UNITED REPUBLIC OF TANZANIA

MINISTRY OF WATER

Updated Environmental and Social Impact Assessment (ESIA) Report for the Proposed Construction of Farkwa Dam, Water Treatment Plant and Water Conveyance System to Chemba District Council and Dodoma City, Dodoma Region, Tanzania

Ministry of Water
Kolon Building adjacent to DUWASA Head Office,
Chimwaga Road, P.O Box 456,
40473 Dodoma, Tanzania,
Tel: +255 26 2322602/+255 26 2322602
Email: ps@maji.go.tz

Submitted to:

The National Environment Management Council
35 Regent Street, P.O. Box 63154,
11404 Dar es Salaam, Tanzania.
Tel: +255 (022)2774852/89; Fax: +255 (022) 2774901
E-mail: nemc@nemctan.org

Prepared by:

TRES CONSULT (T) LIMITED
Tanzania Rapid Environmental Solution Consultants Limited

TRES House, Plot No. 236/1 TRA Road, Mwenge Area
P.O Box 31155 Dar es Salaam
Phone (+255) 0713 425442/ 0782 425442
Fax: +255 22 2461054,
E-mail: tresconsultants@gmail.com
Website: www.tresconsult-tz.com

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BASIC INFORMATION ABOUT THE PROJECT

Project title:	Proposed Construction of Farkwa Dam, Water Treatment Plant and Water Conveyance System to Chemba and Dodoma City and Chemba District Council, Dodoma Region, Tanzania
Location:	Chemba District Council and Dodoma City, Dodoma Region, Tanzania
Proponent Contacts:	Permanent Secretary, Ministry of Water; Kolon Building adjacent to DUWASA Head Office, Chimwaga Road, P.O Box 456, 40473 Dodoma, Tanzania, Tel: +255 26 2322602/+255 26 2322602 Email: ps@maji.go.tz
Sponsor of the project:	Government of the United Republic of Tanzania
EIA Consultants:	TRES-Consult Tanzania Limited, TRES House, Plot No. 236/1, TRA Road, Mwenge Area, P.O Box 31155 Dar es Salaam, Tanzania Phone (+255) 0713425442/ 0782663447; Fax: +255 22 2461054; E-mail: tresconsultants@gmail.com; Contact Person: Bashiru Abdul / Abel Sikaona
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ABBREVIATIONS AND ACRONYMS

CBD	Central Business District
CDA	Capital Development Authority
CFRD	Concrete Faced Rockfill Dam
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CO2	carbon dioxide
CoI	Corridors of Impact
COSEPE	Civil Education is the Solution for Poverty and Environmental management
CVC	Conventional Concrete
DUWASA	Dodoma Urban Water Supply and Sanitation Authority
EARS	East African Rift System
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMA	Environmental Management Act
EMP	Environmental Monitoring Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plans
EU	European Union
EWURA	Water Utilities Regulatory Authority
FSL	Full Supply Level
GCM	General Circulation Models
GCM	General Circulation Models
GE	Google earth satellite image
GERCC	Grout Enriched RCC
GIS	Geographic Information Systems
GoT	Government of Tanzania
GPS	Global Positioning System
HADO	Hifadhi Ardhi Dodoma
HEM	Hydro-Electrical and Mechanical
HIV/ AIDS	Human Immuno Deficiency Virus/ Acquired Immune Deficiency Syndrome
HSE	Health, Safety and Environment
H-V-A	Height-Volume-Area
IDWB	Internal Drainage Water Basin
IPDP	Indigenous Peoples Development Plan
IRR	Internal Rate of Return
ITCZ	Inter Tropical Convergence Zone
IUCN	International Union for Conservation of Nature
LIDAR	Light Detection and Ranging
LRP	Livelihood Restoration Plan
MCM	Millions of Cubic Meters
MOL	Minimum Operating Level
MoW	Ministry of Water
MUSD	Million United State Dollar
MWL	Water Levels
NAPA	National Adaptation Program of Action

NEMC	National Environment Management Council
NGOs	Non-Governmental Organization
NOx	Nitrogen oxides
NPV	Net Present Value
O&M	Operation and Maintenance
OH&S	Occupational Health and Safety
OP/BP	Operational Policy and Bank Procedure
OSHA	Occupation Safety and Health Authority
PAC	Powdered Activated Carbon
PAP	Project Affected People
PMF	Probable Maximum Flood
PMO-RALG	Prime Minister's Office, Regional Administration and Local Government
RAPs	Resettlement Action Plans
RAS	Dodoma Regional Administrative Secretary
RCC	Roller Compacted Concrete
RVA	Residual Value of Asset
SD	Saddle Dam
SSE	South South East
TAC	Technical Advisory Committee
TANESCO	Tanzania Electric Supply Company Limited
TANESCO	Tanzania Electric Supply Company
TANROAD	Tanzania National Roads Agency
TMA	Tanzanian Meteorological Agency
TOR	Terms of Reference
TSS	Total suspended solids
TTCL	Tanzania Telecommunications Company Limited
UDSM	University of Dar es Salaam
ULV	utra-low volume
UNDP	United Nations Development Programme
URT	United Republic of Tanzania
UTM	Universal Transverse Mercator
VEO	Village Executive Office
VPO	Vice President Office
WEO	Ward Executive Office
WGS	World Geodetic System
WRM	Water Resource Management
WTP	Water Treatment Plant

1 EXECUTIVE SUMMARY

1.1 OVERVIEW OF THE PROJECT

The Government of United Republic of Tanzania through the Ministry of Water is implementing the Water Sector Development Programme (WSDP) with the aims of improving access to water supply and sanitation services in rural and urban areas. The target of WSDP is to meet the Tanzania's Development Vision, which aims at achieving an absence of abject poverty by 2025, where several achievements are called for including increased access to safe water to be raised to 90% by 2025 in the rural areas and 100% in urban. Therefore, the Ministry of water (MoW) is coordinating the implementation of Farkwa Dam Construction Project comprising (i) Main and Saddle dam construction (ii) Water Treatment Plant (WTP) and (iii) Conveyance system to Dodoma City and Chemba District Council. Also, under this project there will be a component of catchment protection and conservation, in order to conserve the upstream catchment of the dam site.

The overall objectives of the project are to improve water supply services to beneficiaries living within Dodoma City, Chemba District, Bahi District and Chamwino District, the communities along the conveyance system by increasing the quantity of water available in the water distribution system and improving its quality to remain in compliance with Tanzanian and International standards. Increased clean and safe water availability to Dodoma City and the Chemba, Bahi and Chamwino District Councils will contribute to poverty reduction and general social well-being of the people. The present main source of water is the Makutupora well field with an upgraded supply capacity of 61,000 gross m^3/day. This present source is considered not to be reliable enough for the supply of a growing population. The Ministry of Water carried out pre-feasibility studies, which identified Farkwa area as potential site for development of a Dam "Farkwa Dam" that would provide a reliable source of water supply to the Dodoma City. The Farkwa Dam is proposed to be constructed immediate downstream the confluence of Bubu and Mkinki rivers located in Mombose and Bubutole Villages of Farkwa Ward, Chemba District, Dodoma Region. The site is approximately 130 kilometres North of Dodoma on the road to Kondoa District.

The Dam consists of 25m high composite RCC and earthfill Main Dam with intake, outlet works and spillway – FSL 1,110m, 10 m high earthfill Saddle Dam and the site access roads. Other component includes the main Conveyance System consisting of 115 km long conveyance pipeline with an end connection to the Kilimani Tank N°2 in Dodoma; Conveyance System consisting of 51 km long conveyance pipeline to Chemba, water treatment plant, pump station, pumps and associated Hydro-Electrical and Mechanical (HEM) equipment located downstream of the dam on the left river bank; associated civil works and HEM equipment and the Interim tank to be located approximately 14 km from the dam site.

1.2 BACKGROUND OF THE ENVIRONMENTAL IMPACT ASSESSMENT

The Environmental Management Act, Cap 191and the Environmental Management (EIA and Audit) (Amendment) Regulations, 2018, Regulations require that all projects, undertakings and activities that may have potential adverse impacts to the environment to be subjected to the EIA study before their commencement. First schedule of the Regulations categorized canalization of water courses; abstraction and/or utilization of ground and surface water for bulk supply and water treatment plants as category ''A" project which requires the project proponent to undertake a full-fledged Environmental Impact Assessment (EIA) study before its commencement. The EIA certification is part of the project authorization

process. The Environmental and Social Impact Assessment (ESIA) for the proposed Farkwa dam was conducted according to the Environmental Management (EIA and Audit) (Amendment) Regulations, 2018 and submitted to the National Environment Management Council (NEMC) for certifiфcation. Based on the ESIA submitted to the NEMC, MoW was issued an Environmental Impact Assessment (EIA) Certificate in accordance with Section 92(1) of the Environmental Management Act, Cap 191. The EIA Certificate was signed by the Minister 0n 09th March 2016.

Cognizant of the elapsed period from when the ESIA was prepared in 2015 and cleared by NEMC in 2016, TRES Consult (T) Limited was commissioned by the Ministry of Water to update the Environmental and Social Impact Assessment (ESIA) report to document significant modifications in the prevailing biophysical and socioeconomic baseline conditions, incorporating the environmental and social risks and impacts associated to the added project components, identify and assess potentially negative and positive environmental and social impacts of the modified Project scope. The updated ESIA also is intended to reflect improvements and modifications to the Project design, fill in gaps identified in the previous ESIA work and align the assessment with international standards including the International Finance Cooperation (IFC) environmental and social performance standards, World Bank Group EHS Guidelines, African Development Bank (AFDB) Operational Safeguards and the Equator Principles, (June 2006).

The update builds on final ESIA study undertaken in 2014/2015 as the study was reviewed and found to be both comprehensive and broadly accurate. The updated ESIA Report, supporting documentation, and management plans have been prepared in accordance with the Environmental Management Act, cap 191 and Environmental Management (EIA and Audit) (Amendment) Regulations, 2018, and took into account the other relevant government policies, laws and regulations relevant to project and the environment. The ESIA update identifies the likely types of environmental and social impacts associated with the construction and operation of the proposed project. It assesses the magnitude and likelihood of these impacts based on previous work commissioned the Ministry of Water and currently available project information.

1.3 BRIEF DESCRIPTION OF THE PROJECT SITE

Administratively the proposed project site will be located in Mombose and Bubutole villages, Farkwa Ward, Chemba District, Dodoma Region. Water from the dam area will be conveyed to Chemba District and Dodoma City through a pipeline. Villages/Mtaa along the conveyance system to Chemba are Donsee, Tumbakose, Rofati, Gwandi, and for Dodoma City are Farkwa, Donsee, Makorongo, Khubunko, Babayu (chemba), Babayu (Bahi), Asanje, Mayamaya and Zanka will also be supplied with the water. Other Mtaa where the conveyer system will pass are within the Dodoma City.

The land uses in the project area varies from settlement areas at Mombose and Bubutole village centres and mainly agriculture fields and pasture areas for livestock. Comperatively undisturbed habitats are found along the Bubu River bed from and right downstream of the proposed Farkwa Dam. The main dam will be located across the valley downstream of the confluence of the Bubu and Mkinki rivers, allowing to take advantage of the additional hydrological inflow from the Mkinki river. A saddle dam will be constructed across the suspected old river bed of the Mkinki river, which forms a low topographical point approximately two kilometres North of the main dam site.

At the Dam site, the Bubu valley is intersected by a shallow granitic hill which forces the Bubu and Mkinki rivers to pass along its Southern foot forming the main section of the valley. On the northern side of the hill the connection to the steep slopes of the Bubu Fault is formed by a flat saddle. In the main section the

Bubu River flows from NE to SW. The river bed is divided in two narrow branches (Bubu and Mkinki rivers) separated by a small granitic island and has at the dam axis an elevation of 1,086.0m (a.s.l) and a total width of about 60m. The main section appears asymmetric. The right side has a relatively constant slope of about 40m/km and is almost entirely covered of Quaternary deposits of silty sands with some gravel. The left side is much steeper with an average slope of about 75m/Km and shows strong variations of slope.

The Quaternary overburden is discontinuous whereas the granite outcrops frequently. The thickness of the Quaternary overburden can be about 3.5m at the foot of the slopes, but it is usually 2.5m on the right side and 1.5m on the left. These deposits cover a huge granite massive which extends over the whole surrounding area and forms the bedrock which is heavily faulted and jointed. The riverbed deposits of well graded fine sands are thin (about 1.5m) and of small extent. Because of the steep slope of the rapids the Bubu River flows partly in a rocky bed of granite. The overburden of the saddle section is 4 to 6m thick and consists of soils with the same characteristics as in the main section. On the left side the abutment granite outcrops in huge blocks. On the right slope no outcrops of bedrock could be found.

The vegetation of the area is characterized with miombo woodland, wooded acacia, bush land and thicket as well as riverine vegetation along the river course. The vegetation of the area harbors or are being visited by different kind of species of avifauna, medium sized mammals, reptiles, small mammals, large mammals, and arthropods. Out of these the specialized flora and fauna study shows that there are significant presences of birds in the area compared to other higher levels animals. The study further indicates that none of the fauna species that are regarded as endemic or rare to Farkwa was recorded. However, fauna species that are under CITES Category or IUCN-listed species (threatened or vulnerable) was recorded.

Within the proposed area of inundation there are a number of man-made features apart from natural features. There are public and individual/household structures to mentioned notable ones there are two primary schools of Mombose and Bubutole in the respective villages, two mosques, three churches, two boreholes with the water tanks and their associated pumping stations. Along the conveyance system there are also a number of structures that will be encountered by the pipeline such as, residential properties, farmlands, and roads.

1.4 INSTITUTIONAL AND LEGAL FRAMEWORK FOR IMPLEMENTATION OF THE PROJECT

1.4.1 Institutional arrangements for the project

The construction of the proposed Farkwa Dam and Water Conveyance to Chemba and Dodoma City will require an effective institutional and management arrangement in order to ensure achievement of the intended benefits. Also the successful implementation of the ESIA recommendations depends on the commitment and capacity of various institutions and stakeholders to implement the recommendations effectively. Thus, the arrangement as well as the roles and responsibilities of the institutions and persons that will be involved in the implementation monitoring and review of the ESIA recommendations are discussed below.

Ministry of Water: the Ministry of Water is the overall overseer of all water projects in the country and is responsible for enacting various policies, laws, strategies, regulations and guidelines on the implementation of water projects and the provision of water and sanitation services in the country. The

Ministry has an overarching responsibility to ensure that the proposed project is carried out to the highest environmental standards strictly in accordance with the ESIA and the mitigation measures set out therein. The Ministry of Water will be supporting the ESIA and Environmental and Social Management Plan (ESMP) process. Will take over use, management and maintenance after the contract has been completed.

Dodoma Urban Water Supply and Sanitation Authority (DUWASA): DUWASA is an autonomous water utility in charge of the water supply and sewerage disposal services to urban residents of Dodoma City. Being classified as a category "A" urban water Authority in Tanzania, DUWASA is required to cover at full cost its operations and maintenance including part of its investment costs. As the foreseen asset owner and operator, DUWASA will among others things implement all recommendation or conditions attached to the environmental certificate of the project; carry out statutory environmental monitoring pertaining to the performance of the specific mitigations measures contained in the project and report the environmental monitoring results to NEMC.

Consulting Engineer (CE): the MOW will engage a Consulting Engineer (CE) to supervise the project construction and ensure that all environmental requirements are met on behalf of the proponents. The Consulting Engineer will ensure that all environmental mitigation is properly implemented and will carry out routine inspections and audits of the Contractors activities. The CE will act as the interface between the Contractors and MOW in relation to contract implementation and implementation of the mitigation under the ESMP. The CE will also review the detailed site specific contractor ESMPs together with MOW.

The National Environmental Management Council (NEMC): NEMC will play a key role in monitoring the project during the construction and operational phases to ensure that the mitigation measures set out in this report are fully implemented. Specifically, NEMC is responsible for enforcement, compliance, review and monitoring of the EIA during the construction and operational phases.

Contractors: the project will be implemented by Contractors (CC) under and Engineer, Procure Supply and Construct Contract. The Contractors will be responsible for constructing the Project in accordance with the Technical Specifications required. Based on their proposed construction method they will draw up detailed site-specific contractor ESMPs as required. These will be issued to the CE for approval and must be approved before any construction commences. The Contractors will implement the project fully in accordance with the ESIA Mitigation measures, "this ESMP" and the detailed site-specific contractor ESMP approved by the Consulting Engineer (CE). Each Contractor will nominate a Site Environmental Management Officer (SEMO) who will be the Contractor's focal point for all environmental matters. The SEMO will be routinely on-site for the duration of the construction works.

CHEMBA - Rural Water Supply and Sanitation Agency (RUWASA): the Water Supply and Sanitation Act No.5 of 2019, among other things, established the Rural Water Supply and Sanitation Agency (RUWASA) which took over mandates that were previously vested to PO-RALG, Regional Secretariats (RSs) and Local Government Authorities (LGAs). The RUWASA has offices at Headquarters, Regional and District levels as opposed to previous structure which compose of office at LGAâ ™s level and RSs. The RUWASA Chemba District Offices under the District Manager will be the key implementer of the proposed project in Chemba District.

