The summary of major irrigation components are presented below.

2.2.1.2 Headworks and Spillway

The weir is a small gravity dam; constructed in concrete. Water is abstracted and guided to the conveyance system. Since the river section is relatively narrow, the weir spillway crest and intake structures will occupy by large the available space, allowing only for side retaining walls which will guide the river flows while retaining the excavations formed. The main design requirements for the design of the weir dam can be summarized as follows.

- To be able to abstract the required flows; for both irrigation and domestic water supply
- To avoid clogging the intake with gravel, pebbles or any other debris;
- To avoid coarse sediment entering the diverted flow conveyance system;
- To ensure stability against hydrostatic and sediment load and withstand the impact of rolling boulders and coarse sediment.
- To be simple and require a minimum amount of maintenance.

An intake with bottom racks, comprises of the following main components:

- The overflow spillway, which blocks the river providing an overflow water level sufficient for the required water abstraction at the full range of river flows;
- The sloped intake channel, formed on the dam crest and covered by an inclined rack, which withdraws the whole or part of the overflow and conveys it to the forebay tank;
- Upstream and downstream protection of the excavated riverbed with concrete slabs and riprap against high flow velocities

The spillway structure for the weir is a frontal concrete spillway with vertical upstream and ogee shaped downstream faces. The crests of the retaining walls left and right of the proposed dam are set at an elevation sufficient to sustain the flood flows. Figure 2.3 and 2.4 shows Mwaithu intake and weir designs.



Figure 2.3: Mwaiwathu intake

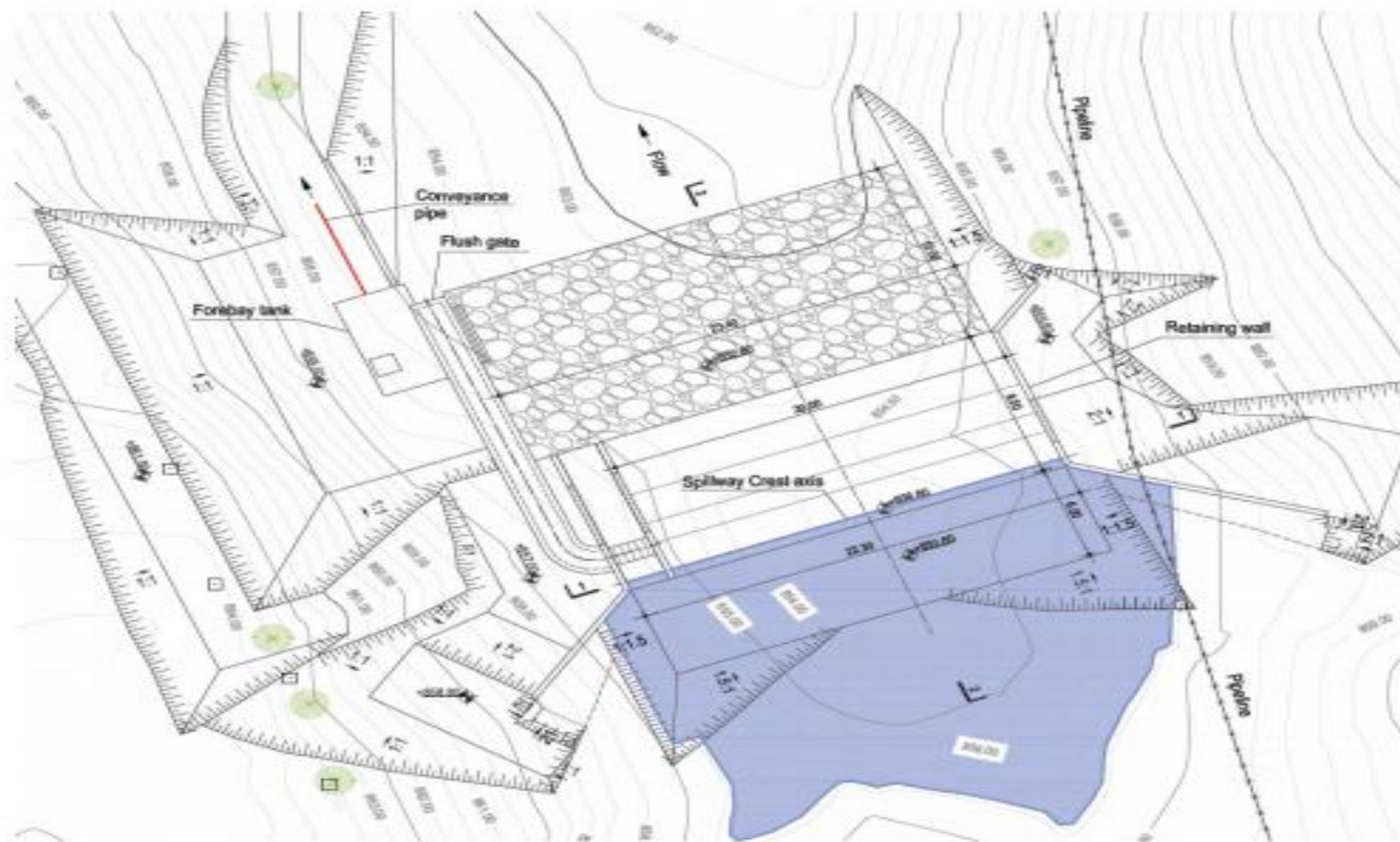


Figure 2.4: Mwaiwathu Weir layout

2.2.1.3 Conveyance system

Water is conveyed from the Phalombe river via an existing 1km long GI and PVC pipeline, 200mm diameter conveying 40 l/s to an existing night storage reservoir. The conveyance is in good condition, no leakages and well supported and anchored. There is a section of the conveyance line which has PVC pipes to be replaced 6 GI 200mm pipes. The pillars supporting the 200mm GI pipe are also in good condition with solid bases (Fig 2.5). No maintenance works for pillars will be required.



Figure 2.5: Mwaiwathu 200mm IG pipes Conveyance line

2.2.1.4 Night Storage Reservoir

There is an existing night storage reservoir which allows for water abstraction period of 24 hours from the intake. The capacity of the reservoir is 2,700 m³ (42m x 42m x 1.5m) enough to satisfy daily scheme requirements. Minor works have been proposed to be done at the reservoir including desilting, replacement of the intake pipe, lining with HDPE membrane and a wire fence for access. Lining with HDPE will prevent seepage losses, and a fence will ensure the safety of the community, particularly the kids. The area around the reservoir was surveyed, and drawings and BoQs for the fence were created in accordance with the recommended specifications. Figure 2.6 shows cross section of the night storage reservoir at Mwaiwathu.



Figure 2.6: Existing Night Storage Reservoir

2.2.1.4 Irrigation System

Determination of pipeline orientation and alignment is based on the general relief of the area as observed from the topographical map which was produced from the engineering survey data. The layout of the irrigation scheme is produced by following some points which are applicable to gravity-fed system. Irrigation system consisting of intake, conveyance, distribution, field application and drainage should consider the topography.

- Pipe gradient is down the slope to allow for gravity flow
- Pipes to generally be positioned along natural crests
- Drains to be designed in such a way that excess water can be easily drained away from the scheme
- Pipeline to convey water from higher to lower elevations through gravity
- Management of system should be considered for the canal network design, and a tertiary block will usually be about 25 to 30ha in area
- Field canal should not be longer than 1km to avoid excessive losses by seepage

The system at Mwaiwanthu is furrow and basin field system which will require farmers to construct field canals and field drains. Irrigation will be done via hydrant. Gate valves will be used to manage the flow of water into the field via receiving chambers, which will help disperse energy and prevent scouring around the offtake point.

2.2.1.5 Hydraulic Structures

Hydrant Chambers: Hydrants in surface irrigation systems regulate and evenly distribute water to different sections of the field. They control water flow from the tertiary pipeline, ensuring uniform distribution across furrows or basins. They often have adjustable valves to control flow. They are essential for efficient water management and optimal crop production in surface irrigation.

Factors Considered for hydrant chamber designs:

- Design Interpretation: Ensure the design is easy to understand and implement.
- Operational Flexibility: Design for flexibility in operation and maintenance.
- Cost: Consider the cost of materials, installation, and ongoing maintenance.
- Maintenance: Plan for easy access to valves and other components for maintenance.
- Water Pressure: Avoid high water pressure in the system.
- Pipe Routing: Minimize the length of the pipes and avoid unnecessary pumping.
- Number of Appurtenances: Minimize the number of appurtenances (gate valves, check valves, etc.)
- Water Velocities: Avoid very low or high velocities in the pipes.

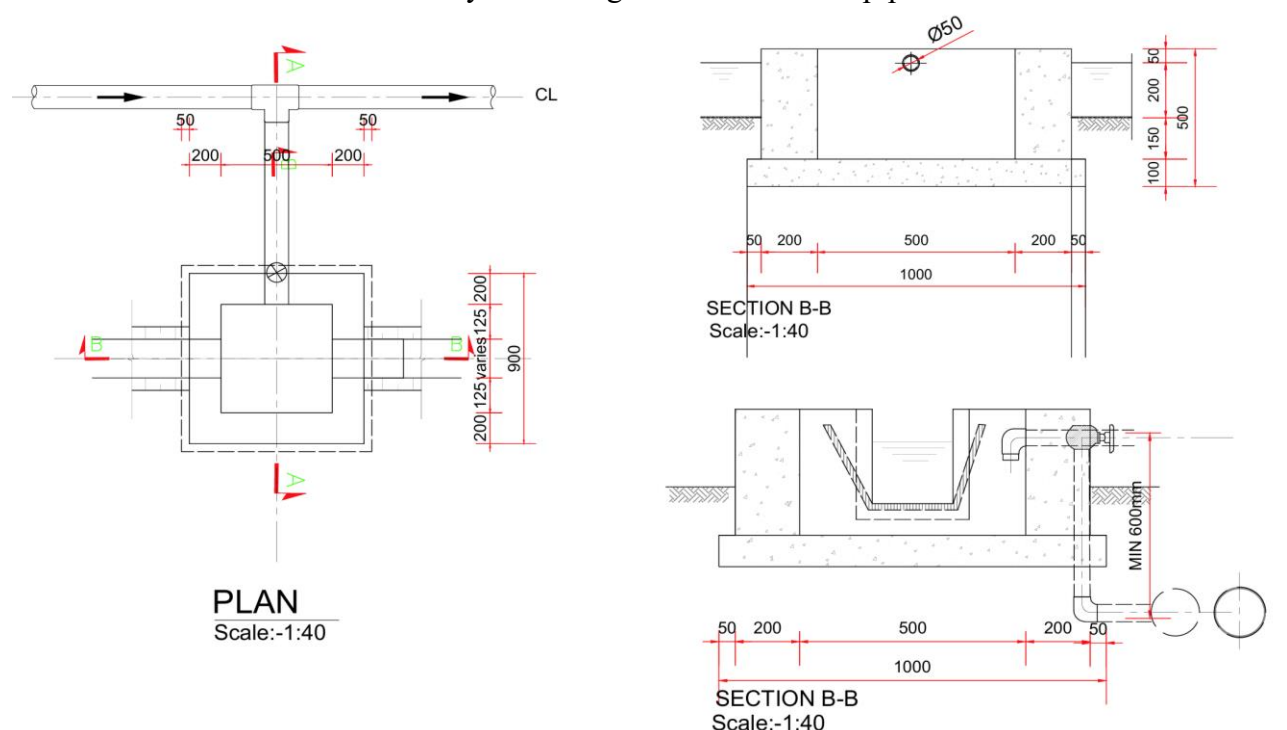


Figure 2.7: Hydrant Chambers

Pipe Capacity Review: The pipe capacities were reviewed following a recalculation of the crop water requirements and adjustment to the irrigation schedule. The pipe capacity adjustments are presented below (Table 2.1):

Table 2.1: The pipe capacity adjustments

Pipe ID	Original Capacity (l/s)	Original Size (mm)	Revised Capacity (l/s)	New Size (mm)
Delivery Pipe	252	160	69.4	400
MP1	126	160	30.8	250
MP1-SP1	Not Available	110	9.4	160
MP1-SP2	Not Available	110	3.5	90
MP1-SP3	Not Available	110	6.4	110
MP1-SP4	Not Available	110	5.0	110
MP2	126	160	38.6	250
MP2-SP1	Not Available	110	4.6	110
MP2-SP2	Not Available	110	7.4	160
MP2-SP3	Not Available	110	2.7	90
MP2-SP4	Not Available	110	4.5	110
MP2-SP5	Not Available	110	5.1	110
MP2-SP6	Not Available	110	2.7	90

Washout Valve chambers: Washout structure has been incorporated at the end of each pipeline in the system. It will be used to clear sediments or debris by opening the butterfly valve. The sediments will be ejected through the drains that will be connected to the nearest drainage channel or river

Culverts: Culverts will allow water to flow under obstructions like roads. They manage water flow, prevent flooding, and maintain the system's efficiency. They're crucial for controlling water current and acting as bridges for traffic.

Drainage System: The scheme has well-protected natural drainage channels which will be ideal to drain the scheme of excess water. Farmers will be required to construct field drains connecting to these natural drains.

2.2.1.6 Scheme Roads

The scheme has only one access road leading from the S147 road to the scheme office/reservoir area. The road is 4m wide with side drains. The road will require grading and gravel fill in some sections and removal of rocks on a section near the main road. Pipe culverts will be required on 1 section at the marketplace

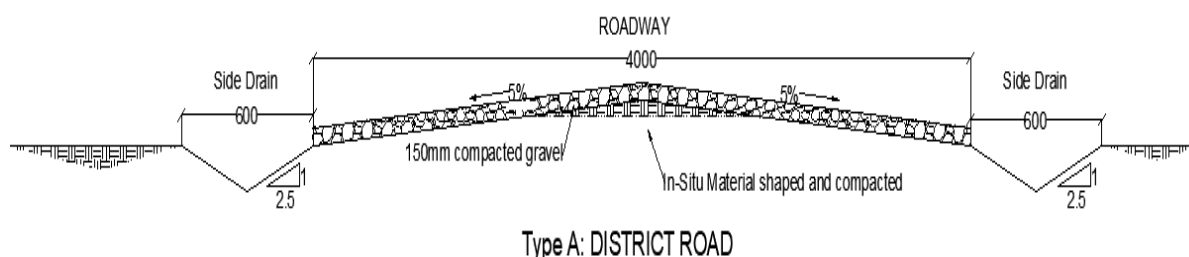


Figure 2.8: Scheme roads designs

2.2.1.7 Sanitary Facilities

The farmers have proposed the renovation of their scheme-building offices. The renovation includes installing window glasses, window handles and stays, painting the walls, and

replacement of exterior and interior doors and installation of solar lighting. These offices are used to store farm inputs, WUA records and host meetings and other administrative stuff. The current offices are out of date and lack electricity. The scheme building is designed in a way that can be used as the Engineer's office during the construction and as an administrative office thereafter. The building will have sanitary facilities segregated by gender and solar lighting. The facilities in the building will be friendly to persons with disabilities.

2.2.2 Formation of committee responsible for management, operation and maintenance of the irrigation.

Formation of committee responsible for management, operation and maintenance of the irrigation. The existing Water User Association (WUA) will be responsible for the operation and maintenance of the structure. The committee will ensure:

- i coordination between the communities and consultant and contractor during the construction phase
- ii Issues of land and environment are properly handled; and
- iii There is proper management of the irrigation scheme including carrying out maintenance work after the project has phased out, among other functions.

Operation and maintenance of the irrigation scheme is the responsibility of the Water Users Association (WUA). Operation and maintenance manual will be prepared. The protection facilities (concrete key, apron, handpicked stone rip rap) have been incorporated in the designs in order to secure the stability of weir structure to avoid weir breakage. Erosion control was at the core of the design both at intake and in the field, sluice gates have been allocated to flush sediments, scour gate has been incorporated in the designs, the intake box has been designed to be sediment free and washout chamber has been included in the conveyance to flush away sediments. In addition to design consideration, Catchment Management Interventions are being implemented to control siltation and catchment management plans were developed to guide the processes.

2.2.3. Construction Phase

The planned construction works at Mwaiwanthu Irrigation Scheme will involve upgrading the headworks (protection rails), Night Storage Reservoir (NSR), in-field water distribution structures, access roads, and drainage systems. The scheme's main structural challenges include damaged offtake weirs and deterioration of the primary water delivery system. Rehabilitation of the main access bridge is also required. Currently, local residents rely on shallow wells and the stream for water supply; therefore, the project will include drilling boreholes to provide safe drinking water.

Site preparation activities will include shrub clearing and ground levelling. Excavations, haulage, backfilling, and compaction will be the main activities during construction of the proposed structures. Haulage of earth materials especially gravel within the vicinity of the project area and systematic placement of the materials in layers and compaction will form part of the major civil works. Haulage of rocks for masonry construction and other materials such as sand and cement will also form part of the major masonry construction works.

The main activities for this phase are:

a. Site Assessment

The major activities during site assessment include assessment of existing services, location of structures, access roads, slope, etc. This will inform where construction camp, stockpiles, if services need to be relocated.

b. Mobilization

The major activities undertaken during mobilization are those related to the recruitment of construction workers; establishment of the contractor's site office; construction of five toilets for both male and female workers and storage for materials; mobilization of construction equipment and machinery (Excavator, Backhoe loader, Tipper, Low bed Truck, Concrete mixture, Roller Compactor and De-watering pump) ; Drilling of borehole and procurement of construction materials. (e.g., stone aggregates, sand, cement, gravel, etc.). Traffic Management Plan will have to be developed and included in the C-ESMP.

c. Excavation, filling, and compaction

To ensure stability, the structures have been designed in such a way that they rest on a stable foundation the depth of which will be guided by the results of the soil surveys to be conducted on site. The excavation of the cut-off trench would extend into the stable base to ensure that excavations are stabilized. Relief wells and water pumps (which are part of dewatering mechanisms) shall be provided to stabilize the foundation trenches should there be an accumulation of groundwater. Backfilling will start with the cut-off trench in layers until the base of the entire foundation has been reached. In an event that bed rock is encountered during excavation of the foundation, the rock surface will be cleaned with wire brush and all fractures sealed with cement grout before backfilling commences to avoid seepage.

Compaction will be done by compactors to help in making the area suitable for further construction. This one would only be done at optimum moisture content that is when the material can be rolled to a pencil thickness without breaking and/or sticking to any tool used for compaction). If material is dry, moisture would be added using watering cans or water tanker. Construction loaders would be used to remove the debris from the ground. Debris would be removed and taken away so that the area is completely cleared off the debris. Ideally Construction materials such as bricks, stones, cement, and sand will be sourced locally.

d. Construction of the main components of the irrigation scheme

According to the design report, the key infrastructure to be constructed during the construction phase of the project includes, water intake, conveyance pipelines, distribution canals and infield roads. The construction of civil works of the proposed project infrastructure will take place during this phase of the project. The construction phase is expected to take approximately twelve months. During the construction phase, the project is expected to employ approximately 100 employees, of whom 50 will be unskilled, 30 semiskilled and 20 skilled. The contractor will have a campsite where workers will be accommodated. Deliberate provisions will be instituted to employ locals where required skills are locally available. The workers from the surrounding villages will be staying in their houses. The main activities under construction phase shall include but not limited to the following:

- Clearing of access roads and paths where required.
- Improvement of existing roads where necessary
- Excavation and stockpiling of excavated materials (gravel and stone aggregate).
- Cordoning the construction site; and
- Fencing the area within, which access will be limited to construction workers.

During civil works, excavation or use of machinery will be undertaken where there is adequate space at a particular construction site. The use of human labour will be considered for small works and where space is a hindrance. It is expected that some machinery will be required during the construction of the conveyor structure, main and secondary canals and main drainage structures. This will be due to large earth volume to be moved. Choice will therefore be made for the proper equipment required for the execution of the relevant work.

(e) Creation of borrow pits

During construction works borrow pits will be created as the contractor will be seeking for gravel in other areas away from the Scheme. The sites earmarked for borrow pits must be by approved the district councils prior to establishment and after use. All the borrow pits created by the contractor must be backfilled before the contractor leaves the sites. To achieve this the contractor will be required to conduct progressive rehabilitation of borrow pit.

2.2.3 Demobilization phase

After the construction works are completed, some of the activities to be carried are: Clearing of debris/ waste from the site; Removal of project equipment and machinery from the site and disposing them; Rehabilitating of borrow pits; Planting of trees in areas where they were removed; and demobilization of any excess labor force.

2.2.4 Operation and Maintenance Phase

A number of activities will be undertaken during the operation and maintenance phase including the following:

a. Demarcation of plots and clearing the land

This will involve the demarcation of land into plots and clearing the land of existing vegetation. Plots that have never been cultivated before will have a wide variety of perennial grass and herbaceous plants.

b. Cultivating the ground

Tilling the ground enables compost to be incorporated into the soil where plant roots can access the nutrients. Continuous irrigation carries the smaller particles of soil down to a level where they settle eventually forming a pan, which interrupts drainage and root penetration, hence cultivation of the ground makes the soil loose.

c. Planting of crops

The type of crops to be grown will depend on several issues. These include soil types, demand on the local market, climatic conditions, among others. The soil conditions will be corrected by applying lime where soils have a lower pH.

d. Making compost

Farmers will be trained in making compost to enhancing and productivity and increase crop production. Application of compost can start before any seed is sown. The bulk of compost is made of materials cleared from gardens, swept up from around the house or litter from crop. Each type of waste material can be added in various layers, which are mixed when the heap is turned. The decomposition process is quickened, and nutrients are increased by adding droppings from chickens, goats, rabbits, or cattle to the compost. Good compost takes 6 - 8 weeks to mature.

e. Applying fertilizer

In addition to compost, application of fertilizer also improves crop production. This can be in the form of basal dressing followed by top dressing. The farmers will be trained on fertilizer application and effects of continuous fertilizer application such as destruction of soil texture. Farmers may choose to use both manure and fertilizers to enhance production and manage the soils.

f. Controlling pests and diseases

Different methodologies will be used to control pests and diseases in the irrigation scheme. These will include: the use of 'Bury or Burn' of plants attacked by pests and diseases, practicing crop rotation to reduce the transfer of pests and diseases, use of chemical sprays according to manufacturer instructions, Use of Integrated Pest management (IPM), Use of organic pesticides and use of biological pest/disease control method among others. The use of chemicals will be

a last resort after other methodologies has failed. The scheme will develop and implement a pest management plan.

g. Cleaning of structures

To ensure sustained usage of the irrigation scheme, the Water User Association (WUA) will be working with the community leaders by among other things ensuring that the structures are taken care of by performing certain duties that will be assigned to the Maintenance Sub-Committee and Catchment Management Committee during commissioning. The WUA members will be trained on how to take care of the scheme and supporting structures including headworks, pipelines, canals, distribution boxes. All structures in the irrigation system starting from headworks to the scheme command will be kept clean and ensure that they do not keep stagnant waters. This will be done by doing the following:

- i. Install galvanized steel trash rack on the top of intake box to prevent the inflow of the debris or trash.
- ii. Opening of silt flashing gates at the intake
- iii. Put screens in strategic areas in the canal for easy removal of debris.
- iv. Opening of washout valves located at the lowest points in the pipeline system
- v. Ensure farmers are trained in inspections of structures and conduct routine inspections.
- vi. Clearing blockages and debris from the structures on time
- vii. Sensitizing farmers on proper waste management
- viii. Designating an area for temporally storage of waste

To prevent sedimentation in the intake, washout structure has been incorporated at the lowest point of the pipeline system. It will be used to clear sediments by opening gate valve placed in the chamber occasionally. The sediments will be ejected through the drainpipe that will be connected to the nearest river.

h. Harvesting of crops and storage

The project will adopt the farmer company model as a commercial vehicle to drive livelihood transformation among farmers. A key focus will be on reducing post-harvest losses to maintain the quality and value of agricultural produce. To this end, warehouses will be constructed at Mwaiwathu, serving both as drying and handling facilities to reduce impurities and spoilage. Beyond loss reduction, these warehouses will function as aggregation centers, attracting offtakers and enhancing the bargaining power of farmers and their companies. Harvesting will be done at crop maturity to preserve quality. Highly perishable crops will be promptly transported to markets, while crops meant for household consumption will be used before deterioration. Farmers will also be encouraged to reserve adequate food stocks for their families to ensure food security and improved nutrition.

2.3 Implementation Arrangement

The Project Implementation Team as the project management unit answerable to the AfDB has the role of ensuring that all the Environmental and Social Safeguards are implemented to satisfy the funding conditions. This will include conducting inspections and monitoring activities, as well as reviewing monthly and incidence reports from the Contractor. Additionally, the PMU has the right of entry to investigate suspected or reported incidences. Refer to Table 2.2 for roles and responsibilities.

The project will be implemented through the consortium led by FAO with other members comprising of IFAD, and UNOPs.

Table 2.2: provide key roles and responsibilities to consortium members.

#	Consortium member	Role and responsibilities
1	Food and Agriculture Organization (FAO) – Lead Agency	Provide overall leadership, coordination, and project management. Ensure harmonization across consortium partners and alignment with project goals. Lead on implementation of environmental and social safeguards, capacity building, and monitoring & evaluation. Facilitate policy dialogue and knowledge sharing.
2	International Fund for Agricultural Development (IFAD)	Lead the development of irrigation-level farmer organizations. Support capacity building in market access, agribusiness development, and value chain integration. Facilitate linkages between farmer organizations and service providers, including financial institutions and offtakers.
3	United Nations Office for Project Services (UNOPS)	Provide technical guidance and oversight for the design, construction, and supervision of irrigation infrastructure. Provide technical guidance and oversight for the design, construction, and supervision of water and sanitation, warehouse infrastructure. Ensure adherence to international engineering and construction standards. Oversee procurement and contract management related to infrastructure works.
4	Ministry of Agriculture's Department of Irrigation (DoI)	Lead on implementation of all engineering-related aspects of the project in line with national standards. Provide policy guidance and regulatory oversight to ensure compliance with Malawi's laws and regulations. Support coordination with line Ministries and departments, district-level authorities and local irrigation committees.

FAO will be a lead partner vested with responsibility of catchment management practices, procurement of services and goods for the project, development of environmental and social safeguarding instruments and its implementation. 2022 FAO's Framework for Environmental and Social Management in addition to 2023 AfDB's ISS and MEPA will be main guiding E&S policies during implementation of this project. 2022 FAO's Framework for Environmental and Social Management defines the transformation to more efficient, inclusive, resilient and sustainable agrifood systems that lead to better production, better nutrition, a better environment, and a better life, and leave no one behind. Better production will involve ensuring that consumption and production patterns are sustainable and will be achieved by making food and agriculture supply chains more efficient and inclusive at the local, regional and global levels, and building resilient and sustainable food systems in a changing climate and environment. Better nutrition will contribute to the goal of ending hunger, food insecurity and malnutrition in all its forms, through promoting nutritious food and increasing access to healthy diets. Achieving a better environment will involve protecting and restoring terrestrial and marine ecosystems and promoting their sustainable use, and combating climate change through more efficient and circular food systems. Inclusive economic growth that reduces inequalities, for example, between urban and rural areas, high and low-income countries, and women and men defines the better life.

To ensure successful implementation of this Environmental and social assessment and its ESMP herein the report there is a need for concerted efforts from various key stakeholders. Presented in Fig 2.9 is possible structure of this institutional organization.

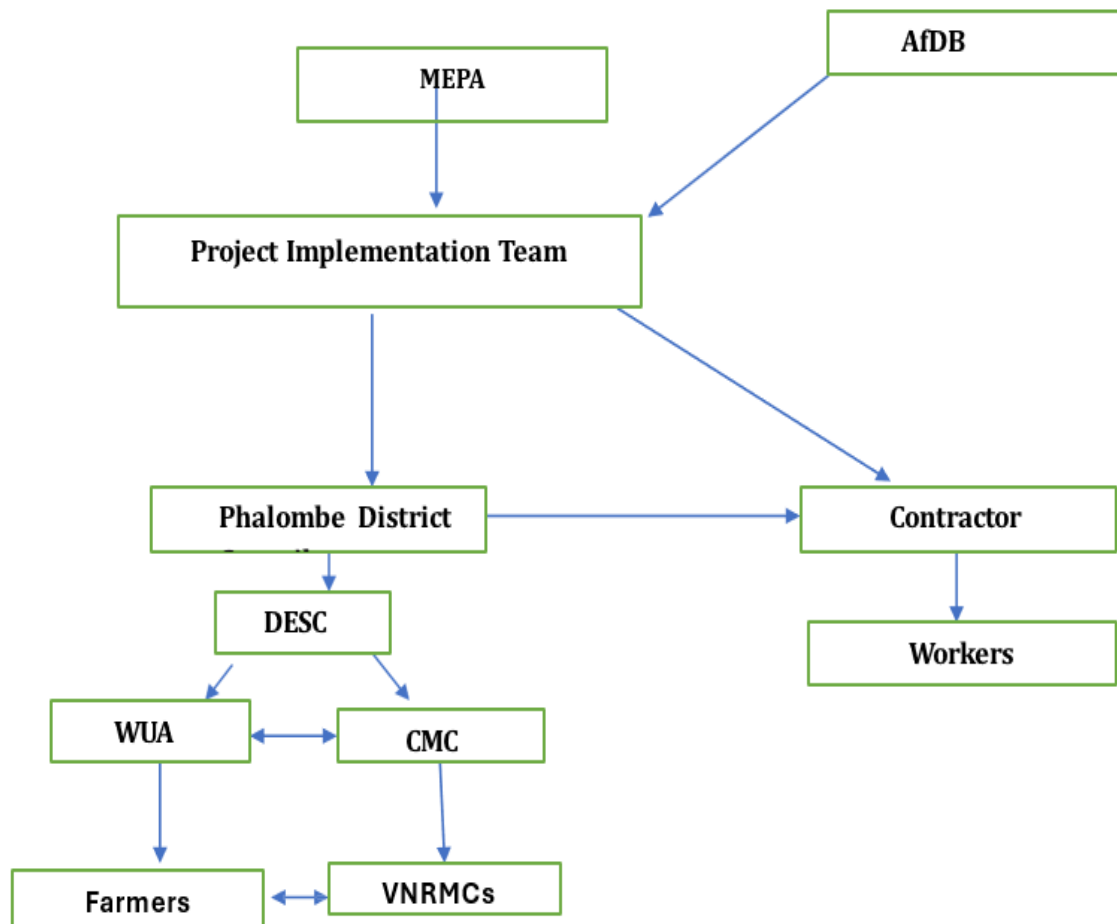


Figure 2.9: Illustrates the possible structure of this institutional organization

The key stakeholders include MEPA, Africa Development Bank, The Project Implementation Team, Phalombe District council, Water User Association (WUA) and Contractors and the Farmers among others. Figure 9 illustrates the possible structure of this institutional organization and details of the responsibilities of each of the key players are:

The Project Implementation Team (PMT) is ultimately responsible for compliance with all conditions of report approval. The PMT shall:

- Ensure that the assessment report approval and all required approvals and permits have been obtained prior to commencement of construction activities on the site;
- Ensure that MEPA has been notified of the date on which construction activities will commence prior to commencement of any activity;
- Ensure that all conditions of approval are complied with;
- Appoint the required specialists to input into the planning and design phase;
- Ensure that the recommendations of the report are included in the construction works contract;
- Ensure that operation of the project is undertaken in line with the requirements of the operational phase report; and

- Continuously seek to improve any negative environmental and social impacts, which result from the operational phase.

Contractors: The construction work team will include one Contractors who shall perform the following roles:

- Ensure implementation of all applicable environmental mitigation measures during all works on site;
- Ensure that all workers, suppliers, agents etc. are fully aware of the environmental requirements detailed in this report;
- Conducting capacity building for the workers in relation to the implementation of the measures proposed in this report;
- Ensure that the works on the site are conducted in an environmentally controlled manner;
- Inform the project through Phalombe District Council and MEPA should environmental conditions on the site deteriorate, e.g. dumping, pollution, littering and damage to vegetation etc.;
- Carry out instructions issued by Supervising Engineers and other relevant institutions including MEPA, required to comply with this assessment report; and
- Order the removal of person(s) and/or equipment not complying with the Environmental and social assessment report.
- Engage E&S Safeguard Specialist who will be responsible for monitoring and reporting implementation of C-ESMP.

All Staff: All construction and operation and maintenance employees and visitors must receive site induction of the requirements of this assessment report prior to starting work on the Project. The induction will include but not limited to the environmental and social parameters depending on their involvement in the Project.

The District Council and DESC. The District Council's Environmental Officer must work with the project in monitoring the implementation of this assessment report. Water User Association (WUA), Catchment Management Committee (CMC), Village Natural Resource Management Committee (VNRMC) and Farmers; Work with contractors to implement some the activities highlighted in this report including planting of trees, vetiver grass, supervise the contractor in the implementation of activities highlighted in this report.

Malawi Environmental Protection Authority (MEPA) is the regulator for the protection of environment. It has the responsibility of reviewing this report and issuing an approval to proceed with the development. MEPA has officers who will conduct inspections and monitor compliance with the implementation of the report during the construction and operation phase of the project. This assessment report has also provided other stakeholders who have monitoring roles as provided by the legal framework for Malawi. These stakeholders have the right of entry, and the Clerk of Works will be required to record and implement their recommendations.

2.4 Land ownership and land tenure

The land earmarked for the proposed project belongs to the community members and is owned under customary land tenure of Malawi Customary Law and the Malawi Land Act of 2016 and is customary land in which land is owned by the state and is held in trust by the Traditional Authorities (TAs) who in turn gives Village Heads the responsibility for administration and allocation of land to family heads for their right to use land. Scheme owners allow non-

landowners access to the land during the irrigation season through paying of annual rental fee. The land is handed back to the landowners for their rain-fed cultivation. However, the non-landowners are members of the schemes. The project will facilitate development and signing of land use agreements between landowners and scheme committee and chiefs.

2.5 Capacity Building

The successful implementation of the Environmental and Social Management Plan (ESMP) for the Mwaiwathu Irrigation Scheme depends heavily on the capacity of implementing stakeholders, particularly at the district and community levels. Capacity building involves equipping individuals with the knowledge, skills, and access to information necessary to effectively develop, implement, and monitor environmental and social safeguards. The assessment identified gaps in understanding and application of these safeguards among key actors, especially District Council staff and frontline personnel. To address these gaps, targeted training programs are essential. These should be led by FAO, with technical support from the African Development Bank (AfDB) and the Malawi Environment Protection Authority (MEPA). The training will focus on enhancing practical knowledge of ESMP implementation, monitoring, and reporting, thereby ensuring that all stakeholders are well-prepared to manage environmental and social risks and contribute to the scheme's sustainability.

3. LEGAL AND POLICY FRAMEWORK

This chapter presents relevant policies, legal and administrative framework within which this assessment report was prepared. Legislation, policies, and instruments exist that support environmental and social management of the project approvals.

3.1 Policy Framework

3.1.1 The National Environmental Policy (2005)

The overall goal of the policy is to promote sustainable social and economic development through the sound management of the environment and natural resources. The policy promotes the rights of every person to a clean environment while also at the same time it advocates that every person has a duty to promote sustainable utilization and management of the environment and natural resources. The policy recognizes the need for trade-offs between economic development and environmental degradation and calls for the use of EIA and environmental monitoring as tools for minimizing impact of development on the environment. The rehabilitation and operation of Mwaiwathu Irrigation Scheme will therefore integrate the principles of the environmental policy so that it is carried out in an environmentally responsible manner.

3.1.3 National Agriculture Policy (2016)

The policy goal is to achieve sustainable agricultural transformation that will result in significant growth of the agricultural sector, expanding incomes for farm households, improved food and nutrition security for all Malawians and increased agricultural exports. The policy has identified eight policy priority areas, of which three are applicable to the implementation of the project: Mechanisation of Agriculture; Agricultural Market Development, Agro-processing and Value Addition; and Food and Nutrition Security. The implementation of the project will therefore contribute to the policy by increasing agricultural production and productivity; increasing agricultural diversification through the promotion of different types of crops; and improving nutrition and food security.

3.1.4 Malawi National Irrigation Policy (2016)

The overall goal of the policy is to contribute to sustainable national economic growth and development through enhanced irrigated agriculture production and productivity. The policy amongst others provides for increased irrigated agriculture production and productivity for local and export use using irrigation technologies that take into account climate change; increased employment opportunities; and enhanced land and water productivity through sustainable land tenure arrangements, catchment management and water harvesting. The policy has identified three policy priority areas of which two are applicable to the implementation of the project: Sustainable Irrigation Development; and Sustainable Irrigation Management. The implementation of the project will therefore contribute to the achievement of the policy objectives by increasing land under sustainable irrigation farming; facilitating crop diversification and intensification; increasing investment in irrigation development; and provision of employment.

3.1.5 National Land Policy (2002)

The policy seeks to optimize utilization of Malawi's land resources for development. The policy provides an institutional framework for land management and outlines procedures for protecting land tenure rights, land-based investments and management of development at all levels. The policy classifies land into three categories as customary, private and public.

Customary land is land under the control of traditional leaders which is mainly used for subsistence farming and some for residential, graveyard and woodlot purposes. Private land is land under private ownership either through freehold or leasehold land. Public land is held by Government and covers land under government property, such as buildings, roads, game reserves and forest. The proposed project is going to be carried out on existing schemes that are under customary land as such land issues will not arise from the implementation of the project.

3.1.6 National Forestry Policy (2016)

Amongst others the policy aims at promoting sustainable contribution of woodlands and trees towards the improvement of quality of life for Malawians by conserving the resources for the benefit and to the satisfaction of diverse and changing needs of Malawi population, particularly rural smallholders. The policy prevents unnecessary changes in land-use that promote deforestation, or endanger the protection of forest which have cultural, biodiversity or water catchment values. The implementation of the proposed project will therefore ensure that forest resources are conserved.

3.1.7 National Water Policy (2005)

The policy addresses all aspects of water management including development of water resources and service delivery and it emphasizes that every Malawian has an equal right of access to water and sanitation services for sustainable socio-economic development of the country. The overall policy goal is sustainable management and utilization of water resources in order to promote water of acceptable quality and sufficient quantities and ensure availability of efficient and effective and sanitation services that satisfy the basic requirements of every Malawian and for the enhancement of the country's natural ecosystems. It is therefore important that the implementation of project will not contribute towards the degradation and depletion of water resources in the zone of influence. The pesticides from the schemes have huge potential to negatively impact natural water bodies. The project will explore measures to put in place to ensure that activities promoted by project do not harm water bodies.

3.1.8 National Sanitation Policy (2008)

The National Sanitation Policy provides a vehicle to transform the hygiene and sanitation situation in Malawi. It provides both guidelines and an action plan whereby 2020 all the people of Malawi will have access to improved sanitation, safe hygienic behaviour will be the norm and recycling of solid and liquid waste will be widely practiced leading to healthier living conditions, a better environment, and a new way for sustainable wealth creation. One of the policy objectives is the improvement of hygiene, sanitation, and recycling of waste in towns. The implementation of this project should therefore ensure that sanitation issues addressed by the policy should be met through composting of organic waste; provision of adequate wastewater disposal facilities at all wastewater-generating points; and ensuring the proper design and access to refuse collection points at the schemes.