Local Government District Authorities: the layout of the proposed project cuts across the area of jurisdiction of three LGA authorities namely Chemba district Council and Bahi district Council and the Dodoma City Council. These entities have mandates and interest on the welfare of the people of their

respective areas and provide the overall oversight for implementation and monitoring of development programmes in their respective areas. The Water Supply and Sanitation Act, 2019 empowers the District Councils to regulate the activities of COWSOs.

Villages likely to be affected by the proposed project: Various rural villages will be affected by the project. these include villages located within the dam reservoir, which will have to resettle in another area; villages within the vicinity of the Bahi Swamp, which are relying on the river flow for economic activities; villages located along the conveyance pipelines, which establishment will be impacted on during the construction phase and potentially the post-construction phase. Villagers in these areas need to share and participate in implementing the proposed environmental mitigation measures to address the downstream effects.

1.4.2 Legal and regulatory framework for implementation of the project

A legal and regulatory framework is essential for providing mandate, allocating specific responsibility and accountability to key factors and stakeholders, and also prescribes and enforces specific operating environmental procedures and standards. An institutional framework is required to develop policies, guidelines and plans; to ensure compliance with laws and regulations; and to monitor, review and adapt policies, plans and regulations in the light of experience. Examples of some of the most relevant national policies and strategies include: the National Environmental Policy (2004); the Land Policy (1995); the National Water Policy (2002); the National Energy Policy (2015); the National Fisheries Sector Policy and Strategy Statement (1997); the National Forestry Policy (1998); the National Wildlife Policy of Tanzania (2007); the National Mineral Policy (1998); the National Agriculture Policy (2013); the National Human Settlements Development Policy (2000); the National Construction Policy (2003); the National Health Policy (2017); the National Policy on HIV/AIDS (2001); the National Women and Gender Development Policy (2000); the National Employment Policy (2008); the National Transport Policy (URT, 2003); the Tanzania Development Vision 2025; the Third National Five Year Development Plan (FYDP III; 2021/22 – 2025/26); the Rural Sector Development Strategy (2001); the National Water Sector Development Strategy (2006 to 2015) and the National Water Sector Development Programme (WSDP) of 2006-2025

Again the ESIA was conducted in general compliance with the following legislations: the Environmental Management Act, Cap 191; the Water Resource Management Act, 2009 (Act No. 11/2009); the Water Supply and Sanitation Act, 2019 (Act No. 5/2019); the Land Act, [Cap.113 R.E 2019]; the Village Land Act, [Cap.114 R.E 2019]; the Land Acquisition Act, [Cap.1183 R.E 2019]; the Courts (Land Disputes Settlements) Act, 2002; the Fisheries Act, 2003 (Act No. 22/2003); the Mining Act, 2010 (Act No. 14/2010); the Energy and Water Utilities Regulatory Authority Act, [Cap.414 R.E 2019]; the Local Government (District Authorities) Act, [Cap.287 R.E 2019]; the Local Government (Urban Authorities) Act, [Cap.288 R.E 2019]; the Land Use Planning Act, 2007 (Act No. 6/2007); the Urban Planning Act, 2007 (Act No. 8/2007); the Contractors Registration (Amendments) Act, 2008 (Act No. 15/2008); the Engineers Registration (Amendment) Act, 2007 (Act No. 24/2007); the Standards Act, 2009 (Act No. 2/2009); the Occupational Health and Safety Act No. 5 of 2003; the Employment and Labour Relation Act, 2004 (Act No. 6/2004); the Workers Compensation Act, 2008 (Act No. 20/2008); the HIV and AIDS (Prevention and Control) Act, 2008 (Act No. 28/2008); the Industrial and Consumer Chemicals (Management and Control) Act, 2003 (Act No. 3/2003); the Wildlife Conservation Act, 2009 (Act No. 5/2009) and the Road Act, 2007 (Act No. 5/2007)

Relevant regulations are: the Environmental Management (Environmental Impact Assessment and Audit) (Amendment) Regulations, 2018; the Environmental Management (Fee and charges) (amendment)

Regulations, 2019; the Environmental Management (Registration and Practicing of Environmental Experts) Regulations, 2020; the environmental Management (Water Quality Standards G. N. No. 238) Regulation, 2007; he environmental Management (Air Quality Standards G. N. No. 237) Regulation, 2007; the Environmental Management (Quality Standards for Control of Noise and Vibration Pollution) Regulations, 2015; the Land (Assessment of the Value of Land for Compensation) Regulations, 2001; the Water Resources Management (Dam Safety) Regulations, 2013 GN. No. 237 of 2013; the Water Supply Regulations, GN No. 90 of 2013; the Water Resources Management (Water Abstraction, Use & Discharge) GN No.190 2010; the Water Resources Management (Registration of Water User Association) Regulations GN. No. 22 of 2010; the Environmental Management (Hazardous Waste Control and Management) Regulations, 2019; and the Environmental Management (Solid Waste Management) Regulations, 2009.

1.5 MAJOR AND MODERATE POSITIVE AND NEGATIVE IMPACTS

Major significant impacts for the purposes of this report are mainly considered as the impact types which are of moderate and high negative significance over a long period of time, in terms of their duration. Those impacts which are of high negative significance as well as cumulative also fall into this category. The impacts identified as significant for this project are listed as follows:

1.5.1 Terrestrial flora

The implementation of the proposed project inflicts a permanent irreversible loss of impoundment area approximately 48 km^2 which composed mainly of miombo woodland, wooded acacia, bushlands and thicket. Clearance of estimated 130 km x 30 m (Dodoma City) and 30m x 51m (Chemba) of the terrestrial land for way-leave for the pipeline could also cause damage to habitats and contained flora and fauna at several places along the conveyance system. Cumulative impacts from bush fire/burning and cutting down of trees were the main activities recorded during the ESIA study. None of these habitats (miombo woodland, wooded acacia, thicket and bush land) is presently undisturbed or natural in terms of plant composition or maturity. The proposed project activities, will significantly affect their importance in terms of biodiversity. The present bush fire/burning and cutting down of trees (logging) by local people and the proposed action will destroy these plant and animal habitats and entail a significant irreversible, however non-quantifiable impact on the local wildlife populations. The expected further development of the area, including the construction of permanent or temporary structures notably access roads, construction camps, embankment, spillway and the operational and maintenance phase of the project will add to the effects of the ongoing cumulative impacts by local people.

1.5.2 Terrestrial fauna

The area is having a good number of terrestrial fauna. Seven fauna species were recorded as threatened or vulnerable or in CITES categories. It was also noted that water bodies notably Bubu, Mkinki Rivers and Bahi swamp potentially provides habitat for aquatic species particularly fish and amphibians. At the time of study part of the site has been modified by activities of local people including burning, cutting down of trees and honey gathering. The proposed development would have a significant impact in terms of destruction, loss of fauna habitat and blockage of wildlife movement (corridor). All of the miombo woodland, wooded acacia-grassland, thicket and riverine forest within the site will be inundated. It can be noted from the study findings that there are species within or around the site that are classified as threatened, endangered, vulnerable or of significant conservation value. According to the study results, development of the proposed dam and water conveyance system will also affect some fauna species of

conservation concern, important bird nesting or nursery areas. Some bird nesting or nursery areas were observed within the proposed development site.

1.5.3 Aquatic fauna and flora

Generally, the area has low aquatic species diversity some of the notable ones include fish species in the family Clariidae (*Clarius spp.*) and Cichlidae (*Oreochromis spp.*) and amphibian (*Ptychademа mascariensis*). These species were found in shallow pools in the few stretches of Bubu River and dug ponds within Bahi Swamp area during dry season period. Riparian vegetation studied have a linear and narrow form as they are paralleled the stream channel of Bubu River, and are either diffuse or sharp edges attributable to the nature of species interactions across the ecotone and disturbances. The dominant species recorded include *Ficus sycomorus, Ficus thoningii, Ficus lutea, Ficus sur, Kigelia africana, and Acacia spp*. The Bahi swamp was noted to be covered by an extensive area dominated by *Cyperus spp.* During the study, the entire swamp was dry and composed mainly of remnant patches of *Cyperus spp.* Among of these, no any species is regarded as rare or endemic as per IUCN – near threatened list and CITES Appendix II category. Most of the species that were recorded are of low conservation concern; however, they form important part of the riverine vegetation and through river bank protection against erosion.

1.5.4 Environmental Flow

Bubu River is seasonal in the project site and further downstream to Bahi swamp area (recipient of Bubu River). The River originates from Manyara Region and traverses two distinct climatic areas which are wet tropic in higher altitude and semi-arid in central regions of Tanzania. Major contribution (>80%) of this River to the project site and further downstream is mainly from wet tropical areas upstream other than from within the semi-arid areas. The River catchment is 54% of the entire Bahi catchment area and among of the two main inflows to the Bahi Swamp the other being Mponde River, both of which originates from northern highlands i.e. wet tropic areas (M. McCartney, 2007).

The paddy irrigation is one of the livelihoods that depend on the river flows. The area under irrigation in Bahi area is more than 10,000 hectares. The total area that is directly depending on Bubu River is 3,658 hectares under seven schemes with 7,316 farmers. Likewise, the livestock keeping is one of the livelihoods that depend on water resources in terms of drinking water as well as fodder. The data obtained from the Bahi District Council office shows that in 2006 Livestock Census there were 64,895 cattle, 12,500 Goats and 2,492 Sheep in the villages along the Bubu River. Downstream of the Dam site water is also being used for domestic purpose e.g. drinking, washing and cooking. However, it is used in small amount, almost negligible as there is no water supply scheme. Residents along the River are individually fetching directly from the River. Reduced flow if is significant might threaten ecosystem which depends on the flowing water downstream which in turn might results into disappearance of some species on these areas. The riverine vegetation and aquatic life may be permanently affected by inadequate water flow. The in-stream flow requirements to sustain the riverine ecosystem demands will fully be covered by the irrigation and livestock mitigation flows as the two are located downstream part of the river just before the Bahi swamp.

1.5.5 Sedimentation

Sediment is a naturally occurring material that is broken down by processes of weathering and erosion, and is subsequently transported by the action of wind, water and/or by the force of gravity acting on the

particle itself. The suspended sediments in the Bubu River is the major problem in lowering the in water resources potentials. The Consultant made use of historical measurements sheets of gauging's and sediment load at Farkwa gauge station, which was found to be the only station providing sufficient records for the analysis. It is to be noted that the catchment of this station represents over 98% of the overall catchment, and therefore geographically represents very well the catchment. The sediment curve was used to derive suspended sediment yield from the daily discharge record at Farkwa gauge station. Annual sediment loads are the deducted and shown to be in the range of 16,000 to 1,316,000 tons. The mean annual load is 287,834 tons. The total load includes suspension load and bed load transport. The bed load transport is taken as 15% of the suspension load. The total volume is deducted from the total load by considering a sediment density equal to 1,300 kg/m3, which is a representative value for the sandy deposits observed in the Bubu River.

The sediment rate was assessed by applying the trap efficiency to the annual sediment yields. As sediment is trapped, the reservoir storage capacity is decreased and in turn, the trap efficiency decreases. For practical purposes, the initial trap efficiency can be used as a constant up to 50 percent storage depletion. Furthermore, construction of the dam at the area will attract some human activities that can lead to soil erosion at and around the Farkwa dam area. The possible human activities within the catchment leading to degradation can be due to agricultural activities (improper farming practices on the slopes within the catchment, increased use of pesticides and fertiliser); deforestation; etc.

1.5.6 Climate change

The possible impacts of climate change on the hydrological characteristics of the Bubu River at Farkwa were assessed. Given that the long-term rainfall record at Dodoma (1930-2010) does not show any significant trend, projections were made based on the climate projections and on the previous studies in Tanzania. Three possible scenarios of future rainfall (-15%, 0%, +15%) and, two possible scenarios of future temperature (+1°C, +3°C) were derived from the observed series. The hydrological modeling was applied on these scenarios to calculate the impacts on runoff. The main observations is that the impacts on runoff are ranging from -62% to 68%. The most severe impact on runoff is observed for the combination of a 15% decrease in rainfall and a 3°C increase in temperature in comparison to the reference. The combination of a 15% increase in rainfall and a 1°C increase in temperature results in a 68% increase in runoff. The impact on runoff is mostly driven by the rainfall. This is consistent with the high runoff variability, which is observed since 1957. A small increase in rainfall produces a high increase in runoff. Conversely a small decrease in rainfall produces a high decrease in runoff. The range of possible impacts on runoff is consistent with the runoff evolution observed in the 20th century for several rivers in Africa (White Nile, Senegal River).

Nevertheless, it should be borne in mind that the feasibility study for this project analysis averages the outputs of a number of GCM, some of which *do* predict an increase in annual runoff in the region. This prediction is also made in other reviews, such as de Wit and Stankiewig, (2006) who projected a rise in perennial drainage to a total of 136% in Central Tanzania. There is also a suggestion in some models of a slight increase in flood flows and risks. In relation to floods, the feasibility study weighted scenario predicts a slight increase in high flow levels in rivers (specifically, the flow which is exceeded 10% of the time will increase by 15 to 20%). The project itself will greatly increase the security of water supply to farmers and improve flood control, thereby mitigating against the potential impacts of climate change.

1.5.7 Human wildlife conflicts

The nearby area is somehow visited by wildlife from the Swagaswaga Game Reserve which normally invades and destroys the crops of the community around. With the proposed damming the wildlife are believed will be attracted to the water body for drinking which in turn might increase the visitation as well as inversion into the community farms. Thus, it is expected that the human wildlife conflict will be exacerbated in the area.

1.5.8 Quality of soils and water

The majority of the rural populations within the catchment area are small-scale farmers and agro-pastoralists. Their semi traditional farming system is characterized by low use of farm inputs. Traditional agricultural production in the area is coming under pressure from market forces; with the result that high-input agriculture is increasingly coming to play a major role in the economies of rural communities. The use of pesticides in the catchment area is common in horticultural crops for controlling common plant and animal diseases. The mixing of more than one type of pesticide in a tank is common with the aim of increasing the killing effects of the pesticides. The mixing process is mostly done in respective farms in drums without safety precautions, and the containers and equipment used were washed and rinsed in the irrigation canals. It is also common to find the empty pesticide containers disposed in the farmers and public areas such as market places. The use of ULV formulations (e.g Durban 24ULV and Fenom C 170 ULV) in water spray was a common practice among farmers. Poorly controlled agricultural activities and application of pesticides upstream can lead to accumulation of the pesticide residues (Organ chlorates and Carbonates), in the dam and cause water contamination and the product of hydrolysis or the action of micro – organisms will result into a more toxic creation than the original products.

1.5.9 Socio-economic

The ESIA study identified both positive and negative socio economic impacts for the entire life cycle of the proposed project which are presented below:

Potential Negative social impacts

- Relocation/resettlement of people, farms, properties and disruption of economic activities
- Increased conflicts over local water resources (communities downstream)
- Increase conflict with people living in the upper catchment
- Damage or loss of project structures due to anthropogenic activities
- Public health hazards due to Water-borne and water-related diseases
- Disruption of existing infrastructure and services (blocked access road, water supply)
- Increased population influx
- Public health hazards/safety due to social Interactions
- Conflicts among workers and the local population in the project area

Potential positive social impacts

- Improved water quality and quantity
- Improved health and sanitation status within the Region
- Increased revenues and stimulation of industries
- Increased income to locals from employment opportunities

- Benefit to local producers and suppliers of construction materials
- Increase of government revenue collections
- Improved living standards
- Skills transfer to locals
- Increased fish production
- New market for agricultural produce from the villages
- Increased market base for local products

1.6 CONSULTATIONS

The stakeholders and public consultation was organized to obtain comments and concerns from all individuals, groups or organizations that might be affected or might affect (positively or negatively) the proposed Construction of Farkwa Dam, Water Treatment Plant and Water Conveyance System to Chemba District Council and Dodoma City, Dodoma Region, Tanzania project in one way or the other. The identification of stakeholders was based on the role and relevance of an organization, group or individual to the proposed project. Some of the stakeholders such as the Ministry of Water, Ministry of Land Housing and Human settlements, Internal Drainage Water Basin (IDWB) Board (IDWB head office in Singida Municipality and IDWB sub-office in Dodoma City), Central Zone Irrigation head office Dodoma, Central Zone Irrigation sub-office at Bahi, Dodoma Urban Water Supply and Sanitation Authority (DUWASA), Tanzania National Roads Agency (TANROAD), Tanzania Electric Supply Company Limited (TANESCO), Dodoma Regional Administrative Secretary (RAS), Capital Development Authority (CDA), Dodoma Municipal Council, Chemba District Council, Bahi District Council, Kondoa Township Water Supply Pump House office, Farkwa Ward Office, Mombose Village Council, Bubutole Village Council etc were pre-determined based on the nature of the project. Others and affected groups at the proposed project site and area of influence unfolded as consultations went along.