3.1.9 National HIV and AIDS Policy (2012)

The goal of this policy is to prevent Human Immunodeficiency Virus (HIV) infections, to reduce vulnerability to HIV, to improve the provision of treatment, care and support for people living with HIV and Acquired Immune Deficiency Syndrome (AIDS) and to mitigate the socio-economic impact of HIV and AIDS on individuals, families, communities, and the nation.

Thus, the implementation of the project should put in place measures that will ensure minimum vulnerability of workers and communities to HIV and AIDS during the project lifespan.

3.10 National Gender Policy (2000 amended 2015)

The National Gender Policy recognizes that women play important roles in the socioeconomic development of the country. This contribution is however not matched with their access to and control over resources such as land and capital and their enjoyment of benefits from management and use of natural resources. The project affected people will include women, men, the youth, and girls including some who may be vulnerable. The National Gender Policy advocates for gender mainstreaming in the planning and implementation of projects to ensure that the needs of different groups of people affected by a project are taken care of in a manner that promotes equity. The project must ensure that principles that promote equity among different beneficiaries are applied during planning and implementation of its activities. The goal of this policy is to mainstream gender in the national development process in order to enhance participation of women and men, girls and boys for attainment of sustainable and equitable development. Since the project will employ both men and women a deliberate effort will be made to ensure that both male and female are given equal opportunities to participate in activities related to the project including employment. In addition, women will be provided with separate sanitation facilities from men.

3.11 National Climate Change Management Policy (2016)

The goal of the National Climate Change Management Policy is to create an enabling policy and legal framework for a pragmatic, coordinated and harmonized approach to climate change management. The Policy provides strategic direction for Malawi's priorities for climate change interventions and outlines an institutional framework for the application and implementation of adaptation, mitigation, technology transfer and capacity building measures.

3.12 Decentralization Policy (1998)

The policy aims at integrating governmental agencies at the district and local levels into one administrative unit, through the process of institutional integration, manpower absorption, composite budgeting and provision of funds for the decentralized services; diverting the centre of implementation responsibilities and transfers these to the districts; assigning functions and responsibilities to the various levels of government; and promoting popular participation in the governance and development of districts. This policy has implications for the project by ensuring that project activities are integrated into district level planning and are being implemented in close collaboration with Phalombe district staff.

3.2 Regulatory Framework

3.2.2. National Regulatory Framework

3.2.2.1 Constitution of the Republic Malawi (1995)

The Constitution of the Republic of Malawi is the supreme law of the land. The Constitution provides the mandate for setting the national environmental policy. Section 13(d) outlines the principles of sustainable development as such the activities to be carried out in this proposed project should conform to principles outlined in the Constitution. Specifically, the Constitution stipulates that the environment should be managed to ensure the:

- a. Prevention of environmental degradation.
- b. Provision of a healthy living and working environment for the people of Malawi.

- c. Accordance of full recognition to the rights of the future generations by means of environmental protection; and
- d. Conservation and enhancement of biological diversity of Malawi.

The implementation of the project will therefore ensure that measures are put in place to protect the environment, and that biological diversity of the area is preserved.

3.2.2.2 Environment Management Act (2017)

The Act provides the legal basis for the protection and management of the environment and conservation and sustainable utilization of natural resources. Section 31 of the Act prescribes the types of projects for which an EIA may be required and outlines the EIA process to be followed in Malawi of which all project developers in both the public and private sectors must comply with. Section 31 (2) and (3) requires that an ESIA is required unless MEPA as an Authority for environmental protection has given consent to proceed due to completion and approval of satisfactory ESIA report or due to non-requirement of an ESIA. The development of the ESMP and submission to MEPA for approval therefore serves to fulfil the requirement of the Act to protect and manage the environment; and conserve and sustainably utilize natural resources.

3.2.2.3 Irrigation Act (2001)

The Act amongst others provides for the sustainable development and management of irrigation, protection of the environment from irrigation related degradations. Part IX of the Act provides for the prohibition certain activities within and around irrigation schemes. Section 46 (1) stipulates that No person shall - (a) engage in practices which are destructive or potentially destructive to the catchment area of a river or public watercourse supplying water to an irrigation scheme or farm.

Section 47 (1) stipulates that No person shall - (a) set or cause to be set on fire crops on an irrigation scheme or farm; or (b) without reasonable cause, refuse to assist in averting, fighting, or extinguishing a fire on an irrigation scheme or farm.

The proponent will therefore put in measures to conserve the catchment area, protect the irrigation schemes from bush fires and to fight bush fires.

3.2.2.4 Pesticide Act (2000)

The Act provides the legal and administrative framework for registration, procurement, distribution, export, importation, storage, usage and disposal of pesticides and related materials. The Act empowers the Pesticide Control Board (PCB) to register and issue certificates and permits for the procurement, distribution, use and disposal of pesticides amongst others to minimize the potential adverse effects from pesticides to the people or non-target species and the environmental in general.

In order to comply with the provisions of the Act, the proponent will ensure that farmers and workers are provided with appropriate training in handling, storage and use of chemicals and pesticides; and appropriate protective gear and equipment for the handling and use of pesticides; and handling and disposal of containers of pesticides. The proponent will be required to immediately report to the Registrar of the board any injuries, illness or death of any worker arising from and pesticides. In addition, the proponent will ensure that only authorized pesticides will be used in the scheme.

3.2.2.5 Forestry Act (1997)

The Act recognizes the need to promote participatory social forestry and empowerment of communities for conservation and management of trees within the country. In addition, it mandates the district forestry office to carry out activities that promote the development and management of forest resources in the district. Thus, it authorizes the office to protect, guide, plan, coordinate and facilitate sustainable management and utilization of forest resources in the district. The demand for burnt bricks would escalate deforestation within the district as such the implementation of the project promoted the use of environmentally friendly materials such as cement blocks for the construction of the structures thereby reducing deforestation.

3.2.2.6 Local Government Act (1998)

The Act provides legal mandate for local councils in the planning, administration and implementation of various issues and development programmes in their respective geographical areas. One main function of the councils is that of local environmental planning and management. Some of the environmental; management functions provided in section 2 of the second schedule of functions outlined in the Act include town planning, building control, local afforestation programmes, control of soil erosion, and appropriate management of solid and liquid wastes. The implementation of the proposed project will therefore ensure compliance with the Act. Phalombe district council will therefore ensure that measures are put in place to control of soil erosion and re-vegetation of the surrounding areas and monitoring of the proposed ESMP. In addition, Phalombe district council has to put in place measures for collection, recycling, treatment and disposal of solid wastes from the site.

3.2.2.7 Physical Planning Act (2016)

The Physical Planning Act, 2016 regulates land use planning and physical developments in Malawi. The Act seeks to promote orderly spatial physical planning in order to optimize use of land and services infrastructure; and protect and conserve fragile ecosystems in space. This is achieved by guiding physical developments through provision of planning permission following appropriate scrutiny by local planning committees or the Commissioner for Physical Planning. The Act in Part IV also provides for the need by local authorities to develop physical development plans in order to have sustainable and systematic development. Section 46 of the Act requires any developer to submit plans to the local physical planning authority for approval before implementation. The proponent will therefore be required to submit development plans for this proposed project to ZDC for further scrutiny and granting of development permission in accordance to the provisions of this Act.

3.2.2.8 Water Resources Act (2013)

The Act provides the legal framework for the establishment, powers and duties of the National Water Resources Authority (NWRA) which is responsible for the regulation of water use, protection and conservation water resources. As a regulatory body, The NWRA is responsible for preparation of national master plan for water resource use, management, protection and conservation, and monitoring of water resource management activities. Part VIII (sections 88 - 103 of the Act) outlines some important measures to prevent and control pollution to public water resources. Furthermore, the Act provides for an operator to apply for water abstraction rights if ground water or surface water is to be abstracted. In this regard the implementation of this project will ensure that solid waste is properly managed and that solid waste and wastewater or chemicals are not dumped into the nearby stream. The proponent will therefore

be required to apply for a water abstraction licences from NWRA in order to abstract ground and surface water for irrigation if not already in place.

Part X Section 111 prohibits any construction activity that blocks or otherwise impedes the flow of water in a watercourse unless a license authorizing the activity has been obtained in accordance with the provision of Part V of this Act. Any person engaged in such activities shall be liable for all the costs for the removal of such structures or any damage to persons, property, or the environment caused by the unauthorized blockage. The proponent will therefore have to apply for a permit from NWRA in order to construct dams on the schemes if not already in place.

3.2.2.9 Public Health Act (1948)

The Act provides the legal framework for planning and management of a wide range of health-related issues including environmental health, occupational health and solid waste management. Relevant parts of the Act applicable to the proposed project are sections 79, and 87 and 88. Section 79 parts (a) and (b) empowers local authorities to enforce the provision of sewage works for large scale development projects. Section 87 stipulates the need for properly designed drainage works for new buildings so as to carefully drain out storm water and sub soil from building sites and cartilage. Section 88 stipulates the requirements for separate toilets for both male and female persons in public buildings. In order to comply with the requirements of the Act the implementation of the project will ensure that adequate toilets for both men and women are provided during the construction and operation of the irrigation project.

3.2.10 Occupational Safety, Health and Welfare Act (1997)

The Act makes provision for the regulation of conditions of employment in workplaces about safety, health and welfare of employees. Section 6 provides for the registration of workplace with the Director of Occupational Safety, Health and Welfare, General safety facilities stipulated for most workplaces include the following: adequate ventilation, not overcrowded, cleaning materials and cleanliness of workplaces, lighting, washing facilities, change rooms for some workers, sanitary conveniences and first aid kits. Both employers and employees are required to be sensitized on basic procedures for proper use and operations of the welfare and safety facilities within workplaces.

Part II Section 6 and of the Act provides for the registration of workplaces under this Act as may considered necessary or desirable and that the occupier of a registered workplace shall not carry on therein any activity other than that specified in the registration certificate or provisional registration permit, as the case may be. Section 56 and 57 provide for prevention of fire outbreaks, and control of incidences of the outbreaks within workplaces. In addition, they stipulate measures that relate to work in confined spaces and recommended means of fire escapes from workplaces which have to be properly labelled and kept free of obstruction at all times. Section 58 and 59 provides for the provisions of protective clothing (such as gloves, footwear, screens and goggles, ear muff, breathing masks and head covering) to protect workers from excessive exposure to nuisances such as emissions of dust and fumes from some work activities.

Section 63 stipulates to matters relating to bulk storage of dangerous materials and matters dealing with noise. In order to comply with the requirements of the Act, both the contractor and the proponent will provide separate sanitation facilities for men and women and

appropriate Personal Protective Equipment (PPE) to all employees. Furthermore, the contractors will have to apply for registration of the sites as workplace.

3.2.2.11 Gender Equality Act (2012)

The Act makes provisions for integration of both male and female in functions of society. The Act is intended to eliminate harmful social and cultural practices, ensure more equal opportunity in the workplace, enhance education and training opportunities equally for male and female, enhance access to sexual and reproductive advice for everyone, and ensure that everyone is treated with dignity, integrity and without discrimination regardless of sex. To comply with the requirements of this Act, the contractor and the operator will undertake the following amongst other: put in place a code of conduct for employees; provide equal employment opportunities to both men and women; and put in place measures to avoid cases of sexual harassment.

3.2.2.12 Land Act (2016)

The Act highlights the sustainable use of land resources by strengthening and clearly defining security of tenure. Land tenure and land use are recognised as essential and critical in sustainable environmental management in Malawi as people are more inclined to manage well land that they know it belongs to them. Section 15 of the Land Act vests the powers to manage public land in the Minister hence the proposed development will have to adhere to all requirements related to ownership of the land.

3.2.13 HIV and AIDS (Prevention and Management) Act (2012)

The Act amongst others makes provision for the prevention and management of Human Immunodeficiency Virus (HIV) and Acquired Immune Deficiency Syndrome (AIDS) and to provide for the rights and obligations of persons living with HIV or affected by HIV and AIDS. Thus, the implementation of the project should put in place measures that will ensure minimum vulnerability of workers, vendors and communities to HIV and AIDS during the implementation of the project.

3.2.14 Malawi Bureau of Standards Act (2012)

Malawi Bureau of Standards (MBS) provides national standards in all fields of interest as a base or guideline for measuring the quality, performance or fitness for intended use of a product or service. Standards that may be applicable for irrigation scheme are: MS733:2005: The Malawi Standard for borehole and shallow well water quality specifies the requirements for untreated or raw ground water in boreholes and shallow wells suitable for human consumption and all usual domestic purposes; MS214:2005: Malawi Standards for drinking water quality, specifies the physical, biological organoleptic and chemical requirements for drinking water; and MS 173:2005: Acoustics – Noise pollution – Tolerance limits.

The contractor will have to take into consideration these standards in the course of implementing the infrastructure development.

3.2.15 Occupational Safety, Health and Welfare Act (2014)

The Occupational Safety, Health and Welfare Act regulates work conditions with respect to safety, health, and welfare of workers. The Act seeks to ensure that workplaces are safe, and that the welfare of workers is protected. The act also provides that workers should be provided

with protective wear to ensure that they are safe while they are working. These may include gloves, heavy duty boots, helmets and overalls.

3.2.2.16 The Plant Protection Act, 2018

The act guides the establishment of the Plant Protection Unit within the Department of Agricultural Research Services in the Ministry of Agriculture to be vested with responsibility of eradication of pests and diseases destructive to plants; prevention of the introduction and spread of pests and diseases destructive to plants and plant products; promotion of appropriate measures for their control.

The Unit shall carry out the following functions to enforce this Act:

- a. propose, review and formulate the phytosanitary measures and other necessary regulations under this Act and matters arising from the application of any such measures and regulations;
- b. conduct surveillance and inspection of growing plants, including areas under cultivation and wild flora, and of plant material in storage or in transport, for the purpose of reporting the occurrence, outbreak and spread of pests, and for the purpose of preventing the introduction or spread of pests;
- c. protect endangered areas, as well as designate, maintain and keep under surveillance pest free areas and areas of low pest prevalence;
- d. promote integrated pest management and control in Malawi;
- e. declare any pest as a quarantine pest or a regulated non-quarantine pest under this Act;
- f. conduct the periodic updating and dissemination of lists of plant material and other regulated articles, the importation of which into Malawi is prohibited or restricted based on pest risk analysis or applicable international standards;
- g. provide clear justification to other countries concerning phytosanitary measures applied, either through pest risk analysis or by reference to applicable international standards, and notify the relevant international and regional organizations as well as trading partners of adopting new measures or modification of the existing measures, or relevant instances of non-compliance with import requirements;
- h. establish auditing and trace-back procedures for plants, plant material and other regulated articles for phytosanitary certification;
- i. organize the exercise of pre-clearance inspections where requested by importing countries;
- j. ensure the preservation of the phytosanitary security of consignments after certification and before export;
- k. organize disinfestations or disinfections of consignments of plants, plant material or other regulated articles;
- l. organize and control the issuance of phytosanitary certificates and import permits by plant health inspectors,
- m. promote public awareness relating to regulated pests and the distribution of information regarding the means of their prevention and control;
- n. establish minimum qualifications and the oversight of training and development of plant health inspectors, and other staff;
- o. develop pest diagnostic, investigative and analytical capabilities as well as the establishment of laboratories and quarantine stations at such places as may be deemed necessary;
- p. establish the procedures for accreditation of any quarantine station, official analyst, official laboratory or any other person or institution from the public or private sector involved in phytosanitary matters;

- q. liaise with competent authorities in neighbouring countries on plant protection matters;
- r. carry out international cooperation in the field of plant protection and to participate in relevant sub-regional, regional and international organizations, and provide information regarding import and export regulations in force, and technical requirements for plant material and other regulated articles, on request of any interested international, regional or a similar organization in another country;
- s. charge and collect fees in respect of Phytosanitary certificates or permit applications made by applicants and for other services provided by the Unit;
- t. Perform any other functions the Minister thinks necessary to achieve the objectives of this Act.

3.2.17 The Plant Breeder's Rights Act, 2018

the act directs the establishment of the Plant Breeder's Rights Fund which shall consist of (a) such moneys as may be appropriated by Parliament for the purposes of the Fund; (b) all levies and fees from all varieties registered under this Act and all varieties in the commercial seed industry in Malawi which shall be prescribed by the Minister under this Act; (c) all other fees payable under this Act; (d) such sums or other assets as may be received for the purpose of the Fund by way of voluntary contributions or donations; and (e) such sums as are paid by way of penalties or costs in respect of offences under this Act. The act stipulates paying of royalties to the plant breeders. It is a duty of the project to trace the originators of all plant species/varieties promoted in this project.

3.2.2.18 The Biosafety Act, 2018

The Act makes provision for the control of genetic modification of organisms and related activities for so as to prevent danger and damage to public health and the environment. The Act is applied to: (a) the genetic modification of organisms; (b) the importation, development, production, testing, release, use and application of genetically modified organisms; and (c) the use of gene therapy in animals, including human beings. It shall be administered by the Minister responsible for environmental affairs. The Act sets out the establishment of a Biosafety Fund for the safe management of biotechnological activities. No person shall engage in activities covered by this Act without a GMO licence or other licence issued by the Minister under this Act. The Act also provides rules relative to labelling and packaging of GMO's or products containing GMO's and provides rules for advertisement. This act is important because some modifications of plant and animal species/varieties can be detrimental as it can encourage infestation of pests and diseases.

3.2.2.19 The Seed Act, 2014

The Seed Act in Malawi regulates the production, sale, and importation of seeds, and sets minimum standards for germination and purity, and provides for seed certification. The act directs establishment of the Malawi Seed Regulatory Authority which shall regulate the production, processing, sale, and exportation of seeds; regulates the release and registration of crop varieties; sets minimum standards for germination and purity; and provides for the certification of seeds. The aim of the act is to improve the quality of plants and plant products; to increase plant production; to prevent the introduction of plant pests and diseases and to enhance rural income and livelihood. The project will have to ensure that the seeds planted by farmers in the schemes are in line with this act and that they are not violating the act.

3.2.20 The Control and Diseases of Animals Act, 2018

The act gives responsibilities to the owners of animals to be vigilant in protecting environment and people from affected by animal diseases. The act states that every person having in possession or charge an animal affected or suspected of being affected with disease shall—(a)

keep such animal separate from animals not so affected or suspected, and cause the animal affected or suspected to be tied up, or put in an enclosed place; and (b) forthwith give notice of the fact of the animal being affected or suspected to the nearest inspector or police officer. (2) Any police officer so notified shall forthwith notify the nearest inspector, who shall give such directions and take such steps as may be necessary for the purpose of ascertaining the existence and nature of the disease, and on being satisfied that such disease exists he shall forthwith report the disease to the Chief Veterinary Officer. Proliferation of pests and diseases of animals can be reduced if the direction of this act is being followed, it is therefore important that people within the project area are sensitized of this act.

3.2.2.21 The Noxious Weeds Act, 2014

The Noxious Weeds Act is a law that defines noxious weeds and prohibits their disposal in certain ways. The act also establishes who is responsible for eradicating noxious weeds. No person shall throw any noxious weed or the seed of such noxious weed into any river or stream, or on to any road or land. Any person disobeying this section shall be liable to the penalty prescribed in section. To dig up, pull up, and burn noxious weeds, or to use other methods authorized by the Minister. While increasing crop production, smallholder farmers benefitting from this project may encounter noxious weed, it is important that they are informed on how to dispose of.

3.2.2.2 The Fertilizers, Farm Feeds and Remedies Act, 2014

An Act to provide for the registration of sterilizing plants and certain remedies; to provide for the establishment of committees for fertilizers, farm feeds and remedies; to regulate and restrict the sale of fertilizers, farm feeds and certain remedies, and substances of animal origin intended for the manufacture of fertilizers or farm feeds and to provide for matters incidental to the foregoing.

- Use of sterilizing plant: No person shall use any sterilizing plant for the sterilizing of bones or other substances derived from an animal carcass unless such plant has been registered under this Act.
- Security of supply: The Minister may, for the purpose of ensuring supply of farm requisites, and on such terms and conditions as he deems fit, enter into arrangements with any supplier of farm requisites, or person dealing with farm requisites.

3.2.2.3 Occupational Safety, Health and Welfare Act (1997)

The Act regulates work conditions with respect to safety, health, and welfare of workers. During construction phase, there will be a number of workers working on the site using different types of machinery and facilities. The Act therefore places a duty of care on contractors throughout the project construction phase and similarly, the workers have a duty to take reasonable care for their own safety and health. The Act provides for the need for a fire protection system, fire detection and alarm. The developer will ensure that devices for fire protection are placed at strategic places to deal with any fire out breaks. The developer will further ensure that there is adequate protection for the workers who will be on site during operation phase as required by the Act and that all the necessary firefighting equipment's are made available on site especially during operation phase.

The duty of ensuring safety, health, and welfare of workers is on the employer. However, every employee is required to take reasonable care for his/her own safety and that of other workers. The key provisions relevant to the project under discussion are as follows:

- (i) Section 13(1) places a duty on every employer to ensure the safety, health and welfare of all his employees at work;
- (ii) Section 51(1) mandates that manufacturers, importers and suppliers of hazardous substances used at workplaces shall provide sufficient information on such substances as well as the precautions to be taken; and
- (iii) Section 81 (7) stipulates that where the use of hazardous chemicals is likely to penetrate the skin and cause rash, skin contact with hazardous chemical shall be avoided and personal hygiene and the type of clothing worn shall be such as to enable rapid removal of any chemical from skin contact.

Section 66 of the Occupational Safety, Health and Welfare Act (1997) defines the procedure to be followed in case of the occurrence of an accident which either causes loss of life or disables a person from carrying out the normal duties at which he is employed. Furthermore, it stipulates measures that relate to work in confined spaces (section 55), measures taken to prevent and deal with fire (section 56), matters relating to bulk storage of dangerous materials, matters dealing with noise (section 63) and general matters relating to health and safety.

3.2.2.24 Public Health Act, Cap 34.01

The Public Health Act requires developers to provide sanitary and health facilities in workplaces to promote health and well-being of the primary occupants. The clauses enshrined in the Act advocate for measures to be undertaken to preclude slackness that would lead to harm of one's health or the public at large. The EIA report recognizes the importance of practicing improved hygiene and use of improved sanitary facilities for sustainable livelihood. The developer will construct sanitary facilities and will ensure good hygiene practices, some of which have been mainstreamed in the Environmental and Social Management Plan (ESMP). Furthermore, the developer will have to comply with the requirements of this Act by providing for waste disposal facilities in accordance with the anticipated volumes of waste. The Public Health Act also provides for the protection of human health through prevention and guarding against introduction of infectious diseases into Malawi from outside, to promote public health and the prevention, limitation or suppression of infectious, communicable or preventable diseases, to advice and direct local authorities in regard to matters affecting the public health to promote or carry out research and investigations in connection with the prevention or treatment of human diseases. This Act provides the impetus for a healthy environment and gives regulations to waste management, pollution and human health.

3.2.3 Regulations

3.2.3.1 Environment Management (Waste Management and Sanitation) Regulations, 2008

The Regulation provides for the management of general or municipal solid waste, liquid, and hazardous waste. Specifically, Parts III, V and VII are relevant to the implementation of this project. Part III specifies the requirements for waste separation at source; general responsibility for proper storage of municipal waste; circumstances for waste disposal by generator; collection of municipal solid waste; and disposal of general or municipal solid waste. Part VII provides for the requirements for transportation and storage of waste; license for waste transportation or storage; and materials for storage of waste. The proponent of this project shall therefore ensure measures are put in place for handling, storage, transportation and disposal of solid, liquid and hazardous wastes to avoid soil contamination and water pollution.

3.2.3.2 Environment Management (Chemicals and Toxic Substances Management) Regulations, 2008

In respect to the proposed project, these Regulations apply to the sale and handling of toxic substances and chemicals which have the potential for harm to human health or the environment. Specifically, Part II of the regulations empowers local authorities to make by-laws relating to the management of toxic substances and chemical wastes in their respective area of jurisdiction. Such by-laws shall ensure that the disposal method of chemical or toxic wastes is in an environmentally sound manner. Furthermore, the local authority shall be responsible for management of chemicals and toxic substances in accordance with the provisions of the Regulations. The implementation of the project will therefore ensure that measures for handling and use of toxic substances and chemicals are put in place to protect humans and environment.

3.2.2.3 Public Health (Corona Virus and COVID-19) (Prevention, Containment and Management) Rules, 2020

Corona Virus and COVID-19 rules in Part II provide general preventive measures which are divided into two parts of (i) prevention of spread of Corona Virus by persons and (ii) measures by the government to prevent, contain and manage the spread of COVID-19. With regards to prevention by persons, the rules stipulate in Section 3 (1) that a person shall do the following acts in order to prevent the spread of the Corona Virus:

- When in a public area, wear a face mask at all times;
- Keep a social distance of at least one metre, from other persons;
- Wash hands frequently with soap and water, for at least forty seconds or use an alcohol-based hand sanitizer with a minimum alcohol content of seventy percent, for at least twenty seconds;
- If hands are dirty or soiled, not use an alcohol-based hand sanitizer, rather, wash hands with soap and water;
- When coughing or sneezing, cover nose and mouth with handkerchief or tissue paper or sneeze into a flexed elbow;
- Refrain from touching face, mouth, nose and eyes; and
- Avoid handshakes

3.2.3.4 Regulation of Pesticides Storage, Distribution and Disposal

The office of the Registrar is mandated to ensure that all registered and licensed pesticide dealers conform to the regulations for safe handling of the pesticides. Pesticides dealers should follow the “safety” guidelines on transportation, distribution, application, storage and disposal of pesticides as guided in the pesticide protocol.

The PCB must ensure that all stakeholders observe safe handling of pesticides. The Registrar is mandated to make frequent checks in all premises where pesticides are stored to ensure safety. The Registrar is also mandated to take stock of obsolete pesticides in all premises. The PCB will advise the Malawi Government on how to dispose of obsolete stock. This will involve collecting obsolete stocks from all premises and arranging for disposal.

3.4 Strategies, programmes and plans

3.3.4.1 National Environmental Action Plan (NEAP), 1994

The NEAP adopted in 1994 estimated that the discounted economic cost of the major forms of degradation, which include soil erosion, deforestation, water resources degradation, fisheries depletion and biodiversity loss amounted to 10% of the formal Gross Domestic Product (GDP).

Considering the small size of the economy this is a substantial economic loss to Malawi and therefore the NEAP addresses these problems by reshaping the mechanisms governing the management of natural resources in Malawi. NEAP recommended a number of mitigation measures that were outlined in the Environmental Support Programme whose main objective was to integrate environmental issues into the country's social and economic development programme. NEAP is still being used as a framework for all development plans in the country, to ensure environmentally sustainable development, in line with the strategic objectives of Agenda 2063.

3.4.2 The Malawi Vision 2063 (2021-2063)

The Malawi 2063 is the successor to Vision 2020 and becomes the new overarching development strategy for Malawi aiming at transforming the nation into a wealthy and self-reliant industrialized upper middle-income country by the year 2063. The Malawi 2063 is designed to create a mind-set shift from poverty reduction and aid dependency to wealth creation and self-reliance. The new agenda recognizes environmental sustainability as one of the 7 enablers for the country to transform. The vision emphasizes that development interventions must be based on minimizing depletion of natural resources and be sustained without causing further harm to the environment. The new vision recognizes that country's underlying concern as a nation is that while people might enjoy the spoils of the environment today, the nation owes it to future generations of Malawians to do so responsibly and sustainably with an ethic of care. Planning and implementation of project activities will ensure that principles of environmental sustainability are integrated.

3.4.3 National Adaptation Plan Framework (2020)

The purpose of the National Adaptation Plan (NAP) Framework for Malawi is to guide the country in advancing its NAP process. The NAP Framework has built on the NAP Roadmap, validating and updating the vision, objectives and mandates identified therein. It reaffirms the structure and approach for the NAP process, linking it to existing or planned policies, plans, strategies and legislation that will enable Malawi to address its medium- and long-term adaptation needs. The NAP stocktaking report has also served as a key foundation for the NAP Framework.

The NAP Framework has been linked to the objectives of this project through its focus on: sustainable development; uplifting the poor and vulnerable; gender; participation and ownership; and, incorporating traditional knowledge.

3.2.1 International conventions and treaties

Under the Treaties and Conventions Publication Act of 2014, which enable the publication of certain international treaties, conventions and agreements to which Malawi has acceded or become signatory, or any article, term, covenant or provision of any such treaty, convention or agreement. Malawi has signed various international environmental conventions which must be adhered to. Some of these include:

- The United Nations Framework Convention on Climate Change;
- Kyoto Protocol;
- Convention for the Protection of the Ozone Layer and Its Montreal Protocol

- United Nations Framework Convention on Climate Change (UNFCCC)
- UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage, 2003
- The Convention on Biological Diversity 1992 (CBD)
- The Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention, 1972)
- The African Convention on the Conservation of Nature and Natural Resources, 1968

3.2.1.1 The Kyoto Protocol

The United Nations Framework Convention on Climate Change (UNFCCC) and the subsequent Kyoto Protocol is an attempt to initiate a process to develop a more specific and binding agreement on the reduction of greenhouse gas emissions in an attempt to address the cause of global warming. Malawi is party to both the Convention and the Kyoto Protocol. The Conference of the Parties to the UNFCCC in Kyoto, Japan in December 1997 resulted in a consensus decision to adopt a protocol under which industrialized countries (Annex 1 parties) will reduce their combined greenhouse gas emissions by at least 5% compared to 1990 levels in the period 2008 to 2012. Malawi being a developing country (non-Annex 1 party) does not have to make any comparable greenhouse gas emission reductions.

In developing the Kyoto Protocol, the need to promote sustainable development was recognized. This means implementing policies and measures to, among others, enhance energy efficiency, protect and enhance sinks and reservoirs of greenhouse gases, promote sustainable forms of agriculture, increase the usage of new and renewable forms of energy and of advanced, innovative and environmentally sound technologies. The Kyoto Protocol is a legally binding instrument. In response, Malawi policies are starting to place emphasis on cleaner technology and production, and a shift towards sustainable development.

3.2.1.2 Convention for the Protection of the Ozone Layer and Its Montreal Protocol

The Montreal protocol to the Vienna Convention for the Protection of the Ozone Layer is an international treaty designed to protect the ozone layer by phasing out the production of a number of substances believed to be responsible for ozone depletion. The treaty was opened for signature in January 1987 and was last revised in 1999 at Beijing. It has been ratified by 96 countries; Malawi inclusive.

The Ozone depleting substances are Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs). The ozone shield is important because it protects plant and animal life on land from the sun's ultraviolet rays, which can cause skin cancer, cataracts, and damage to the immune system.

Thinning of the ozone layer also may alter the DNA of plants and animals. Ozone depleting substances also act as greenhouse gases, with several thousand times the per-molecule greenhouse potential of carbon dioxide. Malawi has put a regulation in place to guide in the adherence to this Protocol; The Environment Management (Chemicals and Toxic Substances Management) Regulations, 2008.

Malawi has developed and is implementing a Hydrochlorofluorocarbons (HCFCs) Phase-out Management Plan (HPMP). Because of this plan, Malawi has already phased out chlorofluorocarbons (CFCs) and methyl bromide, which are ozone-depleting substances and is on track to phase out more than 40% of HCFCs by 2030 as per the Montreal Protocol schedule. Is therefore important that rehabilitation of Mwaiwathu scheme adhere to this requirement by ensuring that materials and equipment do not use substances and chemicals that are banned by this convention.

3.2.1.3 United Nations Framework Convention on Climate Change (UNFCCC)

The Convention on Climate Change sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. The convention encouraged industrialized countries to stabilize greenhouse gases while the Kyoto protocol commits them to do so. Malawi ratified the convention in April 1994. Malawi was one of few countries that ratified this convention first, demonstrating its commitment to addressing climate change issues nationally and globally through cooperation. During rehabilitation of Mwaiwathu scheme, carbon dioxide is expected to be released from construction vehicles and equipment, and this will need to be limited in conformity with this convention.

3.2.1.4 UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage, 2003

The 2003 Convention for the Safeguarding of the Intangible Cultural Heritage calls on States that have ratified it to safeguard living heritage on their own territories and in cooperation with others. Ratified by more than 80 countries, it seeks to celebrate and safeguard the intangible heritage distinctive for particular communities. Malawi ratified the convention in 2010 and following the ratification, Malawi's Department of Culture conducted various awareness-raising activities between 2003 and 2010, engaging with officials, traditional authorities, teachers, youth, journalists, and community members. The department also initiated a review of the national cultural policy and related legislation, and strengthened community-based inventorying of intangible cultural heritage (ICH) through training programs for youth. In 2015, the National Culture Policy was approved, recognizing the importance of ICH. The National Arts and Heritage Council of Malawi was established to oversee the safeguarding of both natural and cultural heritage. The project will therefore safeguard any intangible cultural heritage that may be in the project area during the implementation of the project.

3.2.1.5 The Convention on Biological Diversity 1992 (CBD)

The CBD was one of the major outcomes of the 1992 United Nations Conference on Environment and Development, termed the "Earth Summit" in Rio de Janeiro. The three main goals of the Conventions on Biological Diversity (CBD) are the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising from utilization of genetic resources. The CBD calls for a much more holistic approach to biodiversity, by recognizing its ecosystem, species and genetic levels. The environmental and social assessment report has identified potential impacts that are likely to impact biodiversity, and possible measures have been proposed to promote its conservation in line with this convention.

3.2.1.6 The Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention, 1972)

The convention considers the following as "cultural heritage"; monuments: architectural works, works of monumental sculpture and painting, elements or structures of an archaeological nature, inscriptions, cave dwellings and combinations of features, which are of outstanding universal value from the point of view of history, art or science. Each State Party to this Convention recognizes that the duty of ensuring the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage referred to in Articles 1 and 2 and situated on its territory, belongs primarily to that State. It will do all it can to this end, to the utmost of its own resources and, where appropriate, with any international assistance and co-operation, in particular, financial, artistic, scientific and

technical, which it may be able to obtain. Mulanje Mountain is a UNESCO World Heritage Site and is recognized as Mount Mulanje Cultural Landscape, the designation was granted during the 47th session of the World Heritage Committee in Paris. It is therefore important that project especially during rehabilitation of the headworks (which is within Mulanje Mountain Forest Reserve) is implemented in accordance with this convention requirement.

3.2.1.7 The African Convention on the Conservation of Nature and Natural Resources, 1968

The Contracting States to African Convention on the Conservation of Nature and Natural Resources are required to undertake to adopt measures to ensure conservation, utilization and development of soil, water, flora and faunal resources in accordance with scientific principles and with due regard to the best interests of the people.

The Contracting States to this convention are also required to ensure that conservation and management of natural resources are treated as an integral part of national and/or regional development plans. In addition, during the formulation of all development plans, full consideration is required to be given to ecological, as well as to economic and social factors. The headworks for Mwaiwathu scheme is within the protected Mulanje Mountain Forest Reserve as such conservation of biodiversity and ecosystem will have to be taken seriously during construction and operation phases of this project.

3.4. Applicable environmental and social safeguards of the African Development Bank (AfDB) for the project.

The African Development Bank's Integrated Safeguards System (ISS) was updated in 2024 and applies to all new AfDB-financed investment projects, including the present one. The Operational Safeguards (OS), ten in total, define the obligations that projects financed by the African Development Bank must comply with throughout their lifecycle.

The Operational Safeguards (OS) are designed to help Borrowers manage project-related risks and impacts, and to enhance their environmental and social performance by applying a risk- and results-based approach. They include:

- OS1: Environmental and Social Risk and Impact Assessment and Management
- OS2: Labor and Working Conditions
- OS3: Efficient Resource Use and Pollution Prevention and Management
- OS4: Community Health, Safety, and Security
- OS5: Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement
- OS6: Biodiversity and Habitat Conservation, and Sustainable Management of Living Natural Resources
- OS7: Vulnerable Groups
- OS8: Cultural Heritage
- OS9: Financial Intermediaries
- OS10: Stakeholder Engagement and Information Disclosure.

OS1: Environmental and Social Risk and Impact Assessment and Management

The OS 1 focuses on the Assessment and Management of Environmental and Social Risks and Impacts and it applies to all AfDB-financed projects and covers a wide range of environmental

and social issues, including pollution, resource use, community health and safety, and labour conditions. It mandates that borrowers identify, assess, and manage environmental and social risks associated with a project throughout its lifecycle, including conducting an environmental and social assessment (ESA) during project preparation. OS1 aims to ensure projects avoid or minimize negative environmental and social impacts, and promote sustainable development.

The OS 1 guide that Borrowers must conduct an ESA to identify, assess, and manage environmental and social risks and impacts and that the process should be integrated into project preparation, ensuring environmental and social considerations are addressed from the outset. It requires the development of mitigation measures and management plans to address identified risks and impacts. OS1 emphasizes the importance of stakeholder engagement and disclosure of information related to environmental and social risks and impacts. Projects are monitored and evaluated to ensure compliance with OS1 requirements and the effectiveness of mitigation measures.

OS2: Labor and Working Conditions

The OS 2 is aimed at promoting fair treatment, non-discrimination, and equal opportunity for workers; protect workers' rights; and ensure safe and healthy working conditions in all AfDB-supported operations. The emphasis is that the Projects must comply with national labour laws and relevant international labour standards, particularly those of the International Labour Organization (ILO). It provides guidance on what is supposed to be included in the Employment Terms and Conditions such as Clear communication of employment terms; Prohibition of forced labour and child labour, and Respect for freedom of association and collective bargaining rights.

Under Occupational Health and Safety (OHS), OS2 emphasises that Employers must provide a safe and healthy work environment and that Risk assessments and preventive measures are required to minimize workplace hazards. The other inclusion in the OS2 is Worker Grievance Mechanism which direct establishment of accessible and transparent grievance mechanisms for workers to raise concerns without fear of retaliation. This OS directs that protections must extend to all categories of workers, including those hired through contractors or working in community-based arrangements and that the Bank encourages elimination of ambiguous categories like "community workers" to ensure full labour protections.

OS3: Efficient Resource Use and Pollution Prevention and Management

AfDB's 2023 Integrated Safeguards System (ISS) Operational Safeguard 3 (OS3) focuses on Efficient Resource Use and Pollution Prevention and Management. OS3 aims to ensure that development projects minimize environmental damage by promoting resource efficiency, preventing pollution, and managing waste effectively. It emphasizes the need to protect natural resources, human health, and the environment by adopting cleaner technologies and practices.

The OS3 encourages the optimal use of resources, minimizing waste and promoting recycling and reuse. The OS2 promotes the adoption of cleaner technologies and practices to minimize pollution of air, water, and land. The OS 3 recognise that effective waste management strategies are essential to reduce the negative impacts of waste on the environment and human health. The OS3 aligns with broader climate action goals by promoting measures to reduce greenhouse gas emissions and enhance resilience to climate change impacts.

OS4: Community Health, Safety, and Security

Community Health, Safety, and Security focuses on protecting communities from risks associated with AfDB-financed projects. It requires borrowers to conduct comprehensive risk assessments to identify potential threats to community well-being, including those arising from project activities, the influx of workers, and interactions between workers and local populations. Key risks addressed include Sexual Exploitation, Abuse, and Harassment (SEAH), Gender-Based Violence (GBV), child labour, and modern slavery. Borrowers must implement targeted mitigation measures, establish accessible grievance mechanisms, and ensure timely response procedures for complaints.

OS4 also considers broader health and safety concerns such as infectious disease transmission, hazardous material exposure, and strain on public health infrastructure. It mandates the development of Stakeholder Engagement Plans (SEPs) and information disclosure strategies to keep communities informed and involved throughout the project lifecycle. While not a primary focus, OS4 positively acknowledges climate change risks and the need for inclusive infrastructure, especially for persons with disabilities. As part of the broader ISS framework, OS4 reinforces AfDB's commitment to social sustainability, human rights, and community resilience.

OS6: Biodiversity and Habitat Conservation, and Sustainable Management of Living Natural Resources

Biodiversity and Habitat Conservation aims to ensure that AfDB-financed projects protect biodiversity, maintain ecosystem services, and promote the sustainable use of living natural resources. The safeguard applies to all projects that may impact natural habitats, critical habitats, or ecosystems with high biodiversity value. Borrowers are required to identify and assess biodiversity risks and impacts early in project planning. Projects must avoid adverse impacts on critical habitats and endangered species. Where avoidance is not possible, mitigation measures must be implemented to achieve no net loss of biodiversity, and preferably a net gain in critical habitats.

OS6 also promotes the sustainable management of natural resources, including forests, fisheries, and agricultural lands. It encourages the use of Good International Industry Practices (GIIP) and compliance with international conventions such as CITES (Convention on International Trade in Endangered Species). The safeguard emphasizes community involvement, especially where local populations depend on natural resources for their livelihoods. It also requires Biodiversity Management Plans (BMPs) and monitoring systems to ensure long-term conservation outcomes.

OS7: Vulnerable Groups

Vulnerable Groups aims to ensure that AfDB-financed projects respect the rights and dignity of vulnerable and marginalized populations. These groups may include women, children, persons with disabilities, indigenous peoples, the elderly, and economically disadvantaged communities. OS7 requires that such groups be identified early, consulted meaningfully, and protected from disproportionate harm throughout the project lifecycle.

A key requirement is the application of Free, Prior, and Informed Consent (FPIC) for projects affecting indigenous peoples or similarly vulnerable groups. Projects must also ensure equitable access to benefits, including employment and services, and establish inclusive grievance mechanisms that are accessible and responsive to the needs of these populations. Social assessments must include disaggregated data to understand differentiated impacts, and mitigation measures should be tailored accordingly. OS7 reinforces the Bank's commitment

to social inclusion, human rights, and sustainable development, and is closely linked with other safeguards.

OS8: Cultural Heritage

Cultural Heritage is designed to ensure that African Development Bank-financed projects respect and protect cultural heritage throughout the project lifecycle. This includes both tangible and intangible heritage—such as historical sites, sacred places, traditional knowledge, and cultural practices—that may be affected by project activities. The safeguard requires borrowers to identify and assess cultural heritage early in project planning, using culturally appropriate methods and engaging relevant communities. Projects must avoid or minimize adverse impacts on cultural heritage and, where avoidance is not possible, implement mitigation measures in consultation with affected groups.

OS8 also emphasizes the importance of community participation, especially where cultural heritage is integral to identity and livelihoods. In cases where cultural heritage is discovered during implementation, procedures must be in place for chance finds, ensuring respectful handling and reporting. Overall, OS8 promotes the preservation, appreciation, and sustainable use of cultural heritage, aligning with international standards and reinforcing the Bank’s commitment to inclusive and respectful development.

OS10: Stakeholder Engagement and Information Disclosure

Stakeholder Engagement and Information Disclosure ensures that all AfDB-financed projects engage stakeholders transparently and inclusively throughout the project lifecycle. The safeguard requires borrowers to develop and implement Stakeholder Engagement Plans (SEPs) that outline how affected communities, civil society, and other relevant parties will be consulted and informed.

The engagement process must be inclusive, culturally appropriate, and gender-sensitive, ensuring that vulnerable and marginalized groups are not excluded. Borrowers must disclose project information early and continuously, including environmental and social risks, mitigation measures, and grievance mechanisms. OS10 also mandates the disclosure of the Independent Recourse Mechanism (IRM) and project-level grievance systems to affected communities, enabling them to raise concerns safely and effectively. The safeguard promotes transparency, accountability, and trust, aligning AfDB with international best practices in participatory development

The relevance of each of the ten (10) Operational Safeguards (OS) has been assessed in relation to the project, particularly in terms of environmental and social aspects. Based on the nature, characteristics, and scope of the proposed works, 08 OS have been identified as applicable, as shown in the table 3.1 below.

Table 3.1: Summary of Operational Safeguards (OS) Applicable to the Project

Operational Safeguards	Key Requirements	Relevance to the Project
OS1: Environmental and Social Risk and	• Classify projects (A, B, C, FI) based on potential environmental and social risks to determine the level of assessment needed.	Mwaiwathu Irrigation Scheme should identify and manages environmental and social risks early in the project cycle. It

Impact Assessment and Management	• Conduct environmental and social assessment to identify, evaluate, and manage risks and impacts. • Apply the mitigation hierarchy (avoid, minimize, mitigate, compensate) and develop Environmental and Social Management Plans (ESMPs). • Engage stakeholders early and continuously and disclose relevant project information in accessible formats. • Establish systems for monitoring safeguard implementation and provide accessible grievance mechanisms for affected communities.	requires a detailed environmental and social assessment to evaluate potential effects on land, water resources, biodiversity, and local communities. The safeguard mandates the development of an Environmental and Social Management Plan (ESMP) to guide mitigation and monitoring efforts. OS1 also emphasizes stakeholder engagement and public disclosure to ensure transparency and community participation. This is crucial for the Mwaiwathu project to promote sustainability, minimize harm, and align with AfDB's environmental and social standards.
OS2: Labor and Working Conditions	• Projects must adhere to national labour laws and international standards, especially those of the International Labour Organization (ILO). • Ensure non-discrimination, equal opportunity, and clear communication of employment terms; prohibit child labour and forced labour. • Provide a safe and healthy work environment, conduct risk assessments, and implement preventive safety measures. • Establish accessible, transparent systems for workers to raise concerns and seek redress without fear of retaliation. • Extend safeguards to direct, contracted, and community workers, ensuring fair treatment and labour protections across all categories.	OS2 ensures that all workers involved in the Mwaiwathu Irrigation Scheme are treated fairly and in accordance with national labour laws and international standards. It requires the project to provide safe working conditions, prevent child labour and forced labour, and respect workers' rights, including freedom of association. The scheme must establish clear grievance mechanisms for workers to report concerns without fear of retaliation. These measures are essential to promote decent work, protect vulnerable labour groups, and ensure ethical implementation of the irrigation infrastructure.
OS3: Efficient Resource Use and Pollution Prevention and Management	• Projects must optimize the use of energy, water, and raw materials through design and operational improvements. • Implement measures to prevent or reduce emissions to air, water, and land, including greenhouse gases, noise, and waste.	OS3 ensures that the Mwaiwathu Irrigation Scheme promotes efficient use of water, energy, and other natural resources throughout its design and operation. It requires the project to implement pollution prevention measures to avoid contamination of soil, water bodies, and air, especially from

	• Identify and manage hazardous substances to avoid risks to human health and the environment. • Promote waste reduction, reuse, and recycling; ensure safe disposal of non-recyclable waste. • Apply internationally recognized standards and technologies to minimize environmental impacts and enhance sustainability.	agricultural runoff and construction activities. The scheme must manage waste and hazardous materials responsibly to protect both the environment and public health. These practices support long-term sustainability and align the project with AfDB's environmental performance standards.
OS4: Community Health, Safety, and Security	• Borrowers must identify and assess risks to community health, safety, and security, including those from project activities and worker-community interactions. • Implement specific measures to prevent and respond to Sexual Exploitation, Abuse, and Harassment (SEAH), Gender-Based Violence (GBV), child labour, and modern slavery. • Address risks such as disease transmission, hazardous materials exposure, and pressure on public health infrastructure. • Develop Stakeholder Engagement Plans (SEPs) and ensure communities are informed about project risks and available grievance mechanisms. • Establish accessible, transparent systems for communities to raise concerns and receive timely responses and redress.	OS4 ensures that the Mwaiwathu Irrigation Scheme identifies and manages risks to community health, safety, and security arising from construction and operational activities. It requires measures to prevent and respond to issues such as Gender-Based Violence (GBV), Sexual Exploitation, Abuse, and Harassment (SEAH), child labor, and modern slavery. The scheme must also address potential health risks like disease transmission and strain on local health services due to worker influx. Stakeholder engagement and accessible grievance mechanisms are essential to ensure community concerns are heard and addressed effectively.
OS6: Biodiversity and Habitat Conservation, and Sustainable Management of Living Natural Resources	• Identify and assess potential impacts on biodiversity, natural habitats, and ecosystem services early in project planning. • Avoid adverse impacts on critical habitats and endangered species; apply the mitigation hierarchy to achieve no net loss or net gain in biodiversity. • Promote sustainable management of forests, fisheries, and other living natural resources, ensuring long-term ecological balance. • Engage local communities, especially those dependent on natural resources,	OS6 ensures that the Mwaiwathu Irrigation Scheme protects biodiversity and natural habitats that may be affected by irrigation infrastructure and water use. It requires assessment of potential impacts on ecosystems and species, especially in areas near wetlands, forests, or protected zones. The project must implement mitigation measures and promote sustainable use of natural resources, including soil and water. Community involvement is essential to support conservation efforts and

	in conservation planning and decision-making. • Develop and implement BMPs with clear mitigation, monitoring, and reporting measures aligned with international standards.	safeguard livelihoods dependent on local biodiversity.
OS7: Vulnerable Groups	• Projects must identify individuals or communities who may be disproportionately affected due to social, economic, cultural, or physical disadvantages. • Required for projects affecting indigenous peoples or similarly vulnerable groups, ensuring their rights and participation in decision-making. • Engagement must be culturally appropriate, accessible, and tailored to the needs of vulnerable groups throughout the project lifecycle. • Projects must ensure vulnerable groups benefit fairly from project opportunities and are not excluded or harmed. • Establish grievance systems that are accessible, safe, and responsive to the specific needs of vulnerable populations.	OS7 ensures that vulnerable groups—such as women, persons with disabilities, elderly individuals, and economically marginalized households—are identified and meaningfully included in project planning and implementation. The Mwaiwathu Irrigation Scheme must ensure these groups have equitable access to project benefits and are protected from disproportionate harm. Where indigenous or similarly vulnerable groups are affected, Free, Prior, and Informed Consent (FPIC) may be required. Inclusive engagement and tailored grievance mechanisms are essential to uphold social equity and safeguard human rights throughout the project lifecycle.
OS8: Cultural Heritage	• Borrowers must identify and assess potential impacts on both tangible and intangible cultural heritage early in project planning. • Projects must avoid adverse impacts on cultural heritage where possible; if unavoidable, appropriate mitigation measures must be developed in consultation with affected communities. • Engage local communities, especially those with cultural ties to the heritage, in decision-making processes to ensure respect and inclusion. • Establish and implement procedures for managing unexpected discoveries of cultural heritage during project implementation. • Ensure that project activities do not disrupt or disrespect cultural traditions, sacred sites, or practices.	OS8 ensures that the Mwaiwathu Irrigation Scheme identifies and protects cultural heritage sites and practices that may be affected by construction or land use changes. The project must engage local communities to understand the cultural significance of areas and avoid or mitigate any adverse impacts. Procedures for managing chance finds—such as historical artifacts or sacred sites—must be in place during implementation. Respecting cultural heritage fosters community trust and aligns the project with AfDB’s sustainability and inclusion goals.

	and align with national and international heritage protection standards.	
OS10: Stakeholder Engagement and Information Disclosure	• Borrowers must engage stakeholders from the earliest stages of project development, ensuring participation is inclusive, culturally appropriate, and gender sensitive. • Develop and implement SEPs that outline how stakeholders will be consulted, informed, and involved throughout the project lifecycle. • Provide timely, accessible, and relevant project information to affected communities and stakeholders in appropriate formats and languages. • Establish clear, accessible, and responsive grievance systems that allow stakeholders to raise concerns and seek redress. • Maintain continuous dialogue with stakeholders, updating them on project progress, changes, and responses to feedback or grievances.	OS10 ensures that stakeholders—including local communities, farmers, and district authorities—are actively engaged throughout the planning and implementation of the Mwaiwathu Irrigation Scheme. It requires the development of a Stakeholder Engagement Plan (SEP) to guide inclusive consultations and ensure that project information is disclosed in accessible formats. This helps build trust, address concerns early, and promote transparency in decision-making. Effective grievance mechanisms must also be established to allow stakeholders to raise issues and receive timely responses.

3.5 Institutional Framework

Institutional responsibilities for the co-ordination, planning, administration, management and control of development and environmental issues are fragmented among a number of agencies, ministries and organizations. The major institutions involved are presented in Table 3.2 below.

Table 3.2: Institutional framework

Malawi Environment Protection Authority (MEPA)	The Malawi Environment Protection Authority (MEPA) oversees environmental compliance, ensuring the project meets national environmental standards and conducts proper Environmental and Social Impact Assessments (ESIAs).
National Water Resources Authority (NWRA)	The National Water Resources Authority (NWRA) regulates water use and allocation, ensuring sustainable abstraction and protection of water resources.
Ministry of Transport and Public Works	The Ministry of Transport and Public Works is responsible for developing and maintaining the country's transport and public infrastructure. It formulates and implements policies for roads, railways, aviation, marine transport, and public buildings. The Ministry ensures that transport systems are safe, efficient, and environmentally sustainable. It also manages land and housing services related to infrastructure development.

Ministry of Local Government	The Ministry of Local is responsible for promoting decentralization and strengthening local governance structures. It coordinates development initiatives at the district and community levels to ensure inclusive and participatory planning. The Ministry also supports local councils in delivering public services efficiently and transparently. Additionally, it fosters community empowerment and accountability to enhance sustainable development and good governance
The Ministry of Finance	The Ministry of Finance is responsible for managing the country's public finances and economic policy. It oversees budgeting, taxation, debt management, and financial planning to ensure macroeconomic stability. The Ministry also coordinates donor aid and monitors public investments to support national development. Its work promotes transparency, accountability, and efficient use of resources to reduce poverty and foster sustainable growth.
The Ministry of Agriculture	The Ministry of Agriculture is responsible for promoting sustainable agricultural development to ensure food security and economic growth. It formulates policies and implements programs in crop production, livestock, irrigation, and land resource management. The Ministry also supports agricultural research, extension services, and agribusiness to improve productivity and market access. Its efforts aim to enhance rural livelihoods and reduce poverty through increased agricultural output.
The Ministry of Lands	The Ministry of Lands is responsible for managing land administration and ensuring equitable access to land for all citizens. It oversees land policy implementation, including reforms that promote secure tenure and sustainable land use. The Ministry also regulates physical planning and development to support orderly urban and rural growth. Additionally, it is digitizing land records to improve transparency, efficiency, and dispute resolution in land management.
Ministry of Natural Resources and Climate Change	The Ministry of Natural Resources and Climate Change is responsible for managing and conserving the country's natural resources, including forests, minerals, and water. It develops and implements policies to address environmental protection and climate change adaptation. The Ministry also oversees environmental impact assessments and promotes sustainable resource use. Additionally, it provides early warning systems and supports climate resilience initiatives to safeguard communities and ecosystems.

3.5.1 Administrative Framework of the ESIA Process

Section 7 of the Environment Management Act (2017) establishes the Malawi Environment Protection Authority (MEPA) as the principal agency for the protection and management of the environment and sustainable utilization of natural resources. Section 13 stipulates that MEPA shall have a secretariat headed by the Director General. Under Section 31 (1) of the Environment Management Act (2017), the Minister responsible for Environment may, on the recommendation of the Malawi Environment Protection Authority established under section 7

of the Act, specify, by notice published in the Gazette, the type and size of a project which shall not be implemented unless an Environmental and Social Impact Assessment is carried out. The Director General of MEPA is empowered, under the Act, to require changes to a project in order to reduce environmental and social impact and to reject a project, if, in his/her view, the project will cause significant and irreparable injury to the environment. A person not satisfied with a decision of the Director may appeal to the Environmental Appeals Tribunal.

According to Section 25 of the Act, the Malawi Environment Protection Authority shall establish Advisory Committees as advisers, consultants, reviewers or technical experts to assist in the conduct of its regulatory responsibilities. The advisory committee shall review all ESIA reports and make recommendations to the Malawi Environment Protection Authority (MEPA) Board for Approval

3.5.2 Summary of the licenses that need to be obtained for this project

The rehabilitation of Mwaiwathu scheme will require regulatory licenses and approvals to ensure that it is in line with sound environmental management practices and is in compliance with relevant existing legislation. These licenses and approvals are summarized the Table 3.3:

Table 3.3.: A list of Licences/Approvals required including status

No	Licence/ Approval required	Description	Regulatory Reference	Issuing Institution
1	ESIA Certificate	ESIA Certificate	EMA, 2017	MEPA
2	Waste and Hazardous Waste Licenses License	License to store, transport and dispose of hazardous wastes generated from construction site	EMA, 2017	MEPA
3	Development Permission	Permission to develop/construct the irrigation scheme in Thyolo	Under the Local Government Act 1998;	Planning Committee of Thyolo district Council
4	Water Abstraction Permits	Permit to abstract water from the rivers or to drill boreholes	Water Resources Act (2013)	National Water Resources Authority (NWRA)
5	Effluent discharge Permit.	Regulate the quality of wastewater, means and of discharge into surface drainage system	Water Resources Act (CAP 72.03)	National Water Resources Authority (NWRA)
6	Workplace Registration certificate	Every workplace is required to be registered and must commit to abide by all of the country's labour laws	OSHA (1997) Occupational Health, Safety and Welfare Act (Cap 55:01)	Ministry of Labour Director of Occupational Health, Safety and Welfare.
7	Sand Mining Permits	Any sourcing of sand for construction activities requires a permit from councils.	Mines and Minerals Act (2019)	Thyolo District Council

8	Mining licence (For gravel sites and quarry sites)	Any sourcing and mining of quarry and gravel	Mines and Minerals Act (2019)	Ministry of Mines
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4. BIOPHYSICAL AND SOCIAL ECONOMIC ENVIRONMENTAL OF THE PROJECT AREA

4.1 Biophysical Environment-Introduction

This chapter presents the baseline information on the biophysical, social, and economic environment within Mwaiwathu Irrigation Scheme. A thorough understanding of the existing environmental conditions is essential for identifying potential project impacts, evaluating their significance, and recommending appropriate mitigation measures.

The study employed scientifically validated and recommended methodologies to collect data from within the project footprint. This information was then analysed to support the Environmental and Social Assessment process.

4.2 Terrestrial Flora (Biological Environment)

The main objective of this assessment was to document and characterize the existing vegetation types and plant species occurring within Mwaiwathu irrigation scheme including area where transect walk was conducted i.e. from intake to the down area of the irrigable land.

Specific Objectives

- To classify the vegetation types and document their species composition within the broader project area.
- To identify and record plant species occurring within the defined project footprint.
- To identify key plant species of conservation concern, including those listed as threatened under the IUCN Red List, species listed under CITES Appendices, as well as any rare or endemic flora.
- To document plant species of local value, particularly those used by surrounding communities for medicinal and other traditional purposes.
- To advise the project developer on vegetation conservation strategies, including implications of altered environmental conditions (e.g., changes in plant life forms from mesophytic to hydrophytic due to the presence of water bodies), control of invasive species, and approaches for in-situ and ex-situ conservation.

4.2.1 Approach

The assessment employed a qualitative ecological methodology, using transect walks to systematically document vegetation across the project site. Vegetation was classified according to physiognomic characteristics, such as structural form and dominant life forms. Plant species were identified in the field by a qualified forester, supported by key botanical references, including *Evergreen Forest Flora of Malawi* (White et al., 2009) and *Flora of Malawi* (Hyde et al., 2021).

Additional tools and references included:

- **CITES Appendices** – for identifying species of international conservation concern.
- **IUCN Red List of Threatened Species** – for determining conservation status.

The IUCN Red List is the most widely recognized global tool for evaluating the conservation status, trends, and threats to both plant and animal species, supporting biodiversity protection. It categorizes species into nine groups based on parameters such as rate of decline, population size, geographic range, and degree of fragmentation. The online resource is accessible at <http://www.iucnredlist.org>.

- i) Extinct (EX) – No known individuals remaining.
- ii) Extinct in the Wild (EW) – Known only to survive in captivity, or as a naturalized population outside its historic range.
- iii) Critically Endangered (CR) – Extremely high risk of extinction in the wild.
- iv) Endangered (EN) – High risk of extinction in the wild.
- v) Vulnerable (VU) – High risk of endangerment in the wild.
- vi) Near Threatened (NT) – Likely to become endangered in the near future.
- vii) Least Concern (LC) – Lowest risk. Does not qualify for a more at risk category. Widespread and abundant taxa are included in this category.
- viii) Data Deficient (DD) – Not enough data to make an assessment of its risk of extinction.
- ix) Not evaluated (NE) – Has not yet been evaluated against the criteria.

Under the IUCN Red List “threatened species” refers to three categories namely Critically Endangered, Endangered, and Vulnerable.

i) Critically Endangered (CR)

A taxon is critically endangered when the best available evidence indicates that it is facing an extremely high risk of extinction in the wild.

In the project area, non-of the plant species in this category have been identified.

ii) Endangered (END)

A taxon is endangered when the best available evidence indicates that it meets any of the criteria for Endangered and is therefore facing a very high risk of extinction in the wild. No endangered species were found in the project area.

iii) Vulnerable (VU)

A taxon is Vulnerable when the best available evidence indicates that it is facing a high risk of becoming endangered in the wild.

4.2.2. Findings-Vegetation categories classified in the study area

Vegetation serves as an integrator of environmental conditions, reflecting the climatic, topographic, soil (edaphic), and biological characteristics of a given area. As such, the composition and structure of vegetation can offer valuable insights into the agricultural and ecological potential of a landscape. Moreover, certain land uses are directly dependent on vegetation resources, making vegetation inventories critical for planning and sustainable resource management (Timberlake et al., 1993).

The Mwaiwathu Irrigation Scheme area exhibits ecological diversity and supports a mosaic of both natural and human-modified land cover types. The landscape is predominantly composed of open grasslands and expansive agricultural lands, which together underpin local biodiversity and rural livelihoods. The terrestrial environment consists of a mix of indigenous vegetation and cultivated species, with commonly occurring trees including *Mangifera indica* (mango) and *Carica papaya* (pawpaw). These fruit trees are typically grown around homesteads for household consumption and local trade.

Physiognomic classification within the proposed project area identifies two main vegetation types:

i) Bushed Grassland

This category is defined by grass-dominated landscapes interspersed with scattered shrubs and small trees.

ii) Cropland

This category includes areas where natural vegetation has been cleared and replaced by agricultural crops—both annual and perennial—including vegetable gardens. Indigenous trees are still present in some areas, often interspersed with shrubs and bush patches, contributing to the area's ecological mosaic.

The proposed project site is generally composed of indigenous trees often interspaced by patches of shrub and bushes (Table 4.1).

Table 4.1: Tree species and their uses

Botanical Name	Chichewa	English	Protection status			Origin	firewood	Timber Building	Furniture	Tools Carvings	Rope	Animal Fodder	Edible Parts	Medicine/other
			National level	UICN	CITES Appendix									
<i>Acacia polycantha</i>	Mthethe	White thorn	NA	LC	Not Listed	I	++	++	+	++		++	Gum	VD,SN,TR
<i>Acacia sieberiana</i>	Minganzono	Papebark acacia	NA	LC	Not Listed	I	+	+	0	0		++		
<i>Acacia tortilis</i>	Nchongwe	Umbrella thorn	NA	LC	Not Listed	I	++				+	+		
<i>Afzelia quanzensis</i>	Msamba mfumu	Pod Mahogany	NA	NT	CITES Appendix II	E						+		
<i>Albizia lebbeck</i>	Mtangamtanga	womens tongue	NA	LC	Not Listed	I	++	++ +	++	++		++		TN
<i>Pterocarpus angolensis</i>	Mlombwa		NA	NT	CITES Appendix II	I	++ +	++ +	++ +	+++	++ +	+++		
<i>Afzelia quanzensis</i>	Mkongomwa		NA	NT	CITES Appendix II	I	++ +	++ +	++ +	+++	++ +	+++		
<i>Gmelina arborea</i>	Malayina		NA	LC	Not Listed	E	++ +	++ +	++ +	+++	++ +	+++		
<i>Albizia versicolor</i>	Mtangamtanga	Poison-pod albizia	NA	LC	Not Listed	I	++ +	++ +	++ +	+++		++		SP,Pods are poisonous
<i>Azanza garkeana</i>	Mtowo	Snot apple	NA	LC	Not Listed	I	+			+	+		Fruit	Host to cotton stainer
<i>Bauhinia thonningii</i>	Chitimbe	Monkey bread	NA	LC	Not Listed	I	+	0		0	++	+++	Pods	GP, DY, SP, BP, RU, CN
<i>Bridelia micrantha</i>	Mpasa	Bridelia	NA	LC	Not Listed	I	++ +	++ +	++ +	+++				BP, GP, PE, ST

<i>Caesalpinia decapetala</i>	Kapitagwilere	Mauritius thorn	NA	LC	Not Listed	I								
<i>Combretum imberbe</i>	Mnangali	Leadwood	NA	LC	Not Listed		++ +	++	0	++				SP,CO, RP
<i>Cordyla africana</i>	Mtondo	Wild mango	NA	LC	Not Listed	I	++ +	++ +	++ +	+++		+++	Fruit	Gum-resin
<i>Dichrostachys cinerea</i>	Chimphongala	Sickle bush	NA	LC	Not Listed	I	++ +			+++		+++		SN, BP, GP
<i>Erythrina abyssinica</i>	Muwale	Red-hot poker tree	NA	LC	Not Listed	I				0				PO
<i>Eucalyptus species</i>	Bulugam	Gum	NA	LC	Not Listed	E	+	++						
<i>Ficus capensis</i>	Mkuyu	Cape fig	NA	LC	Not Listed	I	0	0			+	++		SK
<i>Flacourtia indica</i>	Nthudza	Indian plum	NA	LC	Not Listed	I	0						Fruit	BP, GP, RP, RU, ST
<i>Gliricidia sepium</i>	Fliricidia	Mexican lilac	NA	LC	Not Listed	I	++	++ +	++ +	++				RP
<i>Leucaena diversifolia</i>	Lukina	Leucaena	NA	LC	Not Listed	E	++	0	0					PO, IN
<i>Moringa oleifera</i>	Chamwamba	Horse-raddish tree	NA	LC	Not Listed	E						++		
<i>Prosopis juliflora</i>		Mesquite	NA	LC	Not Listed	E								
<i>Pyracantha coccinea</i>	Mchende	Fire thorn	NA	LC	Not Listed	E	+	++	++	++		++	Fruit	OL, CO, MAL, GP, TR, S
<i>Sclerocarya birrea</i>	Mfula	Marula	NA	LC	Not Listed	I	++	+	+					PO
<i>Senna Siamea</i>	Keshya wa milimo	Cassia	NA	LC	Not Listed	E	+	+	+					PO
<i>Senna spectabilis</i>	Keshya wa maluwa	Cassia	NA	LC	Not Listed	E	0					+++		
<i>Sesbania sesban</i>	Yembe	Mangoe	NA	LC	Not Listed	I	++	++ +	++	++		++	Fruit	
<i>Syzgium cordatum</i>	Katope	Water berry	NA	LC	Not Listed	I								
<i>Tephrosia vogelii</i>	Mthuthu	Fishbean	NA	LC	Not Listed	I/E								
<i>Terminalia sericea</i>	Napini	Silver terminilia	NA	LC	Not Listed	I	++	++ +	++	++				GP, ST, RP, TR

<i>Toona Ciliate</i>	Sendrella	Toon tree	NA	LC	Not Listed	E	++		+					
<i>Trichilia emetica</i>	Msikidzi	Natal mahogany	NA	LC	CITES Appendix III	I	+	+	+	+				PE, BP, GP, RU, SP, OL
<i>Vetiveria zazaoides</i>	Thedzi	Vetiver grass	NA	LC	Not Listed	E						0		
<i>Ziziphus abyssinica</i>	Kankhande	Jujube	NA	LC	Not Listed	I	++ +	+	+	+		++	Fruit	RP
			NA	LC	Not Listed									

Origin: I=Indigenous; E=Exotic, Use Ratings: +++ = Excellent; ++ = Very Good; + = Good; 0 = Fair; Blanks = Poor or Unknown

Uses key

AB : Aboricide	MAL: Malaria	SN: Snake bites
BP: Head/ Body pains	MM: Multi medical	SP: Soap
CN: Contraceptive	OL: Oil	ST: Stomach disorders
CO: Cosmetic	PE: Purgative/Enema	TN: Tannius
DY: Dyes	PO: Poisonous	TR: Traditional beliefs
GP: General purpose medicine	RP: Respiratory/ Colds	VD: Venereal diseases
IM: Impotence	RU: Rheumatism	WT: Water treatment
IN: Insecticide	SK: Skin disorders	



Figure 4.1: Landscape of the proposed project site catchment



Figure 4.2: Landscape of the proposed project site catchment (also showing part of night storage reservoir)

During the transect walk, open grassland systems were predominantly observed in areas with sparse or removed tree cover. These grasslands comprise a mix of perennial and annual grass species that support livestock grazing and function as critical catchment recharge zones during the rainy season. Despite their ecological importance, these ecosystems are increasingly vulnerable to degradation caused by overgrazing, recurrent burning, and potential invasion by alien plant species.

A substantial portion of the Mwaiwathu landscape is dedicated to subsistence and smallholder agriculture. Key crops include *Zea mays* (maize), the staple food in the region; *Manihot esculenta* (cassava), *Cajanus cajan* (pigeon pea) and *Ipomoea batatas* (sweet potatoes) typically cultivated in sandy soils for both food security and income. Other crops include groundnuts, beans, pigeon peas, and a range of vegetables, cultivated based on soil type and water availability. The continued expansion of agricultural land through the clearing of natural vegetation remains a leading driver of biodiversity loss in the district.

In light of the increasing anthropogenic pressures particularly from agriculture and fuelwood collection it is crucial that land use planning within the project promotes sustainable natural resource management. Recommended strategies include community-based forest conservation, agroforestry practices, control of invasive species, and the ecological restoration of degraded woodlands. These interventions will be essential to safeguarding long-term ecosystem resilience within the project area.

4.3 Terrestrial Fauna (Biological Environment)

4.3.1 Methodology

The terrestrial fauna assessment employed a qualitative ecological approach, combining transect walks with stakeholder consultations to systematically record wildlife observations within the Mwaiwathu Irrigation Scheme. The survey focused on documenting the diversity and distribution of mammalian species, with particular emphasis on avifauna. Species identification was undertaken in the field by a qualified forester, supported by field guides and reference materials for mammals and birds of Malawi. Mwaiwathu

4.3.2. Findings

Field observations and community consultations conducted during the transect walk revealed a diverse assemblage of vertebrate and invertebrate fauna within the project area, encompassing a range of taxonomic groups across multiple ecological niches.

Mammals: Several mammalian species were identified, including *Procavia capensis* (Rock hyrax), a small, hyraxid mammal associated with rocky outcrops, and a variety of chiropteran species such as *Nycteris thebaica* (Common slit-faced bat), *Rhinolophus landeri* (Lander's horseshoe bat), and *Hipposideridae* species (Leaf-nosed bats), commonly roosting in caves and forested habitats. Other notable small mammals included *Elephantulus fuscus* (Dusky elephant shrew), *Heliosciurus mutabilis* (Mutable sun squirrel), *Heliophobius argenteocinereus* (Silvery mole rat), *Acomys spinosissimus* (Spiny mouse), and *Grammomys dolichurus* (Woodland mouse).

Avifauna: The area supports several avian species of conservation concern, particularly montane forest specialists such as *Chamaetylas choloensis* (Thyolo alethe) and *Apalis chariessa* (White-winged Apalis), both of which are restricted to the Eastern Afromontane biodiversity hotspot and are considered vulnerable due to habitat loss.

Reptiles: Reptilian diversity in the area includes *Nadzikambia mlanjensis* (Mulanje Chameleon), an endemic species, along with *Chamaeleo dilepis* (Flap-necked chameleon), *Hemidactylus mabouia* (Common house gecko), *Trachylepis boulengeri* (Boulenger's skink), *Varanus niloticus* (Nile monitor), *Lamprophis fuliginosus* (Brown house snake), *Philothamnus semivariegatus* (Spotted bush snake), and *Psammophis mossambicus* (Olive grass snake).

Amphibians: Amphibian species observed and reported include *Sclerophrys gutturalis* (Guttural toad), *Hyperolius argus* (Argus reed frog), *Xenopus muelleri* (Mueller's platanna), *Pyxicephalus adspersus* (African bullfrog), and *Chiromantis xerampelina* (Grey tree frog).

Invertebrates (Insects): The survey also documented various insect taxa spanning multiple ecological guilds. Representative families include: *Carabidae* (ground beetles), *Buprestidae* (jewel beetles), *Meloidae* (blister beetles), *Curculionidae* (weevils), *Gyrinidae* (whirligig beetles), *Pentatomidae* (stink bugs), *Papilionidae* (swallowtail butterflies), and *Coreidae* (leaf-footed bugs).

The presence of this faunal diversity underscores the ecological significance of the area and the need for integrated biodiversity conservation measures within the project's Environmental and Social Management Framework (ESMF).

4.4 Water quality analysis and sampling

4.4.1 Water analysis for domestic/portable water

4.4.1.1 Drinking Water Analysis

Domestic water samples were collected from intake, borehole, and outlet points used for household consumption within the project area. Laboratory analyses were conducted by the Ministry of Water and Sanitation's Water Quality Laboratory in Blantyre. Testing adhered to the Standard Methods for the Examination of Water and Wastewater (21st Edition). The results were evaluated against the Malawi Standards for Drinking Water (MS214:2005) and the Malawi Standards for Boreholes and Shallow Wells (MS733:2005) to assess compliance and potability (Table).

4.4.1.2 Chemical Water Quality

The pH levels of water samples ranged from 6.01 to 6.79, falling within the acceptable range of 6.0–9.5 as stipulated by MS214:2005. All assessed chemical parameters—including sodium, calcium, magnesium, iron, and potassium—were within the permissible limits for safe drinking water.

4.4.1.3 Physical Parameters

Physical parameters, specifically electrical conductivity and Total Dissolved Solids (TDS) were within the allowable thresholds under MS733:2005. Electrical conductivity ranged from 30 to 217 $\mu\text{S}/\text{cm}$, and TDS values were between 17 and 118 mg/L —well below the maximum allowable limit of 3,500 $\mu\text{S}/\text{cm}$ and 2,000 mg/L , respectively. These values indicate that the sampled water sources were suitable for human consumption at the time of sampling. Table 4.2 shows Water quality analysis results

Table 4.2: Water quality analysis

Parameters	Intake	Borehole	Outlet	Malawi Standards for Boreholes and Shallow wells (MS733:2005).
pH	6.13	6.79	6.02	6.0 – 9.5
Conductivity ($\mu\text{S}/\text{cm}$ at 25°C)	217	206	30	3500
Total Dissolved solids (TDS), mg/L	93	118	17	2000
Sodium (Na^+), mg/L	8	7	4	500
Potassium (K^+), mg/L	0.6	2.9	0.5	-
Calcium (Ca^{++}), mg/L	8.4	41.56	12.31	250
Magnesium (mg^{++}), mg/L	3.7	31.80	0.624	200
Iron (Fe^{++}), mg/L	0.040	0.081	0.029	3.0

All tested water samples taken from the borehole, intake and shallow wells within Mwaiwathu scheme fall within the acceptable limits for physical and chemical parameters as outlined in Malawi Standards (MS733:2005) for Boreholes. Key indicators such as pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS), and metal ion concentrations (e.g., calcium, magnesium, sodium, and iron) were all well below the maximum permissible thresholds.

The pH values across all sampling points ranged from 6.02 at the outlet to 6.79 at the borehole. These values fall within the acceptable range of 6.0 to 9.5 prescribed under the Malawi

Standards (MS733:2005), indicating that the water is mildly acidic to neutral. This pH range is suitable for human consumption and does not pose any risk of corrosion to water infrastructure or adverse health effects. The electrical conductivity (EC), which reflects the total ionic content in the water, was recorded between 30 $\mu\text{S}/\text{cm}$ (outlet) and 217 $\mu\text{S}/\text{cm}$ (intake). These values are significantly below the maximum allowable limit of 3,500 $\mu\text{S}/\text{cm}$. The low EC levels indicate minimal salinity and suggest that the water is of good quality for both drinking and agricultural use. Similarly, Total Dissolved Solids (TDS) values were found to be very low, ranging from 17 mg/L at the outlet to 118 mg/L at the borehole, compared to the national limit of 2,000 mg/L. These values suggest that the water is fresh, with low concentrations of dissolved inorganic substances. This enhances its palatability and confirms its suitability for domestic use. The sodium (Na^+) concentrations in all samples were very low, ranging from 4 to 8 mg/L, against a standard limit of 500 mg/L. Such levels pose no health concerns and are favourable even for individuals with sodium-restricted diets. Likewise, potassium (K^+) levels ranged from 0.5 to 2.9 mg/L. Although there is no defined limit under MS733:2005 for potassium, the values observed are typical for natural waters and are not considered hazardous. For calcium (Ca^{2+}), concentrations varied from 8.4 mg/L at the intake to 41.56 mg/L at the borehole, all well below the allowable limit of 250 mg/L. This suggests that the water contributes a beneficial amount of calcium without the risk of scale formation. Magnesium (Mg^{2+}) concentrations also remained within safe levels, ranging from 0.624 mg/L to 31.80 mg/L, significantly lower than the threshold of 200 mg/L. These two minerals together contribute to moderate water hardness, which is not harmful and may provide essential nutrients. Iron (Fe^{2+}) levels were minimal, ranging from 0.029 mg/L to 0.081 mg/L, well below the maximum allowable limit of 3.0 mg/L. Such low concentrations eliminate concerns about metallic taste, staining, or sedimentation associated with higher iron levels.