The process started with physically contacting some of the preliminary stakeholders identified or project Affected People (PAPs). These consultations began in 18/10/2012 when Ministry of Water and TRES Consult (T) Limited staffs visited the project site at Mombose and Bubutole Villages in Chemba District. Meetings were held with individual stakeholders or representatives of organizations. These consultations included presentation of an introductory letter accompanied by a project brief of the proposed project. Public notices in daily newspapers (in English and Kiswahili) were published describing the proposed project.

1.6.1 Consultation activities

Scoping exercise: The Scoping Report was prepared in November and December 2013. During the preparation of this report, informal meetings were held with relevant authorities at national, district and local levels to obtain background information and to seek views on potential route corridors and on the draft Terms of Reference for the ESIA. Stakeholders consulted their comments were primarily concerned with the impacts of the project on the local community and on gathering background information. Their comments were used in the development of the final Terms of Reference (TOR) and the selection of the alternative routes and sites. Upon completion of the Scoping Report and approval of the same by NEMC, the Consultants issued a public notification of ESIA commencement that included ways interested parties could obtain more information.

Draft ESIA report preparation: A second round of consultations was conducted from 09th March to 20th March 2014. The process was completed based on the findings of the draft ESIA, consisting of further

informal agency meetings, formal public meetings and formal agency meetings. In the meetings, the ESIA Team explained the scope of the project and after the presentation the Consultants solicited views from the audience. Key issues considered during consultations include land use of the project site, involuntary resettlement, any conflicts, envisaged negative environmental impacts, negative social impacts, positive impacts of the project, management aspects of the identified negative impacts, enhancement mechanism of positive impacts and aspects to be considered for sustainable project operations. In all cases Stakeholders' views were sought on their acceptance of the project.

Consultative stakeholders meeting in Dodoma: a one day consultative stakeholders meeting for the Environmental and Social Impact Assessment (ESIA) for the proposed Construction of Farkwa Dam, Water Treatment Plant and Water Conveyance System to Chemba and Dodoma City, Dodoma Region, Tanzania was organized by Ministry of Water at the Dodoma Hotel, Dodoma City, Dodoma Region, Tanzania, on 19th September, 2014. The meeting was attended by 72 people including the Minister - Ministry of Water, Deputy Minister - Ministry of Information, Youth, Culture and Sports; Honorable MPs of all Districts found within the project area; District Commissioners; District Council Chairpersons; District Administrative Secretaries; District Executive Directors; District Water Engineers; Honourable Councilors; Ward Executive Officers; Vice President's Office (Environments) (VPO) representative; Capital Development Authority (CDA) representative; Ministry of Land, Housing and Human Settlements representative; Irrigation Zone Office representative; Ministry of Minerals and Energy representative, Chairperson of Internal Drainage Basin Water Board (IDBWB), Government and Public Agencies representatives, Ministry of Water the IDBWB and DUWASA officials,. The main aim of the meeting was to involve key stakeholders in the ESIA process and to ensure that relevant key environmental and social economic issues are identified before the ESIA is conducted to ensure that ESIA study is focused and covers all important issues.

Updating ESIA Consultation Activities: In recognition of stakeholders' participation in decision making, this stakeholders study was designed as addendum to the stakeholders' consultation done during the preparation of the 2015 ESIA report for the proposed project. As such a number of public consultative meetings were held with PAPs residing at Bubutole, Mombosee, Tumbakose, Rofati and Gwandi villages, RUWASA and LGAs' departments in Chemba District Council from 2nd August to 06th August 2021. The meetings were also attended by relevant stakeholders including Political leaders and Officials from Local Government Authorities as well as other interested and affected parties. The aim was to get views from stakeholders in terms of how they understood the dynamics of the environment and socio-economic aspects in which the proposed project will be located and any possible underlying causes, issues or concerns that could lead to changes over time as a result of implementing the project. Consultations with stakeholders having either experience or expert knowledge on the study area were also conducted to validate existing data as well as get their advice on any additional sources of information that was not readily available.

1.6.2 Project acceptance

Consultation with local stakeholders indicated that they viewed the proposed Farkwa Dam, Water Treatment Plant and Water Conveyance System to Chemba and Dodoma City project as a positive venture that will stimulate social economic development and poverty reduction in terms of productivity and income generation. Most of the villagers in Mombose, Bubutole, Farkwa Ward authorities and all neighboring villagers are aware of the proposed project since the project was approved by the village, ward and municipal councils' meetings. Also some of the villagers were involved in the valuation and compensation exercise. Stakeholders indicated that constructed dam and provision of irrigation water will

provide both permanent and temporal employment to the local people. This means more income for the community in the area resulting into increased economic activities and there are could a lot of food security. Also they provided that the operation of the dam will have an influence on the population size of the area, attract tourism activities in the area and will bring fish farming in the project area.

1.6.3 Stakeholders concerns

The ESIA study provided a wide variety of views and opinions on what are considered to be the main concerns and issues of different stakeholders. Issues raised during the stakeholder consultation process were compiled and summarized below and have been elaborated in more detail and considered in proceeding chapters for impact assessment and incorporation in the Environmental Management Plan.

(i) Perceived Negative Impacts

Destruction of natural resource: The stakeholders were concerned that the potential areas for dam inundation are rich in wildlife and plant resources. They were worried about the potential loss of and disturbance to the natural environment from construction activities at the dam area and along the conveyance system, from earthmoving equipment's and machines, noise and vibrations from machinery, etc. If construction work is not properly conducted they may affect those natural resources.

Water quality degradation: Stakeholder pointed out that the water quality of the Bubu River will be affected negatively by the proposed dam construction activities. This is due to the transport and sedimentation of materials re-suspended by backfilling activities. Also stakeholders were of opinion that human activities upstream may cause water contamination due to the use of improper sanitation facilities and poor farming methods (improper use of fertilizers; increased water treatment costs.

Pollution of the Bubu River: During interviews, stakeholders were quick to associate the project with the negative impacts likely to affect the Bubu river. One of the commonest negative impacts mentioned is the pollution of the river from fuels, lubricants and oil spills during construction phase.

Loss of land-based resources and properties: Stakeholder were of concerns that the project activities will affect some of the land-based resources and properties in the project area which people depend on for their livelihoods. These could include loss of farmland and crops, medicinal plants, trees for construction poles, residential houses, grazing area, burial sites, sacred sites etc.

Low compensation: - Concern that Ministry of Water will not pay sufficient compensation if the proposed project activities affect farmland, crops, grazing areas, woodland resources, houses and property which people depend on for their livelihoods, or burial sites and sacred sites of cultural importance. The commented that the compensation rates for the affected crops and houses which are stipulated by Tanzanian law are outdated. Stakeholders are of the opinion that these rates are very minimal and not sufficient for replacement of affected resources and property.

Effects of loss of social contacts in case of resettlement: If residents need to be resettled, the affected person/individual and their family will be moved from their relatives and friends contacts to a new area. Stakeholders suggested that the Ministry of Water should engage in an open dialogue with Farkwa Ward authorities and village governments to ensure the compensation process is implemented fairly in order to avoid conflicts.

Impacts on downstream users: Stakeholder mentioned that one of the most important effects of dam construction and operation is the deprivation of water to downstream users and living organism. However the level of deprivation will depend on amounts of water that will be allowed to flow from the dam back into the river and supplemented with amounts from the catchments.

Restricted access to natural resources: the project areas have natural resources, cultural sites and access roads from one village to another. The inundated area and project infrastructures could restrict access to natural resources and other uses of the area and this may cause nuisance and disturbance to current users.

Increased flooding tendencies: The negative impact mentioned is the probability of the over flooding of the dam thus causing destruction to the environment, the community and their properties downstream.

Increased diseases incidences: Interaction due to increased people after construction of the dam, may increase susceptibility to health problems especially HIV/AIDS and Sexual Transmitted Diseases.

Diminishing of forest commodities and loss of current land: Communities consider the project area as a source of poles for house construction, medicinal plants, grass land for livestock and dry season cattle fodder, firewood, households' settlements, provides outlets to other sub villages and sources for indigenous fruits and juices. Some people had proposed planting trees of different types as a mitigation measure although others could not agree to that, as they thought that the new trees would be exotic and not indigenous leading into fruits and juices becoming exotic.

Road destruction: The roads within the project area are in poor condition and no regular maintenance is scheduled by the Regional/District Authority. As the number and volume of the vehicle load is expected to increase during mobilization and construction phases, the roads may deteriorate further.

Drowning incidences: Communities were worried of human drowning cases due to increased water. It was suggested that by laws should be enacted to protect the dam from those who would have wanted to use it carelessly.

Loss of infrastructure: As a result of the construction of the proposed dam some areas in the vicinity of the site will be cut off from others through submergence of roads and bridges. The proposed project should consider alternative routes to link the different areas that will be affected and construct roads preferably tarmac and associated infrastructure such as bridges.

Small holder farming: Communities who are currently using the area for settlements and agriculture had the opinion that the project will take up their valuable land that has been the source of livelihoods for years. Commenting on the mitigation measures to the impact on these communities, it was suggested that those to be affected should be compensated before their land is taken up. This will enable them to start new homes and agricultural activities elsewhere.

(ii) Perceived Positive Impacts

Increased water supply: Currently Dodoma City is experiencing water rationing due to the fact that water demand is higher than the water supplied. The proposed construction of Farkwa Dam, Water Treatment Plant and Water Conveyance System to Chemba and Dodoma City will improve water supply capacity of the existing infrastructure to a large extent.

Enhanced household food security and improved livelihoods: Food and vegetable production will be enhanced and permanently produced due to availability of water throughout the year. Increased production of food and readily available source of protein i.e. fish, will increase the nutrition status of the villagers. Farmers will be able to produce enough for consumption and sale thereby raising their income which would result into improved livelihoods.

Employment opportunities: It is expected that during dam construction, the project will employ both skilled and unskilled workers. However, a concern was expressed that the project proponent/contractor might probably bring in outside labourers. Where skilled labour is concerned, this will almost certainly be the case. Employment in dam related activities will provide a source of income to a number of people.

Improved village economic status: Communities are anticipating that their village status will be improved as many people will have money, new houses will be constructed, people will buy transport like bicycles, parents will pay school fees for their children and development feeling in general will be enhanced among communities.

Availability of clean and safe water: Currently the villages of Farkwa Ward lack reliable sources of clean and safe water. The problem becomes more acute during the dry season. Local stakeholders are optimistic that the dam will help to combat this chronic water shortage and hence improve the health and sanitation status of the villagers.

Saving productive time: People travel over long distances in search of water, particularly during the dry season. Improved access to water will save the villagers' time in terms of the time spent on fetching water and trekking their livestock to watering points. The saved time will be allocated to other economic/productive activities and contribute to the community well-being.

Health and safety hazards: Village reports on the health status indicate that malaria is apparently the leading disease for all age groups especially during the rain season. The presence of stagnant fresh water might exacerbate the situation and if there will be no adequate security measures e.g. fencing, there are possibilities of accidents, with vulnerable groups being children and livestock falling into the dam.

Induced development: The quantity of water that will be reserved exceeds the villagers' day-to-day requirements. In this situation, water from the dam will as well be used for other development activities such as construction of residential houses which are in a poor state, a cattle dip, a dispensary (they currently have none at Mombose and Bubutole) and expansion of a primary school.

1.7 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The Environmental and Social Management Plan (ESMP) is presented below in table 1.1 below. This ESMP for the proposed Farkwa dam project aims to address the impacts associated with the proposed project. So, the following proposed environmental management measures are intended to strengthen the current plan.

Based on the assessment undertaken as part of the ESIA, a series of mitigation measures have been identified which aim to reduce and / or eliminate the predicted impacts of the project. It is important that these mitigation measures are appropriately applied to the project mobilization, construction and operation, and this management plan provides a strategic framework for their implementation. The Contractor shall implement components relevant to design, mobilization of materials and machines and

actual construction. The estimated costs for implementing the mitigation measures are just indicative. Additionally, the ESMP include an estimate of the costs of the measures so that the project proponent can budget the necessary funds. Appropriate bills of quantities should clearly give the actual figures. In any case the consultant used informed judgment to come up with these figures.

1.7.1 Purpose of the ESMP

The purpose of the ESMP is to describe the measures that should be implemented by the Contractors and Ministry of Water during the implementation of the project to eliminate or reduce to acceptable levels key potential impacts and social and health impacts related to project activities. The specific measures set out in the ESMP must be fully adhered to by all the project parties. In particular, the project must strive to avoid significant impacts on the bio-physical, socioeconomic, or health aspects during implementation. Avoidance through good detailed design of site specific works and through preparation of the detailed site specific contractor ESMPs will be key to success in this area. Where impacts cannot be avoided they must be mitigated against using appropriate measures. The ESMP has been developed:

- To bring the project to comply with Government of Tanzania applicable national environmental and social legal requirements social policies and procedures;
- To provide guidance on EHS issues as required by the AfDB Group EHS Guidelines
- To outline the mitigating/enhancing, monitoring, consultative and institutional measures required to prevent, minimise, mitigate or compensate for adverse environmental and social impacts, or to enhance the project beneficial impacts.
- To provide an operational reference and tool for environmental management during project rehabilitation and operation activities.

All contractual and legal obligations relating to the ESMP apply to the main Contractors and any Sub-Contractors appointed by them. It is the responsibility of the Construction Contractors to provide adequate resources to ensure effective implementation and control of the ESMP. The Sub-Contractor is responsible to its respective Contractor for compliance with the measures presented in the ESMP. It is also the responsibility of the Construction Contractors and their Sub-Contractors to ensure that all project staff is trained and procedures are understood and followed.

1.7.2 Key Players in Implementing the ESMP

In order to ensure the sound development and effective implementation of the ESMP, it will be necessary to identify and define the responsibilities and authority of the various persons and organisations that will be involved in the project. The following entities will be involved on the implementation of this ESMP:

- Funding Institutions
- Ministry of Water;
- Consultants;
- Contractor;
- The National Environmental Management Council (NEMC).

(a) Funding Institutions

The Government of the United Republic of Tanzania through the Ministry of Water will received financing from the International Bank for Reconstruction and International Development Association (IDA) toward

the cost of Water Sector Development Program. The MoW intends to apply a portion of the funds to finance construction of the proposed project. The funding organization will have overarching responsibility to ensure that the Project is carried out to the highest environmental standards strictly in accordance with the ESIA and the mitigation measures set out therein. Additionally, it is a requirement of the funding Institution that environmental and social impacts are managed in accordance with the AfDB Operational Guidelines.

(b) Ministry of Water

The responsibility for ensuring that mitigation measures specified in this ESMP and the contract documents are implemented will lie with the MoW. The environmental monitoring staff / Environmental Field Officer (EFO) and a Health and Safety Officer (HSO) from MoW and if necessary, representatives from NEMC will undertake monitoring during construction and operation phases of the project.

(c) Environmental Consultant

The appointed Environmental Consultant will be required to oversee the construction programme and construction activities performed by the Contractor, in compliance with the present ESMP. It is recommended that prior to commencement of actual construction; the Environmental Consultant should submit a work site plan that complies with the national environmental guidelines and an updated ESMP for the different phases of the work. The environmental plan should specify in particular the location of sources of materials, disposal area of construction debris and arrangements for traffic management. The plan should take into consideration the mitigation measures proposed in this ESIA Project Report. MoW or Contractor should also appoint an Environmental Field Officer (EFO) and a Health and Safety Officer (HSO) or Consultant who will be responsible for the following tasks:

- Drafting environmental aspects during project implementation;
- Managing environmental and safety aspects at the work sites;
- S/He shall participate in the definition of the no working-areas;
- Recommending solutions for specific environmental problems;
- S/He shall facilitate the creation of liaison group with the stakeholders at the project site and shall monitor the compliance ESMP;
- Organising consultations at key stages of the project with the stakeholders and interested parties;
- S/He will be required to liaise with the MoW Environmental Management Unit or NEMC on the level of compliance with the ESMP achieved by the Contractor on a regular basis for the duration of the contract;
- Controlling and supervising the implementation of the ESMP;
- Preparing environmental progress or "audits" reports on the status of implementation of measures and management of work sites.

(d) The Contractor

The project will be implemented by Contractor and will be responsible for constructing the project in accordance with the Technical Specifications required. The Contractors will implement the project fully in accordance with the ESIA Mitigation measures. The Contractor will nominate an Environmental Site Officer (ESO) who will be the Contractor's focal point for all environmental matters. The ESO will be routinely on-site for the duration of the construction works.

(e) The National Environment Management Council

The National Environmental Management Council of Tanzania will play a key role in monitoring the project during the construction and operational phases to ensure that the mitigation measures set out in chapter 7 above are fully implemented.

1.7.3 Environmental audit procedures

In complying with the requirements of the Environmental Management Act Cap 191 the project will conduct independent audits biannually and submit on annual basis, an environmental monitoring report. The annual report will review the performance of various environmental parameters. The MoW will also ensure compliance with the audit requirements. Environmental auditing will seek to undertake the following, as its minimum requirements:

- Review all monitoring data and, if deemed warranted by the independent third-party auditor, undertaking an independent round of monitoring.
- Review various environmental reports compiled throughout the year.
- Review operations, inspect facilities and observe monitoring activities for purpose of assessing effectiveness of the Company's environmental management procedures, implementation and identifying potential improvements if deemed appropriate.
- Prepare an audit report complete with photographic record and recommendations.