All tested water quality parameters are compliant with the national standards. The values indicate that the sampled sources (Intake, Borehole, and Outlet) provide potable water with low mineralization, minimal contamination, and suitable pH balance. The water is deemed safe for drinking and household use without requiring advanced treatment, though routine monitoring is recommended to detect any future changes in quality.

4.4.2 Water analysis for surface water/irrigation use

Surface water samples from the intake, middle, and outlet points were analysed to assess their suitability for irrigation, with results compared against Malawi Standards (MS733:2005, MS539:2013, and MS678:2013). The assessment covered both physical and chemical parameters relevant to irrigation and environmental health. Table 4.3 below shows the results from analysis of water sample collected at intake.

Table 4.3: Intake water sample analysis results

Parameters	Intake	Middle	Outlet	Malawi Standards (MS678:2013)
pH	7.70	6.30	6.90	6.5 – 9.0
EC ($\mu\text{S}/\text{cm}$ at 25°C)	27	101	174	-
NTU	0	13	3	25
DO	9.49	7.97	10.5	>5
BOD (mg/L)	7.52	5.16	3.92	20
COD (mg/L)	32.31	22.13	22.54	60
SS (mg/L)	3	10	0	30
PO_4^{3-} (mg/L)	0.477	0.318	0.315	0.15

The pH values ranged from 6.30 at the middle point to 7.70 at the intake, all within the acceptable range of 6.5 to 9.0 specified by MS678:2013. These pH levels are conducive to both irrigation and aquatic ecosystem health, with no risk of acidification or alkalinity-related issues for crops. Electrical conductivity (EC) values increased along the flow path, from 27 $\mu\text{S}/\text{cm}$ at the intake to 174 $\mu\text{S}/\text{cm}$ at the outlet. While there is no specific EC threshold under MS678:2013, these values are considered very low and indicate minimal salinity—suitable for irrigation use with no threat to soil or crop health. Turbidity (NTU) and Suspended Solids (SS) were well within acceptable limits. Turbidity values ranged from 0 NTU at the intake to 13 NTU at the middle point, far below the threshold of 25 NTU. Similarly, SS values were low, ranging from 0 to 10 mg/L, against the permissible limit of 30 mg/L. These low values suggest minimal particulate pollution and good physical water quality for agricultural application. Dissolved Oxygen (DO) levels were consistently high, ranging from 7.97 to 10.5 mg/L, exceeding the minimum requirement of 5 mg/L. These levels indicate good oxygenation and suggest a healthy aquatic environment with minimal risk of hypoxia. Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) values were all within acceptable limits. BOD values declined from 7.52 mg/L at the intake to 3.92 mg/L at the outlet, while COD ranged between 22.13 and 32.31 mg/L well below the maximum limits of 20 mg/L and 60 mg/L, respectively. These findings indicate moderate organic pollution, with no immediate concern for oxygen depletion or microbial overloading in the water system.

However, a key concern arises from Phosphate (PO_4^{3-}) concentrations. All sampling points recorded values significantly exceeding the allowable limit of 0.15 mg/L under MS678:2013, with concentrations ranging from 0.315 to 0.477 mg/L. These elevated phosphate levels suggest potential anthropogenic inputs, most likely from domestic wastewater, agricultural runoff (fertilizers), detergents, or sewage discharge. If left unmanaged, excess phosphates can contribute to eutrophication, leading to algal blooms, reduced oxygen levels, and long-term deterioration of water quality.

While most physical and chemical parameters are within permissible limits for irrigation, the elevated phosphate levels pose a significant environmental concern. This highlights the urgent need for improved wastewater management, control of agricultural runoff, and regular monitoring of surface water sources to safeguard the long-term viability of water for irrigation and protect downstream ecosystems.

To ensure sustained water quality for both drinking and irrigation, taking heed of the following recommendations would safeguard the interventions namely.

- Although current water quality results indicate suitability for irrigation and domestic use, regular monitoring is essential. This is particularly important during the dry season when reduced water flow and increased evaporation can concentrate dissolved solids and ions, potentially affecting water quality over time.
- To ensure long-term sustainability, it is recommended to adopt efficient irrigation scheduling and technologies, such as drip or sprinkler systems. These methods not only enhance water use efficiency but also reduce the risk of future salinity accumulation in the soil, which can compromise crop productivity.
- Given that the water catchment drains into larger river systems used for both consumption and irrigation downstream, it is critical to implement and maintain robust solid and liquid waste management practices. This will help prevent contamination and safeguard water quality across the broader watershed.

- In addition, baseline soil testing for salinity should be conducted in irrigated areas. Regular assessments will allow early detection of any adverse changes in soil quality and inform adaptive management strategies for both soil and water.
- The dual suitability of the water for domestic and agricultural purposes underscores the need for an integrated water use planning framework at the scheme level. A multi-use water resource management plan should be developed to ensure fair, efficient, and sustainable allocation of water among all users, while protecting environmental health.

4.5 Soils

4.5.1 Sampling approach

The soil assessment employed a multi-method approach combining field surveys, one-on-one interviews, and soil sampling with laboratory analysis. An integrated soil quality assessment framework was adopted, encompassing the simultaneous evaluation of physical, chemical, and biological attributes. While each indicator was analyzed using standard methodologies, the integrated approach provided a more comprehensive understanding of overall soil health than would be obtained by examining individual properties in isolation.

Fieldwork included visual assessments of vegetation cover, cropping systems, and physical signs of land degradation—such as gully formation and surface erosion. Additional in situ measurements were conducted for infiltration rates, soil depth, and rooting depth.

A range of soil sampling techniques was applied:

- Disturbed samples were collected using augers for laboratory determination of soil organic matter, pH, electrical conductivity, salinity, total nitrogen (N), extractable phosphorus (P), and potassium (K).
- Undisturbed samples were collected using corers for the assessment of soil bulk density and water-holding capacity.
- Specialized surface and subsurface samples were taken for soil structure determination and microbial biomass carbon analysis.

Soil depth measurements were undertaken to determine the barrier-free depth accessible to plant roots in both the proposed command areas and the catchment zone. Straight vertical soil cuts were made to allow physical inspection for rooting barriers, with recorded measurements of total soil depth and effective rooting depth of on-site vegetation. The assessment followed Lafitte (1994), which notes that roots of mature domesticated crops can typically extend to 1.2 m depth, but root growth ceases at any encountered barrier, preventing access to deeper water and nutrients.

Infiltration rates were measured in the field using double ring infiltrometers as described by Parr and Bertrand (1960). These measurements provided critical data on soil permeability and water infiltration capacity, informing both irrigation design and soil conservation planning.

4.5.2. Soils

The soil analysis conducted across ten locations and two depths (0–20 cm and 20–40 cm) provides a comprehensive understanding of the physical and chemical characteristics of soils in the project area. The dominant soil textures are Sandy Clay Loam (SCL) and Sandy Clay (SC), with a few samples classified as Sandy Loam (SL) (Table 12). These textures indicate moderate to high water-holding capacity and good structural stability, suitable for a variety of crops including maize and beans. However, in areas with higher clay content, there may be a

need to manage infiltration and aeration challenges. Soil erosion in the area is minimal given the soil type in the irrigation command area is sandy loam soil which is resistant to erosion and also the terrain in the area is generally gentle.

The dominant soil type is sand clayey loamy, these soils need frequent watering, as they tend to harden once they have less moisture. It is also important to note that the movement of water is restricted due to small soil pores. As such, application of nutrients should be direct within the crop root zones.

Table 4.4 Soil analysis results

Sample Ref/ID	Depth(cm)	% Silt	% Clay	CLASS	pH	OC %	OM %	N %	P ppm	Na cmol/kg
Sample 1. N784136/E8249213	0-20	12	34	SCL	7,30	0,78	1,34	0,07	8,14	0,005
	20-40	12	38	SC	7,08	0,91	1,56	0,08	5,55	0,006
Sample 2. N784400/E8249714	0-20	14	28	SCL	7,17	0,49	0,85	0,04	69,86	0,000
	20-40	14	34	SCL	7,23	0,70	1,20	0,06	6,05	0,012
Sample 3. N783907/E8249824	0-20	8	26	SCL	6,65	0,47	0,80	0,04	8,71	0,006
	20-40	8	28	SCL	6,81	0,41	0,71	0,04	5,64	0,008
Sample 4. N7883503/E8249787	0-20	6	12	LS/SL	6,77	0,39	0,67	0,03	16,63	0,006
	20-40	4	18	SL	6,57	0,44	0,76	0,04	11,61	0,007
Sample 5. N783443/E8249582	0-20	10	20	SL/SCL	6,66	1,01	1,74	0,09	2,76	0,004
	20-40	12	28	SCL	6,84	1,06	1,83	0,09	3,07	0,003
Sample 6. N783697/E8249423	0-20	14	38	SC	6,72	1,11	1,92	0,10	1,31	0,005
	20-40	12	40	SC	6,56	1,01	1,74	0,09	3,27	0,003
Sample 7. N783770/E8249223	0-20	12	18	SL	6,60	0,78	1,34	0,07	4,98	0,004
	20-40	12	24	SCL	6,55	0,96	1,65	0,08	2,49	0,011
Sample 8. N783558/E8249036	0-20	14	24	SCL	6,39	0,75	1,29	0,06	5,17	0,008
	20-40	10	32	SCL	6,14	0,75	1,29	0,06	2,80	0,006
Sample 9. N783767/E8249034	0-20	8	24	SCL	6,24	0,85	1,47	0,07	1,51	0,005
	20-40	10	30	SCL	6,33	0,88	1,52	0,08	1,50	0,007
Sample 10. N783967/E82248942	0-20	10	34	SCL	6,39	0,75	1,29	0,06	1,49	0,004
	20-40	14	34	SCL	6,51	0,75	1,29	0,06	1,55	0,007

4.5.3 Findings

The analysis showed that Soil pH ranges from slightly acidic to neutral (6.14–7.30), which is generally conducive to nutrient uptake and biological activity. Soils on the lower end of this range may require liming for crops that are sensitive to acidity. The organic carbon (OC) and organic matter (OM) contents vary moderately across the site, with some areas—such as Sample 6—showing higher fertility, while others indicate low organic content, suggesting the need for organic inputs like compost or manure to improve soil health.

Total nitrogen (N) content ranges from 0.03% to 0.10%, with moderate values in most locations. Low nitrogen levels in some samples may limit crop productivity and would benefit from nitrogen fertilization or crop rotations with legumes. Available phosphorus (P) levels show significant variability, ranging from very low to extremely high. While high phosphorus in Sample 2 suggests enrichment from fertilizer or organic waste, low levels in several other samples highlight the need for site-specific phosphorus management to address potential deficiencies and reduce the risk of environmental pollution from runoff. On the other hand, exchangeable sodium (Na) levels are consistently low across all sites, indicating no risk of sodicity or salinity, and confirming the soils are well-suited for irrigation with good quality water. Salinity is one of the major determinants of soil performance to support irrigation activities.

While the soils at Mwaiwathu are generally moderately fertile and suitable for agriculture, targeted interventions such as organic matter enhancement, pH correction, nitrogen and phosphorus supplementation, and proper soil monitoring will be essential to optimize productivity and sustainability.

Mwaiwathu

4.5.4 Geology

The geology of Phalombe District, where the Mwaiwathu Mwaiwathu Irrigation Scheme is located, is complex and geologically significant, shaped by alkaline igneous activity and associated hydrothermal processes. The area forms part of the Mozambique Belt, a Precambrian crystalline basement terrain that has undergone multiple tectonic deformation events (Carter & Bennett, 1973). This geotectonic history has resulted in a landscape rich in mineralogical diversity and structural complexity. Phalombe is particularly renowned for its ring complexes and rare earth element (REE) mineralization, which are key geological features of both regional and economic importance.

Notable Geological Features

- Carbonatites – Found primarily at Tundulu Hill and Songwe Hill, these carbonate-rich igneous rocks (notably *sövite*, or calcite carbonatite) are closely associated with REE mineralization, making them significant for mineral exploration.
- Fenites – Metasomatically altered rocks, widespread in Tundulu, often brecciated and enriched in potassium feldspar. These are typically associated with carbonatite intrusions and reflect intense hydrothermal alteration.
- Ring Complexes – Circular igneous bodies such as Tundulu Hill, Nkalonje Hill, and the Michese Intrusion exhibit intrusive and extrusive volcanic features. Many are vented and infilled with breccias and agglomerates, indicating past explosive volcanic activity.

The Phalombe Plain, which extends around these upland geological features, is underlain by lacustrine and fluvial deposits. These sediments reflect active depositional processes linked to Lake Chilwa, an endorheic lake situated in a tectonic depression, contributing to the area's fertile soils and alluvial aquifers. The geology of Phalombe, including the Mwaiwathu scheme area, reflects a long history of alkaline magmatism, hydrothermal alteration, and tectonic reworking. This has produced a diverse and resource-rich geological environment characterized by:

- REE-bearing carbonatites and alkaline intrusives,
- Unique alteration zones and mineral assemblages,
- Varied hydrogeological conditions conducive to groundwater development.

The combination of mineral potential, fertile alluvial plains, and groundwater resources presents opportunities for both sustainable agricultural development and responsible mineral exploration.

4.5.5 Hydrology

Groundwater in Phalombe District, where the Mwaiwathu Irrigation Scheme is situated, is recharged mainly by meteoric water (rainfall) with minor contributions from magmatic fluids (Carter & Bennett, 1973). Aquifers occur in both fractured crystalline Basement Complex rocks and unconsolidated alluvial deposits of the Phalombe Plain. The fractured aquifers generally yield moderate quantities of water, while the shallow alluvial aquifers are more productive but highly susceptible to contamination.

The district's hydrogeology is shaped by key natural features, including Lake Chilwa, the Phalombe Plain, and numerous ephemeral streams. Lake Chilwa, a shallow, endorheic lake, is hydrologically linked to the surrounding aquifers. Historical fluctuations in lake levels and salinity—documented in paleo-hydrological studies—are believed to influence groundwater salinity in the Phalombe Plain (Chilton & Smith-Carington, 1984).

The Phalombe Plain forms part of the broader Zomba–Phalombe Plain and is underlain by Basement Complex rocks overlain by alluvial deposits. Groundwater quality concerns include elevated fluoride, chromium, and cadmium from natural geochemical sources, and increased nitrate and phosphate from agricultural runoff and inadequate sanitation systems.

Phalombe is highly flood-prone, with both riverine flooding and flash floods occurring during tropical cyclones and extreme rainfall events. Ephemeral streams contribute to seasonal flooding, soil erosion, and sediment deposition, often affecting agriculture, infrastructure, and water supply systems. Floodwaters also heighten the risk of groundwater contamination.

The interaction between Lake Chilwa's fluctuating hydrology and regional aquifer systems is a critical factor for long-term water resource management. Effective strategies will require regular water quality monitoring, flood risk mapping, and the integration of climate-resilient water infrastructure to safeguard both supply and quality.

Table 4.6: Krisha-Murthy 1987 Flood Growth Factor

Flood Growth Factors						
Hydrological Years	T (Years)					
	10	20	50	100	200	500
1	1.94	2.35	2.88	3.27	3.68	4.21
2	1.92	2.32	2.83	3.21	3.62	4.14
3	1.76	2.1	2.51	2.82	6.14	3.51

Table 4.7: Peak Floods

Area	T _c	C	Q ₁₀	Q ₂₅	Q ₅₀	Q ₁₀₀	Q ₂₀₀
km	hours		m ³ /s	m ³ /s	m ³ /s	m ³ /s	m ³ /s
9.9	0.65	0.42	104.4	116.8	125.8	134.2	152.7

From an agricultural production perspective, the availability of perennial flow is a major asset, supporting dry season farming and improving food security. However, the seasonal variability and flood risk require integrated water management strategies including:

- Water storage infrastructure (e.g., night storage reservoirs) to buffer low flow periods;
- Flood protection structures (embankments, spillways, etc.);
- Efficient irrigation scheduling to optimize water use during peak demand.
- Catchment protection to reduce sedimentation and runoff.
- Crop calendar adjustments to align with hydrological realities.

In summary, the Phalombe River provides a reliable but seasonally constrained water source, with flash flood risk being a major hydrological challenge. For agriculture to thrive sustainably under these conditions, infrastructure resilience, adaptive management, and hydrological forecasting must be integrated into the operation of the irrigation scheme.

4.5.6 Topography

Mwaiwathu is characterized by a diverse topography that includes flat alluvial plains, gently undulating uplands, and steep escarpments, particularly along the eastern edge where it borders the Mulanje Massif. The scheme lies within the Phalombe Plain, a low-lying area that receives drainage from surrounding highlands, making it prone to seasonal flooding. Elevations range from below 600 meters in the valley bottoms to over 2,500 meters at the peak of the Mulanje Mountain. This varied topography influences land use patterns, hydrological dynamics, and soil formation, with flatter areas supporting intensive agriculture and the steeper zones hosting forest reserves and catchment areas.

4.5.7 Existing land use

Farmers in Mwaiwanthu Irrigation Scheme are primarily agricultural, reflecting the broader rural landscape of Malawi. Farming is predominantly subsistence-oriented and resource-constrained, with low crop yields that fall significantly below potential. Agriculture is generally not approached as a commercial enterprise but rather as a social and cultural necessity, integral to household survival rather than a strategy for economic advancement. Landholdings are small, and under typical rain-fed conditions, farmers plant in November or December and

harvest around April or May. During the dry season (May–November), most land remains idle, and livestock graze on residual crop stubble.

Due to limited land availability and growing food insecurity, farmers adopt one of two strategies: either rent additional farmland, which is often unaffordable due to high rental costs, or intensify production on existing plots by planting more than once per year made possible through irrigation. The dominant rain-fed crops include maize, cassava, beans, cowpeas, pigeon peas, and tomatoes, while beans are the primary irrigated crop within the scheme. Use of improved seed varieties is minimal and mostly limited to maize, often accessed through the government's Fertilizer and Input Subsidy Programme (FISP). Fertilizer use is inconsistent among farmers, dictated by the availability of financial resources. Overall, land use is characterized by low productivity, limited input use, and a dependence on seasonal rainfall, underscoring the importance of irrigation and intensified land use to improve food security and rural livelihoods.

4.6 Soil erosion and assessment

Land degradation poses a significant threat to agricultural productivity and environmental sustainability in the Mwaiwanthu Scheme area. The most prominent degradation processes include soil erosion, vegetation decline, aridity, soil salinization, and declining soil organic carbon. Among these, soil erosion and vegetation loss are the most critical, directly impacting land fertility and crop yields. These processes are primarily driven by increasing population pressure, which leads to over-cultivation, reduced fallow periods, overgrazing, and the expansion of agriculture into marginal lands. Unsustainable farming practices such as poor soil conservation, limited crop rotation, and insufficient ground cover further accelerate land degradation.

Stakeholder consultations held during project development identified key threats, impacts, and locally relevant solutions to address these environmental and socio-economic challenges. It was agreed that a shift towards sustainable land management (SLM) is necessary to reverse degradation trends. Such practices may include agroforestry, conservation agriculture, contour ridging, organic matter enhancement, and reforestation. The degradation observed is a result of cumulative unsustainable land use practices over time, highlighting the urgent need to identify and address the root causes through a combination of community engagement, policy support, and technical interventions. Implementing context-specific SLM strategies is vital to restore soil health, enhance resilience, and secure long-term productivity in the area.

4.6.1 Approach

The mosaics of images covering the project were downloaded from freely available USGS and Earth Explorer websites (<http://earthexplorer.usgs.gov/> and <http://glovis.usgs.gov>). The images were those acquired during the dry seasons (July–November) and with cloud cover $\leq 10\%$. They were Sentinel2 from 2020 and Landsat (5/8) from the years 1990, 2000, and 2010.

The collection of training data, using QGIS software, and classification, using Random Forest (RF), were iterative processes whereby the quality of training data was assessed using generated variables from the RF and the quality of the classification was assessed by overlaying the classification output on the corresponding color composite and visually checked for classification accuracy. High resolution Google Earth images were also used to check the quality of image classification. The classification of the four image mosaics produced the 1990, 2000, 2010, and 2020 Land Use and Land Cover (LULC) maps. Change detection was then done using post classification comparison analysis in Erdas Imagine software by comparing the produced LULC maps. This resulted in the three change detection maps, i.e., 1990 to 2000, 2000 to 2010, and 2010 to 2020.

A GIS based analysis using the Revised Universal Soil Erosion (RUSLE) Model was applied to estimate potential soil loss risk by water for any location within the area. The analysis provides spatial pattern of the potential soil loss risks caused by rainfall. The RUSLE (Renard et al., 1994) estimates long term average annual soil loss caused by rill and interrill erosion and it is of the form:

$$A = R \times K \times L \times S \times C \times P$$

Where, A = soil loss (t/ha-y)
R = annual rainfall erosivity index (MJ-mm/ha-h-y);
K = soil erodibility (t-ha-h/ha-MJ-mm);
L = slope length factor, dimensionless;
S = slope steepness factor, dimensionless;
C = cover and soil management factor, dimensionless, and
P = support practice factor, dimensionless.

4.6.2 Findings

Annual Rainfall Erosivity Index

Rainfall erosivity is the potential ability for rainfall to cause soil loss. In order to avoid calculating Annual Rainfall Erosivity Index solely from rainfall amounts, and due to limited time resources to conduct field experiments for determination of rainfall erosivity, rainfall erosivity dataset (GIS files) developed by Panagos P, et al. (2012) was used. The generation of this Rainfall Erosivity dataset by Panagos P, et al. (2012) involved the following steps: a) the collection of high-temporal resolution rainfall data; b) the calculation of the erosivity factor (R-factor) for each rainfall station; c) the normalization of R-factor values calculated with rainfall data collected at different time steps (1 min to 60 min), and d) the spatial interpolation of the R-factor point values.

K factor estimation

Calculation of C factor uses the soil texture data. The soil texture data were obtained from SOTER and being processed in the ArcMap. The SRB boundary was masked on each textural layer. The K was calculated using formula:

$K = 2.459 \times 10^{-5} M_n + 1.333 \times 10^{-4}$ (Mulengera & Payton, 1998). Where, $M_n = \text{Silt}\% (\text{Silt}\% + \text{Sand}\%)$ and the K values are in t-ha-h/ha-MJ-mm.

LS factor calculation

DEM (srtm-90m) covering SRB was processed by calculating slope using the ArcGIS software. The DEM was initially pre-processed to remove small imperfections of the data using Fill spatial analyst tool, followed by flow direction and flow accumulation using spatial analyst tool called “Hydrology” and finally the LS was computed using Raster calculator in spatial analyst toolbar of ARCGIS software. The LS factor was calculated using the formula: $\text{Power} (\text{“Flow accumulation”} \times \text{cell resolution}/22.1, 0.6) \times \text{Power} (\text{Sin} (\text{slope} \times 0.01745)/0.0896, 1.3)$ and then divided by 100.

C factor estimation

To determine the C-factor from remote sensing data, a widely used method based on the Normalized Difference Vegetation Index (NDVI) was applied. The NDVI is a widely used indicator of green vegetation vigor by the calculation of the spectral reflectance difference between red and nearinfrared bands of the satellite image. Landsat 8 Operational Land Imager (OLI) sensor data with 30-m spatial resolution (acquired in 2022 during the dry season and with cloud cover $\leq 10\%$) was used to compute NDVI. The Landsat 8 images were downloaded

from USGS and processed in ArcMap. The bands of each image were composited, followed the mosaic process of the images. Then, the NDVI was calculated using Image Analysis tool. Under the option menu in the image analysis window, the bands were selected where 4 being the Red band and 5 being NIR followed by calculating the NDVI by clicking the NDVI tool in the Processing menu of the image analysis window. The boundary of SRB was then masked and the C factor was calculated by raster calculator using the formula proposed by Durlington *et al.*, 2014 and later adapted by Colman in 2018.

$$C_{RA} = 0.1 \times \frac{(-NDVI + 1)}{2}$$

P factor estimation

Due to lack of information on local indicative P values, the P value used in this study was 1 on assumption that there is no significant support practice followed by farmers in the SRB area.

Table 4.8: Soil erosion risk classes and indicators for appraisal in the field

Class	Erosion Rate (Ton/Ha)	Indicators
Very slight	<2	No evidence of compaction or crusting of the soil; no wash marks or scour features; no splash pedestals or exposure of tree roots; over 70% plant cover (ground and canopy)
Slight	2 - 5	Some crusting of soil surface; localized wash but no or minor scouring; rills every 50 -100 m; small splash pedestals, 1 – 5 mm depth, where stones or exposed trees protect underlying soil, occupying not more than 10% of the area; soil level slightly higher on upslope or windward sides of plants and boulders; 30 – 70% plant cover
Moderate	5 - 10	Wash marks; discontinuous rills spaced every 20–50m; splash pedestals and exposed tree roots mark level of former surface, soil mounds protected by vegetation, all to depths of 5–10mm and occupying not more than 10% of the area; slight to moderate surface crusting; 30–70% plant cover; slight risk of pollution problems downstream if slopes discharge straight into water courses.
High	10 - 50	Connected and continuous network of rills every 5–10m or gullies spaced every 50–100 m; tree root exposure, splash pedestals and soil mounds to depths of 10–50mm occupying not more than 10% of the area; crusting of the surface over large areas; less than 30% plant cover; danger of pollution and sedimentation problems downstream.
Severe	50 - 100	Continuous network of rills every 2–5 m or gullies every 20m; tree root exposure, splash pedestals and soil mounds to depths of 50–100mm covering more than 10% of the area; splays of coarse material; bare soil; siltation of water bodies; damage to roads by erosion and sedimentation.
Very severe	100 - 500	Continuous network of channels with gullies every 5–10m; surrounding soil heavily crusted; severe siltation, pollution and eutrophication problems; bare soil.

Catastrophic	>500	Extensive network of rills and gullies; large gullies (>100m ²) every 20 m; most of original soil surface removed; severe damage from erosion and sedimentation on-site and downstream.
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Source: after Morgan et al 2004

4.7. Climate and weather conditions of the project area

Climate projections from the Department of Climate Change and Meteorological Services (DCCMS, 2021) indicate a significant warming trend for Malawi over the future climatological periods 2020–2039 and 2040–2059, with temperatures expected to increase by 1.03°C to 1.58°C. Rainfall is projected to decline slightly by 3.56–4.03 mm, although distribution is anticipated to improve during the wet season, characterized by fewer dry spells and longer wet periods. Conversely, the dry season—particularly from September to November—is expected to experience extended dry spells, which underscores the importance of developing irrigation infrastructure, climate-resilient farming systems, and integrated water resource management to sustain agricultural productivity.

Consistent with national climatic patterns, Phalombe District, including the Mwaiwanthu Scheme area, experiences two distinct seasons: a cool, dry season from April to October and a hot, wet season from November to March. Maximum temperatures typically range from 23.4°C in July to over 32°C in October and November, while minimum temperatures in July average between 9.5°C and 18.9°C. Annual rainfall ranges from 808 mm to 1,080 mm, with January being the wettest month (averaging 239 mm), followed by February (200 mm) and December (194 mm), based on historical data from 2004 to 2010. These climatic conditions, coupled with projected variability, necessitate adaptive planning and resilient agricultural interventions within the project area.

4.7.1 Rainfall season

According to the 2024 Department of Climate Change and Meteorological Services (DCCMS) rainfall forecast for the 2024/2025 season, precipitation patterns are expected to be influenced by a weak La Niña event. La Niña refers to the unusual cooling of ocean waters over the eastern-central equatorial Pacific Ocean, a phenomenon known to affect global and regional climate systems.

For Phalombe District, the onset of rainfall is projected to occur between the third and last week of November 2024, with cessation anticipated during the first week of April 2025. This suggests a seasonal length of approximately 110 to 150 days, providing a moderately long window for rain-fed agricultural activities.

However, the season is likely to be marked by prolonged dry spells, with a notable risk of one-week dry periods in February. Such interruptions during the mid-season could have implications for crop growth and yield, particularly for maize and other sensitive crops, making timely planting and supplementary irrigation critical for minimizing production losses.

The table 4.9 and figure 4.4 below show monthly rainfall distribution for the season with a normal band in grey.

Table 4.9 Monthly Rainfall

Month	Normal range		Forecast
Oct	1.4	19.4	46.9
Nov	44.4	80.5	24.2
Dec	173.1	244.3	173.8
Jan	231.2	333.6	239.0
Feb	186.8	232.7	212.2
Marc	95.6	165.7	169.8
Apr	12.1	44.5	90.8

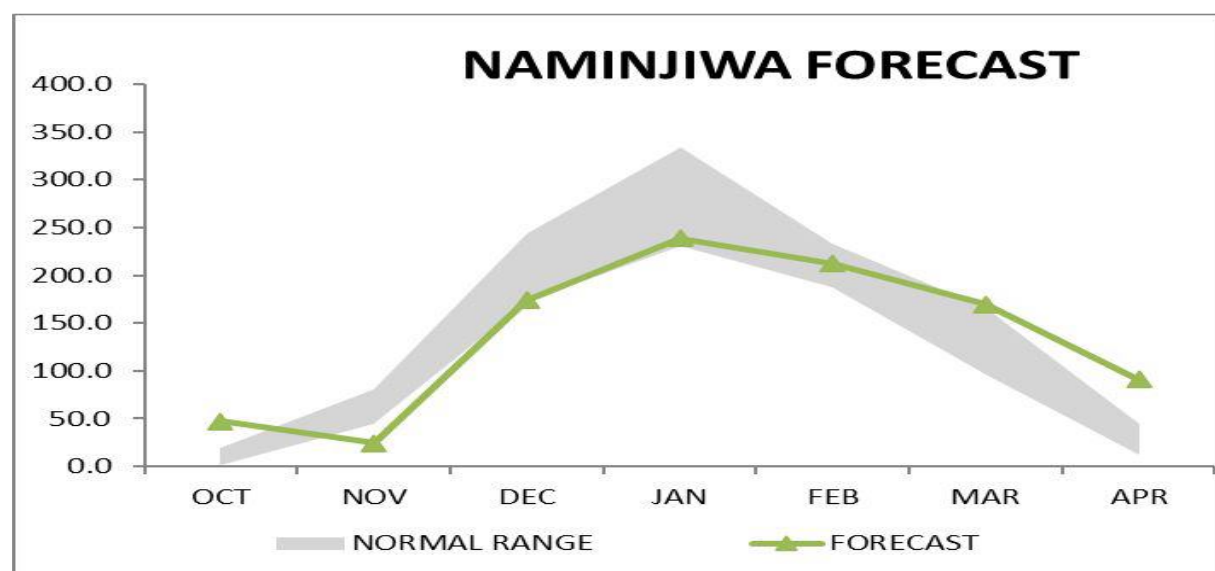


Figure 4.4: Monthly Rainfall distribution

Rainfall generally occurs between October or November and March in southern Malawi with rainfall distribution heavily influenced by topography.

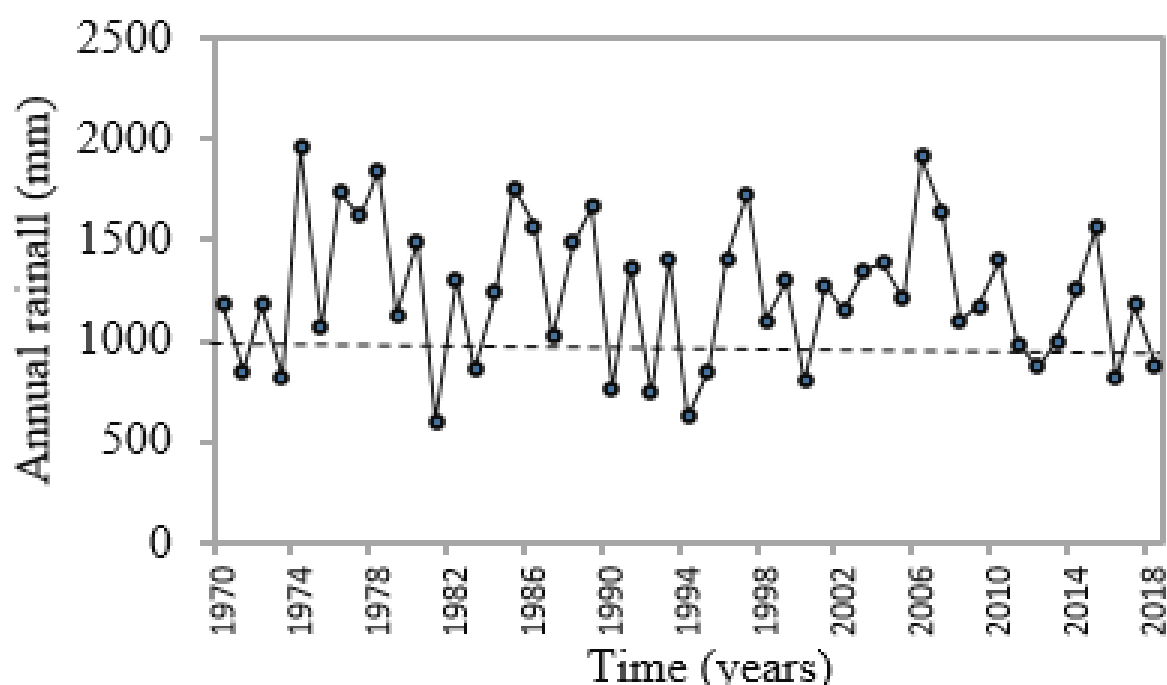


Figure 4.5: Time series plot of annual rainfall for Naminjiwa weather station (1970-2018)

As can be seen from the figure of time series plot for Naminjiwa that the area receives an annual rainfall of up to 1,005 mm and the rainfall regime and season is mono-modal (Fig 16)

4.7.2 Temperature

The Mwaiwathu area experiences a mean annual temperature of 22.5°C, with minimal monthly variation between October and March. The minimum recorded temperature is 13.3°C, while the maximum reaches 31.3°C. On an annual scale, the mean minimum and maximum temperatures are 17.6°C and 27.7°C, respectively. The region maintains a mean humidity of 67%, ranging from 50% to 80%, which supports crop growth but also influences pest and disease dynamics. Wind speeds average 292 km/day, with fluctuations between 233 and 354 km/day, contributing to evapotranspiration and microclimate regulation. Sunshine duration averages 6.9 hours per day, and solar radiation is approximately 18.7 MJ/m²/day, providing sufficient energy for photosynthesis. The reference evapotranspiration (ET_o) ranges from 3.57 mm/day to 6.72 mm/day, with a mean of 4.74 mm/day, peaking in October during the dry season. These climatic parameters are crucial for irrigation planning, crop scheduling, and water resource management in the scheme..

4.8 Air quality

Potential sources of emission surrounding the proposed site include:

Vehicle entrainment on unpaved roads: Vehicle-entrained dust emissions from the unpaved roads potentially represent a significant source of fugitive dust. When a vehicle travels on an unpaved road, the force of the wheels on the road surface causes the pulverisation of surface material. Particles are lifted and dropped from the rolling wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. The quantity of dust emissions from a given segment of unpaved road varies linearly with the volume of traffic. Emissions depend on source parameters that characterise the condition of a particular road and the associated vehicle traffic. Dust emissions from unpaved roads have been found to vary directly with the fraction of silt in the road surface materials. Other parameters include vehicle speeds,

mean vehicle weight, average number of wheels per vehicle and road surface moisture. Although vehicle entrainment on unpaved roads has been found to result in high fugitive dust emissions, these impacts are often limited to close to the source (USEPA, 2006).

Vehicle tailpipe emissions: Atmospheric pollutants emitted from vehicles include hydrocarbons, CO, CO₂, NO_x, SO₂ and particulates. These pollutants are emitted from the tailpipe, from the engine and fuel supply system, and from brake linings, clutch plates and tyres. Hydrocarbon emissions, such as benzene, result from the incomplete combustion of fuel molecules in the engine. Carbon monoxide is a product of incomplete combustion and occurs when carbon in the fuel is only partially oxidized to carbon dioxide. Nitrogen oxides are formed by the reaction of nitrogen and oxygen under high pressure and temperature conditions in the engine. Sulphur dioxide is emitted due to the high sulphur content of the fuel. Particulates such as lead originate from the combustion process as well as from brake and clutch linings wear (Samaras and Sorensen, 1999).

Domestic fuel burning: Pollutants released from these fuels include CO, NO₂, SO₂, inhalable particulates and polycyclic aromatic hydrocarbons. Particulates are the dominant pollutant emitted from the burning of wood. Smoke from wood burning contains respirable particles that are small enough in diameter to enter and deposit in the lungs. These particles comprise a mixture of inorganic and organic substances including aromatic hydrocarbon compounds, trace metals, nitrates and sulphates. Polycyclic aromatic hydrocarbons are produced as a result of incomplete combustion and are potentially carcinogenic in wood smoke (Maroni et al., 1995). The main pollutants emitted from the combustion of paraffin are NO₂, particulates, carbon monoxide and polycyclic aromatic hydrocarbons. Domestic fuel burning shows a characteristic diurnal and seasonal signature. Periods of elevated domestic fuel burning, and hence emissions, occurs in the early morning and evening for space heating and cooking purposes. During the winter months, an increase in domestic fuel burning is recorded as the demand for space heating and cooking increases with the declining temperature. A national survey conducted by the Central Statistic.

Agricultural activities: Emissions from agricultural activities are difficult to control due to the seasonality of emissions and the large surface area producing emissions (USEPA, 1995). Expected emission resulting from agricultural activities include particulates associated with wind erosion and burning of crop residue, chemicals associated with crop spraying and odiferous emissions resulting from manure, fertilizer and crop residue. Dust associated with agricultural practices may contain seeds, pollen and plant tissue, as well as agrochemicals, such as pesticides. The application of pesticides during temperature inversions increases the drift of the spray and the area of impact. Dust entrainment from vehicles travelling on gravel roads may also cause increased particulates in an area. Dust from traffic on gravel roads increases with higher vehicle speeds, more vehicles and lower moisture conditions.

Table 4.10: WHO ambient air quality thresholds

Pollutant	Averaging period	WHO ambient air quality thresholds
Sulphur dioxide (SO ₂)	24-hour	20
	10-minute	500
Nitrogen dioxide NO ₂)	1-year	40
	1-hour	200
Particulate matter (PM ₁₀)	1-year	20
	24-hour	50
Particulate matter (PM _{2.5})	1-year	10

	24-hour	25
Ozone (O ₃)	8-hour daily maximum	100

4.4 SOCIO-ECONOMIC ENVIRONMENT

Farmers at Mwaiwathu primarily engage in subsistence crop farming, growing staples like maize, cassava, sorghum, and rice mainly for household consumption, with limited surplus sold locally. Most operate on small plots averaging 0.5 hectares. In areas with irrigation infrastructure, some farmers cultivate high-value crops such as maize or vegetables. Livestock rearing mainly goats and chickens is practiced on a small scale, often serving as a financial buffer. Increasingly, farmers are adopting climate-smart practices such as agroforestry, mulching, and organic fertilizers, supported by NGOs and lead farmer training. Additionally, village savings and loan associations (VSLAs) are helping farmers access credit for micro-enterprises and commercial farming, gradually shifting livelihoods from subsistence to more diversified and resilient income sources.

4.4.1 Population growth and characteristics

The 2018 Malawi Population and Housing Census reported that Phalombe population for TA Mkhumba where Mwaiwathu scheme is located had a population of 110,623, contributing to the Phalombe District's total of 429,450. The district's annual growth rate of 3% exceeds both national (2.9%) and regional (2.7%) averages, indicating rapid demographic expansion. The age structure reveals a youth-heavy population, with 45.5% under 15 years, 50% aged 15–64, and only 4.5% aged 65 and above. This youthful profile suggests a high dependency ratio and emphasizes the need for strategic investments in education, healthcare, and employment.

It is envisaged that the fast-growing, young population may strain local resources, requiring proactive planning in social services, infrastructure, and livelihood programs to support sustainable development. To address the development pressures from a rapidly growing and youthful population in TA Mkhumba, farmers can play a central role by adopting sustainable irrigation practices that boost productivity and resilience. Empowering farmers with training, access to affordable irrigation technologies, and support for cooperative farming can transform agriculture into a sustainable livelihood engine that meets the needs of the growing population.

4.4.2 Land tenure

Land Tenure System

Malawi's land tenure system is governed by a combination of customary, leasehold, freehold, and public land arrangements, with over 65% of land under customary tenure. The Land Act of 2016 provides the legal framework to enhance tenure security and streamline land administration. Customary land, managed by communities under traditional laws, can now be formally registered as customary estates, giving individuals legal recognition of their land rights. Leasehold land is granted by the government for fixed periods (33, 50, or 99 years), mainly for commercial or residential use, and is subject to conditions like ground rent and development obligations. Freehold land, which offers perpetual ownership, is rare and discouraged under current policy. Public land is held by the state for communal purposes such as forests, roads, and government facilities.

Land Consolidation in Malawi

Land Consolidation in Malawi is a strategic process aimed at reorganizing fragmented and scattered landholdings—especially under customary tenure—into more structured and contiguous parcels. This approach is essential in rural areas where population pressure and inheritance practices have led to increasingly smaller and inefficient farm plots. Guided by the Land Act (2016) and the Customary Land Act (2016), land consolidation supports broader land reform efforts by enabling the registration of customary estates, improving tenure security, and facilitating better land use planning. Key objectives include enhancing agricultural productivity, promoting climate-smart land use, reducing land disputes, and enabling infrastructure development. Pilot projects in districts like Mchinji and Ntcheu, supported by partners such as FAO and the EU, have demonstrated the potential of consolidation to transform rural economies.

At Mwaiwathu, all land within the irrigation scheme falls under customary tenure. Once landowners' rights are verified by the Phalombe District Council, they are eligible for landownership certificates, which can be used to access loans. This has two major implications: first, landowners can invest in their land using borrowed funds, potentially improving productivity; second, rental prices may rise, possibly discouraging irrigation farmers from leasing land. Since the scheme does not own land but rents it seasonally using it for winter irrigation farming and returning it for summer rainfed farming the scheme management committee must establish bylaws that encourage landowners to invest in their land while maintaining affordable access for irrigation farmers. This balance is crucial for ensuring sustainable land use and inclusive rural development.

Mwaiwathu 4.4.3 Land use

The villages surrounding the Mwaiwathu Irrigation Scheme, like most rural communities in Malawi, are predominantly agricultural settlements where livelihoods are centred on crop cultivation and small-scale livestock rearing. Farming is primarily resource-limited subsistence agriculture, with yields often far below potential. For most households, farming is viewed less as a commercial enterprise and more as a social and cultural necessity—a means of survival rather than a pathway out of poverty.

Under typical rain-fed conditions, farmers plant their crops in November or December and harvest in April or May. From May to November, the land is generally left idle, with crop residues grazed by livestock from the villages. Given the small landholdings, planting only once per year does little to address household food insecurity. Farmers therefore adopt two main strategies:

1. Renting additional land during the rainy season to increase planted area, although this is often constrained by high rental fees.
2. Multiple cropping on the same plot within a year, especially where irrigation is available.

In the surrounding areas, rain-fed production focuses on maize, cassava, pulses (beans, cowpeas, pigeon peas), and tomatoes. Within the Mwaiwathu Scheme, similar crops are grown under irrigation, but beans are the dominant irrigated crop due to their shorter growth cycle and good market value. Use of improved seed varieties is mostly limited to maize and is primarily accessed through the Fertilizer and Input Subsidy Programme (FISP). Fertilizer application practices vary among scheme members, largely depending on financial capacity.

4.4.4 Land suitability for irrigated agriculture

Malawi's Land Use Planning Policy (2015) provides a national framework for promoting sustainable and coordinated land development across sectors such as agriculture, housing, infrastructure, and environmental management. The policy aims to ensure land tenure security, support climate resilience, and guide the efficient use of land resources. A key feature is its emphasis on decentralized and participatory planning, empowering district councils and local communities to develop Customary Land Use Plans (CLUPs) that reflect local priorities and guide development at the grassroots level.

The policy supports land zoning to reduce land-use conflicts and enhance productivity, particularly in rural areas where land fragmentation and competing interests are common. In areas like Mwaiwathu, this approach is crucial for aligning irrigation schemes with broader land use goals. By integrating CLUPs into local governance, communities can better manage land for rainfed and irrigated agriculture, infrastructure development, and conservation. For schemes like Mwaiwathu, the policy provides a foundation for balancing seasonal land rental arrangements with long-term planning, ensuring that landowners, farmers, and scheme managers work collaboratively to optimize land use while maintaining access and affordability.

Irrigation farming is a powerful tool for improving agricultural productivity and reducing poverty among smallholder farmers including Mwaiwathu. It allows farmers to control water application, fertilizer use, and pest management, enabling consistent crop production throughout the year. Since the land is already suitable for arable farming, irrigation can significantly enhance yields if farmers adopt improved seed varieties and apply recommended inputs. However, success depends on strong support systems particularly the availability of extension workers who can train farmers in good agricultural practices (GAPs). With proper guidance and access to resources, irrigation farming can transform subsistence agriculture into a reliable and income-generating livelihood.

4.4.5 Construction of scheme structures

The construction of the intake structure must adhere to recommended engineering standards, using a proper mix of cement, sand, and quarry stone. Pipes should be metallic and at least 125 mm in diameter to ensure durability and efficiency. The irrigation scheme will allow farmers to cultivate crops twice a year, excluding the rainy season. This will enhance household food security and income generation for participating farmers.

4.4.6 Deforestation/Afforestation

While some forest degradation has occurred due to farming activities in the surrounding area, the project will contribute to forest restoration. The scheme land itself is already under cultivation and does not currently contribute to deforestation. The project will promote afforestation efforts and enforce bylaws to support ecosystem conservation.

4.4.7 Cultural sites

There are no cultural heritage sites within the project area that would be affected by the scheme. However, each village has a graveyard, which is respected and protected—tree cutting in these areas is strictly prohibited.

4.4.8 Social amenities

Mwaiwathu irrigation scheme of Chingwalu Village, located within Waruma EPA in TA Nkhumba, Phalombe District, has access to basic social amenities, though infrastructure remains limited. Education services are available through nearby primary schools, and the

proximity to EPA ensures strong agricultural extension support, with active extension workers assisting farmers. Healthcare access is facilitated by John Chilembwe Hospital in Migowi, which is within walking distance, and smaller health posts may serve the local population. Water and sanitation remain challenges, with most households relying on boreholes and wells, and toilet coverage still improving. Electricity access is minimal, with most homes using solar lanterns or paraffin lamps. Security services are accessible via Phalombe Police Station, also within walking distance. These amenities, while modest, provide a foundation for community resilience and support the development of local initiatives such as irrigation schemes.

4.5 Women, Gender and Gender impacts

Addressing challenges such as household food insecurity requires the active involvement of women, who are central to agricultural production, food preparation, and household nutrition. Without their participation, long-term and sustainable solutions to food insecurity and rural poverty are unlikely to succeed. Women must therefore be integrated into every stage of the project, from planning and decision-making to implementation and benefit-sharing.

At Mwaiwathu, women have identified several key gender-related challenges that hinder their ability to contribute fully to food and livelihood security. These include limited access to productive resources such as land, agricultural inputs, and credit; time and labour burdens due to unpaid care responsibilities; and low representation in leadership and decision-making structures. Additionally, cultural norms may restrict women's participation in community-level institutions and training opportunities, further exacerbating gender disparities.

The project recognizes that empowering women and promoting gender equality are not only human rights imperatives but also essential for improving agricultural outcomes and household wellbeing. As such, gender-responsive strategies will be mainstreamed into project activities, including capacity building, inclusive governance structures, and targeted support to enhance women's access to irrigation, inputs, extension services, and markets. By ensuring that women are active agents of change, the project aims to enhance the resilience and food security of all households within the scheme.

4.5.1 Household Heads

During the women-only focus group discussions, participants unanimously indicated that men or husbands are traditionally regarded as the heads of households, primarily because they are perceived as capable of foreseeing challenges and planning effectively for the family's wellbeing. This perception reflects deeply rooted cultural norms that assign men the role of primary decision-makers and strategic planners within the household.

Women emphasized that household leadership entails responsibility, particularly in ensuring household food security. As such, men, in their role as heads, are expected to lead by example, receive support from all household members, and make decisions that contribute to the family's stability and resilience. Discussions also revealed that women entrust men with guiding household behavior, including discouraging food waste and promoting prudent use of resources.

The consultations further highlighted that when food is consistently available, women experience greater emotional and psychological stability, which enables them to better support their children. This insight underscores the importance of inclusive household planning and the need to strengthen both men's and women's roles in ensuring food and nutritional security. While men are recognized as household heads, the findings suggest that collaborative approaches to household management—in which women are empowered and involved—are key to achieving sustainable development outcomes.

5.1.1 Human Settlement

The surrounding human settlement is characterized by scattered, low-density villages, typical of rural Phalombe. Households in the area are primarily engaged in subsistence farming, with irrigation offering a pathway to increased productivity and food security. The scheme targets vulnerable groups, including women, youth, and persons with disabilities, promoting inclusive development. Most homes are built using local materials, and access to basic services such as electricity, piped water, and healthcare is limited. However, proximity to facilities like John Chilembwe Hospital and Phalombe Police Station ensures some level of service access. The population is expected to remain stable, with livelihoods improving due to the scheme's impact on agriculture and income generation.

5.1.2 Social Services

The Mwaiwathu Irrigation Scheme benefits from national and district-level agricultural support under Malawi's National Agriculture Policy and National Irrigation Policy. These frameworks promote irrigation development, agriculture diversification, and extension services through programs like the Programme for Rural Irrigation Development (PRIDE). Extension workers from the Naminjiwa EPA actively support farmers with training in climate-smart practices, input use, and irrigation management.

Health access is moderate, with John Chilembwe Hospital in Migowi serving as the nearest major facility. Smaller health posts may exist nearby, but infrastructure and staffing are limited. The scheme's proximity to Migowi ensures that farmers can access essential health services within walking distance. Details of the statistics of the prevalence of different diseases treated per season at the hospital are provided in Table 4.11

Market access remains a challenge due to poor infrastructure, low farm-gate prices, and limited market coordination. Farmers mostly rely on local and traditional markets, which are vital for food distribution but lack formal structures. These markets are critical for livelihoods, food security, and community cohesion, especially for women and youth. Strengthening urban-rural linkages and investing in market infrastructure such as storage, transport, and pricing systems—is essential for improving farmer incomes.

Community development efforts around Mwaiwathu are supported by inclusive planning and donor-backed initiatives. The scheme promotes gender equity, with a majority of landowners being women, and encourages participatory governance through local committees. Development partners like FAO and IFAD support resilience-building, capacity development, and access to finance, helping communities transition from subsistence to commercial farming

Table 4,8: Details of different diseases treated per season

ID	Disease	Dry season	Rainy season
1	Malaria	<900	>1500
2	Bilharzias	<80	>500
3	Diarrhea	<100	>500
4	Dysentery	<100	>500
4	Pneumonia	<100	<100
5	Respiratory diseases	<100	>500
6	HIV/AIDS	>700	>700

- **Water for domestic use** – The communities rely upon 4 working boreholes and dug well in the area as a source of domestic water supply.
- **Sanitation and waste management** - Households in the area dispose their refuse by ground crude dumping. Since during the operation of the scheme will generate some solid waste, household solid waste will be disposed in rubbish pits behind the homes. The rotten rubbish will be used to produce organic manure for the gardens to improve the soil fertility. Pit latrines will be constructed for use by scheme members.
- **Roads network:** The site can be accessed all year round up to the villages.
- **Education:** There is 1 primary school and 1 secondary school in the area. These are Mapanga Primary School (2 km from the site) and Phwadzi CDSS at Lisungwi (8 km from the site).
- **Energy source:** Major sources of energy in the surrounding villages are charcoal and firewood.
- **Telecommunication** - The area is within the coverage of Airtel, MTL and TNM networks hence people are able to send and receive calls and messages from friends and relatives using the cell phones. The site is serviced by Fatima Post Office.
- **Tribes:** The communities around the Mwaiwathu Irrigation Scheme in TA Nkhumba, Phalombe District, are predominantly of the Lhomwe tribe, which constitutes the vast majority of the local population.
- **Religion:** The area is largely Christian, with over 90% of residents affiliated with various Christian denominations, while a small minority practice Islam or other faiths. These communities are culturally cohesive, with strong traditional leadership and social structures that support communal development. Religious institutions play a vital role in social support, education, and development initiatives, often partnering with NGOs and government programs to enhance livelihoods and promote inclusive growth.

5 STAKEHOLDER CONSULTATIONS AND PUBLIC ENGAGEMENT

5.1 Introduction

The stakeholder engagement process was designed to ensure that all interested and affected parties had access to accurate, accessible, and objective information about the project, and were provided with meaningful opportunities to participate throughout its development and implementation. For this project, consultations aimed to:

- Inform stakeholders about the project, especially areas where understanding was limited.
- Gather insights on current pesticide management practices in the project areas under the AfDB-supported initiative.
- Collect input and feedback to inform the Stakeholder Engagement Plan (SEP) and draw on local knowledge for project design and implementation.
- Build public confidence through transparency and accountability.
- Identify benefits, concerns, risks, and mitigation measures.

These engagements also sought to promote stronger community participation, align project goals with community needs, improve risk management, raise awareness of development objectives, and strengthen local engagement capacities.

A mixed-methods approach was used to capture stakeholder perspectives. This included focus group discussions (FGDs), face-to-face interviews, and key informant interviews. FGDs, involving 15–20 farmers, were held at Mwaiwathu Irrigation Scheme in Phalombe, ensuring representation of men, women, and youth. Additional targeted meetings were conducted with smallholder farmers in all targeted Extension Planning Areas (EPAs), as well as with agro-dealers, extension workers, and subject matter specialists.

Between 4th and 6th March 2025, a total of 70 stakeholders participated in consultation meetings for the Mwaiwathu Irrigation Scheme. This included 33 farmers (71.4% of participants), of whom 17 were women (66%) and 13 were men (34%), alongside 17 government officials (28.6%). The consultations were designed to ensure inclusive engagement, gather local insights, and address community concerns related to the project's design and implementation. The methodology included public meetings, focus group discussions disaggregated by gender and age, and key informant interviews with traditional leaders and other influential figures. Figure 5.1: shows Stakeholder engagement/Consultation meeting with Mwaiwathu farmers (cross section of men)

From these discussions, several action points were identified for consideration during project implementation. These include the need for clear communication on project benefits and timelines, addressing land tenure and compensation concerns, ensuring gender-sensitive approaches, strengthening extension support, and promoting community ownership. These inputs are vital for shaping a responsive and inclusive irrigation development process.

Some engagements were in person, while others were via phone. A structured checklist guided discussion, which explored agricultural systems, environmental and health concerns, safety and security issues, socio-economic activities, and existing linkages with actors in the agricultural sector. The consultations were tailored to reflect the environmental and social realities of the project-affected areas.



Figure 5.1: Stakeholder engagement/Consultation meeting with Mwaiwathu farmers (cross section of men)



Figure 5.2: Stakeholder engagement/Consultation meeting with Mwaiwathu farmers (cross section of women)

5.2 Stakeholder Identification, mapping and Analysis

Key stakeholders were identified, and their needs, expectations, priorities, and objectives in relation to the program were assessed. This analysis informed the most appropriate mode and level of engagement for each group. Particular emphasis was placed on recognizing individuals and groups who may face barriers to participation or be disproportionately affected by the project due to marginalization or vulnerability.

Stakeholders were categorized into primary and secondary groups based on their influence over the project:

- Primary stakeholders are individuals or institutions with direct decision-making authority or the capacity to significantly influence project outcomes.
- Secondary stakeholders are influencers who, while not decision-makers, can shape outcomes through their access to and influence over primary stakeholders.

Although local communities are often regarded as secondary stakeholders, they are central to the project's success. Their active participation, ownership, and support are vital for smooth implementation. Over time, community members can transition into project partners. Ensuring

their meaningful engagement builds trust, fosters collaboration, and promotes sustainable results.

2.2.1 Types of Stakeholders

2.2.1.1 Affected parties

Affected parties in this project are individuals or groups whose livelihoods may be directly or indirectly impacted by the implementation of project activities. Primary among these are smallholder farmers participating in the project, who will be the direct beneficiaries of project interventions. Additionally, other smallholder farmers residing or cultivating in areas targeted by the project will benefit indirectly. The project is also expected to generate broader socioeconomic opportunities such as employment, business growth, and increased demand for local services which may positively affect various local groups and individuals. These opportunities, if effectively harnessed, could significantly enhance the project's value to the wider community (Table 16).

2.2.1.2 Other Interested parties

Interested parties include a broad range of stakeholders involved in, or affected by, the project but not directly impacted in terms of livelihood. These comprise institutions and individuals involved in project planning, delivery, oversight, or advocacy at national, district, and community levels. At the national level, the Ministry of Agriculture (MoA) will play a lead role in project implementation and monitoring. At the district level, key actors include district councils, NGOs, and related agencies responsible for supporting project delivery and ensuring proper mitigation of adverse impacts. Community leaders, political representatives, religious groups, and civil society organizations at the local level also form part of this category and play an essential role in promoting community.

Some interesting discussions and revelations from the stakeholder engagement meetings encompassed the following

2.2.1.3 Female headed household

During focus group discussions, women expressed concern over the vulnerabilities faced by female-headed households in the project area. These households often struggle to access basic resources and services, largely due to the compounded responsibilities placed on women as sole providers and decision-makers. Participants noted that female-headed households typically rank lower across key wellbeing indicators such as children's education, food security, income generation, and health outcomes. As a result, many women expressed a reluctance to take on household leadership roles, citing the emotional and financial strain as well as the lack of respect for their authority, even from within their own families.

This insight is particularly important given the project's objective of enhancing household food security. Without targeted support, female-headed households are at risk of being left behind in the implementation of irrigation and livelihood activities. To ensure equity and inclusivity, the project must integrate affirmative action's specifically designed to empower female-headed households. These may include priority access to irrigation plots, targeted training in agronomic and water management practices, provision of agricultural inputs, and community-based support mechanisms. By enabling the meaningful participation of female-headed households, the project can contribute to reducing gender disparities and improving food and livelihood security for the most vulnerable.

2.2.1.4 Spousal and family relations

During consultations, women raised concerns about family dynamics in polygamous households, which are common in the area. They observed that men often take second wives when they become more financially stable, a decision that significantly impacts household cohesion and food security. According to participants, younger or second wives tend to have more influence over the husband, often taking precedence in household decision-making. This shift in power dynamics is perceived by first wives as a loss of status and respect, leading to feelings of embarrassment and demotivation.

Women reported that, in such situations, first wives may withdraw from contributing to household productivity, including agricultural labour, which can result in reduced food security and weaker household resilience. Moreover, men are said to prioritize the welfare of second wives and their children, such as paying their school fees, while neglecting responsibilities toward the first family. To address this issue, women recommended that the project include awareness and sensitization activities targeting men, with a focus on the social and economic impacts of polygamy, particularly its role in undermining household unity and food security.

2.2.1.4 Gender Based Violence (GBV)

Women participating in the consultations identified poverty as a key underlying trigger of gender-based violence (GBV) within households. They explained that when men lack the financial means to meet household needs, it often leads to frustration, anger, and blame, which is frequently directed at their wives. This frustration can escalate into physical and emotional abuse, further destabilizing family wellbeing. Women noted that in such situations, men perceive their spouses as the cause of household misfortunes, despite the broader structural and economic challenges at play.

Conversely, women also reported that persistent poverty generates tension on their part, leading to disrespect or loss of patience towards their husbands, particularly when basic needs remain unmet. This creates a cycle of resentment and conflict, which undermines cooperation within the household. Women emphasized that household wellbeing and poverty reduction are only achievable when there is mutual respect and emotional stability. They called for increased awareness among men that women's happiness and support are essential for building resilient, food-secure households, and for the project to integrate gender-transformative approaches that foster more equitable, peaceful domestic relations.

Figure 5.1: Stakeholder Analysis Matrix

Level	Stakeholders	Issues	Interest	Likely Influence	Level of impact/influence	Engagement mechanism
National	Programme Implementation Unit staff	• Implementing Agency and • Timely coordination and communication	• Timely implementation of project activities • Effective communication and coordination	Influence and engage stakeholders to participate in the implementation of the project activities	High/High	Formal meetings
	Department of Irrigation	• Designing and Rehabilitation of irrigation infrastructure and storage facilities • Provision of water for agriculture	• Support designing and rehabilitation of climate resilient irrigation infrastructure including operation and maintenance • Support the project in sustainable utilization of water for increased crop and animal production	• Rehabilitation and Resilient irrigation infrastructure including storage facilities/ aggregation center • Increased agricultural production with irrigation water	High/High	Formal meetings
	Department of Land Resource Conservation	Leadership on land conservation and restoration (catchment management)	Ensure sustainable management of land conservation and restoration practices (catchment management)	Influence farmers to adopt good land sustainable and conservation practices (Catchment management)	High/High	Formal meetings
	Department of Agricultural Extension Services	Agriculture Extension support services including Farmer Training and mentorship	• Farmer groups support and provision of extension services • Promote farmer led innovations in agriculture • Agri business/commercialization	• Ensuring farmers, groups and producer associations have access to inputs, markets	High/High	Formal meetings

Level	Stakeholders	Issues	Interest	Likely Influence	Level of impact/influence	Engagement mechanism
			of farm produce and value addition	• Adoption of new technologies and innovations • Ensure business development services enabling them to produce for the market		
	Department of Animal Health and Livestock Development	Farmer training and mentorship and Animal health to support integrated homestead farming	Sustainable animal husbandry practices are being implemented and integrated homestead farming enhanced	Influence farmers to adopt sustainable animal husbandry practices and integrated homestead farming (for food and nutrition enrichment)	Low/Low	Formal meetings
	Department of Agricultural Research Services	• Administers pesticide registration and has the mandate to oversee importation and testing of all pesticides, research on farming technologies, and Climate research	• Curbing importation and utilization of unlicensed and illegal pesticides and promote sustainable pest management practices	Availability of pesticides and technical support to farmers and frontline staff	Low/Low	Formal meetings
	Department of Agricultural Research Services (Seed Services Unit)	• Seed production quality assurance	• Provide technical support and capacity building to seed producers (seed production protocols)	Influence provision of quality basic seed and inputs	High/Low	Formal meetings

Level	Stakeholders	Issues	Interest	Likely Influence	Level of impact/influence	Engagement mechanism
	Department of Crops and Development	• Crop production and productivity and mechanization	• Provide technical support in crop production and productivity and • Ensure access to mechanization	• Increased technical knowledge and skills among farmers • Enhancing access to farm implements and machinery • Influence cropping pattern	High/High	Formal meetings
	Mega Farm Unit	• Farm Mechanization and mega agricultural production	• Enhance access to farm implements for better and improved farm mechanization	Enhance availability of farm implements and machinery to farmers	Low/Low	Formal meetings
	SEEDCO	Production of quality seed	• Provision of quality inputs (basic seed, fertilizer, pesticides) • Market for the seed (Offtaker)	• Production of quality seed • Commercialization of seed produced	High/High	Formal markets
	Department of Disaster Management Affairs (DODMA)	Flood and drought management	Disaster risk management and support to affected communities	Support to farmers when faced with flood and drought events	Low/Low	Formal meetings
	Department of Nutrition	Custodian of Nutrition multisectoral policy	Reduced malnutrition for the farmers and children	Advocate for good WASH and nutrition behaviours	High/Low	Formal meetings
	Ministry of Trade and Industry	• Provides policy guidance in producer groups/cooperatives development and strengthening as part of the	• Support farmers on formulation of cooperatives and market identifications • Enhance certification of farm produce and linkage to formal markets	• Registration of cooperatives and training of business management • Ensure improved standards in quality of farm produce for	High/Low	Formal meetings

Level	Stakeholders	Issues	Interest	Likely Influence	Level of impact/influence	Engagement mechanism
		agricultural commercialisation efforts • Certification of produce for commercial purposes		commercial purposes (and linkage to formal markets)		
	Ministry of Water and Sanitation	Irrigation and domestic water Management	Support farmers on catchment management and technical support to water-related interventions	Influence the farmers to adopt good catchment management practices	High/Low	Formal meetings
	Ministry of Lands	• Land ownership to facilitate consolidation, production and land use and management • procedural catchment management guidelines	Support farmers on equitable access and secure tenure to land for production	Grievance redress mechanisms on land related conflicts and train farmers on land ownership	High/Low	Formal meetings
	Ministry of Natural Resources and Climate Change and the Environmental Affairs Department (EAD)	Provide policy and technical guidance in implementation of all-Natural Resource Management (NRM) related activities	Provision of technical support on Environment and Climate Change issues to farmers	Provide technical support to climate-proof farming and mitigation measures for climate-related impacts	Low/Low	Formal meetings
	Department of Climate Change	Climate and weather information services	Support farmers on decisions related to crop calendar	Seasonal climate outlook and weekly weather updates to	High/Low	Formal meetings

Level	Stakeholders	Issues	Interest	Likely Influence	Level of impact/influence	Engagement mechanism
	and Meteorological Services			support farmers in decision making processes		
	Ministry of Youth, Sports and Recreation (MYSR)	Increased youth engagement in agricultural-related interventions	Promotion of youth's interest in agriculture and engagement in creating employment opportunities for the youth	Engage young people to venture in agribusiness	Low/Low	Formal meetings
	Ministry of Gender Community Development and Social Welfare	Policy direction and monitoring of Gender Equality and women empowerment	Gender sensitive, safe, healthy development project	Promote gender, occupational safety and health (OSH), disability, youth and community development aspects of the project	High/High	Formal meetings
	Ministry of Labour	Labour relations in the project and protecting children against child labour	Enforce labour guidelines		Low/Low	Formal meetings
	Ministry of Health	Oversight and education on occupational health and safety and communicable diseases.	Health and Nutrition of the people	Enforce Public Health Laws and Provide Health services Mobilize for Health	Low/Low	Formal meetings
	Ministry of Information and Digitalisation	communications on government projects such as AIP, markets and weather updates	production and timely dissemination of public information	Influence adoption of new technologies in agriculture, help farmers to know where agricultural inputs and markets are	High/Low	Formal meetings

Level	Stakeholders	Issues	Interest	Likely Influence	Level of impact/influence	Engagement mechanism
	Malawi Environmental Protection Authority (MEPA)	Environmental issues and Environmental Impact Assessments for projects.	Environmental conservation and protection	Approve ESIA and RAP Report	High/Low	Formal meetings
	CEPA	Policy advocacy on sustainable development and environmental management	Public awareness on the need for policy reforms	Increased crop and animal production	Low/Low	Formal meetings
	National Water Resources Authority	Management of water resources, Water Supply, Sanitation, Climate Change	Construction of the intake as per approved standards, water permits/licenses	Enforcements of conservations activities around the dam and in the command area.	Low/Low	Formal meetings
	Department of Forestry	Promotion of forestry resources	Limiting deforestation of planted forest in project area Enhancing tree regeneration in catchment areas	Will give approval before part of the forest is taken over by the project Access to tree seedlings for catchment restoration	High/Low	Formal meetings
	NGOs	All development related issues	Development of rural population	Advocate for the project	Low/Low	Formal meetings
	Pesticide Control Board of Malawi	Regulation of pesticides importation and utilization	Reduce importation of counterfeit pesticides products Quality assurance of pesticides	Advocate access to quality and certified pesticides products Enhance technical capacity on handling and utilization of pesticides	High/Low	Formal meetings

Level	Stakeholders	Issues	Interest	Likely Influence	Level of impact/influence	Engagement mechanism
District Councils	District Councils	Political and developmental aspects of the project	Implementation and sustainability of the project activities in the district	Influence the community to embrace and implement the project interventions Ensure the sustenance of the activities	High/High	Formal meetings
	District Environment Office	Environmental aspects of the project	Minimal damage to the environment, if not project should improve environment	Recommend project to district leadership and to MEPA.	High/High	Formal meetings
	District Irrigation and Water office	• Hydrological and Engineering aspects of the project	• Safe and beneficial water development project • Rehabilitation of irrigation infrastructure	• Influence district leaders to embrace the project	High/High	Formal meetings
	District Agriculture Office	• Agricultural productivity and production aspects • Agribusiness and nutrition	• More and safer agricultural production and optimal utilization of inputs • Value addition and market linkage	• Mobilise farmers to embrace sustainable agriculture • Enhance crop diversification, agribusiness and nutrition	High/High	Formal meetings
	District Water Office	• Management of water resources, Water Supply and Sanitation,	• Construction of the intake as per approved standards, water permits/licenses	• Enforcements of conservations activities around the intake/dam and in the command area.	High/High	Formal meetings
	District Forestry Office	• Promotion of conservation of forestry resources	• Limiting deforestation of plated forest in project area • Enhancing tree regeneration in catchment areas	Will give approval before part of the forest is taken over by the project • Access to tree seedlings for	High/High	Formal meetings

Level	Stakeholders	Issues	Interest	Likely Influence	Level of impact/influence	Engagement mechanism
				catchment restoration		
	District Lands Office	Land ownership to facilitate consolidation, production and land use and management	Support farmers on equitable access and secure tenure and consolidation of land for production	Grievance redress mechanisms on land related conflicts and train farmers on land ownership	High/High	Formal meetings
	Bvumbwe Research Station	- Biophysical testing (soil and water) for crop production - Research on farming technologies and pesticide effectiveness,	- Provision of biophysical information for optimal production and productivity - Promote adoption of sustainable farming technologies and pest management practices	- Availability of soil and water parameters for crop production - Technical support on pesticides use to farmers and frontline staff	Low/Low	Formal meetings
	Gender/Community Development Office	Gender, livelihood and community development aspects of the project	Gender, financial literacy and inclusive consideration in the project	- Enhance gender integration and inclusiveness of farmers in project activities - Enhance basic and financial literacy among farmers	Low/Low	Formal meetings
TA level	Local Chiefs	Custodian of culture and indigenous knowledge, disputes redress on land-related conflicts and governance issues	To link communities to higher levels of authority and to other stakeholders within decentralized framework	To build confidence of the community in the crop and animal productions and interventions	High/High	Consultation meetings

Level	Stakeholders	Issues	Interest	Likely Influence	Level of impact/influence	Engagement mechanism
	Police and other Security Agencies	Makes sure that security issues are enhanced during patrols	The community always lives in harmony	Provide support to patrols	High/Low	Consultation meetings
	EPAs:	Increased productivity, gender-based issues, income generation issues and better livelihood	Increased production, Inclusivity and reduced malnutrition	Mobilizing support for farming communities and diversifying their livelihood incomes	High/High	Consultation meetings
	Ward Councilors and Member of Parliament	Governance, community education and mobilization issues	To link communities to higher levels of authority and to other stakeholders	To build confidence of the community in the project	Low/Low	Consultation meetings
	NGOs	Train farmers to increase production, on value addition, practice, climate-smart agriculture	Concerned with nutrition and employment in the social economic sectors	Mobilizing local people to diversify their way of living.	Low/Low	Consultation meetings
Community	Village Headpersons	Governance, community education and mobilization	To link communities to higher levels of authority and to other stakeholders	To build confidence of the community in the project	Low/Low	Consultation meetings
	Opinion/Religious Leaders	Governance, community education and mobilization	To disseminate message about the value chains and catchment management	Mobilize members of community to accept and own project	Low/Low	Consultation meetings
	Village-level Committees Agriculture Production Groups	Participate in resources management	To link communities to traditional leaders, and District councils	Mobilize farmers to practice good agricultural practices	Low/Low	Consultation meetings

Level	Stakeholders	Issues	Interest	Likely Influence	Level of impact/influence	Engagement mechanism
	Farmers groups/ Clubs / Associations	Increase production and profits margins	To link farmers to buyers	Mobilize farmers into cooperatives	Low/Low	Consultative meetings
	Women/Youth Leaders	Governance and community education and mobilization issues	Employment, better incomes, better nutrition	Mobilize other members of community to promote good agricultural practices	Low/Low	Consultation meetings
	Technical Assistants	extension and community outreach services	Improved crop and animal production, health surveillance and literacy	Adoption of good agricultural practices, health behaviours and financial literacy	Low/High	Consultation meetings
	Other Community Members/farmers	Increase production	Improved crop and animal production	Adoption of good agricultural practices	Low/Low	Consultation meetings
	NGOs)	Environmental and natural resource management	Improved crop and animal production	Adoption of good agricultural practices	Low/Low	Consultation meetings

5.2 Stakeholder Perception, Views and Concerns

Between 4th and 6th March 2025, a total of 70 stakeholders participated in consultation meetings for the Mwaiwathu Irrigation Scheme. This included 33 farmers (71.4% of participants), of whom 17 were women (66%) and 13 were men (34%), alongside 17 government officials (28.6%). The consultations were designed to ensure inclusive engagement, gather local insights, and address community concerns related to the project's design and implementation. The methodology included public meetings, focus group discussions disaggregated by gender and age, and key informant interviews with traditional leaders and other influential figures. From these discussions, several action points were identified for consideration during project implementation. These include the need for clear communication on project benefits and timelines, addressing land tenure and compensation concerns, ensuring gender-sensitive approaches, strengthening extension support, and promoting community ownership. These inputs are vital for shaping a responsive and inclusive irrigation development process.

5.2.1 Action points for farmers

i. Capacity Building & Skills Development

- Train farmers and scheme committees in operation and maintenance of irrigation, water supply, and storage infrastructure.
- Provide training in Good Agricultural Practices (GAP), focusing on crop production and productivity improvement.
- Train farmers in Integrated Pest Management (IPM), including safe handling, application, and administration of pesticides, insecticides, and veterinary drugs.
- Raise awareness on catchment management, soil conservation, and land restoration.
- Support mentorship of farmers/cooperatives in agribusiness, marketing, and value addition.

ii. Institutional Strengthening & Organization

- Support the establishment and registration of farmer cooperatives.
- Facilitate land tenure security and land consolidation within irrigation schemes.
- Promote gender awareness and provide financial literacy training to farmers.

iii. Market Linkages & Finance

- Facilitate linkages with formal markets/offtakers through contract farming arrangements.
- Connect farmers to financial institutions to access loans for boosting productivity.
- Support farmer access to quality farm inputs, tools, and implements.

iv. Information & Advisory Services

- Provide digital agriculture and climate advisory services.
- Enhance farmer access to market, weather, and extension information platforms

5.2.2 Findings of stakeholder consultations

Stakeholder consultations conducted at national, district, and community levels revealed that the Mwaiwathu Irrigation Scheme is inherently multisectoral, requiring collaboration across various institutions involved in irrigation, agriculture, land management, water, nutrition, gender, and public health. While district-level actors operate in a complementary manner, the absence of a unified cross-sectoral workplan presents both a coordination challenge and an opportunity for the project to support integrated planning. Phalombe District has established technical working groups and thematic committees covering areas such as environment, agriculture, and disaster risk reduction which can serve as platforms for aligning project activities with district priorities.

The project area is already home to several ongoing development initiatives. To avoid duplication and enhance impact, the project should leverage existing programs, build on community engagement mechanisms, and formalize partnerships with active development actors. Evidence of effective collaboration during past emergencies, such as Cyclone Freddy, highlights the potential for coordinated responses. Farmers at the scheme grow a wide variety of staple, legume, horticultural, fruit, and cash crops, which are vital for food security and income. Stakeholders recommended promoting contract farming to strengthen market linkages and build on existing crop preferences.

However, productivity is constrained by pests, diseases, and limited access to veterinary services. Key crop pests include fall armyworm, aphids, and termites, while livestock face disease outbreaks due to the absence of Assistant Veterinary Officers and veterinary drugs. The project will address this by promoting small stock production (goats, chickens, rabbits) through a pass-on program as part of nutrition sensitive agriculture interventions.

Evidence of collaboration exists in the districts as shown during emergencies were based on a contingency plan, partners are able to mobilize some resources to support the victims. The project should aim to explore and formalize collaborative arrangements with existing development partners operating within the same geographic and thematic scope. By building on existing synergies, the project shall enhance the effectiveness, sustainability, and resilience of its interventions. This approach will also foster institutional learning and capacity strengthening, while promoting a more coherent and harmonized development response at the district level.

Broader systemic challenges include high input costs, limited market access, climate change impacts, and weak technical capacity. These consultations have been instrumental in identifying context-specific priorities, enabling the project to adopt demand-driven, resilient, and inclusive approaches for sustainable development.

5.5 Grievance Redress Mechanism

A grievance redress mechanism is prepared to ensure that:

- Provide Affected Parties with a chance submit their feedback, comments or grievances.
- Record Received Grievances and comments – all input received through the engagement process should be recorded via meeting records and the grievance log.
- Generate Responses – the Project team will review comments received and generate comments after each phase of engagement.
- Communicate Responses to Stakeholders who have Raised Comments –all

opinions and concerns noted during stakeholder engagements should be recorded by the Project and a summary of the feedback and comments is maintained.

The following means of communication are available to stakeholders through the course of project as follows:

- Verbal feedback,
- email and telephone contact details will be made available to stakeholders for the project contact person; and
- Engagement meetings will be carried out directly with stakeholders during the project implementation period.

The GRM is developed to be implemented by the project to outline the approach of receiving/accepting, assessing, communicating, resolving and monitoring grievances from those affected by Project activities including contractors' activities. The GRM will be set up by the Project but will be linked to the existing GRM at VGH level. Furthermore, this suggested project grievance mechanism is designed to complement the entire project engagement process, and grievances related to the ESIA also can be submitted to this mechanism. Figure 5.3 shows grievance mechanism process.