The final audit report, together with monitoring data for the previous year, will be distributed to the Ministry of Water, the NEMC, and the Chemba District Council through the District Environmental Management Officer for review, guidance and comments. The summary of the key issues of the proposed project and their management are shown in Table 1.1 below.

Table 1.1: Environmental and Social Management Plan

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution
Preparation/Mobilization phase	Loss of /disturbance of biodiversity (flora, fauna and ecosystem)	Minimize clearing of vegetation shall be as minimal as possible so as to avoid much destruction of this natural, unique and small ecosystem. The Contractor shall clearly mark out the extent of clearing within the approved work-site and instruct all construction workers to restrict clearing to the marked areas and not to work outside defined work areas. The MoW shall help to afforestate the area when the construction work is complete.	Type, number, distribution etc. of species	Contractor/ Environmental Consultants / MoW
	Deterioration/impairment of local air quality	During all mobilization related activities, air quality impacts from combustion sources (equipment emissions) shall be minimized through contracting new equipment or through routine inspection and maintenance of combustion emission sources (such as generators, diesel engines, equipment's). No vehicles or equipment to be used that generates excessive black smoke. Maintenance will ensure that equipment is operating efficiently and is not producing excessive emissions.	SO_2: -average 100 µg/Nm^3 (0.129mg/kg) for 24hour	Contractor/ Environmental Consultants / MoW
			NO_2 : 150 µg/Nm^3 for 24-hours average value	
			CO: 10mg/Nm^3 for 8 hours	
			Black smoke PM_{10} : 40 to 60 µg/Nm^3	
			refer also table 6.4 above for TBS/WHO standards	
	Nuisance and disturbance on/offsite receptors from noise pollution	The contractor and project proponent shall ensure all plant, machinery and vehicles are fitted with appropriate mufflers, and that all mufflers and acoustic treatments are in good working order. Also shall ensure all plant, machinery and vehicles are regularly maintained and broken parts are replaced immediately.	shall not exceed 75 dB(A)(peak readings), daytime or 55 dB(A) (peak readings) at night, No complaints from the local people	Contractor/ Environmental Consultants / MoW
	Dust pollution	Dust generating activities shall not be carried out during times of strong winds. Water shall be applied whenever dust emissions are visible at the site in consultation with the Project Supervisor. Vehicles delivering soil materials will be covered to reduce spills and windblown dust and vehicle speeds will be limited to minimize the generation of dust on site and haul	$PM_{2.5}$ not to exceed 250 mg/Nm3 (peak readings),	Contractor/ Environmental Consultants / MoW

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution
		routes. Any complaints received by the Contractor regarding dusts will be recorded and communicated to Project Supervisor.		
	Depletion /degradation at points of source of construction materials	Construction materials will be from the authorized source only. These authorized dealers should have an EIA certificate and the Mining license from the Ministry of Energy and Minerals. The licensed suppliers who hold the EIA certificate and the Mining License comply with ILO labour conditions.	Materials to be sourced in licensed area, No complaints from the local people.	Contractor/ Environmental Consultants / MoW
	Erosion of the top soil and reservoir sedimentation	The MoW and contractor shall ensure that civil or earth work is done during dry season when there are no run off to reduce the impact severity. Temporarily shall bind exposed soil and redirect flows from heavy runoff areas that threaten to erode or result in substantial surface runoff to adjacent water courses. The contractor shall ensure that backfilling is done adequately, compacted, and the site restored.	No erosion tendencies	Contractor/ Environmental Consultants / MoW
	Disruption of traffic flow during mobilization	The contractor shall employ drivers with authenticated class C licence and with a minimum of 3 years of driving after obtaining the class C licence. Transport routes to and from the project site will be agreed with government agencies prior to commencement of the mobilization program. Traffic control measures (e.g. flagmen, appropriate lighting) will be deployed at the project site and strict speed controls will be implemented for all transport vehicles.	As minimum disruption as possible	Contractor/ Environmental Consultants / MoW
Construction Phase	Disruption of the various users of the highway and road reserve	The pipeline route will be surveyed and clearly marked, and cleared of obstacles before starting trenching in a particular area. MoW/Contractor shall endeavour to obtain as much information as possible about underground services in the area (use maps) including: pipe lines, water mains, sewers, telephones, and power conduits, laid wires poles and guy wires, railways (Dodoma City), highways, bridges or other underground or above ground structures and/or properties crossing or adjacent to the pipeline trench being excavated.	As minimum disruption as possible	Contractor/ Environmental Consultants / MoW

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution
	Deteriorated / impairment of local air quality	The proponent is committed to implementing measures that shall reduce air quality impacts associated with construction. All personnel working on the project will be trained prior to starting construction on methods for minimizing air quality impacts during construction. Specific training will be focused on minimizing exhaust gas emissions from heavy construction vehicles. Construction vehicles drivers will be under strict instructions to minimize unnecessary trips, refill petrol fuel tanks in the afternoon, and minimize idling of engines.	SO_2: -average 100 µg/Nm^3 (0.129mg/kg) for 24hour NO_2 : 150 µg/Nm^3 for 24-hours average value CO: 10mg/Nm^3 for 8 hours Black smoke PM_{10} : 40 to 60 µg/Nm^3 refer also table 6.4 above for TBS/WHO standards	Contractor/ Environmental Consultants / MoW
	Noise pollution	Working hours and rules will be established based on the needs to reduce the noise causing nuisance and disturbance, especially by avoiding the cumulative effect of increased noise due to simultaneous operation of different kinds of construction machinery and equipment. Best practice procedures will be implemented in order to reduce construction noise.	shall not exceed 75 dB(A)(peak readings), daytime or 55 dB(A) (peak readings) at night, No complaints from the local people	Contractor/ Environmental Consultants / MoW
	Dust pollution	The batching plant/crushers shall be provided with appropriate dust control measures and be positioned such that the prevailing north-westerly wind does not carry dust fines downwind towards sensitive receptors. Dust emissions from the equipment shall also be controlled by closing all covers and screens and wetting down materials to be crushed.	$PM_{2.5}$ not to exceed 250 mg/Nm3 (peak readings),	Contractor/ Environmental Consultants / MoW
	Increased soil and water pollution downstream	Good house-keeping shall be practiced within material storage compounds or vehicle maintenance yards where the possibility of spillage is great. Vertiver grasses may be used to control areas prone to erosion. Silt fences may be used to reduce suspended solids from surface water runoff. Proper storage of fuels and other chemicals shall be ensured. Machinery will be kept away from surface waters and will have drip trays installed beneath oil tanks / engines / gearboxes / hydraulics which will be checked and emptied regularly.	Maximum 15 ppm for hydro-carbons No leakage /spillage of hydrocarbons	Contractor/ Environmental Consultants / MoW

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution
	Contamination/impaired quality of receiving body – land, water from construction wastes	An efficient collection and disposal system based on the principles of reduction; re-use and recycling of materials, shall be instituted at the project site. Instructions to contractor to put on his/her methodologies for handling hazardous waste such as oils, lubricants and non-combustible waste during bidding process.	Adequate solid waste collection bins and sanitation facilities	Contractor/ Environmental Consultants / MoW
	Contamination of soil and ground water quality from the batching plant	Waste water generated from any concrete batching and pre-cast concrete casting plant activities of washing down mixer trucks, drum mixers and similar equipment shall, wherever possible, be recycled – wastewater discharge shall be kept at a minimum. Following silt removal and pH adjustment where necessary (to within pH range of 6-10), the surplus wastewater may be discharged into sewers or being transported by the cesspit trucks.	As minimum as possible	Contractor/ Environmental Consultants / MoW
	Contamination of river waters from accidental spillages/discharges	Properly maintained and convenient toilet and shower facilities and waste disposal services shall be provided and clearly displayed in the project area; including wastewater collection. All toxic, hazardous and harmful materials (such as caustic and acidic substances, fuels, oils, drums, barrels and asphalt materials) will be stored away from any waterway, in banded areas with impervious bases and soak pits to contain accidental spills.	Maximum 15 ppm for hydro-carbons No leakage /spillage of hydrocarbons	Contractor/ Environmental Consultants / MoW
	Soils damage/disturbance to surface and sub-surface organisms	The proponent will ensure proper demarcation of the project area to be affected by the construction works. This will be aimed at ensuring that any disturbance to flora and fauna is restricted to the actual project area and avoid spill over effects on the neighbouring areas.	As minimum as possible	Contractor/ Environmental Consultants / MoW
	Injuries to the general public due to road accidents	Traffic control measures (e.g. flagmen) will be deployed at all intersections of site access routes and main roads and strict speed controls will be implemented for all transport vehicles. The contactor shall install road bumps at regular intervals to limit speed of vehicles through the village and particularly at school crossings.	No injury and sufficient no of road signs	Contractor/ Environmental Consultants / MoW

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution
	Public health hazards / safety due to social interactions	The MoW and Contactor will devote time in raising awareness of the dangers of the HIV/AIDS within the project premises. Although basic knowledge of HIV/AIDS is high among Tanzanians, knowledge of self-protection measures and behaviour change will be provided and a preference will be given to those who are vulnerable and to empower women for they compose one of the most vulnerable groups. When the need arises MoW and Contractor will seek for professional assistance from organizations working in the field of public health and control of HIV/AIDS for instituting a health education and disease control programme at the workplace.	Tanzania HIV/AIDS Policy, No HIV/AIDS victims	Contractor/ Environmental Consultants / MoW
	Health hazards associated with construction work	Accidents will be minimized through proper arrangements of construction tools and equipment, protecting or guarding the cutting edges, and awareness of the people including workers on the dangers and make them understand how to protect themselves and others. Further, MoW and contractor shall comply with relevant Tanzania (OSHA, 2003) and IFC's Performance Standards and regulations on health and safety requirements including the provision of PPE, registering the work place, submission of designed drawings of the work place for approval, observing reasonable working hours and good working conditions and facilities.	Tanzania OSHA 2003, Low risk to workers and no exposure	Contractor/ Environmental Consultants / MoW
Operation Phase	Damage to the dam and conveyance system due to effects of natural factors and processes	The engineering design and construction of the dam shall ensure that the dam and conveyance system can withstand normal natural processes. The engineering design and construction shall ensure minimal disturbance to the natural terrain of the area. The hills upstream shall be left to act as natural barriers to contain the water in the project site. This will ensure that some parts of the project area will remain undisturbed to maintain natural scenery. The spillway shall be properly designed to ensure that the dam capacity is not exceeded.	Construction as per design specification	Contractor/ Environmental Consultants / MoW

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution
	Sediment loads transported into the dam and degradation of water quality	The natural vegetation in the sides/neighborhoods of the project area shall be conserved whenever possible to minimize soil erosion. Compaction of embarkments shall be done to meet the recommended compaction in the design. Also the project proponent will plant tree around dam boundaries to compensate on tree losses as well as to minimize wind which is one of the factors for excessive evaporation	Turbidity 30 NTU, DO Less than 75% of saturation concentration	Environmental Consultants / MoW
	Impacts on the downstream ecosystem due to delayed and reduced flow	The in-stream flow requirements to sustain the riverine ecosystem demands will fully be covered by the irrigation and livestock mitigation flows as the two are located downstream part of the river just before the Bahi swamp. However, a flow for the ecosystem to the Bahi swamp is considered independently of the later flows, as the irrigation and livestock mitigation flow are to be abstracted / consumed before reaching the Bahi swamp. Based on the study conducted to the Bahi drainage area (Appendix 10) and the discussions among the experts formed ESIA team, it was estimated that 10% of the natural flow of the Bubu River will contribute to the sustenance of the Bahi Swamp ecosystem and its associated ecological services (such as fishing).	Standard dam operational rules, water right user permit, No complains	MoW
	Reduced water quality due to pollution	Identify and promote appropriate latrine technologies within the catchment area. The MoW also may support Local Government Authority within the catchment area to establish and operate basic solid waste management systems. Further a training program shall be developed for farmers on precautionary measures required for the handling, labelling and application of agro-chemicals under field conditions. The training shall be incorporated in a farmer's field school curriculum. Extension workers shall also be able to deliver awareness program on the amounts and conditions for applying fertilizers and pesticides to prevent water pollution.	Nitrate 30 mg/l, Lead 0.05 mg/l, Sulphate 600 mg/l, Turbidity 30 NTU, DO Less than 75% of saturation concentration; Maximum 15 ppm for hydro-carbons; +/- 0.5 from the pH baseline	Environmental Consultants / MoW
	Impacts related with climate change	Climate change was considered in the dam design and no specific mitigation measures are recommended for the Farkwa dam in relation to climate change and hydrology. In times of low flows as a result of drought,	As minimum as possible	Environmental Consultants / MoW

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution
		the maintenance of the river ecological balance remains paramount and as such restrictions on water usage especially for irrigation downstream will be imposed.		
	Change in local ecosystem /stimulate of vegetation growth/ change in species composition	Proper maintenance procedures especially within the dam shall be undertaken regularly to ensure that occurrence of water weeds is kept to a minimal. A detailed biological inventory of the plants and fauna species composition has to be conducted in area upstream and down-stream of the proposed project site.	Standard dam operational rules, water right user permit	Environmental Consultants / MoW
	Human wildlife conflicts	In order to reduce the impact of wildlife migration to the river and to the dam the project proponent shall collaborate with the Chemba District Wildlife Office, Swagaswaga Game Reserve management, forest division and other relevant government agencies in managing wildlife; create buffer zones, providing separate watering points for wildlife. Information, education and awareness programmes for local residents, especially children, with respect to wildlife and its protection.	Standard dam operational rules, water right user permit, No conflict	Environmental Consultants / MoW
	Flooding hazards	The spillway shall be properly designed to ensure that the dam capacity is not exceeded. The proponent shall provide sluice valve for regulating levels in the dam and install a prior warning system against an increase of water within the dam. Also the engineering design and construction of the dam shall ensure that the dam can withstand normal natural processes.	As minimum as possible	Environmental Consultants / MoW
	Contamination/impaired quality of soils and water from poorly controlled agricultural activities	This impact can be reversible if IPM approaches are undertaken or farmers are trained in techniques of agrochemical applications. A training program shall be developed for farmers on precautionary measures required for the handling, labelling and application of agro-chemicals under field conditions. The training shall be incorporated in a farmer's field school curriculum. Extension workers shall also be able to deliver awareness program on the amounts and conditions for applying fertilizers and pesticides to prevent water pollution.	Dissolved phosphate (as P), *5* mg/l*, max*	

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution
	Increased water and soil pollution	During the water treatment process, the flocculation method shall be used for the settling of the fine particles. The incorporated chemical catalyst will be the aluminium sulphate. This chemical product joins the resulting solid sediments, i.e., the sludge that results from the process. This sludge will be disposed of at a storage and dehydration site, with base protected by a plastic membrane. Also the MoW shall consider measures to prevent pollution of ground water while designing the sludge storage site.	Nitrate 30 mg/l, Lead 0.05 mg/l, Sulphate 600 mg/l, Turbidity 30 NTU, DO Less than 75% of saturation concentration; +/- 0.5 from the pH baseline	Environmental Consultants / MoW
	Potential Negative Impacts			
	Relocation/resettlement of people, farms, properties and disruption of economic activities	MoW in collaboration with the local government authorities will work out/calculate the exact size and locations of the required land. Individuals with potential land acquisition issues shall then be subject to a comprehensive sensitization and consultation process. MoW will then initiate a land and property valuation and compensation process guided by relevant Tanzania laws. MoW shall effect compensation before the land is taken over.	As per the provision of Land Act 1999 and O Involuntary Resettlement (OP 4.12)	Environmental Consultants / MoW
	Increased conflicts over local water resources (communities downstream)	This requires the design to ensure that total closure of water is avoided by ensuring that irrigation mitigation flow (27,812,505.6 m3/year), livestock mitigation flow (381,901.5 m^3/year) and 10% of the natural flow of the Bubu River (14.79 MCM/year) is maintained in the river downstream. Further to prevent conflict between irrigation farming and livestock keeping downstream, extension services on improved livestock keeping that is more intensive than extensive shall be promoted.	As minimum conflict as possible, no complaints from the local people	Environmental Consultants / MoW
	Increase conflict with people living in the upper catchment	MoW shall involve communities in managing the upper catchment zone of the water sources. Discussions with relevant village leaders in the catchment zone shall be enhanced and deliberations implemented. Identification of NGOs, CBOs or other cultural groups, which would help in better managing of the catchment, shall be done. Provision of incentives and participation of development programmes in the villages can help to	As minimum conflict as possible, no complaints from the local people	Environmental Consultants / MoW