GRM is designed to meet the requirements of the AfDB, FAO and Equator consultation principles, and it has the following objectives:

- To provide a simple, fair and transparent process for all external parties to submit feedback and to raise grievances. This shall result in outcomes that are fair, effective and lasting.
- To provide a simple process for Project personnel to address any issues and concerns raised by stakeholders in a methodical and time efficient manner.
- To mitigate risks and impacts to all external stakeholders due to project operations, demonstrating company care for the wellbeing of its stakeholders.
- To build trust and goodwill as an integral component of the stakeholder's relation activities, and promote trust and respect with stakeholders, particularly at a community level.
- To enable for the systematic identification of emerging issues and trends, facilitating corrective and pre-emptive engagement.

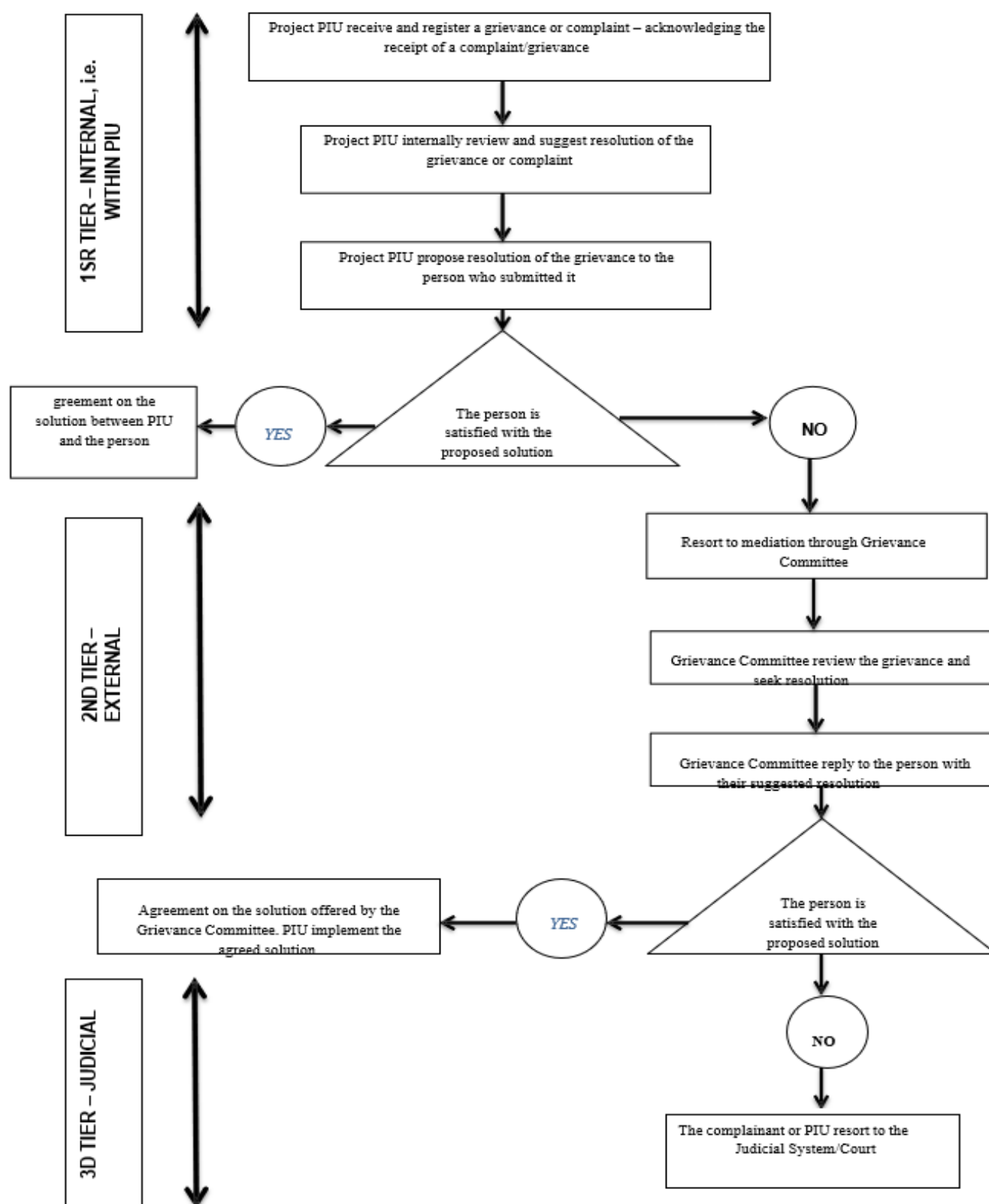


Figure 5.3: The grievance mechanism process

6. IDENTIFICATION AND ANALYSIS OF ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS OF THE PROJECT

6.1 Introduction

Any project brings change to the existing social and environmental conditions in the area. The changes can either be harmful or beneficial to communities or environment. The purpose of the environmental and social assessment study is to understand the existing social and environmental conditions of the area before any project intervention and to be able to predict changes that might occur due to the implementation and operation of the particular project. The following section highlights the impacts anticipated throughout the lifecycle of the proposed project. The impacts identified have been rated using a specific methodology elaborated in this chapter. The impacts are identified across the three phases namely: Construction Phase (including impacts due to project location), Operational Phase and Decommissioning Phase.

6.2 Identification of environmental and social impacts

Several environmental impacts associated with the proposed project were identified through field work, desktop analysis and the use of experts' judgment method. The impacts of this project have been identified by considering project activities against specific environmental characteristic of the area. The impact associated with each intersection of an action and a factor of the environment is described in terms of its significance, nature and extent of impacts using an adoption of the Leopold Matrix (LM) (Leopold et al., 1971). The LM is an interaction matrix with 88 environmental characteristics along the top of the table and 100 possible project actions in the left-hand column considered suitable for use in most construction projects. The method is useful in ensuring that major second order impacts are not omitted from the investigations.

In this case, the LM is combined with other methods including public consultations, baseline surveys and professional judgment to identify, assess and analyse impacts. Based on analysis of the proposed project activities and consultation with stakeholders, both potential positive and negative impacts were identified and displayed using this matrix. The intersections between environmental segments with associated impacts and each of the development activities were rated on a 5-point scale using professional judgment. After scoring, the matrix scores are evaluated to estimate the overall impact of the project on the environment (Illustration in Table 6.1).

Table 6.1: The matrix scores

The scores are interpreted as follows: - 0 =	Negligible impact (not significant, low magnitude, low probability of occurrence, short duration of existence, low or no cross boundary effects, easily reversible, does not easily accumulate)
+/-1 =	Low impact;
+/-2 =	Medium impact
+/-3 =	High impact
+/-4 =	Extremely High Impact (highly significant, high magnitude, high probability of occurrence, long duration of existence, high cross boundary effects, not easily reversible, can accumulate quickly)

6.3 EVALUATION OF THE IDENTIFIED ENVIRONMENTAL AND SOCIAL IMPACTS

The impacts were assessed and interpreted based on a ranking system of high, moderate and low depending on the nature, scope (temporal and geographical) and resilience of the impacts. They can be positive or negative, direct or indirect and the magnitude of each impact is described in terms of being significant, minor or negligible, temporary or permanent, long-term or short-term, specific (localized) or widespread, reversible or irreversible. Generally, temporary impacts having no obvious long-term consequences are regarded as being minor but those with long-term repercussions are classified as significant. The impacts of the project during each of its life cycle stages (construction, operation and decommissioning) are categorized into: impacts on the biophysical environment; health and safety impacts and socio-economic impacts.

6.3.1 Steps of Impact Assessment

The potential impacts of the proposed project were assessed using the following steps:

- a. Characterization of the baseline conditions or rather the existing conditions before the Project is undertaken and any effects are generated;
- b. Description of the Project components throughout the Project lifespan (construction, operation and decommissioning);
- c. Evaluation of alternatives to the Project to see if impacts can be reduced;
- d. Identifying sources of impacts and the impacts themselves that are generated by any aspect of the Project;
- e. Rating of impacts before any mitigation (for negative impacts) or enhancement (for positive impacts) is implemented;
- f. Identification of mitigation and enhancement measures to address the impact; and
- g. Rating impacts after mitigation to produce a “residual” impact rating.

6.3.2 Impacts Rating Criteria

In this assessment the approach based on environmental health and safety risk rating system, has been adopted in order to rate potential social and environmental impacts related to the proposed project. It is important to note that there is no legal definition of significance of the impacts and therefore its determination is partially subjective. The impacts rating approach has focused on the following aspects:

- Nature of the impact: Positive or Negative
- Term of impact: Short, Medium or Long Term
- Likelihood of the event: Low, Medium or High
- Changeability: Reversible or Irreversible. An impact is reversible when the environment can return to its natural state after a mitigation action. In case of positive impact, reversibility means that the positive effect ends
- Duration: Temporary or Permanent
- Localization: Localized or Widespread.

The impacts were evaluated using the parameters of magnitude, significance, probability and duration of occurrence. The evaluation of the identified impacts was guided by careful assessment and judgment of the anticipated consequences with regard to normal standards. Secondly, the evaluation of the impacts was done by assigning values to each impact, using the above parameters. In figures 6-1 and 6.2 the score of each impact was the average value of scores from four environmental and social experts. In each case of the identified impacts, the assessment and assignment of values by the experts was based on the values developed in Table

6.3. Positive impacts were equally evaluated using slightly different criteria. Following is a summary of identified and analysed significant impacts (positive and negative) and their mitigation/enhancement measures.

6.2 Environmental Assessment of Impacts

After identifying the positive and negative environmental impacts the proposed project will have on the environment, further analysis was conducted to determine the extent and significance of the impacts. The aspects that were considered were magnitude, significance, probability of occurrence and duration of impacts which have been properly explained.

6.2.1 Magnitude

Magnitude is a measure of the general degree, extensiveness, or scale of impacts. The magnitude was scored at four levels i.e. household level, local level, regional level and national level.

6.2.2 Significance

This is a measure of the importance of a particular action on the environmental factor in the specific instance under consideration. This was scored using values ranging from +3 to - 3 with a score of 1 representing a low/minimal significance, 2 moderate significance and 3 representing a high significance. Impacts of negative significance were assigned a minus (-) sign and impacts of positive significance are given a plus (+) sign.

6.2.3 Probability of occurrence

Provides an estimate of the probability of an impact occurring before mitigation is applied. The impacts were considered as:

- a) Possible (impact may occur but it is not probable);
- b) Probable (the impact is very likely to occur); and
- c) Definite (impact is unavoidable).

6.2.4 Duration

Refers to the period of time over which an impact may occur, from once-off to continuous for the life of the project. Duration of impacts was considered in terms of the following criteria: Short term (less than 5 years); Medium term (between 5 and 10 years) and Long term (over 10 years). For purposes of this analysis an impact matrix was prepared and is provided in Figure 6.2.

Table 6.2: Environmental and social *Impact Evaluation* (Source: Coastal environmental Services, Benley 2001)

SCORE	(-1) +1	(-2) +2	(-3) +3	(-4) +4	(-5) +5
ASSESSMENT PARAMETER					
Magnitude	Impacts occur or are felt within the site.	Impacts felt within the surrounding area	Impacts <i>affect beyond 3 kilometres radius</i>	Impacts affects all the area	Impacts affects the region
Significance	Low. <i>Small changes which are hardly detectable</i>	Moderate. <i>Impact measurable but does not alter processes</i>	High. <i>Many people, animals, plants affected. Disruption to ecosystem and social systems</i>	Very high. <i>Loss of people, bio-diversity property, loss of local livelihoods systems</i>	Unknown effects Insufficient information is available. Apply precautionary principle
Probability of occurrence	Possible. <i>Impacts can occur but are controllable.</i>	<i>Impact measurable but does not alter processes</i>	Probable. <i>The impact is likely to occur but can be controlled by effective measures.</i>	<i>Impacts will be there for entire operational phase</i>	Definitely to occur.
Duration of occurrence	Short term. During construction phase only.	Medium term. <i>Impacts will be during early operational phase only</i>	<i>The impact is likely to occur but can be controlled by effective measures</i>	Long term. <i>Impacts will be there for entire operational phase</i>	Very long term. <i>For the entire operational phase and after closure.</i>

6.3 Environmental and social impacts arising from project activities.

The Construction activities of Mwaiwathu Irrigation Scheme will generate a few positive as well as negative impacts. The sections that follow outline the different positive and negative impacts that have been identified during the environmental and social assessment study.

6.3.1 Negative impacts

6.3.1.1 During Planning/mobilization phase

Reduced water quality

Mobilisation of materials and large equipment near water sources may degrade water quality through soil erosion or leakage of liquid wastes from machinery. Improper disposal of waste could also contaminate water sources directly or through percolation.

Mitigation Measures:

- Use only well-serviced machinery with no oil or fuel leakages.
- Dispose of all waste at sites officially designated by the Council.
- Restrict operations to the designated camp site to avoid unnecessary disturbance.

Loss of Trees and Vegetation

Tree cutting and vegetation clearance may occur, particularly during camp site establishment.

Mitigation Measures:

- Minimise disturbance to vegetation by confining activities to designated areas.
- Select camp site locations that require minimal vegetation clearance.

Increased conflicts Over Land Use

Conflicts may arise if land designated for the camp site or irrigation scheme is already in use by community members for other purposes.

Mitigation Measures:

- Local leaders/chiefs, together with the Irrigation Committee, should identify rightful landowners and users.
- Use formal land agreement forms with clear terms on winter cropping and land use to ensure mutual understanding among stakeholders.

6.3.1.2 During construction and demobilization phase

- Clearing of land for construction works and unsustainable farming practices within the irrigation scheme will lead to loss of vegetation cover, exposing soils to erosion by wind and water.
- Loose soils from unprotected stockpiles and exposed areas may be washed or blown away, causing siltation of canals and other water bodies.
- The risk is intensified by the steep terrain and construction activities in the project area.

Mitigation Measures:

- Plant vetiver grass on contours and along all canals to stabilize the soil.
- Construct drop structures according to canal design specifications, especially on steep slopes, to reduce water velocity.
- Apply water to stripped soils to reduce erosion risk.
- Use soils from stockpiles to rehabilitate stripped and excavated zones.

- Promote soil and water conservation practices such as mulching, box ridging, and agroforestry.

Increased risk of borrow pits.

- Borrow pits may be created during material haulage for weir construction, camp setup, or from unused/abandoned canals.
- These pits can pose safety risks to community members, especially children and livestock.
- The impact is considered relatively minor due to the absence of settlements within the scheme area and the moderate scale of activities.

Mitigation Measures:

- Barricade the perimeter of borrow pits with orange safety mesh during use.
- Backfill and rehabilitate all borrow pits immediately after use.
- Conduct community sensitization to raise awareness about the risks associated with borrow pits

.Increased Generation of waste from construction activities

- Construction activities such as excavation and removal of topsoil, along with packaging from construction materials, will generate significant waste.
- The risk of improper waste management is high due to the consistent presence of packaging waste and excavation by-products.

Mitigation Measures:

- Dispose of all waste only at sites designated by the District Council.
- Site and establish construction camps at approved locations in consultation with the Supervision Committee.

Loss of trees and vegetation due to infrastructure development

The area does not have a forest reserve nearby but a woodlot along the scheme boundary. There is a likelihood for loss of trees from the woodlot when laying secondary lines and indirect deforestation and loss of vegetation due to migrant workers and increase in pressure on wood resources due to various activities. The risk is moderately significant because the area already bare due to past unsustainable practices. However, the woodlot might be affected by the sub-project activities.

Mitigation measures

- Limiting bush clearance to approved sites.
- Prevent clearing of bush for construction works except where necessary – this to be agreed by the supervision committee/WUA.
- Avoid wanton cutting down of trees and enforce penalties for deliberate and unnecessary cutting down of trees. Planting trees on all bare lands
- Promote use of alternative sources of cooking fuel to migrant workers such as efficient cook stoves such as zipolopolo mbaula, or gas; and avoid use of charcoal or fuelwood.
- Training communities to protect trees and woodlands/forests.

Increased dust emission by construction equipment

Dust will be generated by construction equipment and through clearing of the land, levelling and soil preparation works during construction of reservoirs, canals, access roads and plots. The magnitude will be high if these activities will take place in the dry season; but when done in rainy to winter season then it will be minimal. The risk, however, is insignificant because settlements are away from the scheme where

activities will be taking place.

Mitigation measures

- Control vehicle speed to reduce generation of dust through installation of speed humps and enforcement of speed limits.
- Regular application of water to civil works and earth roads to suppress dust.

Increased risk of child labour

There is potential risk of underage employment of children by contractors as a source of cheap labour. However, due to the Governments regular campaigns against child labour, these cases have significantly reduced in the country. Therefore, the magnitude of this risk is relatively low.

Mitigation measures

- Checking of the workforce by the Consulting Engineer and other members of the supervising engineer, as well as the District Council, Committee etc.
- Enforce Code of Conduct for contractors developed under the project (and signed by all contractors and their staff),
- Enforce Laws of Malawi including prosecution of those who employ children.

Noise pollution

It is anticipated that there will be nuisance from noise from machinery working on site. This will likely affect workers on site but will hardly affect the community due to the distance from the construction site to the settlement sites.

Mitigation measures

- All construction works shall be confined to daylight hours unless permission is obtained from Supervision Committee and consultation with affected communities.
- Provide and enforce use of noise cancelling devices for workers working with noisy machines.

Chemical contamination of soil and water by oil leakages and spillage from machinery and due to water mismanagement

Oil leakages and spillages from the machinery will contaminate water in the streams and soil during construction phase. The contamination may be significant if the spills are not contained within place of occurrence and if storage is compromised. There may also be ground water contamination due to contaminated surface water infiltration and sediment transportation. 59

Mitigation measures

- This can be mitigated by carrying out regular servicing of machinery.
- Training of workers on spill prevention and control
- Use of spill response equipment such as drip trays and absorbents to capture and clean up spillages.
- servicing machinery at a central point and disposing used oil at a site approved by MEPA.
- All hazardous substances to be stored in a bund with a capacity of 1.5 x the largest drum of chemical with appropriate firefighting procedures and equipment, spill containment and proper roofing.

Increased incidences of waterborne diseases

Waterborne diseases resulting from increased irrigation water and stagnant water in open ditches could result into breeding grounds for mosquitoes and snails which may lead to increased incidences of malaria and bilharzia. The risk could be highly significant if not adequately addressed.

Mitigation measures

- All open ditches should be closed or rehabilitated.
- Ensuring absence of stagnant water in the scheme area by empowering the WUA to conduct regular supervisions.

Increased risk of Spread of HIV AND AIDS and other STIs.

Influx of workers in search of employment opportunities may result in high prevalence rates of HIV AND AIDS and sexually transmitted infections cases.

Mitigation measures

- conduct awareness meetings among workers and communities,
- Distribute condoms.
- Development of and strict adherence to Code of Conduct for workers.

Increased risk of Gender based violence (GBV) and Sexual Exploitation and Abuse and Harassment (SEAH)

Gender based violence such as sexual harassment, unequal pay, and other gender-based injustices. The risk is likely going to be significant due to the change in status for the workers, farmers, and the community as a whole due to the coming in of the project.

Mitigation measures

- Conduct awareness meetings,
- Develop and strict adherence to Code of Conduct for contractors and workers.

Conflict over land use

Conflict over land use and ownership could result during construction. The command area is farmland that belongs to the beneficiaries and with the coming in of the scheme, it is envisaged that new arrangements like plot allocation will have to come in. It is these new arrangements plus a high demand for land that will lead conflicts.

Mitigation measures

- Local leaders/chiefs to identify rightful owners and users of land together with the irrigation committee.
- Administer land agreement forms with clear arrangements on how winter cropping will be done to ensure there is common understanding.
- Interferences in marriages

Increased economic activities and incomes may lead to changes in social habits and conflicts in families.

Mitigation measures

- Conduct community sensitization meetings,
- Development of and strict adherence to Code of Conduct for workers

6.3.1.3 During operation phase

Changes in hydrological regimes in the rivers

These can be caused when the amount of water abstracted for irrigation in comparison to the volume of water in the rivers is high hence causing alterations on the downstream river flow regime. Water abstraction for irrigation activities will change (reduce) flow, water quantity and quality in the river downstream thereby adversely affecting ecological balance and activities such as domestic use and other irrigation activities. The magnitude of this risk in the area is very minimal because the scheme will not have an impact on the

downstream water users as the current utilization levels for these water users are low compared to volume of their water right. In addition, the individual water users will not be affected as most of them will be integrated in the proposed Mwaiwathu scheme and others will utilize tail water.

Mitigation measures

- Ensure that the scheme obtains water right.
- Adhere to provisions in water right to, for example, maintain environmental flow requirements
- Improve irrigation and drainage operations to enhance water use efficiency.

Aquifer depletion

Continuous use of water at the rate more than it is being recharged due to use for irrigation and other purposes in the area might in the long run lead to depletion of the aquifers.

Mitigation measures

- Improve irrigation and drainage operations to enhance water use efficiency.
- Enhance catchment conservation practices to increase percolation, reduce run off and enhance recharge.

Increased deforestation

Increased deforestation due to influx of migrant farm labourers may increase demand for fuelwood and other forest-based resources, causing more deforestation in the area.

Mitigation measures

- Introduce efficient, accessible, and affordable cook stoves.
- Establish tree nurseries, and
- Promote tree planting and establishment of woodlots.

Water pollution and river buffer zone

Water pollution resulting from increased exposure to agro-chemical pollutants may be caused while farming in the scheme. People in the area usually grow Irish Potatoes and tomatoes which involves use of pesticides and fertilizers. The risk of water pollution because of this is very high hence need to implement various mitigation measures river buffer zones.

River buffer zones in Malawi are regulated through a combination of legal and policy instruments, primarily the Environment Management Act (EMA, 2017), Water Resources Act (2013), Land Act (2016), and MEPA's ESIA Guidelines (2011). These frameworks collectively mandate the protection of riparian areas as environmentally sensitive zones. Standard buffer widths range from 10 to 30 meters on either side of rivers and streams, depending on the size of the watercourse, slope, and ecological sensitivity. Activities such as cultivation, construction, and settlement are restricted within these zones to prevent erosion, preserve biodiversity, and protect water quality. Buffer zones are treated as public or protected land, and compliance is enforced through the Environmental and Social Impact Assessment (ESIA) process, with penalties for non-compliance including project redesign or restoration obligations

Mitigation measures

- Establishing 10-20 metres buffer zones of trees and grasses between the river and irrigated land to assist filter the chemicals before entering the river.
- Demonstrate and promote use of organic fertilisers.
- Train farmers in integrated pest management to reduce use of chemicals.
- Train farmers proper handling of chemicals to avoid excessive use.

Risk of flooding, water logging and salinization of soil

Risk of flooding due poor weir maintenance, diminished flood control capacity and latter breakage, mismanagement of upper basin and greater sediment transport can result to weir clogging and shortening of the infrastructure lifespan, sedimentation of canals, flooding due to poor operation of canal sluices. Additionally, excessive irrigation of fields may also cause accumulation of water on the soil surface if water use is not well controlled. This impact is likely to be accelerated by the imperfectly drained soil type in the command area which may occur mainly during rainy seasons. Additionally, the inefficient use of water may result into water returning into the river as return flows or percolates into the ground and, this in addition to water loss through unlined canals may saturate the soil with water.

Mitigation measures

- Drafting of the operation and maintenance manual; and training of operators weir maintenance and drafting of a Contingency Emergency Response Plan
- Construct the weir during the dry season when water levels are low.
- Control soil erosion.
- Apply of organic matter to improve soil structure.
- Apply recommended type and amount of chemicals and fertilisers.
- Regularly maintain irrigation and drainage channels/canals to improve seepage.
- Clear clogged channels to allow water to flow.
- Promote effective and efficient use of irrigation water.

Risk of high sediment loads from flooding impacting on the irrigation scheme.

Since the scheme is along Mwaiwathu River, loads of sediment from both suspended load and bed load from upstream may greatly influence the sedimentation of irrigation channels which may eventually cause fluctuations of irrigation discharge to irrigate the desired land in the scheme.

Mitigation measures

- Constructing flood protection structures such as dykes, check dams and infiltration ponds to trap excess water during flooding.
- Planting vegetation to trap sediments and improve seepage.

Increase in occurrence of waterborne diseases.

Increase in occurrence of waterborne diseases, such as malaria and bilharzia due to pools of stagnant water that can lead to breeding of mosquitoes and snails that leads to cases of malaria and bilharzia.

Mitigation measures

- Ensure an absence of stagnant water at the site by constructing proper drainage around the scheme and clearing blocked areas by the committee/WUA.
- Promote good sanitation, hygiene, and use of mosquito nets in the camps and surrounding communities.

Use of unregistered pesticides in the irrigation scheme

Use of unregistered pesticides in the irrigation schemes because of lack of knowledge regarding pesticide use could result into destruction of untargeted species.

Mitigation Measures

- Training and awareness for farmers on harmful/banned and unregistered pesticides.
- Encourage farmers to buy approved pesticides and from registered suppliers.

Diminished land and soil fertility / productivity

Continuous cultivation and use of pesticides and fertilizers might in the long run the soils unproductivity due

to depletion of essential minerals and organisms in the soil. This impact might be aggravated by the risk of flooding and soil erosion.

Mitigation measures Enhance soil and water conservation measures and farming such as mulching, box ridging, agroforestry etc.

- Promote use of organic manure.
- Develop and implement the Integrated Pest Management Plan.
- Plant vetiver grass on contours and along all canals to stabilise them.

6.3.2 During demobilization phase

Loss of employment.

Cessation of construction works will result in termination of employment for workers.

Mitigation measures

To avoid some inconvenience, the following measures should be conducted:

- Inform the workers on the end of construction works.
- Pay terminal benefits to the workers. Increased risk of accidents

Loss of business opportunities

Cessation of construction works will result in loss of business opportunities both for small scale vendors and other service providers who were getting business as a result of the subproject activities. It is therefore important to timely inform the business owners and community members on the closure of the subproject.

Accidents are prone to happen during demobilisation phase.

Mitigation measures

The following measures must be conducted:

- Provision of PPE to workers
- Conduct safety and health awareness.

Increased generation of construction rubble/waste

At the end of construction and rehabilitation works some of the temporary structures will be demolished as such generation of rubble and waste will increase. To reduce the problem, the following measures should be applied:

- Designate specific places for the disposal of waste in consultation with the district council and dispose all non-reclable and non-reusable wastes in those places.
- Development and implementation of a Waste Management Plan

6.3.3 Positive impacts

6.3.3.1 During planning and mobilization phase

Creation of local employment opportunities.

The planning phase involves recruitment of consultants to come up with structural designs and other studies including recruitment of workers. These activities provide employment for both skilled and non-skilled workers.

Mitigation measures

- contractor will be encouraged to employ at least 80% of the workforce from locals to maximize project benefits to the local communities, and in particular look to include 40% women and vulnerable groups in the workforce.

6.3.3.2 During construction

Creation of job opportunities

Semi-skilled and un-skilled labourers on the project will be sourced from the local community. Many people will be employed to perform labour intensive work such as land preparation, construction of access roads and construction and installation of irrigation infrastructure.

Enhancement measures contractor will be encouraged to employ at least 80% of the workforce from locals to maximize project benefits to the local communities, and in particular look to include 40% women and vulnerable groups in the workforce.

Increased business opportunities

Local suppliers and contractors will be engaged in construction works and provision of construction materials such as stones bricks and sand, and through provision of food and other materials and services to the workers.

Enhancement measures

- Purchase as many local materials as possible, whilst considering their environmental footprint, during construction phase. These might include quarry, cement, sand from approved sites, etc.
- Encourage specific CIGs to take advantage to expand their business activities.
- The contractor will be encouraged to purchase as many local materials as possible.

6.3.3.3 During operation phase

Increased crop production due to improved irrigation

Improved irrigation facilities will result in enhanced agricultural output by participating farmers as yields per hectare will be increased.

Enhancement measures

- Provide trainings in modern farming technologies and business management to enhance farmer's skills on their production and marketing.

Improved food security at household and district level

Irrigating food crops for two or more cycles in a year will result in significant increase in food production at individual households with surplus for sale within and outside the area in the district. This will assist in improving food security of the district.

Enhancement measures

- Provide regular and timely extension services to participating farmers on good crop husbandry practices to enhance productivity of irrigated land.
- Promote use of improved seed varieties, as well as of inorganic and organic fertilizers
- Ensure all irrigable land is fully utilized to ensure continuous and sustainable production of crops.

Improved rural livelihoods and income levels.

Timely production and sale of high value crops, such as carrots, green paper, onions, ginger, tomatoes, peas, chili, cabbage, and other leafy vegetables, will attract vendors from urban and suburban markets to come and buy such crops resulting in improved economic status of rural livelihoods and incomes at household level. This can be enhanced by encouraging formation of specific CIGs to take advantage of increased production to expand their business activities.

Enhancement measures

- Introduce or facilitate formation of common interest groups (CIGs) as stated above.
- Train farmers in safe and effective handling of vegetables, recommended and safe use of pesticides and packaging for value addition.
- Link farmers / formed CIGs to profitable outlets.

Increased creation of employment opportunities

Various stages of crop production, such as land preparation fertilizer application, harvesting, pest control, storage, marketing etc., may require hiring of casual labour transport, thereby creating regular employment for the local community.

Enhancement measures

- Encouraging the irrigation committee to employ as many locals as possible to maximise project benefits to the local communities, and in particular look to include women and vulnerable groups.

Increased skills in good irrigation farming practices.

Farmers participating in irrigation farming will benefit from knowledge and skills in irrigation technics from district irrigation officers and Council extension staff to enhance their skills in production of various value crops. This will be enhanced by conducting frequent training and refresher courses on irrigation best practices and ensuring regular exchange visits among schemes.

Enhancement measures

- Conduct frequent training and refresher courses on irrigation best practices.
- Promote exchange visits among schemes.

Efficient and effective water distribution to and within the irrigation scheme

Currently Mwaiwathu Irrigation Scheme currently uses a common intake point with poor distribution lines that are not aligned / sealed with concrete resulting in high loss of water due to seepage. Construction of new facilities will improve water supply and distribution to all farmers for successful crop production. This can be enhanced by training farmers in effective and efficient use and conservation of water for adequate distribution ensuring regular clearing of irrigation canals to avoid blockage of water supply.

Enhancement measures

- Train farmers in effective and efficient use and conservation of water for adequate distribution
- Ensure regular clearing of irrigation canals to avoid blockage of water supply

Table 6.3: Impact identification Matrix

SN	Category	Impact	Impact Nature	Probability of Occurrence	Duration of impact	Magnitude of impact	Significance of impact	Ranking of Impact (-3 to +3)
				Possible (impact may occur but it is not probable); Probable (the impact is very likely to occur); and Definite (impact is unavoidable)	Short term (less than 5 years); Medium term (between 5 and 10 years) Long term (over 10 years)	Household level – affecting an individual/family; Local level – affecting a municipality / township, district; National level – affecting the country	High significance, Medium significance, Low significance, (+)	-High significance, +/- 3 -Medium significance, +/- 2 -Low significance, +/-1 (+) denotes positive impact (-) denotes negative impact
1	Planning/mobilization phase							
1.1	Economy and livelihoods	Increased creation of local employment opportunities.	Positive	Certain	Medium-Term	High	High	+3
1.2	Water resources	Reduced water quality	Negative	Certain	Medium-Term	Low	Low	-2
1.3	Flora	Loss of trees and vegetation	Negative	Possible	Short-Term	Low	Moderate	-1
1.4	Land use	Increased conflicts over land use	Negative	Possible	Short-Term	Low	Moderate	-1
2	Construction Phase							
2.1	Economy and Livelihoods	Increased creation of local employment opportunities.	Positive	Certain	Medium-Term	High	High	+3
		Increased availability of market for construction materials and services	Positive	Certain	Medium-Term	High	Moderate	+2
		Improved benefits from capacity enhancement through on-the- job training	Positive	Certain	Long-Term	Medium	Moderate	+2
		Increased incidences of child labour	Negative	Possible	Medium-Term	Low	Moderate	-1
		Increased cases of sexual harassment and Gender Based Violence	Negative	Possible	Medium-Term	Low	Low	-2
2.2	Air Quality & Fugitive Emissions	Increased generation of particulate matter (particularly dust emissions)	Negative	Possible	Short-Term	Low	Moderate	-1
		Increase in combustion emissions	Negative	Possible	Short-Term	Low	Moderate	-1
2.3		Increased Chemical contamination of soil and water pollution	Negative	Certain	Medium-Term	High	Moderate	-2

	Quantity and Quality of Water Resources	Increased generation of Liquid Wastes	Negative	Possible	Medium-Term	Medium	Moderate	-2
		Increased generation of solid waste	Negative	Unlikely	Short-Term	Low	Low	0
		Increased Aquifer depletion and changes in water regimes	Negative	Possible	Long-term	Medium	High	-2
2.4	Soil Degradation	Increased Contamination of soil with chemicals	Negative	Possible	Short-Term	Medium	Moderate	-2
		Increased susceptibility of soil to erosion	Negative	Certain	Short-Term	High	Moderate	-2
2.5	Noise and Vibration	Increase in ambient sound levels	Negative	Certain	Temporary	High	Moderate	-2
2.6	Waste	Poor management of non- hazardous and general waste	Negative	Certain	Short-Term	High	Moderate	-1
		Poor management of hazardous waste	Negative	Possible	Medium-Term	Medium	Moderate	-1
2.7	Flora and Fauna	Loss of natural habitat for flora and fauna	Negative	Certain	Long-Term	High	Low	-2
		Introduction of invasive and alien species	Negative	Unlikely	Long-Term	Low	Low	0
2.8	Community Health and Safety	Increased number of communicable diseases such as STIs, HIV and AIDS	Negative	Certain	Long-Term	High	High	-3
		Increased Social conflicts resulting from access to jobs	Negative	Possible	Short-Term	Medium	Low	-2
		Increased levels of air emissions	Negative	Possible	Medium-Term	High	Moderate	-2
		Increased risk of traffic accidents	Negative	Possible	Long-Term	High	High	-2
		Increased Risks of floods and droughts to communities	Negative	Certain	Medium-long term	High	High	-3
2.9	Occupational Health and Safety	Increased risk of accidents and exposure to hazardous material	Negative	Certain	Long-Term	High	High	-3
		Increased risk to diseases, STIs and HIV and AIDS	Negative	Certain	Long-Term	High	High	-3
3	Operation and Maintenance Phase							
3.1	Economy and Livelihoods	Increased development of skills in good irrigation farming practices	Positive	Certain	Long-Term	High	High	+3
		Enhanced efficient and effective water distribution to and within the irrigation scheme	Positive	Certain	Long-Term	High	High	+3
		Improved local socio-	Positive	Certain	Long-Term	High	High	+3

		economy						
		Employment opportunities	Positive	Certain	Long-Term	High	High	+3
		Increased crop production	Positive	Certain	Long-Term	High	High	+3
		Improved food security at household and district level	Positive	Certain	Long Term	Moderate	High	+3
		Increased incidences of child labour	Negative	Unlikely	Medium-Term	Low	Low	-1
		Increased cases of sexual harassment and Gender Based Violence	Negative	Possible	Short-Term	Low	Low	-2
		Risk of flooding due to diminished flood control capacity	Negative	Possible	Medium-term	Moderate	Moderate	-2
3.2	Air Quality & Fugitive Emissions	Increased generation of particulate matter (especially dust)	Negative	Unlikely	Short-Term	Low	Low	-2
		Increase in combustion emissions	Negative	Possible	Short-Term	Low	Moderate	-1
3.3	Land	Increased Conflicts over land	Negative	Possible	Short-Term	Low	Low	-2
		Increased Creation of borrow pits	Negative	Possible	Medium-Term	Low	Low	-2
3.4	Water Quality and Resource	Increased Waterborne diseases	Negative	Certain	Long-Term	Medium	Moderate	-2
		Increased Generation of Liquid Wastes	Negative	Possible	Short-Term	Low	Moderate	-2
		Reduced water availability	Negative	Unlikely	Short-Term	Low	Moderate	-2
		Increased Changes in hydrological regimes in the river	Negative	Certain	Medium-Term	Low	Low	-2
3.5	Soil Degradation	Increased Contamination of soil with chemicals	Negative	Possible	Medium-Term	Medium	Low	-2
		Increased susceptibility of soil to erosion	Negative	Unlikely	Temporary	Low	Moderate	-1
		Diminished land fertility / productivity	Negative	Likely	Medium-term	Medium	Moderate	-2
		Increased Risk of high sediment loads from flooding impacting on the irrigation scheme	Negative	Likely	Short-term	Medium	High	-2
3.6	Noise and Vibration	Increase in ambient sound levels	Negative	Certain	Short-Term	Medium	Moderate	-2
		Increased Risk of earth movement	Negative	Unlikely	Temporary	Low	Low	0
3.7	Generation of Solid Wastes	Increased of non-hazardous and general waste	Negative	Certain	Medium-Term	Medium	Moderate	-1

		Increased of hazardous waste	Negative	Possible	Medium-Term	Medium	Moderate	-1
3.8	Flora and Fauna	Loss of natural habitat for flora and fauna	Negative	Unlikely	Medium-Term	Low	Low	0
		Introduction of invasive and alien species	Negative	Unlikely	Medium-Term	Low	Low	0
3.9	Community Health and Safety	Increased number of diseases, Sexually Transmitted Infections and HIV and AIDS	Negative	Certain	Long-Term	High	High	-3
		Social conflicts resulting from access to jobs	Negative	Possible	Long-Term	Low	Low	-2
		Increased levels of air emissions	Negative	Possible	Long-Term	Medium	Moderate	-1
		Increased risk of traffic accidents	Negative	Unlikely	Medium-Term	Low	Low	0
3.10	Occupational Health and Safety	Increased risk of accidents and exposure to hazardous material	Negative	Certain	Long-Term	High	High	-2
		Increased risk to diseases, STIs and HIV and AIDS	Negative	Certain	Long-Term	High	High	-2
4	Demobilization							
4.1	Economy and Livelihoods	Loss of local employment opportunities.	Negative	Certain	Medium-Term	High	High	-2
		Loss of business opportunity	Negative	Certain	Long-Term	Medium	Moderate	-1
		Increased incidences of child labour	Negative	Possible	Medium-Term	Low	Moderate	-1
		Increased cases of sexual harassment and Gender Based Violence	Negative	Possible	Medium-Term	Low	Low	-1
4.2	Land	Increased Conflicts over land	Negative	Possible	Medium-Term	Medium	Moderate	-1
		Increased Creation of borrow pits	Negative	Certain	Medium-Term	Low	Moderate	-1
4.3	Water Quality and Resource	Increased Waterborne diseases	Negative	Unlikely	Medium-Term	Low	Low	0
		Reduced water availability/quality	Negative	Possible	Long-Term	Low	Low	-1
4.4	Soil Degradation	Increased contamination of soil with chemicals	Negative	Certain	Short-Term	Medium	Moderate	-1
		Increased susceptibility of soil to erosion	Negative	Likely	Medium-term	Medium	High	-3
		Diminished land fertility / productivity	Negative	Certain	Short-Term	Medium	Moderate	-1
4.5	Noise and Vibration	Increase in ambient sound levels	Negative	Possible	Medium-Term	Medium	Moderate	-1
		Risk of earth movement	Negative	Unlikely	Medium-Term	Low	Low	0

4.6	Generation of Solid Wastes	Increased of non-hazardous and general waste and increased generation of wastes	Negative	Unlikely	Medium-Term	Low	Low	0
		Increased of hazardous waste	Negative	Certain	Long-Term	High	High	-3
4.7	Flora and Fauna	Loss of natural habitat for flora and fauna	Negative	Possible	Long-Term	Low	Low	-2
4.8	Community Health and Safety	Increased number of diseases, Sexually Transmitted Infections and HIV and AIDS	Negative	Certain	Short-Term	Medium	Moderate	-1
		Increased Social conflicts resulting from access to jobs	Negative	Unlikely	Temporary	Low	Low	0
4.9	Occupational Health and Safety	Increased levels of air emissions	Negative	Certain	Medium-Term	Medium	Moderate	-1
		Increased risk of traffic accidents	Negative	Possible	Medium-Term	Medium	Moderate	-1
		Increased risk of accidents and exposure to hazardous material	Negative	Unlikely	Medium-Term	Low	Low	0
		Increased risk to diseases, STIs and HIV and AIDS	Negative	Unlikely	Medium-Term	Low	Low	0

7. RISK AND HAZARD ASSESSMENT

7.1 Introduction

Risk is the possibility that an event or action will cause harm, loss, or an undesirable outcome. In environmental and social contexts, risk refers to the likelihood of negative impacts occurring as a result of a project or activity, and the severity of those impacts if they do occur. The risk is usually defined in terms of Probability (how likely it is to happen) and Impact (how serious the consequences would be). For example, in an irrigation project, a risk might be that excessive water use could lead to water shortages for nearby communities. The probability might be high during dry seasons, and the impact could be severe if it affects drinking water supplies. While A hazard is any source of potential harm or adverse effect on people, the environment, or property. It refers to a condition or situation that can cause damage, but it doesn't necessarily mean the damage will happen — that depends on exposure and vulnerability. In environmental and social contexts, hazards can be: Natural (floods, droughts, earthquakes), Human-made: pollution, unsafe infrastructure, chemical spills, and Social: conflict, displacement, poor working conditions. For example, at Mwaiwathu irrigation scheme, stagnant water in canals is a hazard because it can become a breeding ground for mosquitoes, which may lead to malaria outbreaks.

A hazard is something that has the potential to cause harm, while a risk is the likelihood that the harm will actually occur and how severe it would be. Hazards are the sources of danger, such as polluted water or unsafe infrastructure, whereas risks assess how probable and impactful those dangers are in a specific context. In monitoring projects like irrigation schemes, understanding both helps in planning effective mitigation and safety measures.

7.2 Environmental Risks and Hazards

Mwaiwathu Irrigation Scheme in Phalombe District like other small-scale irrigation projects in the region, presents both opportunities and challenges. While it aims to improve agricultural productivity and livelihoods, it also introduces several environmental and social risks and hazards that must be carefully managed. The figure 7.1 highlights some of potential sources of risks that is not well managed can lead to hazards. It is therefore important to be vigilant about ensuring that risks are avoided. Proper understanding of impacts and proposed measures could not only avoid hazards but can help farmers to sustainably produce high yields of crops from Mwaiwathu scheme.

Figure 7.1 highlights some of potential sources of risks and hazards for Mwaiwathu scheme

IT	Potential Source	Risks	Hazards
1	Water Resource Depletion	Excessive abstraction of water from nearby rivers or streams may reduce downstream flow, affecting aquatic ecosystems and other users	Seasonal water shortages and conflicts over water use
2	Soil Erosion and Degradation	Land clearing and intensified cultivation can lead to erosion, especially on sloped terrain	Loss of fertile topsoil, reduced agricultural productivity, and sedimentation in water bodies
3	Pollution from Agrochemicals	Use of fertilizers and pesticides can contaminate surface and groundwater	Water pollution, health risks to communities, and biodiversity loss
4	Flooding and Stormwater Hazards	Poorly designed irrigation infrastructure may fail to manage stormwater effectively	Flooding of fields and nearby settlements, damage to infrastructure

5	Salinization and Nutrient Loss	Improper irrigation practices can lead to salt buildup in soils and nutrient depletion	Reduced crop yields and long-term soil infertility
6	Health Risks	Stagnant water in canals and reservoirs can become breeding grounds for disease vectors	Increased incidence of waterborne diseases like malaria and bilharzia
7	Land Use Conflicts	Disputes over land ownership and access, especially where tenure is unclear	Social tension and disruption of project activities
8	Occupational Safety	Construction and maintenance activities may expose workers to physical hazards	Injuries and accidents on-site
9	Exclusion of Vulnerable Groups	: If not properly managed, the scheme may marginalize women, youth, or persons with disabilities	Inequitable access to benefits and increased social inequality

7.3 Variation of vulnerability

Vulnerability varies between individuals within community with some groups particularly more vulnerable than others. There is as much variation in adaptive capacity between individual households as between communities exemplifying the way in which adaptive capacity varies at individual household level. Vulnerability is often assumed to be generally correlated with poverty. Poor households are least likely to access early warning information, have insurance, and are generally assumed to have less adaptive capacity to cope with declines in livelihoods. They might have challenges to quickly shift from declining livelihood to the other. Other individual factors other than poverty can also affect vulnerability of persons. For example, women in the area are more vulnerable to floods owing to increased livelihood of being around the home and increased burdens of care after floods. Women in the area (due to cultural issues), have fewer economic options, a greater lack of rights and access to resources and may be more likely to endure the burden of care after hazards.

7.3.1 The types of external stresses

- Natural hazards, either hydro-meteorological (floods, landslides, storms, droughts) or geophysical (earthquake, volcanic eruption, tsunami).
- Armed conflict and civil unrest.
- Epidemics and pandemics.
- Drastic changes in the socio-economic environment, such as a surge in prices of essential goods, restrictive government legislation such as export and import bans.
- Serious violations of international human rights law and international humanitarian law.
- Environmental hazards (industrial accidents, severe pollution).

7.3.2 Potential Emergencies

Possible emergency situations that may occur during execution of works such as rehabilitation of feeder road, reticulation system, storage facilities, viaduct, and conveyance system for irrigation and water supply, maintenance, and repair works are as follows:

- Accidents and Injuries: Accidents leading to injuries such as falls, crushing, and cuts among workers are possible and require immediate intervention.
- Collisions and Pedestrian Accidents: Traffic accidents, particularly collisions due to careless driving, are common in areas with road works. Accidents involving workers and construction

equipment can also occur. Proper site marking, reducing speed limits, using traffic direction signs, and barriers are necessary precautions.

- **Collapse and Cave-Ins:** Collapses of structures or ground during construction can cause injuries or entrapment of workers. Conducting soil analysis, implementing structural reinforcement techniques, and working in safe areas are crucial to avert the emergency. Availability of emergency rescue equipment is necessary.
- **Equipment Failures:** Malfunctions of construction machinery can lead to injuries or material damage. Implementing regular maintenance and inspection programs, training operators and workers on equipment usage, and having spare equipment are essential.
- **Fuel Leaks and Chemical Fires:** Leakage of fuel from construction machinery or fuel depots can cause fires upon contact with sparks or heat. Some chemicals used in road construction are flammable, increasing the risk of fire. Availability of fire extinguishers, proper storage of flammable materials, and providing fire safety training to workers are important.
- **Dust Formation and Chemical Exposure:** Dust generated during construction can cause respiratory problems and accidents due to reduced visibility. Airborne chemicals from construction materials can threaten the health of workers and surrounding communities. Use of dust control systems and providing workers with respiratory protective equipment are necessary.
- **Extreme Temperatures:** Workers are at risk of heatstroke and dehydration, especially during summer months. Providing regular water breaks, shaded areas, and training workers on heatstroke symptoms are necessary precautions.
- **Injuries:** Cuts, fractures, sprains, and other physical injuries can occur frequently. Availability of first aid supplies, ensuring workers use safety equipment, and providing occupational safety training are important.
- **Heart Attacks and Strokes:** Intense physical exertion during work can lead to serious health problems such as heart attacks or strokes. Regular health check-ups and availability of emergency response equipment are necessary, along with providing health and safety training to workers.
- **Floods and Water Inundations:** Heavy rains can result in flooding of work areas, causing damage to workers and equipment. Checking and reinforcing drainage systems and regularly monitoring weather forecasts are necessary precautions.
- **Landslides:** There is a risk of landslides, especially during work on slopes. Conducting soil surveys, applying stabilization techniques, ensuring the safety of work areas, and continuous monitoring are necessary.
- **Lack of Protective Equipment:** Serious injuries can occur if workers do not use adequate personal protective equipment. Providing personal protective equipment to workers and making its use mandatory are important.
- **Inadequate Signage:** Inadequate or incorrect signage during road works can lead to traffic accidents and injuries to workers. Proper marking of work areas and the use of safety barriers are necessary precautions.

Possible emergency situations that may occur after explosions in stone and gravel quarries, requiring emergency intervention, include:

- **Collapse and Subsidence After the Blast:** Unexpected collapses or subsidence may occur after the explosion. This can lead to injuries or entrapment of workers, necessitating fast and effective rescue operations.
- **Post-Explosion Fires:** Sparks or high temperatures generated by the explosion can ignite fuel or other combustible materials, causing fires. These fires can spread rapidly and become difficult to control, highlighting the critical importance of having firefighting equipment and training ready.
- **Gas Leaks:** During the explosion, underground gas pockets may be released, leading to leaks and potentially poisoning or explosion hazards. Gas detectors and rapid evacuation plans are vital in such situations.

- **Air Pollution and Dust Explosions:** Large amounts of dust may be airborne after the explosion, leading to respiratory problems or dust explosions. Using dust control systems and personal protective equipment (PPE) is necessary.
- **Equipment Failures:** Equipment used during or after the explosion may malfunction, leading to machine accidents or other hazardous situations. Regular equipment maintenance and having backup equipment in emergencies are important.
- **Injuries and Traumas:** Flying rock fragments or debris during the explosion can cause injuries to workers. Additionally, high noise and shock waves can lead to hearing loss or other physical traumas. Availability of first aid equipment and trained personnel is necessary.
- **Mechanical Failures:** The explosion may damage mechanical systems, posing risks such as mechanical injuries. Backup power sources for emergency procedures for mechanical failures should be established.
- **Seismic Activity especially during blasting of quarry rocks:** Large-scale explosions can trigger local seismic activities, increasing the risk of additional collapses or structural damage. Structural integrity against seismic activity and regular inspections are required.

Possible emergency situations that may occur in accommodation facilities include:

- **Fires:** Electrical faults, unattended candles, or cigarette butts can cause fires in accommodation areas. Regular inspection of firefighting equipment and fire alarm systems, clear marking of emergency exits, and providing fire safety training to workers are essential.
- **Gas Leaks:** Gas leaks from kitchen or heating system pipes can lead to explosion and poisoning risks. Installing gas detectors, conducting regular maintenance, and providing staff with training on recognizing gas leak symptoms are important.
- **Floods:** Exposure to flooding due to heavy rains or plumbing failures can result in property damage and health risks in accommodation areas. Checking waterproofing systems and creating emergency evacuation plans are necessary precautions.
- **Power Outages:** Power failures due to electrical infrastructure problems or external factors can disable security systems and inconvenience guests. Keeping generators on standby and regularly testing them is important.
- **Health Emergencies:** Guests or staff may experience sudden health issues such as heart attacks, allergic reactions, or asthma attacks, cholera etc. Having first aid equipment and trained personnel available and ensuring quick access to emergency healthcare services are vital.
- **Food Poisoning:** Failure to comply with hygiene standards in hotel restaurants or kitchens can lead to food poisoning incidents. Strict adherence to food safety standards and providing hygiene training to staff are crucial.
- **Theft and Security Breaches:** Theft or unauthorized entries in accommodation areas can threaten guest safety. Installing security cameras, employing security personnel, and monitoring entries and exits are necessary security measures.
- **Evacuations Due to Natural Disasters:** Natural disasters such as earthquakes, floods, or hurricanes may require immediate evacuation. Creating emergency evacuation plans and conducting regular drills for guests and staff are important.

Possible emergency situations that may occur in operation include:

- **Traffic Accidents:** Major traffic accidents may occur on the highway. These can lead to road closures or significant disruptions in traffic flow, necessitating quick and efficient emergency response and road clearance operations.
- **Natural Disasters (Earthquake, Flood, Landslide):** Natural disasters such as earthquakes, floods, and landslides can cause severe damage or blockages on roads. Rapid assessment and repair efforts are crucial to restore normal traffic conditions and ensure the safety of road users.

- **Fires:** Fires, either from nearby forests or along the roadside, can spread to the highway, posing a danger to travellers and disrupting traffic. Having firefighting equipment and trained personnel ready is essential for quick response and control.
- **Chemical and Hazardous Material Spills:** Accidents involving vehicles carrying hazardous materials can lead to chemical spills. These spills pose environmental and health risks, making it critical to have gas detectors, containment equipment, and evacuation plans in place.
- **Infrastructure Collapses:** Collapses of water reservoirs, pipeline, bridges, tunnels, or road sections can occur, causing significant hazards and blocking traffic. Prompt rescue operations and structural assessments are necessary to manage such emergencies effectively.
- **Power and Energy Outages:** Power outages affecting road lighting or traffic signals can lead to dangerous driving conditions. Backup power systems and emergency lighting plans are vital to maintain safety and order.
- **Sabotage and Terrorist Attacks:** Acts of sabotage or terrorist attacks targeting highways can cause major disruptions and pose serious safety threats. Immediate security measures and coordination with law enforcement are crucial for handling such incidents.
- **Vehicle and Equipment Failures:** Failure of construction or maintenance equipment can lead to hazardous situations and delays. Regular maintenance schedules and the availability of backup equipment are essential for continuous operation.
- **Injuries and Traumas:** Injuries from flying debris, machinery accidents, or other hazards are possible. Having first aid kits, trained medical personnel, and emergency medical procedures in place is necessary to handle such incidents.

7.4 Emergency Management

Effective management of emergencies is of vital importance to ensure the best possible response can be executed in the shortest possible time. To facilitate swift response in emergencies, the identification of project-related incidents and emergencies, establishment of intervention procedures, and delineation of responsibilities must be defined. This plan outlines potential emergencies and accidents, the responsibilities of assigned personnel during emergencies, preventive measures, and emergency response methods.

7.4.1 Emergency Response Teams

The consultations with district and community level structures revealed that there are three committees which manage disasters when they have occurred. At village level, there is Village Disaster Risk Management Committee (VDRMC) which reports disasters to Area Disaster Risk Management Committee (ADRM). This committee is at Traditional Authority level and compile and coordinate disaster cases from all villages under its jurisdiction. The district level committee is District Disaster Risk Management Committee (DDRMC) which is chaired by Director of Planning and Development. This is the committee that mobilize resources and coordinate implementation of emergency activities. Depending on the disaster, cluster committees are triggered for example if the disaster is cholera, health cluster will be triggered to ensure that they respond to the disaster within the first 24 hours. These structures while there are in place, they do not have resources that can be mobilised immediately after disaster is reported. It takes time for the district level committee to mobilise resources to help the affected households. However, it was also mentioned in both districts that they have a costed contingency plan which they use to mobilize these resources. The contingency plan is integrated whereby emergency plan for all sectors are consolidated in readiness to any sector specific eventualities.

In normal case, when a disaster has occurred, the affected households inform the Village Disaster Risk Management Committee. This committee has members who are trained in providing first aid assistance

and they are the first responders. The committee is reinforced with additional assistance with members from the Area Disaster Risk Management Committee. The Area Disaster Risk Management Committee is responsible for managing disasters at traditional authority level. The major challenge for both committees is limited resources. These committees seek additional support from government institutions such as health and police personnel, these structures are present at local levels. At district level, the committee is comprised of sectoral heads from various departments and is coordinated by the District Disaster Risk Management Officer and chaired by the District Director of Planning and Development. Once this district-level committee has been informed of the disaster, they immediately dispatch cluster team to provide additional support to the affected persons and households. The are cross-cutting teams that are designated to respond to the specific emergencies and these are extinguishing team, rescue team, protection team, and first aid team.

The most common emergencies that might occur at irrigation scheme level can be conflicts arising due to animals grazing the crops of the irrigation farmers, conflicts arising due to inadequate amount of water available for irrigation, in-fighting of farmers due to poor practices of distributing irrigation water to farmers 'blocks, thefts of crops which might trigger conflicts, and other conflicts that might arise due to other reasons at the scheme level. The consultations also revealed that emergencies related to crop pest infestations such as Fall Army worm and human related diseases such as Cholera or COVID are also of significance. These emergencies can immediately be reported to the Village Disaster Risk Management Committee and can be ably handled as per procedures laid out in the district contingency plan. However, there are some scheme-level emergencies that might be difficult to handle and respond to because they are not defined as emergencies in the mainstream definition of the disasters. for example, blockage of main delivery pipe of water from the intake to the scheme such that there no supply of water for irrigation, earthquakes damaging the intake structures, pests and diseases damaging the crops, and others. These emergencies might disrupt the operations of the irrigation scheme and if not properly managed they might have effect on the long-term operations of the irrigation scheme. This plan is therefore designed to ensure that these scheme-level disasters are quickly reported and handled properly without disrupting the operation of the scheme.

7.4.2 Levels and Management of specific emergencies

It is important to understand that there are three levels of emergencies, and each level will require different set of response mechanisms. The levels are as follows:

- Local Emergency: An alert confined to a specific locality.
- Site Emergency: An alert that cannot be localized and which presents danger to other areas within the site boundary or outside the site boundary.
- Evacuation: An alert when all personnel are required to leave the affected area and assemble in a safe location.

If there is any doubt as the whether any hazardous situation constitutes an emergency, then it must be treated as an Evacuation. Every effort must be made to control, reduce or stop the cause of any emergency provided it is safe to do so.

7.4.2.1 Fire

Ensuring the safety of the harvests in the warehouses, crops in the scheme and farmers employees is priority. Each scheme should have an emergency assembly point where farmers and workers can be assembled It is important that drills are conducted once every year where farmers and workers are trained

of using pre-determine and announced emergency routes to the assembly points. The schemes should also have firebreaks to ensure that fire outside the schemes do not cross to affect the crops in the schemes. The warehouses should have portable fire extinguishers which can be used to extinguish any visible flames within the warehouses and scheme management committee should immediately be informed. If the fire in the warehouses is too big, then surrounding communities should be informed by voices so that assistance can be provided.

The fire department should be informed immediately. Employees should de-energize nearby machinery or equipment if possible. It should be ensured to go to the “Emergency Assembly Point” without panic by using the pre-determined and announced emergency exit routes. Workers and farmers should be trained for not passing through a completely smoke-covered area on the emergency escape route, If you have a friend who you were with during the work but disappeared in the assembly area, do not forget to notify your first supervisor when you come to the assembly area.

7.4.2.2 Earthquake

The things that the farmers and workers should do include the following:

- Wait until the earthquake effect passes in the closest sheltered area.
- Protect yourself in case of bending and holding at points that will form a life triangle, such as the sides of the fixed machine body, the sides of the solid goods.
- Heavy objects should not be placed on high places in construction sites. Non-slip-based covers should be used to avoid the items and materials that must be placed from slipping and falling.
- There should be no objects in the work area that could fall or flow on floor coverings, shaft and cavity edges. Large and heavy equipment should be fixed to the floor or wall.
- Stay away from building edges, shafts and elevator shafts.
- Protect yourself from large and heavy materials that could topple or fall.
- Stay away from electrical panels and rooms.
- When the earthquake effect is over, go out of the nearest emergency exit and go to the assembly area.
- Do not use phones except in extreme emergencies.
- Stay away from areas where there is a danger of glass breakage. Leave areas with glass ceilings immediately. If you cannot be abandoned, go to the nearest safe area.
- Do not stand on the threshold (the door may slam and cause injured).
- Do not stand under shelves or any objects that may tip over.
- Protect your head and face.
- Avoid windows, glass partitions, mirrors, stoves, bookcases, tall materials and loose structural elements.
- If you are on the edge of a slope or in a pit, immediately go to a sheltered place.
- Stop the vehicle from running, apply the parking brake if possible.
- Do not park vehicles or construction equipment on or near the slopes.
- Stay away from manholes and pits.
- Be careful not to block the road.
- Try to park as far away from buildings as possible.

7.4.2.3 Flood

This disaster will only occur during rainy seasons and irrigation structures may be affected which may affected crop production during winter season. It is very important that whenever irrigation structures are damaged, immediate repair and maintenance should be done that irrigation season is not affected. Planting of earth-binding vegetation along the riverbanks will reduce the impact of flooding water from eroding the riverbank, the scheme operation team should immediately open the sluice gates so that water does not accumulate at any of the structures in the scheme as this might damage them. The assembly

points within the schemes should be on elevated positions so that affected persons cannot be affected by the floods. Proper assessment should be conducted to identify elevated places where warehouses and offices should be constructed. This will avoid crops and inputs to be damaged by the floods.

7.4.2.4 Stroke of Lightning

This emergency might likely occur during rainy season, there have been incidences of losing lives due to lightning. It is very important that scheme management committee are receiving information regarding this disaster so that they can immediately inform the communities of staying in-doors during thunderstorms/lightning and wait for rains/lightning to pass.

7.4.2.5 Environmental Pollution and Chemicals

In the event of environmental pollution, the aim is to ensure that the spread of the pollutant to other areas in the scheme is avoided. People should be supplied with water outside the contaminated areas and proper assessment should be carried out to ensure that pollution is cleaned and maintained. In the event of an incident pollution and chemicals, the following should be done:

- Ensure that response personnel are wearing appropriate personal protective equipment (PPE).
- Ensure that the spill response kits are available on site.
- The wind direction at the time of the incident should be assessed.
- If there is more than one material, the possibility of chemical reaction should be known and the expert should be consulted.
- All sources of ignition and extinguishing must be turned off (open flames, heaters, electric motors).
- The incident and its magnitude should be investigated and any potential hazards to personnel and facility should be evaluated.
- Proper control measures should be started when a gas and oil spill is confirmed to occur such as the equipment must be turned off and work stopped.
- Ensure that all sources of ignition are turned off.
- If control measures are effective and the emergency is resolved, third parties should be notified, and the scene protected.
- If control methods are ineffective, steps should be taken to partially and completely evacuate the site.
- Documentation of failures and preparatory actions should be fully reported. A trained or authorized person should wear respiratory protection and gas equipment when checking for a gas leak.

7.4.2.6 Sabotage, Terrorism

In the event of suspected sabotage, the following actions should be done:

- Police should be informed immediately
- Do not engage in behaviour that will endanger the safety of the people are the scheme
- Farmers and workers should go to the nearest assembly points

7.4.2.7 Occupational Accidents

In case of an occupational accident, the things to be done are as follows:

- Report the accident to the medical unit while giving first aid assistance to the affected persons
- Additional assistance should immediately be called
- If necessary, when the response team arrives.
- Avoid actions that will delay the intervention of the casualty.

7.4.2.8 Traffic Accidents

In case of a traffic accident involving construction vehicles and machineries, the following should be done:

- The condition of the passengers, if any, is assessed.
- Seriously injured persons should not be moved.
- Call the ambulance unit as soon as possible and give your basic observations about the injured (reporting the accident to the medical unit and giving first aid to the casualty is the main priority).
- If contact cannot be made for assistance, stop passing vehicles and provide the contact numbers of the nearest contact source.
- Prevent actions that will delay the intervention of the injured person.
- Do not leave the scene of the accident until first aid reaches the scene of the accident. Provide all relevant details when you call for emergency assistance (place of accident, occurrence of accident, type of assistance required, telephone number).

7.4.2.9 Food Poisoning

Food poisoning is one of the emergencies that might occur at the irrigation scheme level. It is important that farmers and workers showing symptoms of food poisoning immediately be reported to medical personnel and first aid should be provided. It is important for the personnel in the workplace to receive basic first aid training and to have the knowledge to perform appropriate first aid procedures for individuals showing symptoms of food poisoning. The safety of the area where individuals showing symptoms of food poisoning are located should be ensured, and entry of other employees should be prevented. This helps to bring the situation under control and protects other workers. The persons showing severe symptoms of food poisoning should seek medical attention immediately. Emergency teams should ensure that individuals are directed to a healthcare facility. A detailed investigation of the causes of food poisoning incidents is important to prevent similar incidents from recurring. This helps in preventing similar situations in the future. It is important to record and report all information related to food poisoning incidents. This provides information to relevant authorities and helps in taking necessary precautions.

7.4.2.10 Accidental Explosion

This emergency might occur during construction phase and might be due to explosion of highly inflammable gas or liquid. It is always important to keep inflammable gas or liquid in places far from the residential areas and that recommended storage procedures should be followed.

- Detect risky areas (collapse etc.), and perform initial assessments, and inform the authorities. Form safety perimeter around the risky regions.
- Help the injured and request help from the medical team for intervention. All people in the explosion area shall be kept under observation.
- Detect damages and form an incident report quickly.
- Check for gas leaks. If you hear gas leak sound or odor, open the windows and leave the building.
- If it is possible, close main gas inlet valve and call expert services.
- Check for damage in electric wiring. If you realize fire, worn cables or burning smell, call the electricians working for the Project and request them to turn off the electricity from main breaker.
- Check for damaged water or sewer pipes. If you suspect a damaged pipe, do not use the bathroom/toilet and taps.
- Activating alarm and keeping all lights open as far as possible.

7.4.2.11 Communicable Diseases

- Farmers and workers should receive regular training on the symptoms, prevention methods, and rules of communicable diseases. These trainings ensure employees are aware and help in effectively implementing preventive measures. Importance should be given to the use of PPE.
- Farmers and workers should be encouraged to practice personal hygiene measures such as regular handwashing, use of hand sanitizer, and frequent reminders of hygienic practices.
- Commonly used equipment and tools should be regularly disinfected. Especially, there is a risk of spreading communicable diseases on tools and equipment shared among workers. Personal belongings should not be shared.
- Farmers and workers should be constantly reminded to fully comply with occupational health and safety rules. This is important to protect the health of employees and other workers.
- Mechanisms for recognizing and monitoring disease symptoms should be established among staff, employees, and the general population. Regular monitoring of the health status of employees and immediate reporting of any symptoms ensures early detection of potential cases and limits the spread of the disease.
- It is important to report the outbreak situation to occupational health and safety departments and relevant public health authorities. These organizations will take the necessary steps to control and prevent the spread of the outbreak.
- It is important to quickly isolate and quarantine individuals showing symptoms of communicable diseases. This prevents the spread of the disease and protects public health.

7.4.2.12 Crop Pest Infestations

An effective emergency response to an outbreak of crop pests such as fall armyworm or African armyworm involves rapid, coordinated action to contain the infestation, minimize crop damage, and protect food security. This includes early detection, prompt reporting, and immediate implementation of control measures supported by government, development partners, and local communities. Key emergency actions include:

- Surveillance and Early Warning: Strengthen monitoring systems to detect outbreaks quickly.
- Rapid Assessment: Evaluate the scale and severity of the infestation to guide response.
- Immediate Control Measures: Deploy chemical, biological, or mechanical control methods as appropriate.
- Farmer Awareness and Training: Provide guidance on identification, safe pesticide use, and control methods.
- Input Provision: Distribute emergency supplies like pesticides, sprayers, or protective equipment.
- Coordination: Engage relevant ministries, extension services, and partners for a unified response.
- Post-Outbreak Recovery: Support affected farmers with replanting inputs and technical assistance.

7.5 Capacity building

7.5.1 Construction Phase

The contractor will be responsible to provide basic training farmers and workers on environment, social, occupational health and safety, labour and security issues, including health awareness training and workplace induction training. The training on emergency preparedness and response will consist of the following elements:

- Induction training
- Job-specific expert training (e.g. excavation operators)

- Training of emergency response teams

These trainings will be provided to all personnel with information about business continuity and emergency response and planning. Also, during the construction phase, emergency exercises or drills related to emergencies such as earthquake, fire, etc. will be planned and implemented. Events such as a work accident, hazardous situation, near-miss in the field will be recorded regularly and the training program will be revised in the light of this information.

7.5.2 Operation Phase

During the operation phase, regular training on environment, social, occupational health and safety issues will continue to be provided to all farmers and workers. Training on emergency preparedness and response will include the following elements:

- General emergency awareness training
- Fire safety and response training
- First aid training
- Evacuation procedures training
- Natural disaster preparedness training
- Hazardous materials handling training
- Accident and incident management training
- Emergency communication protocols training
- Drills and simulations
- Crisis management and coordination training

These trainings will be provided to inform all personnel about emergency response and planning. Emergency drills related to emergencies such as earthquakes and fires will be regularly planned and implemented during the operation phase as well. Incidents such as work accidents, hazardous situations, and near misses that may occur on site will be regularly recorded, and the training program will be updated in light of this information.

7.6 Drills and exercises

Emergency preparations are performed through drills. The appointed teams gather at least once a year and perform the drill. During the drill, scenarios are determined for all natural disasters and unnatural disasters. Within the framework of these scenarios, applications are performed, and solutions are proposed to address issues that may arise during the disasters, and they are resolved as part of the evaluations. All information related to these solutions is shared with the workers and farmers. Planning of emergency drills are recorded with the Annual Training Plan. Drills are held at least once a year in order to ensure that the implementation steps of the prepared emergency plan can be followed regularly and implemented. The exercises are audited and reviewed, and necessary corrective and preventive actions are taken. Date of the drill and the exercise, along with the arrangements made to address observed deficiencies, are documented. Emergency plans are revised, and the required corrections are made based on the experiences gained and the issues identified during the drills.

Evacuation drills are held once a year. Place, time of exercise, participating Emergency Response Team members, names of other officials, and results of the exercise are recorded in the "Exercise Minutes." Recommendations for reducing evacuation time and improving overall checks are also made. Fire drills will be conducted according to scenarios determined at the workplace. Fire drills will be held at least twice a year. All personnel will participate in the drill according to the scenario, and their actions will be monitored to reflect real-life conditions. Based on the reports prepared after the drills, deficiencies and erroneous behaviours will be identified, and it is expected that each drill will be more successful than the previous one.

Table 7.2. Annual Training Program

Types of Drill	Frequency
Fire	Once a year
Earthquake	Once a year
Evacuation	Once a year
Rescue	Once a year
Spill	Once a year
Accident	Once a year

7.7 Crop Pest management

Capacity building for preparedness to crop pest infestations involves training farmers to effectively detect, prevent, and manage pests through a range of practical and sustainable techniques. This includes education on pest identification and life cycles, promotion of integrated pest management (IPM) practices, and proper use of pesticides with a focus on safety and environmental protection. Farmers should also be trained to use early warning systems and participate in community-based surveillance. Leveraging on existing demonstrations and farmer field schools can enhance hands-on learning, while strengthening access to extension and digital advisory services ensures continuous technical support. These efforts build farmer resilience, enabling timely and informed responses to pest outbreaks and minimizing crop losses.

7.8 Reporting and monitoring

An internal reporting system will be designed to ensure a timely feedback procedure incorporating results of monitoring into management practices. During construction phase all drills, audits and trainings will be reported to the Project Implementation Management Unit (PIMU) with a copy to the District Irrigation Office (DIO) by the contractor in a monthly manner or whenever necessary. During the operation phase, all drills, audits, and trainings will be reported to District Irrigation Office.

The PIMU and DIO will be promptly notified of any incident or accident related to the Project that has, or is likely to have, a significant adverse effect on the environment, the affected communities, the public or workers including but not limited to; incidents and accidents encountered during construction and operation works, environmental spills, etc.

Sufficient detail will be provided regarding the incident or accident, findings of the Root Cause Analysis (RCA), indicating immediate measures or corrective actions taken or that are planned to be taken to address it, compensation paid, and any information provided by any contractor and supervision consultant, as appropriate. At the request of PIMU and DIO, a report on the incident or accident together with measures proposed to prevent its recurrence will be prepared.

EPRP monitoring will ensure an early warning for emerging risks, which will enable early actions to be taken to mitigate the impacts of such risks. The EPRP, and the Project's site-specific management plans/procedures will be reviewed and revised periodically and if necessary, updates will be made as the Project proceeds. Validity of indicators will also be checked on a regular basis, and as required with the availability of new information.

This Plan is a living document, and the responsibilities, procedures and compliance actions shall be updated as required, for instance, in case of a change in the applicable legislative requirements and standards. In general, the expected review and update frequency is determined as at least once in a year. However, it should be noted that immediately following an emergency, if an additional need arises without waiting for the predetermined frequency, the Irrigation Management Team will review the plan

and report their assessment to the PIMU. If an update is necessary, it will be ensured by the contractor during the construction phase and by Irrigation Management Team during the operation phase.

During the operation phase, Irrigation Management Team, and during the construction phase, the contractor and the contractor's E&S Safeguards Expert are responsible for being fully aware of the content of this plan, ensuring that personnel receive appropriate training, and ensuring that procedures are implemented to comply with this plan.

Regular monitoring and audit activities will be carried out in compliance with the ESMP in order to ensure the implementation of this EPRP. There is a responsibility & authority matrix and specific do's and don'ts during implementation of the emergency. A crisis response manager is designated to oversee the preparedness to cover the entire complex and address day-to-day concerns and problems of all the residents and visitors.

Most of the residents and visitors are ignorant about do's and don'ts during emergency / crisis situation. While it is easy to learn from others' mistakes, it is of paramount importance to have a plan for saving and restoring irreplaceable valuables and important documents, so that life should never be risked to re-enter a dangerous home to salvage such belongings. Important phone numbers are permanently displayed at prominent places and evacuation drill is regularly conducted, so that residents and visitors are not confronted with surprises or helplessness during the crisis.

8. ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLANS

8.1 Environmental and Social Management Plan

The Environmental and Social Management Plan (ESMP) has been prepared to facilitate the integration of the enhancement and mitigation measures in the implementation of this project. The aim of the ESMP is to ensure that project developers prevents, reduces, mitigates, and compensates for the impacts of the proposed project on the biophysical and socio-economic environment.

The ESMP, presented in Figure 7.1 contains the following:

- Potential beneficial and adverse environmental and social impacts of the project
- Enhancement measures for the beneficial impacts and the mitigation measures for the adverse impacts.
- Responsible institutions to implement the mitigation measures.
- Estimated cost for implementing the measures.
- Time frames for implementation of the mitigation measures.

The project developers and the Contractors have the responsibility of ensuring that the ESMP is implemented effectively and fully.