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution
		bring more understanding of the problem and can open up ways for getting better solutions.		
	Damage or loss of project structures due to anthropogenic activities	Marker (warning) tape shall be placed over the pipe but below the soil to warn future workers in the area that a water pipeline lies below to prevent being damaged. Proper documentation of the route detailing coordinates shall be done to ensure that it is possible to locate the route in future. The pipeline directly trenched in the ground shall be placed deep enough to provide adequate protection.	As minimum as possible	Environmental Consultants / MoW
	Public health hazards due to Water-borne and water-related diseases	To mitigate these impacts the proponent shall employ disease vectors disruption techniques such as regulated reservoir operation to curb vectors for malaria and water borne diseases. Also shall encourage natural aquatic life that takes care of mosquito larva as part of the food chain. Whenever possible MoW will support on – going and new community health and safety programmes undertaken by Chemba District Council and Village leaders for community mobilization to control preventable communicable diseases and vectors through awareness and sensitization campaigns.	As minimum as possible	Environmental Consultants / MoW
	Increased population influx	The key to the reduction in immigration of people from other parts of the country that could negatively compete for employment opportunities with the local peoples is to implement a stringent recruitment policy. This will ensure that preference is to be given to existing members of communities, especially those from the local villages such as Farkwa, Gonga, Mombose and Bubutole. A skills audit could be undertaken and a register compiled of persons who have skills that could be used by the project.	As minimum as possible	Environmental Consultants / MoW
	Danger of people drowning either intentionally or accidentally looms within the dam	Awareness raising and education to the communities including posting banners and warning signs at appropriate places shall be provided to advise farmers/villagers on proper use of the dam and by laws shall be enacted to protect the dam from those who would have wanted to use it carelessly.	As minimum as possible	Environmental Consultants / MoW

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution
	Conflicts among workers and the local population in the project area	In the dialogues of health and safety the contractor shall explain to workers about the importance of keeping a good relationship with local communities. Amongst the local workers shall be a group of community liaison, responsible for establishing communication between project staff and community, which will be particularly important in cases of complaint. Such elements shall be familiar with the project in general and being able to properly troubleshoot or forward any complaints/claims.	As minimum conflict as possible, no complaints from the local people	Environmental Consultants / MoW
	Exposure to chemicals, hazardous or flammable materials	Chemicals, hazardous and flammables materials shall be secured, and stored accordingly. Procedures for handling hazardous materials must be in place. They must be locked and only authorized personnel can have access to the materials. MSDS must be available and specific PPE shall be provided and users should be trained.	Tanzania OSHA 2003, Low risk to workers and no exposure	Contractor/ Environmental Consultants / MoW
Decommissioning phase	Loss of vegetation cover and plant diversity	Use existing maintenance access roads and the pipeline maintenance access route to dismantle and transport the decommissioned material. If necessary only clear the minimum width of the route for dismantling operation. Experienced ecological advisors must be appointed and be present on each spread during construction activities to chase animals away and collecting and relocating sensitive species from the area, preventing them to be harmed.	Specific to project core area to be cleared	Contractor/ MoW Designated Environment Officer
	Contamination and impaired water quality	The contractor shall prevent any uncontrolled run-off to waters, especially during rainfall events or when spillages occur. Measures shall be taken to minimize the flow of leakages into trenches that may act as short cuts to the river waters. Channels and sand bags shall be provided on site so as to direct storm water to the proper containment/removal facilities. Demolished materials shall be kept within planned boundaries and with a clear separation distance from waters.	Nitrate 30 mg/l, Lead 0.05 mg/l, Sulphate 600 mg/l, Turbidity 30 NTU, DO Less than 75% of saturation concentration; Maximum 15 ppm for hydro-carbons; +/- 0.5 from the pH baseline	Contractor/ MoW Designated Environment Officer
	Loss of employments	The only major impact that will result when the project is decommissioned is loss of jobs. In order to minimize the impacts that may result from this	All employees covered	Contractor/ MoW Designated

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution
		eventuality MoW will ensure that all employees are members of the pension fund and will ensure that the contributions are made.		Environment Officer
	Noise pollution	During decommissioning the contractor will coordinate activities that produce the most noise levels and portable barriers will be installed to shield compressors. Use of equipment designed with noise control elements will be adopted where necessary. Use of very noisy equipment will be limited to daytime only. All workers operating in noisy areas or operating noisy equipment will be provided with earpieces to protect against extreme noise.	TBS and WHO standards noise emissions shall not exceed 75 dB(A)(peak readings), daytime or 55 dB(A) (peak readings) at night,	Contractor/ MoW Designated Environment Officer
	Dust and exhaust emissions	A site waste management plan will be prepared by the contractor prior to commencement of demolition works. All personnel working on the project will be trained prior to commencing the demolition exercise on methods for minimizing negative impacts on air quality. The contractor will douse the surface with water to suppress excessive dust and whenever possible, water sprinklers shall be used.	To minimize dust emission. PM 2.5 not to exceed 250 mg/Nm3 (peak readings), No complaints from the local community	Contractor/ MoW Designated Environment Officer
	Occupational health and public safety hazards	All workers will be sensitized before the exercise begins, on how to control accidents related to the demolition exercise. A comprehensive contingency plan will be prepared before demolition begins, on accident response. Adherence to safety procedures will be enforced at all stages of the exercise. All workers, pursuant to labour laws, shall be accordingly insured against accidents.	OSHA 2003, Low risk to workers No exposure	Contractor/ MoW Environment Officer
	Enhancement measures for potential positive impacts			
	Employment/Income generation	From the start of the project the contractor during construction and the proponent shall strive to employ local community in most position. Training shall be provided where necessary to give basic understanding on some of the aspects of dam construction in order to increase the number of locals to be involved with the project. Salaries for the workers shall be over and above the government minimum wage.	As maximum as possible	Contractor/ MoW

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution
	Benefit to local producers and suppliers of goods and services	Where ever possible the project will procure materials from local sources. The use of locally available materials and labour for the proposed construction of Farkwa Dam will contribute towards growth of the economy by contributing to the gross domestic product.	As maximum as possible	Contractor/ MoW
	Improvement of health conditions of the population as a result of the consumption of drinking water	The project to upgrade and expand the water supply system will create conditions for improving the lives of the recipient population by providing more efficient access to water supply services. The availability of quality water will help in reducing the incidence of waterborne diseases, increasing the welfare of local people. This will be a positive impact of the project and great motivation for its implementation.	As maximum as possible	MoW
	Planned water supply and reliability of water supply system	The improvement and expansion of water supply system will enable greater responsiveness to the demand, increasing also the reliability of the operating system. The reliability of the system will allow adequate planning for water supplies.	As maximum as possible	MoW
	Rural income improvement	Implementation of the proposed project will induce a commercially sustainable agriculture for improved income level for the household, and thus help in poverty reduction, which is the core socioeconomic problem in the area. Poverty is to be reduced through provision of reliable water, which apart from creating the condition for more production and intensification will also reduce the high risk in agricultural production.	As maximum as possible	MoW
	Opportunities for skills acquisition	This impact is high and of great importance and therefore it will be enhanced by ensuring there is skill transfer through an elaborate programme. Staff will be categorized and each group will be supervised by dedicated skilled personnel to ensure on job training. The proponent will encourage job on training through observation and trial under supervision	As maximum as possible	MoW

1.8 ENVIRONMENTAL MONITORING PLAN

1.8.1 Introduction

The correct and successful implementation of impact mitigation measures in order to reduce adverse impacts on environmental conditions needs to be ensured by a proper monitoring programme. This chapter presents the Environmental and social monitoring plan (EMP) that will be carried out throughout the project implementation to mitigate the impacts and enhance the benefits of the project. The EMP outlines the specific actions that shall be undertaken to ensure that the Project complies with all applicable laws and regulations related to environmental impacts and impact mitigation. The EMP deals with all mitigation required for the physical, biological and socio-economic impacts and focuses on the impacts of higher significance as provided in table 1.1 above.

1.8.2 Objectives of EMP

The EMP applies to, and will be implemented throughout, all phases of the project: mobilization, operation, and decommissioning. The objective of the EMP is to set out clearly the key components of environmental and socio-economic management for the proposed project and thereby ensure that the following concepts are realized throughout the mobilization, construction, operation, and decommissioning.

- negative impacts on the physical, biological and socio-economic environments are mitigated;
- benefits that will arise from the development of the proposed project are enhanced;
- support smooth implementation of project with minimum losses to environmental and social infrastructure;
- compliance and guided by National, International laws, standards and guidelines e.g. effluents standards, noise level standards, occupational and safety standards etc and best practice is achieved; and
- good will and good relations with communities, and governments at local and national levels are maintained.

1.8.3 Monitoring responsibility

Implementation of the EMP is the solely the responsibility of the project proponent. MoW shall supervise and monitor components of the monitoring plan and keep record of monitoring outcome. MoW has ability to provide the necessary supervisory oversight to ensure the mitigation measures are working and where they are not remedial measures are established. MoW is committed to protect, and will enhance the environment.

Detailed parameters to be monitored have been considered along with responsible institution (s). The MoW will endeavor to ensure that resources are available to implement the EMP throughout all phases of project development and decommissioning. The EMP will be subject to the principle of continuous improvement. The details of environmental issues, environmental impacts, proposed parameter to be monitored and timing agencies responsible for execution of proposed actions during mobilisation, construction, operation and decommissioning stages are presented in Tables 1.2 below.

Table 1.2: Environmental and Social Monitoring Plan

Phase	Potential Impacts	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring Method	Target Level / Standard	Responsible Institution	Estimated Costs -TZS
Preparation/Mobilization phase	Loss of /disturbance of biodiversity (flora, fauna and ecosystem)	Size of land cleared, number of trees planted, type of planted trees	Weekly inspection	Project area	M_2, Number of affected species	Site inspection, Visual observation	Type, number, distribution etc. of species	Contractor/ MoW	6,000,000
	Deterioration/impairment of local air quality	SO_2	Once a Month	Project site	Mg/l	Detector tubes	average 100 µg/Nm^3 (0.129mg/kg) for 24hour	Contractor/ MoW	5,000,000
		NO_2	Once a Month	Project site	Mg/l	Detector tubes	150 µg/Nm^3 for 24-hours average value		
		CO	Once a Month	Project site	ppm	Mini-Vol Sampler	10mg/Nm^3 for 8 hours		
		Black smoke PM_{10}	Once a Month	Project site	ppm	Mini-Vol Sampler	40 to 60 µg/Nm^3		
	Nuisance and disturbance on/offsite receptors from noise pollution	Noise level	Weekly checks	Project site	dBA	Noise level meter	shall not exceed 75 dB(A)(peak readings), daytime	Contractor/ MoW	4,000,000
	Air pollution due to dust	Dust level	Twice daily	Project site	µg/m^3	Dust level meter/ Mini-Vol Sampler	PM 2.5 not to exceed 250 mg/Nm3 (peak readings)	Contractor/ MoW	5,000,000
	Depletion /degradation at points of source of construction materials	Documentation on resource procurement practices	Weekly checks	Materials sourcing area	Affected resource	Visual observation	No degradation of local resources, no complaints from local people	Contractor/ MoW	5,000,000
	Erosion of the top soil and reservoir sedimentation	Visible erosion	Weekly checks	project site, borrow pits & quarries	visible erosion	Site inspection, visual observation	No erosion tendencies	Contractor/ MoW	5,000,000
	Disruption of traffic flow during mobilization	Traffic control measures in place	Weekly checks	Project area	Number and	Visual inspection	As minimum disruption as possible	Contractor/ MoW	10,000,000

Phase	Potential Impacts	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring Method	Target Level / Standard	Responsible Institution	Estimated Costs -TZS
					duration of disruption				
Construction Phase	Disruption of the various users of the highway and road reserve	Traffic control measures in place	Weekly checks	Project area	Number and duration of disruption	Visual inspection	As minimum disruption as possible	Contractor/ MoW	5,000,000
	Deteriorated / impairment of local air quality	SO_2	Once a Month	Project area	Mg/l	Detector tubes	average 100 µg/Nm^3 (0.129mg/kg) for 24hour	Contractor/ MoW	5,000,000
		NO_2	Once a Month	Project area	Mg/l	Detector tubes	150 µg/Nm^3 for 24-hours average value		
		CO	Once a Month	Project area	ppm	Mini-Vol Sampler	10mg/Nm^3 for 8 hours		
		Black smoke PM_{10}	Once a Month	Project area	ppm	Mini-Vol Sampler	40 to 60 µg/Nm^3		
	Noise pollution	Noise levels, sound abatement measures in place	Weekly inspections	Project area	dBA	Noise level meter	shall not exceed 75 dB(A) daytime or 55 dB(A) at night,	Contractor/ MoW	6,000,000
	Air pollution due to dust	Dust level	Weekly checks	Project area	µg/m^3	Dust level meter/ Mini-Vol Sampler	PM 2.5 not to exceed 250 mg/Nm3 (peak readings)	Contractor/ MoW	5,000,000
	Increased soil and water pollution downstream	Fuel and hazardous material storage areas, plant, machinery, re-fuelling & delivery areas	Weekly inspections	Project area	mg/l	Sampling and analysis(Spectrophotometer)	Maximum 15 ppm for hydro-carbons No leakage /spillage of hydrocarbons	Contractor/ MoW	6,000,000
	Contamination/impaired quality of receiving body–land, water from construction wastes	BOD, TSS; signs of floating wastes at river; management records	Weekly inspections	Project area	types of waste	Visual inspection	Less complaints from neighboring communities	Contractor/ MoW	5,000,000
	Contamination of soil and ground water	Water turbidity	Once per week	Project area	NTU	Sampling and analysis	< 25 NTU	Contractor/ MoW	5,000,000

Phase	Potential Impacts	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring Method	Target Level / Standard	Responsible Institution	Estimated Costs -TZS
	quality from the batching plant					(Spectrophotometer)			
		Total Solids	Once per week	Project area	mg/L	Drying and Weighing	Minimum disturbance as possible		
		pH	Once per week	Project area		pH meter	6.5-9.2		
	Contamination of river waters from accidental spillages/ discharges	Fuel and hazardous material storage areas, plant, machinery, re-fuelling & delivery areas	Weekly inspections	Project area	mg/l	Sampling and analysis(Spectrophotometer)	Maximum 15 ppm for hydro-carbons No leakage /spillage of hydrocarbons	Contractor/ MoW	4,000,000
	Soils damage/ disturbance to surface and sub-surface organisms	Impacted habitats / Species	Continuously	Project area	Type/quantity/area of fauna/ flora	Visual inspection	As minimum disturbance as possible	Contractor/ MoW	6,000,000
	Injuries to the general public due to road accidents	Traffic control measures in place	Weekly checks	Transportation route, project site	Number & duration of disruption	Visual inspection	As minimum disruption as possible	Contractor/ MoW	5,000,000
	Public health hazards / safety due to social interactions	Incidence of medical reports of HIV/AIDS or other disease,	Every 3months	Project records	Number of people infected	HIV blood tests and surveys	Tanzania AIDS/HIV Policy, No HIV/AIDS victims	Contractor/ MoW	10,000,000
	Health hazards associated with construction work	Registered worker Injury /illness, Proper use PPE	Continuously	Project area	Number of cases, PPE users	Medical records, and site inspection	OSHA 2003, Low risk to workers, No exposure	Contractor/ MoW	6,000,000
Operation Phase	Damage to the dam and conveyance system due to effects of natural factors and processes	Construction workmanship Certificate of works	Every month	Project area	Presence of cracks	site inspection	Construction as per design specification	MoW	10,000,000
	Sediment loads transported into the	Water turbidity	Once per week	Dam site	NTU	Sampling and analysis	< 25 NTU	MoW	5,000,000

Phase	Potential Impacts	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring Method	Target Level / Standard	Responsible Institution	Estimated Costs -TZS
	dam and degradation of water quality					(Spectrophotometer)			
		Total Solids	Once per week	Dam site	mg/L	Drying and Weighing	As minimum disturbance as possible		
		pH	Once per week	Dam site		pH meter	6.5-9.2		
	Impacts on the downstream ecosystem due to delayed and reduced flow	Flow rate downstream	Every month	Dam site	m^3/day	V- Notch Weirs, Frequencies of conflicts	Standard dam operational rules, water right user permit, No complains	MoW	5,000,000
	Reduced water quality due to pollution	Nitrate	Once per day	Dam site, water sources at the quarry & access road	mg/l	Sampling and analysis	30	MoW	6,000,000
		Lead	Once per day		mg/l	Sampling and analysis (AAS)	0.05		
		Sulphate	Once per day		mg/l	Sampling and analysis	600		
		Turbidity	Once per day		NTU	Sampling and analysis	< 25 NTU		
		pH	Once per-day		mg/l	pH Meter	+/- 0.5 from the baseline		
		DO	Twice per day		mg/l	DO meter	Less than 75% of saturation concentration		
	Impacts related with climate change	Performance of the dam, Water levels	Every month	Project area	None	Visual and site inspection,	As minimum as possible	MoW	4,000,000