Table 8.1: Environmental and social Management Plan

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/ monitoring			
	<i>Design, Planning and Mobilization Phase</i>	degradation of water quality	• Ensure use of well serviced machinery with no oil leakages. • Ensure disposal of waste in sites designated by the Council. • Limit operations to site designated for the camp.	DoI/DPW/WUA/PMT	District Environmental Sub Committee (DESC)	2026-2027	-No of vehicles serviced -Wastes disposed in designated site.	700, 000
	<i>Design, Planning and Mobilization Phase</i>	Loss of trees and vegetation	• Ensure minimal disturbance of vegetation and trees by limiting operations to designated site. • Ensure camp is sited in areas where clearing of vegetation will not be involved.	- DFO//PMT	-	- 2026-2027	- Area conserved Camp properly sited	-
	<i>Design, Planning and Mobilization Phase</i>	Conflicts over land use	• Local leaders/chiefs to identify rightful owners and users of land together with the irrigation committee. • Administer land agreement forms with clear arrangements on how winter cropping will be done to ensure there is common understanding	DLO//PMT		2026-2027	-No of land agreement forms signed	500, 000
	Construction Phase	Soil erosion and siltation caused by clearing of land for construction works.	• Plant vetiver grass on contours and along all canals to stabilise them.	Contractor/WUA/DC	DESC/PMU	2026-2027	Area planted with vetiver in meters	500, 000
	Construction Phase		• Construct drop structures as per the designed size of the canal and appropriate for steep slopes to minimise water velocity.	Contractor/WUA/DC	DESC/PMU	2026-2027	Number of drop structures constructed	
	Construction Phase		• Apply water to stripped soils to reduce erosion.	Contractor/WUA/DC	DESC/PMU	2026-2027	Area applied with water and records of water application	
	Construction Phase		• Use soils from stockpiles to rehabilitate stripped and excavated zones.	Contractor/WUA/DC	DESC/PMU	2026-2027	Number of stockpiles or volumes of loose soils used for rehabilitation and backfilling of excavations	

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/ monitoring			
	Construction Phase		Enhance soil and water conservation measures and farming such as mulching, box ridging, agroforestry etc.	Irrigation Committee/ Labour/DoI/WU A/DC(DADO)/PMU	DESC	2026-2027	Area under conservation measures	
	Construction Phase	Risk of borrow pits	Barricading of the borrow pit perimeter with orange safety mesh barricade while in use.	Contractor	DESC/PMU	2026-2027	Area/number of pits barricaded or protected	2, 000, 000
	Construction Phase		Backfilling and rehabilitation of all borrow pits after use.	Contractor	DESC/PMU	2026-2027	No of pits rehabilitated or filled	
	Construction Phase		Sensitize communities on risks of the borrow pits	Contractor/WUA/DC	DESC/PMU	2026-2027	No of sensitization meetings conducted	
	Construction Phase	Increased Generation of waste from construction activities	Dispose wastes in sites designated by the District Council	Contractor/WUA/DC	DESC/PMU	2026-2027	Amount of wastes properly disposed	1, 000, 000
	Construction Phase		Siting and establishing camps at approved sites in consultation with the Supervision Committee	Contractor/WUA/DC	DESC/PMU	2026	Camp properly sited	
	Construction Phase	Loss of trees and vegetation due to infrastructure development	Limiting bush clearance to approved sites.	Contractor/WUA/DC	DESC/PMU	2026-2027	Area cleared	1, 500, 000
	Construction Phase		Prevent clearing of bush for construction works except where necessary – this to be agreed by the supervision committee/WUA.	Contractor/WUA/DC	DESC/PMU	2026-2027	Agreement made	
	Construction Phase		Avoid wanton cutting down of trees and enforce penalties for deliberate and unnecessary cutting down of trees.	Contractor/WUA/DC	DESC/PMU	2026-2030	No of people penalized for the malpractice	
	Construction Phase		Planting trees on all bare lands	WUA/DC	DESC/PMU	2026-2030	No of trees planted	
	Construction Phase		Promote use of alternative sources of cooking fuel to migrant workers such as efficient cook stoves such as zipolopolo mbaula, or gas; and avoid use of charcoal or fuelwood.	WUA/DC	DESC/PMU	2027-2030	No of people adopting use of fuel-efficient stoves/gas	
	Construction		Training communities to protect trees and woodlands/forests.		DESC / PMU	2027-2029	No of members	

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/ monitoring			
	Phase						trained	
	Construction Phase	Increased dust emission by construction equipment	• Control vehicle speed to reduce generation of dust through installation of speed humps and enforcement of speed limits.	Contractor	DESC / PMU	2026-2027	No of speed humps and speed limit signs installed	500, 000
	Construction Phase		• Regular application of water to civil works and earth roads to suppress dust.	Contractor	DESC / PMU	2026-2027	Area applied with water	
	Construction Phase	Increased risk of child labour	• Checking of the workforce by the Consulting Engineer and other members of the supervising engineer, as well as the District Council, Committee etc.	Contractor/Labour	DESC / PMU	2026-2028	Records of workers employed	700, 000
	Construction Phase		• Enforce Code of Conduct for contractors developed under the project (and signed by all contractors and their staff),	Contractor/Labour	DESC / PMU	2026-2027	No of workers signing CoC	
	Construction Phase		• Enforce Laws of Malawi including prosecution of those who employ children.	Contractor/Labour	DESC / PMU	2026-2030	Records of law enforcement/No of visits	
	Construction Phase		• Checking of the workforce by the Consulting Engineer and other members of the supervising engineer, as well as the District Council, Committee etc.	Contractor	DESC / PMU	2026-2030	No of people checked	
	Construction Phase	Noise pollution	• All construction works shall be confined to daylight hours unless permission is obtained from Supervision Committee and consultation with affected communities.	Contractor	DESC / PMU	2026-2027	Agreements signed	As in the BoQs
	Construction Phase		• Provide and enforce use of noise cancelling devices for workers working with noisy machines.	Contractor	DESC / PMU	2026-2027	No of workers provided and using noise cancelling devices	
	Construction Phase	Chemical contamination of soil and water by oil leakages and spillage from machinery	• This can be mitigated by carrying out regular servicing of machinery.	Contractor	DESC / PMU	2026-2027	No of vehicles serviced	2, 500,000
	Construction Phase		• Training of workers on spill prevention and control	Contractor	DESC / PMU	2026-2027	No of workers trained on spill prevention and safety issues	
	Construction Phase		• Use of spill response equipment such as drip trays and absorbents to capture and	Contractor	DESC / PMU	2026-2027	No of spill response	

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/ monitoring			
			clean up spillages.				equipment available	
	Construction Phase		• Construct a storm bund for storage of hazardous substances	Contractor	DESC / PMU	2026-2027	No of storm bund constructed and being used	
	Construction Phase		• servicing machinery at a central point and disposing used oil at a site approved by MEPA.	Contractor	DESC / PMU	2026-2027	No of vehicles serviced	
	Construction Phase	Increased incidences of waterborne diseases	• All open ditches should be closed or rehabilitated.	Contractor	DESC / PMU	2027	No of open ditches or pits filled	500,000
	Construction Phase		• Ensuring absence of stagnant water in the scheme area by empowering the WUA to conduct regular supervisions.	Irrigation Committee / Labour/DoI/WU A/DC(DADO), Health /PMU	DESC	2027-2030	Area free from stagnant water	
	Construction Phase	Increased risk of Spread of HIV AND AIDS and other STIs.	• Conduct awareness meetings among workers and communities,	Irrigation Committee / Labour/DoI/WU A/DC(DADO), Health /PMU	DESC	2026-2030	No of awareness meetings conducted/minutes	500, 000
	Construction Phase		• Distribute condoms.	Irrigation Committee / Labour/DoI/WU A/DC(DADO), Health /PMU	DESC	2026-2030	No of condoms provided	
	Construction Phase		• Development of and strict adherence to Code of Conduct for workers.	Irrigation Committee/ Labour/DoI/WU A/DC(DADO)/PMU	DESC	2026-2027	No of workers who have signed codes of conduct	
	Construction Phase	Increased risk of Gender based violence (GBV) and Sexual Exploitation and Abuse (SEA)	• Conduct awareness meetings among workers and communities,	Irrigation Committee/ Labour/DoI/WU A/DC(DADO)/PMU	DESC	2026-2030	No of awareness meetings conducted	500, 000
	Construction Phase		• Development of and strict adherence to Code of Conduct for workers	Irrigation Committee/ Labour/DoI/WU A/DC(DADO)/PMU	DESC	2026-2027	No of workers who have signed codes of conduct	
	Construction Phase	Conflict over land use	• Local leaders/chiefs to identify rightful owners and users of land together with the irrigation committee.	Irrigation Committee/ Lands/DoI/WU A/DC(DADO)/PMU	DESC	2026-2027	No of land parcels with rightful owners	1, 500, 000

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/ monitoring			
	Construction Phase		Administer land agreement forms with clear arrangements on how winter cropping will be done to ensure there is common understanding.	Irrigation Committee/ Lands/DoI/WU A/DC(DADO)/PMU	DESC	2026-2027	No of land agreement forms signed	
	Construction Phase	Interferences in marriages	Conduct awareness meetings among workers and communities	Irrigation Committee/ Labour/DoI/WU A/DC(DADO)/PMU	DESC	2026-2027	No of awareness meetings conducted	350, 000
	Construction Phase		Development of and strict adherence to Code of Conduct for workers	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DoI PMU	2026-2027	No of workers who have signed codes of conduct	
	Operation phase	Changes in hydrological regimes in the rivers	Ensure that the scheme obtains water right.	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DESC	2026	No of water rights obtained	2,500,000
	Operation phase		Adhere to provisions in water right to, for example, maintain environmental flow requirements of 0.000228906m3/s.	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DoI PMU	2026-2030	Amount of water allowed to flow	
	Operation phase		Improve irrigation and drainage operations to enhance water use efficiency.	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DESC	2026-2030	No of canals that have been improved	
	Operation phase	Increased deforestation	Introduce efficient, accessible, and affordable cook stoves.	DoI DC (DFO) PMU	DESC	2027-2030	No of households using efficient, energy saving stoves	800, 000
	Operation phase		Establish tree nurseries and woodlots	DoI DC (DFO) PMU	DESC	2026-2029	Number of nurseries and woodlots established.	
	Operation phase		Promote tree planting	DoI DC (DFO) PMU	DC (DFO) PMU	2026-2030	No of trees planted and survived	
	Operation phase		Sensitise and train WUA members and staff on catchment management	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DESC	2027-2028	No of members trained and sensitized	

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/ monitoring			
	Operation phase		Establishing 15 metres buffer zones of trees and grasses between the river and irrigated land to assist filter the chemicals before entering the river.	DoI DC (DFO) PMU	DESC	2026-2030	15 m buffer zone established	
	Operation phase	Risk of flooding, water logging and salinisation of soils	Apply of organic matter to improve soil structure.	DoI DC (DLRC) PMU		2026-2030	Area applied with organic fertilizers	1, 000, 000
	Operation phase		Apply recommended type and amount of chemicals and fertilisers.	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DESC	2026-2030	Area applied with recommended type of chemicals and fertilizers	
	Operation phase		Regularly maintain irrigation and drainage channels to improve seepage.	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DESC	2026-2030	Number of channels regularly maintained	
	Operation phase		Drafting of the operation and maintenance manual; and training of operators' weir maintenance and drafting of a Contingency Emergency Response Plan.	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DESC	2027-	Number of O&M developed	
	Operation phase		Apply of organic matter to improve soil structure	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DESC	2026-2030		
	Operation phase		Clear clogged channels to allow water to flow.	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DESC	2026-2030	Length of channels cleared	
	Operation phase	Increased occurrences of waterborne diseases	Ensure an absence of stagnant water at the site by constructing proper drainage around the scheme and clearing blocked areas by the committee/WUA.	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DESC	2026-2030	Length of channels cleared	850, 000
	Operation phase		Promote good sanitation, hygiene, and use of mosquito nets in the camps and surrounding communities.	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DESC	2026-2030	No of awareness meetings	
	Operation phase	Use of unregistered pesticides in	Training and awareness for farmers on harmful/banned and unregistered pesticides.	Irrigation Committee/DoI/WU A/DC(DADO)/PMU	DESC	2026-2029	No of farmers trained approved pesticides	550, 000

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/ monitoring			
	Operation phase	the scheme	Encourage farmers to buy approved pesticides and from registered suppliers.	Irrigation Committee/WUA/DC (DADO)/ PMU	DESC	2026-2-30	No of awareness meetings	
	Operation phase	Risk of high sediment loads from flooding impacting on the irrigation scheme	- Constructing flood protection structures such as dykes, check dams and infiltration ponds to trap excess water during flooding. - Planting vegetation to trap sediments and improve seepage.	DoF/PMU/DoI/DC	DESC	2027	No of structures constructed. Area planted with vegetation	600, 000
	Operation phase	Aquifer depletion	- Improve irrigation and drainage operations to enhance water use efficiency. - Enhance catchment conservation practices to increase percolation, reduce run off and enhance recharge	PMU/DoI/LRCO	DESC	2026-2030	-Number of structures improved. -Area under catchment conservation	500, 000
	Operation phase	Diminished land and soil fertility / productivity	- Enhance soil and water conservation measures and farming such as mulching, box ridging, agroforestry etc. - Promote use of organic manure. - Develop and implement the Integrated Pest Management Plan. - Plant vetiver grass on contours and along all canals to stabilize them.	DLRC/DoF/ WUA/DC	DESC/PMU	2026-2030	- Area under conservation -IPMP developed & implemented	500, 000
	Demobilization phase	Loss of employment	- Timely sensitization and awareness to workers on the end of construction works - Pay terminal benefits to the workers	DC/Labour/PMU/DoI	DESC	2026	-No of meetings conducted/No of workers sensitized. -No of workers given terminal benefits	500,000
	Demobilization phase	Loss of business opportunities	Timely sensitization and awareness to workers & community members on the end of construction works	DC/Trade/ABO/PMU	DESC	2026	-No of meetings conducted. -No of workers sensitized.	500,000
	Demobilization phase	Risk of accidents	- Provision of PPE to workers - Conduct safety and health awareness	DC/WUAPMU	DESC	2026	-No of workers provided with	1,500,000

Receiver	Phase	Impact Identified	Recommended Mitigation/Management Measures	Responsibilities		Timeframe	Indicators	Estimated cost (mk)
				Implementation	Follow up/ monitoring			
							PPEs.	
	Demobilization phase	Increased generation of construction rubble/waste	• Designate specific places for the disposal of waste in consultation with the district council. • Development and implementation of a Waste Management Plan	DC/EDO/PMU	DESC	2026	Amount of wastes disposed in designated places	500,000
TOTAL								76,169,675.17 (USD 43,500.67)

8.2 Environmental and Social Monitoring Plan

The Environmental and Social Monitoring Plan (ESMP) outlines the arrangements, indicators, and resource requirements for monitoring environmental and social performance during both construction and operational phases. Its primary purpose is to ensure that all project activities are carried out in compliance with the Environmental and Social Assessment (ESA) Report, as well as relevant environmental policies and legislation. Resource estimates are provided based on responsible institutions and activity frequency; however, final costs will be determined at the implementation stage.

The District Environmental Sub-Committee (DESC), coordinated by the Environmental District Officer (EDO), will oversee overall environmental performance monitoring. In addition to key monitoring locations identified during the design stage, inspections will also be conducted at the construction camp and any other plant sites deemed relevant during the works.

The monitoring program will cover:

- Assessment of surface and groundwater quality impacts.
- Observation of potential disturbance to important ecological habitats, including riverside ecosystems.
- Unscheduled environmental compliance inspections during construction.
- Final inspection upon project completion to confirm satisfactory site conditions.
- Pre- and post-construction assessments to ensure no loss of natural values.

These measures are designed to maintain high environmental performance standards and to safeguard the ecological and social integrity of the project area.

Table 8.2: Environmental and Social Monitoring Plan and Budget

NO	IMPACT IDENTIFIED	RECOMMENDED ENHANCEMENT/MITIGATION/MANAGEMENT MEASURE	MONITORING INDICATOR	FREQUENCY	RESPONSIBLE INSTITUTION	ESTIMATED COST (MK)
<i>Design, Planning and Mobilization Phase</i>						
1	Reduced water quality	• Ensure use of well serviced machinery with no oil leakages. • Ensure disposal of waste in sites designated by the Council. • Limit operations to site designated for the camp.	-No of vehicles serviced -Wastes disposed in designated site.	Quarterly	DoI/DPW/WUA	700, 000
2	Loss of trees and vegetation	• Ensure minimal disturbance of vegetation and trees by limiting operations to designated site. • Ensure camp is sited in areas where clearing of vegetation will not be involved.	- Area conserved - Camp properly sited	Quarterly	DFO/PMU	-
3	Increased conflicts over land use	• Local leaders/chiefs to identify rightful owners and users of land together with the irrigation committee. • Administer land agreement forms with clear arrangements on how winter cropping will be done to ensure there is common understanding	-No of land agreement forms signed	Quarterly	DLO/PMU	500, 000
<i>Construction and operation Phases</i>						
1	Increased Soil and erosion siltation	• Plant vetiver grass on contours and along all canals to stabilise them.	Area planted with vetiver in meters	Biannually	Agriculture/DoI/PMU	500, 000
		• Construct drop structures as per the designed size of the canal and appropriate for steep slopes to minimise water	Number of drop structures constructed	Quarterly		

NO	IMPACT IDENTIFIED	RECOMMENDED ENHANCEMENT/MITIGATION/MANAGEMENT MEASURE	MONITORING INDICATOR	FREQUENCY	RESPONSIBLE INSTITUTION	ESTIMATED COST (MK)
		velocity.				
		• Apply water to stripped soils to reduce erosion.	Area applied with water and records of water application	Quarterly		
		• Use soils from stockpiles to rehabilitate stripped and excavated zones.	Number of stockpiles or volumes of loose soils used for rehabilitation and backfilling of excavations	Quarterly		
		• Enhance soil and water conservation measures and farming such as mulching, box ridging, agroforestry etc.	Area under conservation measures	Biannually		
2	Increased risk of borrow pits	• Barricading of the borrow pit perimeter with orange safety mesh barricade while in use.	Area/number of pits barricaded or protected	Regularly	Contractor / Supervision Committee/Council/ P MU	2, 000, 000
		• Backfilling and rehabilitation of all borrow pits after use.	No of pits rehabilitated or filled	Quarterly		
		• Sensitize communities on risks of the borrow pits	No of sensitization meetings conducted	Regularly		
3	Increased Generation of waste	• Dispose wastes in sites designated by the District Council	Amount of wastes properly disposed	Weekly	Contractor / DoI / DC/Committee/PMU	1, 000, 000

NO	IMPACT IDENTIFIED	RECOMMENDED ENHANCEMENT/MITIGATION/MANAGEMENT MEASURE	MONITORING INDICATOR	FREQUENCY	RESPONSIBLE INSTITUTION	ESTIMATED COST (MK)
	from construction activities	Siting and establishing camps at approved sites in consultation with the Supervision Committee	Camp properly sited	Biannual		
4	Loss of trees and vegetation due to infrastructure development	Limiting bush clearance to approved sites.	Area cleared	Weekly	Community/Supervision Committee/District Council (DFO)/PMU	1, 500, 000
		Prevent clearing of bush for construction works except where necessary – this to be agreed by the supervision committee/WUA.	Agreement made	Fortnightly		
		Avoid wanton cutting down of trees and enforce penalties for deliberate and unnecessary cutting down of trees.	No of people penalized for the malpractice	Fortnightly		
		Planting trees on all bare lands	No of trees planted	Annually		
		Promote use of alternative sources of cooking fuel to migrant workers such as efficient cook stoves such as zipolopolo mbaula, or gas; and avoid use of charcoal or fuelwood.	No of people adopting use of fuel-efficient stoves/gas	Quarterly		
		Training communities to protect trees and woodlands/forests.	No of members trained	Once-		
5	Increased dust emission by construction equipment	Control vehicle speed to reduce generation of dust through installation of speed humps and enforcement of speed limits.	No of speed humps and speed limit signs installed	Monthly	Contractor/Engineer / PMU	500, 000
		Regular application of water to civil works and earth roads to suppress dust.	Area applied with water	Weekly		

NO	IMPACT IDENTIFIED	RECOMMENDED ENHANCEMENT/MITIGATION/MANAGEMENT MEASURE	MONITORING INDICATOR	FREQUENCY	RESPONSIBLE INSTITUTION	ESTIMATED COST (MK)
6	Increased risk of child labour	• Checking of the workforce by the Consulting Engineer and other members of the supervising engineer, as well as the District Council, Committee etc.	Records of workers employed	Weekly	Labour Office/WUA/PMU	700, 000
		• Enforce Code of Conduct for contractors developed under the project (and signed by all contractors and their staff),	No of workers signing CoC	Weekly		
		• Enforce Laws of Malawi including prosecution of those who employ children.	Records of law enforcement/No of visits	Weekly		
		• Checking of the workforce by the Consulting Engineer and other members of the supervising engineer, as well as the District Council, Committee etc.	No of people checked	Weekly		
7	Increased Noise pollution	• All construction works shall be confined to daylight hours unless permission is obtained	Agreements signed	Weekly	DC/PMU/ DHO/DoI	As in the BoQs
		from Supervision Committee and consultation with affected communities.				
		• Provide and enforce use of noise cancelling devices for workers working with noisy machines.	No of workers provided and using noise cancelling devices	Weekly		
8	Increased Chemical contamination of soil and water by oil leakages and spillage	• This can be mitigated by carrying out regular servicing of machinery.	No of vehicles serviced	Fortnightly	Contractor/Ministry of Lands/	2, 500,000
		• Training of workers on spill prevention and control	No of workers trained on spill prevention and safety issues	Fortnightly	Department of Irrigation/DC/PMU	

NO	IMPACT IDENTIFIED	RECOMMENDED ENHANCEMENT/MITIGATION/MANAGEMENT MEASURE	MONITORING INDICATOR	FREQUENCY	RESPONSIBLE INSTITUTION	ESTIMATED COST (MK)
	from machinery	• Use of spill response equipment such as drip trays and absorbents to capture and clean up spillages.	No of spill response equipment available	Monthly		
		• Construct a storm bund for storage of hazardous substances	No of storm bund constructed and being used	Monthly		
		• servicing machinery at a central point and disposing used oil at a site approved by MEPA.	No of vehicles serviced	Quarterly		
9	Increased incidences of waterborne diseases	• All open ditches should be closed or rehabilitated.	No of open ditches or pits filled	Weekly	Contractor/ Department of Irrigation/DC/PMU	500,000
		• Ensuring absence of stagnant water in the scheme area by empowering the WUA to conduct regular supervisions.	Area free from stagnant water	Weekly		
10	Increased risk of Spread of HIV AND AIDS and other STIs.	• Conduct awareness meetings among workers and communities,	No of awareness meetings conducted/minutes	Monthly	Irrigation Committee DoI/WUA/PMU	500, 000
		• Distribute condoms.	No of condoms provided	Monthly		
		• Development of and strict adherence to Code of Conduct for workers.	No of workers who have signed codes of conduct	Weekly		
11	Increased risk of Gender based violence (GBV)	• Conduct awareness meetings among workers and communities,	No of awareness meetings conducted	Monthly	Irrigation Committee WUA	500, 000

NO	IMPACT IDENTIFIED	RECOMMENDED ENHANCEMENT/MITIGATION/MANAGEMENT MEASURE	MONITORING INDICATOR	FREQUENCY	RESPONSIBLE INSTITUTION	ESTIMATED COST (MK)
	and Sexual Exploitation and Abuse (SEA)	Development of and strict adherence to Code of Conduct for workers	No of workers who have signed codes of conduct	Weekly	DoC/PMU	
12	Increased Conflict over land use	Local leaders/chiefs to identify rightful owners and users of land together with the irrigation committee.	No of land parcels with rightful owners		Irrigation Committee/WUA/DoI/DC/PMU	1,500,000
		Administer land agreement forms with clear arrangements on how winter cropping will be done to ensure there is common understanding.	No of land agreement forms signed	Monthly		
13	Increase interferences in marriages	Conduct awareness meetings among workers and communities	No of awareness meetings conducted	Monthly	Irrigation Committee WUA	350,000
		Development of and strict adherence to Code of Conduct for workers	No of workers who have signed codes of conduct	Weekly	DoI PMU	
14	Increased Changes in hydrological regimes in the rivers	Ensure that the scheme obtains water right.	No of water rights obtained	Monthly	Irrigation Committee WUA	2,500,000
		Adhere to provisions in water right to, for example, maintain environmental flow requirements of 0.000228906m³/s.	Amount of water allowed to flow	Weekly	DoI PMU	
		Improve irrigation and drainage operations to enhance water use efficiency.	No of canals that have been improved	Monthly		
15	Increased deforestation	Introduce efficient, accessible, and affordable cook stoves.	No of households using efficient	Monthly	Irrigation Committee WUA	800,000

NO	IMPACT IDENTIFIED	RECOMMENDED ENHANCEMENT/MITIGATION/MANAGEMENT MEASURE	MONITORING INDICATOR	FREQUENCY	RESPONSIBLE INSTITUTION	ESTIMATED COST (MK)
			energy saving stoves		DoI DC (DFO) PMU	
		• Establish tree nurseries and woodlots	Number of nurseries and woodlots established.	Quarterly		
		• Promote tree planting	No of trees planted and survived	Monthly		
		• Sensitise and train WUA members and staff on catchment management	No of members trained and sensitized			
		• Establishing 15 metres buffer zones of trees and grasses between the river and irrigated land to assist filter the chemicals before entering the river.	15 m buffer zone established			
16	Increased risk of flooding, water logging and salinisation of soils	• Apply of organic matter to improve soil structure.	Area applied with organic fertilizers	Fortnightly	Irrigation Committee/DoI/WUA/DC(DADO)/PMU	1, 000, 000
		• Apply recommended type and amount of chemicals and fertilisers.	Area applied with recommended type of chemicals and fertilizers	Fortnightly		
		• Regularly maintain irrigation and drainage channels to improve seepage.	Number of channels regularly maintained	Weekly		

NO	IMPACT IDENTIFIED	RECOMMENDED ENHANCEMENT/MITIGATION/MANAGEMENT MEASURE	MONITORING INDICATOR	FREQUENCY	RESPONSIBLE INSTITUTION	ESTIMATED COST (MK)
		Drafting of the operation and maintenance manual; and training of operators' weir maintenance and drafting of a Contingency Emergency Response Plan.	Number of O&M developed			
		Apply of organic matter to improve soil structure				
		Clear clogged channels to allow water to flow.	Length of channels cleared	Weekly		
17	Increased occurrences of waterborne diseases	Ensure an absence of stagnant water at the site by constructing proper drainage around the scheme and clearing blocked areas by the committee/WUA.	Length of channels cleared	Weekly	Irrigation Committee/WUA/DC (DEHO)/PMU	850, 000
		Promote good sanitation, hygiene, and use of mosquito nets in the camps and surrounding communities.	No of awareness meetings	Monthly		
18	Increased use of unregistered pesticides in the scheme	Training and awareness for farmers on harmful/banned and unregistered pesticides.	No of farmers trained approved pesticides	Monthly	Irrigation Committee/WUA/DC (DADO)/ PMU	550, 000
		Encourage farmers to buy approved pesticides and from registered suppliers.	No of awareness meetings	Weekly		
19	Increased risk of high sediment loads from flooding impacting on the irrigation scheme	- Constructing flood protection structures such as dykes, check dams and infiltration ponds to trap excess water during flooding. - Planting vegetation to trap sediments and improve seepage.	No of structures constructed. Area planted with vegetation	Biannual	DoF/PMU/DoI/DC	600, 000

NO	IMPACT IDENTIFIED	RECOMMENDED ENHANCEMENT/MITIGATION/MANAGEMENT MEASURE	MONITORING INDICATOR	FREQUENCY	RESPONSIBLE INSTITUTION	ESTIMATED COST (MK)
20	Increased aquifer depletion	- Improve irrigation and drainage operations to enhance water use efficiency. - Enhance catchment conservation practices to increase percolation, reduce run off and enhance recharge	-Number of structures improved. -Area under catchment conservation	Quarterly	PMU/DoI/LRCO	500, 000
21	Diminished land and soil fertility / productivity	- Enhance soil and water conservation measures and farming such as mulching, box ridging, agroforestry etc. - Promote use of organic manure. - Develop and implement the Integrated Pest Management Plan. - Plant vetiver grass on contours and along all canals to stabilize them.	- Area under conservation -IPMP developed & implemented	Quarterly	LRCO/PMU/WUA	500, 000
<i>During demobilization phase</i>						
1	Loss of employment	- Timely sensitization and awareness to workers on the end of construction works - Pay terminal benefits to the workers	-No of meetings conducted/No of workers sensitized. -No of workers given terminal benefits	Quarterly	DC/Labour/PMU/DoI	500,000
2	Loss of business opportunities	Timely sensitization and awareness to workers & community members on the end of construction works	-No of meetings conducted. -No of workers sensitized.	Once	DC/Trade/ABO/PMU	500,000
3	Increased risk of accidents	- Provision of PPE to workers - Conduct safety and health awareness	-No of workers provided with PPEs.	Regularly/ weekly	DC/WUAPMU	1,500,000

NO	IMPACT IDENTIFIED	RECOMMENDED ENHANCEMENT/MITIGATION/MANAGEMENT MEASURE	MONITORING INDICATOR	FREQUENCY	RESPONSIBLE INSTITUTION	ESTIMATED COST (MK)
4	Increased generation of construction rubble/waste	- Designate specific places for the disposal of waste in consultation with the district council. - Development and implementation of a Waste Management Plan	Amount of wastes disposed in designated places	Weekly	DC/EDO/PMU	500,000
TOTAL						28,028,764.79 (USD 16,007.29)

9. CAPACITY BUILDING PLAN

9.1 Capacity Needs

The environmental and social assessment process is a knowledge-intensive and interactive exercise that requires precise identification of project impacts and development of targeted mitigation or enhancement measures. Understanding ecosystem interactions equips farmers with biological and ecological knowledge, enabling them to make informed pest and parasite control decisions. This process is best achieved through experiential learning and action research.

The successful implementation of this Environmental and Social Assessment Report depends on developing and sustaining both institutional and human capacity to facilitate such learning. Experiential learning allows for the integration of scientific and indigenous knowledge, helping to address context-specific challenges at district, ward, and village levels.

Currently, ineffective communication between farmers, extension agents, and researchers often leads to poorly targeted research and limited adoption of promising innovations. Closer collaboration through farmer–researcher interaction, adaptive research, and participatory learning approaches can bridge this gap, making research outputs more practical and relevant.

Farmers should, at a minimum, receive training in:

- Social, biological, and ecological processes underpinning proposed measures.
- Practical application of new knowledge to select compatible methods for reducing production and post-harvest losses, supported by field visits, meetings, and demonstrations.
- Conducting and participating in adaptive research trials.

Capacity building will be implemented through farmer-based collaborative management mechanisms in which all stakeholders are considered equal partners. Beneficiary farmers will be the principal actors, supported by research institutes, academic institutions, sector ministries, NGOs, and other relevant partners, whose role will be to facilitate processes, provide technical guidance, and offer any necessary support.

9.2 Training

9.2.1 Training Content

The training program will address capacity gaps identified during stakeholder consultations. As outlined in Table 20, these trainings are designed to prevent or minimise the occurrence and severity of environmental and social impacts.

9.2.2 Training of trainers

Training will be delivered by qualified consultants, as listed in Table 20. Trainers must have in-depth knowledge of their subject areas and demonstrate the ability to convey both technical content and practical application methods.

9.2.3 National level training

At the national level, training will focus on building and strengthening institutional coordination for implementing and monitoring the measures proposed in this report. Participants will be drawn from key stakeholder institutions, including:

- FAO, UNOPS, IFAD (Project Implementation Team)

- Ministry of Agriculture: Department of Irrigation Services, Department of Crop Development, Department of Land Resources and Conservation, Department of Agricultural Research Services
- Pesticides Control Board
- Other relevant agencies

Representatives from these institutions will present their areas of expertise and explain how their technical skills will be applied in the implementation and monitoring process.

9.2.4 District level trainings

District-level training will target technical staff involved in project implementation, including:

- Members of the District Environmental Sub-Committee (DESC) – Phalombe District
- District irrigation engineers
- District agricultural officers (district and EPA levels)

These officers will be responsible for transferring knowledge and best practices to Water Users Associations (WUAs) and farmers at Mwaiwathu Irrigation Scheme.

9.2.5 Community level trainings

Community-level training will focus on WUA members, sub-committee members, Village Development Committees, Village Natural Resources Management Committees, Village Agricultural Committees, and irrigation farmers responsible for environmental management in their localities. For farmer-specific training, 60 participants will be trained per session over a 2-hour period.

Table 9.1: Training areas for key role players and stakeholders

Enhancement/Mitigation Measures	Training content	Trainers	Participants of the training	Duration of training	Training Cost (000 000' MK)
Foundations of ESIA	Principles and objectives of ESIA Legal and institutional frameworks (national and international) Environmental and social safeguard policies (e.g., MEPA, IFAD, FAO, AfDB, etc.) Stakeholder engagement and public participation	MEPA/ Project Environmental Specialist/ Project Social Specialist	Members of Project Management Team (PMT)	3 hrs	1
Environmental and social safeguards	Environmental baseline data collection and analysis Impact identification and mitigation measures Environmental and Social Management Plans (ESMP) Climate risk screening and adaptation planning Biodiversity and ecosystem services assessment Social baseline studies and vulnerability assessments Gender analysis and mainstreaming	MEPA/ Project Environmental Specialist/ Project Social Specialist	Members of Project Management Team (PMT)	3 hrs	1

	Labor standards and working conditions				
Monitoring and Evaluation (M&E)	Designing M&E frameworks for ESIA implementation Indicators for environmental and social performance Data collection tools and reporting formats Use of GIS and remote sensing in monitoring Adaptive management and feedback mechanisms	MEPA/ Project Environmental Specialist/ Project Social Specialist	Members of Project Management Team (PMT)	3 hrs	1
Risk Management and Compliance	Environmental and social risk assessment Grievance Redress Mechanisms (GRM) Compliance monitoring and audit procedures Incident reporting and corrective actions	MEPA/ Project Environmental Specialist/ Project Social Specialist	Members of Project Management Team (PMT)	3 hrs	1
Communication and Stakeholder Engagement	Participatory approaches in ESIA Conflict sensitivity and resolution Community consultation techniques Communication strategies for diverse stakeholders	Project Environmental Specialist/ Project Social Specialist	Members of District Environment Sub Committee (DESC)	2 hrs	0.8
Introduction to ESIA	Purpose and process of ESIA Roles of DESCs in ESIA monitoring	Project Environmental Specialist/	Members of District Environment Sub Committee (DESC)	2 hrs	0.8

	Overview of Malawi's environmental laws and policies (e.g., Environmental Management Act, EIA Guidelines)	Project Social Specialist			
Environmental and social monitoring	Identifying key environmental indicators (e.g., water quality, soil erosion, waste management) Use of checklists and field tools for environmental monitoring Reporting environmental non-compliance Climate change considerations in local projects Monitoring social impacts (e.g., displacement, community health, gender impacts) Community feedback and grievance handling Inclusion of vulnerable groups (women, youth, persons with disabilities) Conflict resolution and mediation techniques	Project Environmental Specialist/ Project Social Specialist	Members of District Environment Sub Committee (DESC)	2 hrs	0.8
Stakeholder Engagement and Communication	Participatory monitoring approaches Conducting community consultations and public hearings Effective communication and awareness raising	Project Environmental Specialist/ Project Social Specialist	Members of District Environment Sub Committee (DESC)	2 hrs	0.8

	Documentation and reporting of stakeholder concerns				
Compliance and Enforcement	Understanding environmental permits and conditions Role of DESCs in enforcing mitigation measures Collaboration with District Councils and Environmental Affairs Department Legal procedures for reporting violations	Project Environmental Specialist/ Project Social Specialist	Members of District Environment Sub Committee (DESC)	2 hrs	0.8
Case Studies and Field Practical	Review of past ESIA projects in the district Field visits to active project sites Role-playing and simulation exercises	Project Environmental Specialist/ Project Social Specialist	Members of District Environment Sub Committee (DESC)	2 hrs	0.8
Training of safety on handling of pesticides and chemicals	pesticide and chemical identification hazard recognition proper personal protective equipment (PPE) use safe application methods, storage procedures emergency response protocols legal requirements signs and symptoms of exposure	Plant Protection Consultant/ Project Environmental Specialist/ Project Social Specialist	AEDO/ AEDEC/AVO/Lead farmers (50/session)	2 hrs	0.4

	disposal procedures basic first aid related to chemical exposure emphasizing the importance of reading and understanding product labels and following safety guidelines throughout the handling process				
Train and demonstrate on the use of personal protective equipment.	definition and purpose of PPE identifying workplace hazards requiring PPE selecting the appropriate PPE for each hazard proper fitting and donning procedures how to wear, maintain, inspect dispose of PPE correctly limitations of PPE practical demonstrations on how to use different types of PPE	Project Environmental Specialist/ Project Social Specialist	Contractor/Workers/Farmers	2 hrs	0.4
Training farmers in Good Agricultural Practices of all the targeted Value Chains of the project	understanding GAP principles crop-specific GAPs for each targeted value chain (e.g., maize, vegetables, livestock) integrated pest management	Agronomy Consultant/ Value Chain consultant	AEDO/ AEDEC/AVO/Lead farmers (50/session)	2 hrs	0.4

	oil health management, water conservation post-harvest handling record keeping market linkages a quality standards				
Training and sensitization of the farmers and Agro-dealers on the Integrated Pest and disease Management	pest and disease identification concept and application of IPDM how do we implement IPDM examples of IPDM	Plant Protection Consultant/ Project Environmental Specialist/ Project Social Specialist	AEDO/ AEDEC/AVO/Lead farmers (50/session)	2 hrs	0.4
Train farmers in correct application of pesticides	understanding pesticide basics, identifying pests and appropriate pesticides safe handling and mixing procedures proper application techniques personal protective equipment (PPE) usage environmental considerations integrated pest management (IPM) principles emergency response procedures	Plant Protection Consultant/ Project Environmental Specialist/ Project Social Specialist	AEDO/ AEDEC/AVO/Lead farmers (50/session)	2 hrs	0.4

	a strong emphasis on reading and interpreting pesticide labels				
Educate/sensitize farmers on basic relationship between pesticides toxicity, exposure, hazard and safety measures.	Categories of pesticides and chemicals Hazard exposure Emergency response management Safety measures	Plant Protection Consultant/ Project Environmental Specialist/ Project Social Specialist	AEDO/ AEDEC/AVO/Lead farmers (50/session)	2 hrs	0.4
Train farmers in proper handling and application of pesticides	pesticide and chemical identification hazard recognition proper personal protective equipment (PPE) use safe application methods, storage procedures emergency response protocols legal requirements signs and symptoms of exposure disposal procedures basic first aid related to chemical exposure emphasizing the importance of reading	Plant Protection Consultant/ Project Environmental Specialist/ Project Social Specialist	AEDO/ AEDEC/AVO/Lead farmers (50/session)	2 hrs	0.4

Train farmers not to spray toxic chemicals close to water sources	define water sources categories/use of water sources define proximity of water sources categories of pesticides/chemicals emergency response protocols	Water Resources Consultant/ Plant Protection Consultant/ Project Environmental Specialist/ Project Social Specialist	AEDO/ AEDEC/AVO/Lead farmers (50/session)	2 hrs	0.4
Train farmers on reading proper instructions to avoid using expired products	Detection of decanted pesticides Labelling of instructions Dangers of using unlabelled products Detection of fake pesticides Reporting of malpractices to PCB	Plant Protection Consultant/ Plant Protection Consultant/ Project Environmental Specialist/ Project Social Specialist	AEDO/ AEDEC/AVO/Lead farmers (50/session)	2 hrs	0.4
TOTAL					15,016,576 (USD 8,576.00)

10 CONCLUSION AND RECOMMENDATIONS

10.1 Conclusion

The Mwaiwathu Irrigation Scheme presents significant potential to enhance crop production, strengthen food security, and improve the socio-economic well-being of the target communities and surrounding areas. Potential positive impacts and their enhancement measures during both construction and operational phases are outlined in Figure 6.3, while anticipated negative impacts and corresponding mitigation measures are also detailed in the same figure.

An Environmental and Social Management Plan (ESMP) has been developed to address these impacts. The ESMP specifies potential impacts, recommended mitigation measures, implementation timelines, responsible institutions or individuals, and cost estimates. To ensure effective implementation, an Environmental and Social Monitoring Plan has also been prepared. This plan outlines the negative impacts, mitigation measures, monitoring indicators, frequency of monitoring, cost estimates, and responsible parties.

Successful project implementation will depend on strict adherence to the proposed enhancement and mitigation measures, as detailed in the ESMP and Monitoring Plan. By doing so, the project can maximise agricultural productivity, strengthen livelihoods, and deliver long-term socio-economic and environmental benefits to the community in a sustainable manner.

10.2 Recommendations

The following are the recommendations made from the environmental assessment.

- This safeguard instrument should be implemented in accordance with the established schedules and targets, and applied consistently throughout all phases of the project.
- Adequate resources must be allocated to facilitate the effective implementation of the measures outlined in this report.
- All recommended mitigation measures should be fully executed to avoid or minimise predicted negative impacts to the lowest possible level.
- A Supervision Committee should be formed, comprising representatives from the Phalombe District Council, Mwaiwathu Irrigation Scheme Irrigation Committee, and Project Implementation Committees. This committee will be responsible for ensuring that the provisions of this report are strictly adhered to by the contractor and all relevant institutions or individuals.

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Annex 1: List of people consulted at Mwaiwathu Irrigation Scheme

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9	Estery Kamwala	Farmer	
10	Ireen Fukula	Farmer	
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15	Nedson Chirombo	Irrigation Engineer - Phalombe	0993867334
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19	Rodrick Chirambo	Programme Officer, UNOPS	0888855258
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22	Yamikani Bokosi	Irrigation Engineer, DoI	0999600038
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3	Precious Kalalo	Dol	IO	M	0993742355	VCFI2RKI	
4	Wilson Nagoli	Dol	PE	M	099386372	RR39V5Z8	
5	Benjamin Banda	Dol	SIE	M	0886516255	QDPEKPT9	
6							
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4	ESINTA CHASOWA	Thyolo	AEDC	F		K7E3INSJN	
5	FREDRICK K. BANDA	Thyolo	DIO	M		PDG3JJDGY	
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4	Stenner Robin	Agriculture	AEDO	M	0999412560		
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6	Chris Boko	BIRD	CIO	M	0999350031		
7	Yamukani Kross	DoI	CIO	M	0991600235		
8	Rod Chiramba	UNOPS	Partnerships Specialist	M	4258846124913		

Annex 2: Album photo of consultations



Cross section of farmers during a sensitization meeting on 4th March 2025 at Mwaiwathu irrigation scheme in Phalombe District



A cross section of farmers during engagement meeting on 4th March 2025 at Mwaiwathu irrigation in Phalombe District



Consortium members during an engagement meeting with government officials On 6 March 2025 in Lilongwe

Some of the women from Mwaiwathu irrigation in Phalombe during consultation on 4th March 2025