Phase	Potential Impacts	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring Method	Target Level / Standard	Responsible Institution	Estimated Costs -TZS
	Change in local ecosystem /stimulate of vegetation growth/ change in species composition	Species diversity	Once after one year of commissioning	Project area	m2, number of affected species	Visual observation and area computation	Standard dam operational rules, water right user permit	MoW	5,000,000
	Human wildlife conflicts	Reported conflicts	Every month	Project area	frequencies of conflicts	Reported complains, Visual observation	Conflict kept as minimum as possible	MoW	3,000,000
	Flooding hazards	Performance of the dam, Water levels	Every month	Project area	None	Visual and site inspection,	No crack in the foundation	MoW	4,000,000
	Contamination/impaired quality of soils and water from poorly controlled agricultural activities	Water quality – chemical content (of known chemicals and fertilisers), Soil contamination	Once every six months	Dam site	Mg/l ppm	Sampling and analysis (Spectrophotometer)	TBS standard, Dissolved phosphate (as P), *5* mg/l*, max*	MoW	5,000,000
	Increased water and soil pollution	Water quality – sediments, silt, turbidity	Once every six months	Dam site	NTU	Sampling and analysis	< 25 NTU	MoW	6,000,000
	Potential negative impacts								
	Relocation/resettlement of people, farms, properties and disruption of economic activities	Number of affected people	Once before construction	Project site	Numbers	RAP, Reported complains, Visual observation	As per the provision of Land Act 1999	MoW	5,000,000
	Increased conflicts over local water resources (communities downstream)	Reported conflicts	Every month	Project area	Frequencies of conflicts	Visual inspection and interview with local communities	Conflict kept as minimum as possible / No complaints from the local people	MoW	5,000,000

Phase	Potential Impacts	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring Method	Target Level / Standard	Responsible Institution	Estimated Costs -TZS
	Increase conflict with people living in the upper catchment	Reported conflicts	Every month	Project area	Frequencies of conflicts	inspection and interview with local communities	Conflict kept as minimum as possible / No complaints from the local people	MoW	4,000,000
	Damage or loss of project structures due to anthropogenic activities	Affected structures	Once after construction	Dam site	None	Visual inspection	As minimum as possible	MoW	4,000,000
	Public health hazards due to Water-borne and water-related diseases	Prevalence of water-borne diseases	Once every year	Health Centre	Number of Patients and types of ailments	Medical reports	No or minimum incidences of water borne and water related diseases	MoW	5,000,000
	Increased population influx	Number of people	Once every six months	Report files	Numbers	Visual observation	As minimum as possible	MoW	4,000,000
	Danger of people drowning either intentionally or accidentally looms within the dam	Number of people drowning, awareness program in place	Continuously	Project area	Number of cases / injuries	Medical records, and site inspection	Low risk to people No exposure	MoW	5,000,000
	Conflicts among workers and the local population in the project area	Reported conflicts	once every six months	Project site	Numbers	Numbers	Conflict to be kept as minimum as possible	MoW	4,000,000
	Exposure to chemicals, hazardous or flammable materials	Water quality – chemical content, Reported exposure	Once every six months	Down stream	Mg/l ppm	TBS standard	Tanzania OSHA 2003, Low risk to workers and no exposure	MoW	6,000,000
Decommissioning	Loss of vegetation cover and plant diversity	Flora diversity	Once before construction	Upstream and down stream	Numbers and names	Site inspection, survey,	IUCN list CITES list	Contractor/ MoW	5,000,000

Phase	Potential Impacts	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring Method	Target Level / Standard	Responsible Institution	Estimated Costs -TZS
	Contamination and impaired water quality	Nitrate	Once per day	Dam site	mg/l	Sampling and analysis	30	Contractor/ MoW Designated Environment Officer	10,000,000
		Lead	Once per day		mg/l	Sampling and analysis (AAS)	0.05		
		Sulphate	Once per day		mg/l	Sampling and analysis	600		
		Turbidity	Once per day		NTU	Sampling and analysis	< 25 NTU		
		pH	Once per day		mg/l	pH Meter	+/- 0.5 from the baseline		
		DO	Twice per day		mg/l	DO meter	Less than 75% of saturation concentration		
	Loss of employments	Pension fund remittance	Once every year	Project site	Employees registered for pension fund	Workers register book	All workers	Contractor/ MoW	5,000,000
	Noise pollution	Noise level	During decommissioning	Project Site	dBA	Noise level meter	noise emissions shall not exceed 75 dB(A)(peak readings), daytime or 55 dB(A) (peak readings) at night,	Contractor/ MoW Designated Environment Officer	5,000,000
	Dust and exhaust emissions	Suspended solids in air	During decommissioning	Project Site	$\mu g/m^3$	Dust level meter	PM 2.5 not to exceed 250 mg/Nm3 (peak readings), No complaints from the local community	Contractor/ MoW Environment Officer	5,000,000
	Occupational health and public safety hazards	Registered worker Injury / illness, Proper use PPE	Monthly	Work sites	Number of cases/injuri	Medical records, and site inspection	OSHA 2003, Low risk to workers, No exposure	Contractor / MoW	4,000,000

Phase	Potential Impacts	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring Method	Target Level / Standard	Responsible Institution	Estimated Costs -TZS
					es, workers using PPE			Environment Officer	
	Enhancement measures for potential positive impacts								
	Employment/Income generation	Local people employed and training conducted	Continuously during operation	Project records	Local people employed	Numbers of local people employed	As maximum as possible	Contractor/ MoW	4,000,000
	Benefit to local producers and suppliers of goods and services	Procurement records	Continuously during operation	Project records	Amount	Amount	As maximum as possible	Contractor/ MoW	5,000,000
	Improvement of health conditions of the population as a result of the consumption of drinking water	Health conditions within project area	Monthly	Work sites	Number of cases	Medical records, and site inspection	More improvement of health conditions of the population	MoW	5,000,000
	Planned water supply and reliability of water supply system	Water supply	First year of operation	Project records	Water provided	M^3	As maximum as possible	MoW	5,000,000
	Rural income improvement	Income of local people	Continuously during operation	Project records	Amount	Amount	As maximum as possible	MoW	5,000,000
	Opportunities for skills acquisition	Local people trained	Continuously during operation	Project records	Numbers of local people employed	Numbers of local people trained	As maximum as possible	MoW	4,000,000

1.9 ALTERNATIVES CONSIDERED

The general principle involved in identifying the option(s) of the proposed project is to ensure that the option chosen would result in optimal social, economic and environmental returns. Three dam type options were studied for Farkwa Dam i.e. alternative 1- Earth-fill, alternative 2 - Composite RCC and Earth-fill and alternative 3 - Concrete Face Rockfill Dam (CFRD). The technico-economic comparison shows that the composite RCC and Earthfill Dam option (Option 2) presents non negligible technical and economic advantages. The main advantage is brought by the incorporation of the spillway and intake in the dam body, which reduce as well as facilitate the construction works. From an environmental point of view, Option 2 also appears to be friendlier due to a smaller amount of construction materials, excavations and footprint than the other two options. Regarding the FSL of the dam, a FSL at El. 1110 m is recommended:

- The reservoir simulations show that the total water demand (including the additional rural demand provided by the MOW) is satisfied;
- An increase of 1 metre of the FSL leads to evaporation losses greater than the gain in water supply;
- A higher FSL may have impacts on the Swagaswaga Game Reserve;

An increase of 1 metre of the FSL has a cost to be taken into account. It is estimated that the cost increase by approximately 7% every meter. On this basis it is recommended to select the composite RCC and Earthfill Dam Option with a FSL at El.1110m for the Farkwa Dam project.

If the drinking water demand in the Chemba District and Dodoma City beyond 2015 shall be met another feasible alternative to the project including the No-Project option does not exist. The conclusion is that the recommended alternatives in this ESIA report recognizes the viability and need for the proposed development and are designed to address environmental issues and concerns, meets all local regulatory requirements.

1.10 COST BENEFIT ANALYSIS

The cost benefit analysis for the establishing Farkwa Dam and the conveyance system was conducted during feasibility study to evaluate whether establishing the Dam will yield economic and social benefit to the project proponent and communities in Dodoma Region. The aim of the analysis is to calculate the Net Present Value (NPV) and the Internal Rate of Return (IRR) in order to evaluate the profitability of the project.

- The Net Present Value is estimated as the difference between total benefit and project's total cost discounted at the same date. It is derived as summed discounted benefits less sum discounted costs.
- The Internal Rate of Return can be defined as the rate at which the Net Present Value of the net benefit stream in financial terms becomes zero. Thus, it is the rate that equates project's discount financial benefits to discounted financial costs.

The normal cost of capital in the water sector in Tanzania is known to range from 8 to 15%. This parameter was used as reference for the analysis, which was carried out as follows:

- Firstly the Net Present Value was calculated for both discount rates 8% and 15%;

- Secondly the price of water was computed on the basis of a fixed IRR. The computation was made for two IRR values: 8 and 15%, to cover the normal range.

A cost estimate was prepared during the feasibility study for the project infrastructures (dam, conveyance system and others). Cost estimates for the social and environmental impacts mitigation, land valuation and others are also presented here. The dam cost is estimated at 38.6 MUSD for the recommended option (composite RCC and earthfill Main Dam, FLS 1,110m), including the cost for operations and maintenance estimated at 2.6 MUSD. The dam cost without the operations and maintenance cost is therefore estimated at 31.6 MUSD.

The conveyance system cost is estimated at 175 MUSD, including the cost for operations and maintenance estimated at 15 MUSD. The conveyance system cost without the operations and maintenance cost is therefore estimated at 160 MUSD. A provision of 16 MUSD is providing in order to anticipate the increase of the conveyance system cost due to the addition of 3 districts (increase in water demand). The treatment plant cost is estimated at 33 MUSD, including the cost for operations and maintenance estimated at 3 MUSD. These later costs include costs related to access roads but not the cost related to the power supply to the dam site. The total infrastructures cost is therefore estimated at 222 MUSD without the operation and maintenance costs, which are estimated at 20.5 MUS.

The environmental and social mitigation costs were estimated to 12.7 MUSD. The costs of all the pollution control equipment, operation and maintenance of that equipment's and the procurement of the monitoring equipment are included in the project cost. Other cost to be incurred by the project proponent are as detailed under the environmental management and monitoring plans. It was concluded that the potential benefits of the project, in terms of financial and social benefit are substantial. Similarly, the environmental impacts can be reasonably mitigated and the financial resources needed to mitigate negative impacts, when compared to the required investment, are relatively small.

1.11 DECOMMISSIONING PLAN

After completion of mobilization and construction activities, all construction equipment, vehicles and vessels will be removed from site along with any temporary facilities. All equipment, tools and surplus materials (materials are defined in this instance as – items that have been brought to site by the contractor or any other materials taken from the site) will be placed in containers and returned to contractor yard or to another project. Materials and equipment shall be removed from the site as soon as they are no longer necessary to minimize the demobilization work after completion of the project.

Before the final inspection, the site shall be cleared of equipment, unused materials and rubbish so as to present a satisfactory clean and neat appearance. All the camp sites will be built as temporary structures and these will also include the use of movable structures such as movable containers. All the temporary structures that can be beneficial to the community shall be provided freely to the local government for other uses in the area.

1.12 GRIEVANCE REDRESS MECHANISM

The proposed project is anticipated to impact both directly and indirectly, positively and negatively on communities in the project area. These impacts can potentially affect the lives of people living and working in these communities, thus giving rise to grievances. These potential grievances may relate to any aspect of the project. They might be felt and expressed by a variety of parties including individuals, groups,

communities, entities, or other parties affected or likely to be affected by the social or environmental impacts of the project. To address the environmental and social impacts related to the project, was carried out. Despite that the ESIA document was developed for the project, large-scale development projects such as the construction of Farkwa Dam and Water Conveyance System to Chemba and Dodoma City represent dramatic change for communities. While change may lead to opportunity for some, it may put others at risk, despite project efforts to be socially and environmentally responsible, and despite genuine attempts to engage communities and create project safeguards. Risk and change work hand in hand to create conditions where community conflicts arise. To manage the potential grievances related to any aspect of the project, to enable community members to raise concerns about possible negative impacts and to give MOW the opportunity to address those concerns, MOW develop the Grievance Mechanism.

These mechanisms outline the requirements for designing and implementing an appropriately tailored site Grievance Management and Resolution Procedure, or "Grievance Mechanism" for short. It also outlines the Ministry of Water approach to accepting, assessing, resolving and monitoring grievances from those affected by proposed project. The purpose of a Grievance Mechanism document is to manage complaints and grievances from communities and other local stakeholders in a systematic, fair, timely and transparent manner in order to promote mutual confidence and trust. A Grievance Mechanism also provide the site with information about stakeholder issues and concerns and serves as an early warning mechanism that addresses issues before they become more difficult and more costly- to resolve. Timely redress or resolution of such grievances is vital to ensure successful implementation of the project

Grievances can encompass minor concerns as well as serious or long-term issues. They might be felt and expressed by a variety of parties including individuals, groups, communities, entities, or other parties affected or likely to be affected by the social or environmental impacts of the project. It is essential to have a robust and credible mechanism to systematically handle and resolve any complaints that might arise in order that they do not escalate and present a risk to operations or the reputation of the MOW (nationally or internationally). If well-handled, an effective grievance mechanism can help foster positive relationships and build trust with stakeholders.

This Grievance Mechanism has been considered in parallel to the Stakeholder Engagement Plan (SEP) due to the inter-relationship between these two planning mechanisms. It has been designed to meet the legal requirements of Tanzania laws and regulations and the requirements of the International Finance Corporation (IFC) in relation to grievance management. The mechanism for addressing employee grievances is not addressed through this mechanism which is solely to manage the interface with external stakeholders.

11.13 CONCLUSION AND RECOMMENDATIONS

It can be stated that the Project can be implemented and operated without having significant impacts on the bio-physical environment if the proposed mitigation measures are implemented. The project is viable from a social point of view and the implementation of the identified mitigation measures will minimize the negative socioeconomic implications of the project to a minimum.

In order to compensate the loss of assets of affected people and to manage physical relocation properly a Resettlement Action Plan to the Project has been prepared. The implementation of the resettlement plan especially the compensation payment shall be carefully monitored. For construction works it is recommended to hire local workers wherever possible. This will raise the acceptance of the population to the project. Regarding Health and Safety aspects, the Project can be implemented without any

remaining significant risks and impacts, provided that the Health and Safety requirements stated are put in place.

Given the nature and location of the development, the conclusion is that the potential impacts associated with the proposed project are of a nature and extent that can be reduced, limited and eliminated by the application of appropriate mitigation measures. The proposed environmental management plan and environmental monitoring plan if implemented will safeguard the tranquility of the environment.

2 INTRODUCTION

2.1 PROJECT BACKGROUND

The Government of United Republic of Tanzania through the Ministry of Water is implementing the Water Sector Development Programme (WSDP) with the aims of improving access to water supply and sanitation services in rural and urban areas. The target of WSDP is to meet the Tanzania's Development Vision, which aims at achieving an absence of abject poverty by 2025, where several achievements are called for including increased access to safe water to be raised to 90% by 2025 in the rural areas and 100% in urban. Therefore, the Ministry of water (MoW) is coordinating the implementation of Farkwa Dam Construction Project comprising (i) Main and Saddle dam construction (ii) Water Treatment Plant (WTP) and (iii) Conveyance system to Dodoma City and Chemba District Council. Also, under this project there will be a component of catchment protection and conservation, in order to conserve the upstream catchment of the dam site.

The overall purpose of the project is to improve water supply services to beneficiaries living within Dodoma City, Chemba District, Bahi District and Chamwino District, the communities along the conveyance system by increasing the quantity of water available in the water distribution system and improving its quality to remain in compliance with Tanzanian and International standards. Increased clean and safe water availability to Dodoma City and the Chemba, Bahi and Chamwino District Councils will contribute to poverty reduction and general social well-being of the people. The present main source of water is the Makutupora well field with an upgraded supply capacity of 61,000 gross m^3/day. This present source is considered not to be reliable enough for the supply of a growing population. The Ministry of Water carried out pre-feasibility studies, which identified Farkwa area as potential site for development of a Dam "Farkwa Dam" that would provide a reliable source of water supply to the Dodoma City. The Farkwa Dam is proposed to be constructed immediate downstream the confluence of Bubu and Mkinki rivers located in Mombose and Bubutole Villages of Farkwa Ward, Chemba District, Dodoma Region. The site is approximately 130 kilometres North of Dodoma on the road to Kondoa District.

The Dam consists of 25m high composite RCC and earthfill Main Dam with intake, outlet works and spillway – FSL 1,110m, 10 m high earthfill Saddle Dam and the site access roads. Other component includes the main Conveyance System consisting of 115 km long conveyance pipeline with an end connection to the Kilimani Tank N°2 in Dodoma; Conveyance System consisting of 51 km long conveyance pipeline to Chemba, water treatment plant, pump station, pumps and associated Hydro-Electrical and Mechanical (HEM) equipment located downstream of the dam on the left river bank; associated civil works and HEM equipment and the Interim tank to be located approximately 14 km from the dam site.

2.2 PROJECT DEVELOPMENT OBJECTIVES

The overall purpose of the project is to improve water supply services to beneficiaries living within Dodoma City and along the conveyance system by increasing the quantity of water available in the water distribution system and improving its quality to remain in compliance with Tanzanian and International standards. Increased clean and safe water availability Chemba District and Ddodoma City will contribute to poverty reduction and general social well-being of the people.

Figure 2.1: Project Site and Transmission Routes
Source: TRES Fied Data, 2021

2.3 THE SCOPING STUDY

The scoping study was conducted in order to identify environmental and social issues and concerns requiring special attention in the ESIA. The objectives of the scoping study for the proposed project were therefore to document key issues that may be important during the ESIA study and to identify and involve key stakeholders in the ESIA process. This process afforded opportunity to the stakeholders to express

their views and concerns to be included in the ESIA study. Additionally, scoping enabled the team of Consultants to:

- To ascertain key issues that are likely to be important during ESIA;
- To identify main stakeholders that will be negatively or positively impacted by the proposed project and involve all stakeholders in the ESIA process by expressing their views and concerns;
- To identify stakeholders' main concerns regarding the proposed project
- Specifically

    1. Identification of main project alternatives;
    2. Identification of ESIA study boundaries in terms of spatial, temporal and institutional aspects
    3. Identification of information requirements with respect to data requirements, tools and techniques for impact identification, predicting and evaluation
    4. Development of effective methods of approaching the ESIA study with respect to impact identification, prediction and evaluation
    5. Defining the terms of reference for the ESIA study.

Details of the documents reviewed are presented in the bibliography section. The consulted stakeholders and their signatures are presented in Appendix 3. A summary of issues raised by stakeholders is presented in Chapter 5, with details in Appendix 4. Samples of notices that were posted at strategic places at the project site and advertisements in various newspapers are presented in Appendix 2. Stakeholder's issues and concerns were included in the Terms of Reference, which were developed and approved by NEMC.

2.4 OBJECTIVE OF THE ENVIRONMENTAL IMPACT STUDY

The objective of updating the Environmental and Social Impact Assessment (ESIA) of Farkwa Dam aims to document significant modifications in the prevailing biophysical and socioeconomic baseline conditions, incorporating the environmental and social risks and impacts associated to the added project components, identify and assess potentially negative and positive environmental and social impacts of the modified Project scope. This assessment is intended to be used for decision-making by local authorities, lenders and internally by the IA. Additionally, the review and update will take into consideration the AfDB –ESAP (revised 2015) and the amended EIA and Audit Regulation of 2018 of Tanzania. The Terms of Reference provided the specific objectives of the esia as follows:

a) To establish baseline current information on both natural and built environment including socio-economic, physical environment of proposed water supply project;
b) To evaluate potential alternatives;
c) To identify, predict and evaluate foreseeable environmental and social impacts and risks, both beneficial and adverse that may be posed by proposed project;
d) To incorporate all issues related to additional land acquisition and resettlement in order to recommend the review of the existing Resettlement Action Plan (RAP);
e) To identify the appropriate and proportionate environmental and social mitigation measures to prevent, minimize and/or compensate the potential negative impacts and promote potential positive impacts;
f) To develop the ESMMP, for the construction and operation phases for all the planned constructions works and associated facilities.

g) To identify key stakeholders, the roles and responsibilities of the project implementation entity (PIE), implementing agencies and other stakeholders, legislative and regulatory requirements for the implementation of the ESMP
h) To inform statutory and public stakeholders about the potential impacts as well as risks and opportunities of the project and about the proposed mitigation measures.
i) To conduct an environmental and social safeguards capacity assessment for all the key project implementation entities; and recommend measures to address identified gaps to meet the required capacity for effective ESMP and RAP implementation.
j) To review the proposed project implementation mechanism focusing on the adequacy and availability of the required environmental and social safeguards capacity for effective ESMP and RAP implementation.

2.5 APPROACH AND METHODOLOGY OF THE ESIA STUDY

The same methodology used during the previous assessment was adopted to updated this ESIA report. The methodology used for updating the ESIA was commensurate with the Environmental Management (EIA and Audit) (Amendment) Regulations, 2018. This Updated ESIA was undertaken based on checklists complimented by past experience of the Consultants and through discussion with Ministry of Water staff, DUWASA, local government officials and communities in the vicinity of the project site.

This Updated ESIA were done both as a desktop study and field work. It involved review of literature/documents and field studies at the project site to gather information and data on various aspects of the project. The environmental assessment required consultations with a number of stakeholders including responsible Ministries, NGOs and relevant authorities in Farkwa Ward; Dodoma City, Chemba District and Bahi District, Dodoma Region. The study adopted the following approach:

2.5.1 Study Team

A multi-disciplinary team of experienced scientists and environmental professionals was assembled to carry out the required resource assessment, generation of baseline data, determination of potential impacts and recommendation of mitigation measures. An interactive approach among the environmental team members and other project professionals was adopted. The names of the members of the study team and their responsibilities are provided in the executive summary.

The team utilized the checklist for data gathering, analysis, and presentation whereby team members conducted the reconnaissance investigations together to determine the critical elements for analysis and the issues to be highlighted for the design and planning process. Team meetings were held to discuss the progress of investigations and analyses and facilitate integration of data toward an understanding of the systems at work in both the natural and built environment.

2.5.2 Site Visits

The field visit for new sites was conducted by TRES Team from 02nd August to 06th August 2021 and area visited includes dam area, water treatment plant area and conveyance to Chemba. The objective of the site visit was to familiarize with the project requirement, to develop a sense of common understanding on the scope of the assignment, to identify key stakeholders, to develop tools for carrying out the assignment and to develop a concise time plan. Other previous review was conducted from 03rd to 17th November 2013 and involved four different teams (i.e. Environmental Impact Assessment experts,

Hydrology, Flora and Fauna, and Socio-economic). The third site visit was conducted from 09th March to 20th March 2014.

2.5.3 Communications with stakeholders

2.5.3.1 Identification of stakeholders

The identification was based on the role and relevance of an organization, group or individual to the proposed project. Some of the stakeholders such as national authorities e.g. relevant Ministries/Departments/Agencies within VPO/NEMC, Ministry of Land Housing and Human settlements, Internal Drainage Water Basin (IDWB) Board (IDWB head office in Singida Municipality and IDWB sub-office in Dodoma City), Central Zone Irrigation head office Dodoma, Central Zone Irrigation sub-office at Bahi, Dodoma Urban Water Supply and Sanitation Authority (DUWASA), Tanzania National Roads Agency (TANROAD), Tanzania Electric Supply Company Limited (TANESCO), Dodoma Regional Administrative Secretary (RAS), Capital Development Authority (CDA), Dodoma Municipal Council, Chemba District Council, Bahi District Council, Kondoa Township Water Supply Pump House office, Farkwa Ward Office, Mombose Village Council, Bubutole Village Council etc. were pre-determined based on the nature of the project, while others and affected groups at the proposed project site and area of influence unfolded as consultations went along. List of stakeholders is found in appendix 3 of this document.

2.5.3.2 Involvement of Stakeholders

The ESIA study applied different participatory methods to involve all the relevant stakeholders. The consultant ensured that all the concerned parties were given adequate opportunity to participate in the scoping exercise. One-to-one interviews with individual based upon a list of general topics or questions and partly based on an open discussion, were conducted. Focused group discussions with individual stakeholder or representative of an organization, and project affected people were also used to gather information.

In establishing the views of the public concerning the proposed project, the consultants provided introduction letter addressed to each stakeholder briefing the project, need for ESIA and asking the stakeholder to freely raise their concerns to the Consultant. Public notices were posted on strategic places requesting stakeholders who did have opportunity to raise their concerns to do so through written or verbal communications. Furthermore, notices were published in both English and Kiswahili newspapers, see Appendix 2.

2.5.3.3 Identification of stakeholders' concerns

Through interviews, discussions and other communication channels the stakeholders pointed out issues and concerns needs to be addressed by the ESIA study. An issue raised by one individual or a group of people were cross-checked by discussing it over with other groups (triangulation). Stakeholders' views were also sought on their acceptance or supportiveness of the project in the area. Key issues raised by each stakeholder group were summarized in this ESIA. Details of stakeholders consulted, record of main issues raised, names and signatures of people consulted (Chapter 5 and Appendix 3).

2.5.4 Physical Environment

Information was gathered on the existing physical environment, particularly as related to geology, topography, soils, drainage, water quality, air quality and noise.

2.5.4.1 Climate

The climate information such as rainfall was obtained from the feasibility study and the Tanzania Meteorological Agency.

2.5.4.2 Geology, topography, soils

Information on the geology, topography, soils, was obtained by compiling data from existing reports and source agencies. Aerial photos, satellite imagery and other published maps were also examined. Field work was carried out to augment and verify existing information relating to geology and soils and to obtain first-hand knowledge of the topography.

2.5.4.3 Hydrology and drainage

Surface and ground water characteristics were assessed using field investigation as well as maps and data from previous reports. Field investigation was carried out to determine and verify all the existing inflows into the Bubu River, including both natural and man-made features, assessment of drainage issues, sediments transfer and its impact to the dam, interviews with local community members, and round-table discussions with stakeholders.

2.5.4.4 Noise and air quality

The approach taken in determining existing condition relating to noise and air on site was to conduct a research for available historic data. The findings revealed that there were no available data from the site. Measurements were made using standard calibrated instruments (see results in chapter 4).

2.5.5 Biological Environment

As a part of the scoping, EIA and review works for the proposed Farkwa dam and associated distribution facilities, extensive biological investigations were conducted, with emphasis on fauna both terrestrial and aquatic including avifauna, mammals, herptiles and fish within and around the proposed site. A strategic baseline survey of the subject site was carried out for the purposes of investigating the faunal status in the proposed project area at Farkwa dam and associated distribution facilities in Chemba.This study involved literature reviews, Google earth satellite image (GE) analysis, and field observation.

2.5.5.1 Flora

The vegetation was surveyed using both quantitative and qualitative criteria. Quantitative data for all vegetation types were obtained from standard-sized sampling plots. In total, 21 vegetation plots were surveyed where 3 plots were established in each of the vegetation type sampled i.e. miombo woodland (3), acacia woodland (3), savannah (3), acacia-commiphora (3), bushland (3), thicket (3) and riparian vegetation (3), while mountainous habitats were surveyed by observation due to difficulties (penetration / accessibility was not possible) in establishing sampling plots.

A reconnaissance survey of selected vegetations covering pure miombo woodland, acacia woodland, acacia-commiphora, savannah, bushland, thicket and riparian vegetation at the project area were surveyed. Sampling in the selected vegetations were conducted with the aim of checking and assessing the conservation status, floristic composition and degree of human disturbance / interference, and hence help to detect, reveal and predict changes as a result of the impact of proposed dam construction on vegetation characteristics. The sampling plots were of 25 × 25 m for assessing trees and shrubs where possible (some vegetation communities were of smaller size), while in each plot a nested plot of 5 × 5 m was established in the centre of the plot for assessing the herbaceous layer (grasses and herbs) following consideration of the appropriate minimal area as defined by Bloesch (2002).

Qualitative assessment was based on opportunistic collection and observations of tree, shrub and ground floras throughout the fieldwork either along the road to the next destiny or during the investigation tour on foot. The focus was on a) vegetation communities of restricted distribution, either unique assemblages or highly localized in extent and b) taxa of restricted distribution which are either endemic to a small area or are highly disjunctive. Vegetation communities of limited extent such as thickets on termitaria or vegetation patches on rock outcrops were surveyed opportunistically since their size did not allow a full sampling by a vegetation plot. Opportunistic sampling allowed to supplement the data from the vegetation plots and to collect extra plant specimens in order to facilitate taxonomic identification of species.

Opportunistic collection of botanical material was made throughout the selected vegetation habitats and throughout the survey period. This allowed species present in the proposed project area but not represented within vegetation plots to be recorded. Particular effort was put into collecting fertile material as flowers or fruit aid greatly in the identification of plant species.

In order to verify the identification of plant species recorded in vegetation plots and opportunistically, multiple specimens (up to a maximum of five) were taken whenever necessary. All un-identified specimens were pressed in the field and taken to the herbarium of the University of Dar es Salaam for identification. To guide the study a checklist of issues and parameters to follow up was developed and used throughout the exercise.

2.5.5.2 Fauna

The proposed project area was surveyed using methodology outlined in the African Forest Biodiversity (Leon *et al.,* 2002). The target groups of fauna within the proposed project area were surveyed using a combination of standardized, repeatable methods at 'zoological trap sites', surveys of dung and other animal signs along specific transects and opportunistic collection and observation on a casual basis.

Zoological trap sites: Six trapsites of 7-night duration were established in habitats representative of those found within the proposed project area. At each trapsite the following methods were employed:

i) Bucket pitfall traps: Small mammals, ground-dwelling amphibians and reptiles were sampled using three linear transects, each consisting of buckets and a 'drift fence' (figure 2.2). Eleven 20 litre plastic buckets were placed 5m apart and sunk flush to the ground to form each line. A piece of plastic sheeting approximately 0.5m high was erected perpendicular to the bucket line to act as the drift fence, channeling animals moving into the area from either side towards the buckets. Each line was placed no more than 50m apart but was located in order to encompass as great a diversity of micro-habitats as possible. Detailed habitat notes were taken for each pitfall trap. Traps were checked early each morning for the

duration of the trap-site and data recorded on standardised data sheets regarding the identification of each animal captured.

Figure 2.2: Bucket pitfall traps installed in one of the habitats (wooded acacia) at Mombose village

ii) Sherman traps - 36 Sherman traps were arranged around each pitfall trap line (18 each side) at regular spacing but placed in advantageous spots where small mammals would frequent – such as in dense leaf litter/ shrubs and under logs and tree bases. The traps were baited with fried small fish "dagaa" in the afternoon to catch small mammals, which are predominantly nocturnal. They were left closed during the day to ensure no animal was trapped in the metal box in the heat of the day. Captures were identified using field guides, given a mark recapture code and released. Where positive identification could not be made voucher specimens were taken for taxonomic verification.

Opportunistic collection and observations - During these site visits, an account of the fauna composition of the site was recorded when wildlife or their indicators (dung, feathers, footprints or nests) were encountered when walking through the site.

Interviews and review of secondary information - Formal and informal interviews with local people, farmers and government officials were conducted in order to collect factual information on issues of concern regarding wildlife and domesticated animals in the area. Analysis of secondary information included a detail review of the project brief for the proposed project and the pre-feasibility reports

Dung and sign surveys - More cryptic animals were surveyed along six transects of varying length. The transects ran at six different directions i.e. North, north-east, west, south-west, south-east and through proposed mountain islands within the project area. Either side of the central transect line a 2m wide strip was searched for any animal dung, tracks, paths, burrows, diggings, feathers or other signs. All signs of animals (figure 2.3 – 2.5) were recorded and habitat notes were taken for each 50 m stretch of transect.

Figure 2.3: Dik dik (Madoqua kirkii) droppings recorded in wooded acacia habitat

Figure 2.4: Rock hyrax (Procavia capensis) droppings recorded in mountain habitats

Figure 2.5: Scrub hare droppings recorded during the study

Point count method- Bird survey - Point count stations (the positions from which the counts were done) were laid out within the study area in different habitats. Before starting the count at each station, the researcher waited for two minutes to allow birds to settle down following the observer's arrival. At each point all individual birds seen or heard at a distance up to 50 metres were recorded making a radius of 50 metres at each point. Counts were made for 10 minutes at each point and only birds within 50 m distance were recorded. Points were located in dung and sign survey transects to avoid encountering the same birds. However, opportunistic observations through walks around the site were used as a supplement in birds sampling.

Fish sampling / survey - Sampling was done through combination methods particularly interview, scoop nets and seine nets both within proposed project area (Bubu and Mkinki rivers) and outside Bahi swamp (recipient of Bubu river). Rivers and swamp were all dry except for some few shallow pools; this necessitates the use of opportunistic sampling. Scooping was done randomly at different parts of shallow pools. Nets were set early in the morning to allow enough time for catching (figure 2.6). Cages of local fishermen were also used to collect samples in Bubu River, while couple of abandoned cages was recorded at the dried Bahi swamp. Collected samples were identified based on their common/scientific names and photographs taken. Interview was used to supplement the data collected.

Figure 2.6: Scoop netting in section of Bubu River during aquatic fauna sampling

2.5.6 Socio-economic Environment

Effective social impact assessment requires a detailed understanding of the social context of the project, so that predictions of impact can be made with reasonable certainty and practical mitigation measures developed. In addition, the impact assessment process can become an empowering mechanism for disadvantaged groups in its own right, if sufficiently participatory.

The study applied different participatory rural appraisal methods to involve all the concerned stakeholders. Interviews were held with the main stakeholders in the Dodoma Region and Chemba District as well as other institutions that, in one way or another, have interest in, or influence on the project area. Face to face interviews with individual by using semi-structured, partly based upon a list of general topics or questions and partly based on open discussion, were conducted. The local leaders and the Ward Development Committees of Mombose and Bubutole as well as key informants with different background set up i.e. elders, women, youths in the community were interviewed. Observations of the project site and surrounding habitats were made. Also some literature, in terms of reports and documents, were reviewed.

Among other topics, the interviews covered issues on the socio-economic situation in the project area, population and settlement characteristics, developments underway**,** land uses and livelihoods, infrastructures in place, water supply and other utilities, waste management practices problems faced by the community and possible solutions for those problems, as well as the opinion of the communities about the Farkwa Dam project and the effects it is likely to have on their daily activities.

2.5.7 Datasets for mapping

The data used in the PAPs mapping exercise were SPOT 5 and WorldView orthophoto RGB image composites obtained from the Ministry of Lands and Human Settlement Development of Tanzania (Table 2.1). These were used to map detailed land use and cover including housing and farmlands, the minimum mapping units of interest in the study. Other datasets were the land use and cover map by Hunting (1997), the classification scheme of which is used as reference in the development of the scheme for this mapping activity. The administrative wars and villages from the National Bureau of Statistics (Tanzania) were used to locate the administrative units in the dam.

Table 2.1: The datasets used in the mapping activity

Data Type	Year	Spectral & Spatial Resolution/scale	State	Producer
SPOT 5 2010				
Panchromatic: 2.5m, Green: 10m; Red: 10m; NIR: 10m & MIR: 20m	Orthoimage raster	Spot Image (France)		
WorldView 2 2012				
Spatial 0.46 - 0.52m; Spectral: Panchromatic, Coastal, Blue, Green, Yellow, Red, Red Edge, NIR1, NIR2	Orthoimage raster	Digital Globe (US)		

Topo sheet

	1:50,000	Georeferenced sheet	Dept. of Survey, Tanzania

Land Use and Land Cover
1997

N/A	Vector dataset	Hunting, UK

Ward (& village vector dataset
2002 (edited)
N/A

Vector dataset	NBS, Tanzania

The workflow followed the following composite steps:

2.5.7.1 Image preprocessing

All the datasets were re-projected to UTM zone 36 South, and WGS 1984 spheroid and datum to increase overlay consistency. The SPOT orthoimage covered a rectangular extent of the dam area, while that of WorldView covered a rough extent of the proposed dam and the villages of Mombose and Bubutole. These were contrast-enhanced, histogram-matched and clipped to cover the extent of coverage of the proposed dam and village PAPs coverage. These would be overlaid with edited village boundaries and a backdrop of a topographic map sheet.

2.5.7.2 Collection of field data for ground truthing in land cover and use mapping

The data collected in the field were geographical co-ordinates of houses and farmlands in Mombose and Bubutole, sample locations of different land use and cover, and public utilities and cultural sites. Houses and farm information were used to map property and that of land use/cover samples and public utilities would be used as interpretation key during land cover mapping. GPS receivers were configured to UTM zone 36 south and WGS 1984 spheroid and used to collect the location data. The houses and farms were inventoried as a whole, while the latter two were sampled purposively. Names of village names in which the coordinates were collected, and the owners of houses and farms were as well collected. For land use and cover samples, information was recorded on edaphic conditions, cover, and human influence. For each point, four photographs were taken in north to west sequence. All geographical co-ordinates were within 2 - 15m accuracy range. Local aides helped with referential information to observed phenomena.

2.5.7.3 Land use and cover classification

Land use and cover mapping begins with a classification scheme. A custom classification scheme was derived basing on the Hunting scheme (1997) and NAFORMA (2012). Six classes were extracted, beginning with homesteads and farmlands (Appendix 11).

2.5.7.4 Mapping village administrative boundaries

During ground land use/cover sampling, the co-ordinates for village boundary dermacation were recorded. They included a point marking Mombose, and Bubutole villages' confluence. The combination of these and names of locations appended in all the GPS coordinates was used to edit the village

boundaries' dataset developed by the National Bureau of Statistics and determine the number of villages within the area to be affected by the dam.

2.5.7.5 Identification of immediate and proximal PAPs distribution at the dam project area

With the resolve that all inhabitants living and owning property in Mombose and Bubutole are either immediate or proximal PAPs, a standard 60-metre buffer was created around the inundated area. This buffers size accommodates typical environmental impact of dam projects including erosion and alteration of plant habitats within vicinity of the inundation area. Also, considering that likely escalation of communicable and waterborne illnesses reaches as far as 5km from edges of the inundation area as the Grand Renaissance Dam project in Ethiopia states, (Veilleux 2013), ca. 10% of the buffer was adjusted to accommodate majority of houses and farmlands in the project-affected villages (appendix 14 and 16).

2.5.7.6 Mapping PAPs' housing and farmlands at the project area and other land use/cover at the dam

All field data was processed for input in GIS. The coordinates from the GPS receivers were cleaned in a spreadsheet and appended with names of property owners, type of property, field notes and photo numbers. The coordinates were then used to make point datasets ready for map overlays. The datasets were overlaid with high-spatial resolution imagery prepared before to check accuracy and the extent of comprehensive coverage of the property marking. Using high-resolution imagery, the farmlands were delineated to get area coverage of individual and collective farms and attribute data of the point data transferred to the farm delineations where possible (Appendix 16). The houses data was retained in point form and updated where field exercise could not locate some of the houses in the project area.

2.5.7.8 Mapping the structures within the buffered space along the proposed conveyance pipe

The initial study proposed 3 routes for the conveyance pipe. The third route passing alongside the Dodoma-Kondoa Road was selected as most feasible in this survey because the conditions that suit the establishment of the road are essentially suitable for the pipeline as well.

The vector line of the proposed pipe was adjusted to ensure that the minimum distance from the road is 30m. Then a 10m buffer on either side of the proposed pipe line was made. Within the 10m buffer space, buildings and fenced yards were delineated. The farmlands along the path were left out because of limited impact of the pipe path on them compared to buildings. Then the total areal coverage of the structures per village/locality were calculated.

2.5.8 Project description

This involved reviewing available information on the project to gain a basic understanding of the components and their operation. The documents reviewed include:

1	Tractebel Engineering S.A	2014	Farkwa Dam, Feasibility Study Interim Report No 2
2	Tractebel Engineering S.A	2013	Farkwa Dam, Feasibility Study Interim Report No 1
3	Yekom Consulting Engineers and FBNE Limited	2012	Integrated Water Resources Management and Development Plan (IWRMDP) for Internal Drainage Basin (IDB) - Water Resources Assessment Vol. 1 Water availability (Interim Report - Draft)
4	SEURECA in association with NETWAS	2003	Water Supply and Sewerage Improvements in Dodoma City - Feasibility Study, Preliminary Design

			and Environmental Impact Assessment, Volume II Water Resources Studies
5	NORMAN + DAWBARN in association with ACE Consultants	1994	Dodoma and Sewerage Phase III Final Project Preparation Report
6	WATER AND EARTH SCIENCE ASSOCIATE LTD in association with HBT AGRA LIMITED	1993	Feasibility study for the Dodoma Water Supply
7	AGRAR-UND HYDROTECHNIK GmbH	1985	Farkwa Multipurpose Dam scheme - Pre-feasibility study

2.5.9 Policy, legal and institutional framework

Policy, legal and institutional arrangement were compiled from review of documents: policies, legislation, guidelines and standards. Information and data about local by-laws, institutional structures and mandates/authority were obtained from Ministry of Water, Dodoma Urban Water Supply and Sanitation Authority (DUWASA) and local government council and relevant committees.

2.6 IMPACT ASSESSMENT

This was done by superimposing project elements onto the existing natural conditions of the project site. The methodology used considered all potential impacts using a standard matrix approach which takes into account impacts on the physical environment (e.g. air quality, soil and ground water quality), impacts on the ecology (e.g. flora & fauna) and impacts on human socio-economic setting, as shown in Table 2.2:

Table 2.2: Matrix of impact identification

Project Activity	**Physical environment**		**Ecological environment**			**Socio-economic setting**		
	e.g. Air quality	*Fresh water quality*	*Flora*	*Fauna*	*Other ecosystem components*	*Social*	*Economic*	*Cultural*
Site Selection Phase								
Activity 1								
Activity 2								
etc.								
Design Phase								
Activity etc								
Mobilization Phase etc…								

Environmental, health, safety risk (and other risks) is a measure of the potential threats taking into account the likelihood that events will cause or lead to damage or degradation and the potential severity of that damage or degradation. The Consultant used the general criteria, listed below, to evaluate significance of the identified impacts.

i. Magnitude and likelihood of impact to occur
ii. Spatial and temporal extent
iii. Potential to implement mitigation measures and controls
iv. Likelihood and degree/timescale of environmental recovery
v. Value of the affected environment/social component
vi. Level of public concerns
vii. Political repercussions of the project

The scale of negative and positive impacts that are likely to occur were determined using a range of low, medium and high, as follows:

L+ = Low positive
M+ = Medium/moderate positive

H+ = High positive
L- = Low negative
M- = Medium/moderate negative
H- = High negative
0 = No apparent impact

The grades for compliance and ecosystem have also been combined, as shown in figure 2.7 to arrive at an overall grade for the aspect's environmental significance, which favours the higher of the two grades.

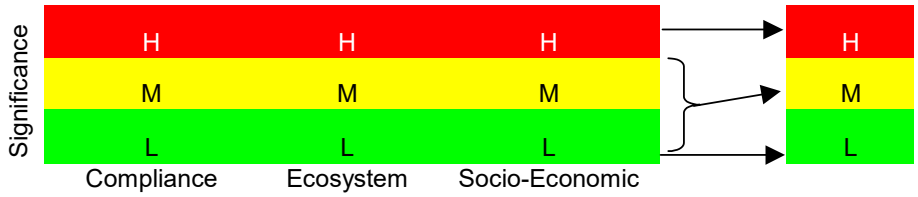

Figure 2.7: The combination of significance grades.

The resulting terms for the overall assessment for each environmental aspect were defined thus:

- **High** – Risk / impact not acceptable (if any criteria is awarded a (H) high grade);
- **Medium** – Risk / impact acceptable if managed (if the criteria have grades combining (M&L) medium and low); and
- **Low** - Risk / impact acceptable (if all criteria are (L) low, and there will be no further comment)

Presence of other activities and human settlement features at the project area, creates the possibility for cumulative effects. The assessment also considers the contribution to local and national environmental and socio-economic issues as well as global environmental issues of air quality.

2.7 REPORT STRUCTURE

The Tanzanian environmental regulations (Environmental Management (EIA and Audit) (Amendment) Regulations, 2018), three international sources of guidance on the contents of an ESIA Report have been taken into account in the preparation of this document: the AfDB Operational Safeguard 1: Environmental and social assessment, the Equator Principles agreed by leading international banks, and Annex III to the EU Environmental Impact Assessment Directive 85/337/EC (UK Department of the Environment 1989). Therefore, the ESIA report comprises the following chapters:

1 Executive Summary: This section presents in a non-technical language a concise summary of the ESIA Report including the baseline conditions; the alternatives considered; mitigation/ enhancement measures; monitoring program; consultations with stakeholders; capabilities of environmental and social units and actions to strengthen those capacities; and cost implications.

2 Introduction: This chapter indicate the purpose of the ESIA, present an overview of the proposed project to be assessed, as well as the project's purpose and needs. It shall briefly mention the contents of the ESIA Report and the methods adopted to complete the assessment.

3 Policy, legal and administrative framework: This chapter concerns the policy, legal and administrative framework within which the ESIA is carried out. It presents the relevant environmental, climate change and social policies of the Bank, co-financiers and borrowing country, as well as the national legal requirements and related constraints relevant to the project.

4 Description of project and justification: The first part of this chapter describe the proposed project, its area of influence and its geographic, ecological, social, economic and temporal context:, various project components, capacity, construction activities, facilities, staffing, working conditions, availability and source of raw materials, production methods, products, schedule of works, land tenure, land use system, potential beneficiaries, affected groups, and offsite investments that may be required.

5 Description of project environment: This chapter determine the limits of the study area that shall be defined in order to encompass all project direct and indirect impacts. The description and analysis of the physical and biological shall address relevant environmental, social and climate change issues within this area, including any changes anticipated before project implementation.

6 Stakeholder Engagement Plan: This chapter summarize the actions undertaken to consult the groups affected by the project, as well as other concerned key stakeholders including Civil Society Organizations.

7 Presentation of the alternatives considered: This part of the ESIA Report consists in analyzing the various feasible alternatives of the project, including the “without project” option. It normally comprises two sections. The first section identifies and describes the potential feasible alternatives that would allow to reach the project objectives. The second section presents a comparison of the potential alternatives on the basis of technical, economic, environmental and social criteria, as well as of public views and concerns.

8 Potential Environmental and Social Impacts: This chapter presents a detailed analysis of beneficial and adverse impacts of various components of the selected project alternative on the physical, biological and human (social, cultural and economic) environments. The methodology of assessment, based on a rigorous scientific method, shall be first presented.

9 Mitigation/Enhancement Measures and Complementary Initiatives: Appropriate mitigation measures shall be identified to prevent, minimize, mitigate or compensate for adverse environmental and/or social impacts. Moreover, enhancement measures shall be developed in order to improve project environmental and social performance.

10 ESMP: This section present management measures including actions, roles and responsibilities, timeframes, monitoring and cost of implementation:

11 Environmental Monitoring Program: This section summarize the surveillance and monitoring activities proposed in the Environmental and Social Management Plan prepared for the project. It also identifies the roles and responsibilities of stakeholders in the implementation as well as the estimated cost of the activities.

12 Cost benefit Analysis: This chapter discusses cost benefit analysis to inform the project developer to make a decision on economic sense to continue with the project or not.

13 Preliminary Decommissioning Plan: This section provides a preliminary decommissioning plan to guide closure and post closure activities for the proposed project

14 Institutional Capacities and Strengthening plan: This section outlines the adequacy of the institutional capacity within the project implementing agency to oversee the implementation of the ESMP.

15 Grievance Redress Mechanism: This section provides a procedures on how to manage the potential grievances related to any aspect of the project, to enable community members to raise concerns about possible negative impacts and to give MOW the opportunity to address those concerns.

16 Conclusion: The Conclusion specify the environmental and social acceptability of the project, taking into account the impacts and measures identified during the assessment process. It shall also identify any other condition or external requirement for ensuring the success of the project.

3 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

3.1 INTRODUCTION

This section of the ESIA Report details the policy, legal and administrative framework for the proposed project, covering national requirements as well as applicable international treaties and conventions, and internal guidelines and standards voluntarily committed to by MOW. The legal obligations relevant to the proposed project have been identified and provided below. The Ministry of Water is committed to best practice environmental performance and strives to ensure the proposed project activities are compliant with Tanzania legal requirements. A policy framework is required to provide broad guidelines on areas of focus in undertaking environmental management activities in the sector. A legal and regulatory framework is essential for providing mandate, allocating specific responsibility and accountability to key factors and stakeholders, and also prescribes and enforces specific operating environmental procedures and standards. Finally an institutional framework is required to develop policies, guidelines and plans; to ensure compliance with laws and regulations; and to monitor, review and adapt policies, plans and regulations in the light of experience.

In preparing plans, for ESIA, the specific institutions take account of location, cumulative and strategic development issues, and define development objectives, economic and environmental standards and targets, and decision criteria. Without such a context the findings of any ESIA will have little meaning; the decision criteria will be inconsistent, and mechanisms for ensuring compliance with any recommendations will be lacking. In particular, there will be no mechanism for addressing cumulative and incremental environmental issues. The project for which this ESIA was prepared needs to comply with the African Development Bank Operational Safeguard 1 Environmental and Social Assessment, which governs the process of determining a project's environmental and social category and the resulting environmental and social assessment requirements; the Equator Principles agreed by leading international banks, Annex III to the EU Environmental Impact Assessment Directive 85/337/EC (UK Department of the Environment 1989) and Tanzania's national environmental policy and legislation. The legislation applicable to this project addresses two important aspects of environmental quality and proper management of natural resources.

For the appropriate implementation of the proposed project, the MoW and associated contractors are recommended to observe the policies, legislation and administrative issues pertaining to the environmental management as indicated below. This chapter addresses policies, laws, regulations, strategies and institutional arrangement that are relevant to the construction of Farkwa Dam, Water Treatment Plant and Water Conveyance System to Chemba and Dodoma City.

3.2 NEED FOR ENVIRONMENTAL IMPACT ASSESSMENT

Environmental Impact Assessment is one of the planning tools which are used to facilitate and promote sustainable development by integrating environmental consideration in the decision making process and ensuring that unnecessary damage to the environment is avoided. It has also to optimize resources use and management opportunities. Due to the importance of Environment Impact Assessment, most sector policies and legislation have incorporated the requirement of undertaking Environmental Impact Assessment prior to the implementation of development projects. The next section will discuss relevant sector policies and legislation relevant to the proposed project.

3.3 RELEVANCE POLICIES

The Tanzania government has been developing and reviewing national policies to address and anchor environmental management in the sectors. Among others, the objective of these policies is to regulate the development undertaken within respective sectors so that they are not undertaken at the expense of the environment. The relevant sectoral and cross – sectoral policies that address environmental management, as far as this project is concerned and which form the corner stone of the present study, are briefly discussed below:

3.3.1 The National Environmental Policy (2004)

The National Environmental Policy document provides framework for making the fundamental changes that are needed to bring consideration of the environment into the mainstream of the decision making processes in the country. It provides for the overall sectoral and cross-sectoral coordination of environmental management activities in various related government departments. The policy provides the framework for the formulation of plans, programmes and guidelines for the achievement of sustainable development. Chapter 4 of the NEP elaborates clearly the importance of ESIA in the implementation of the National Environmental Action Plan (NEAP). Paragraph 64 states that "*It is in the context of an ESIA regime that policy guidance on choices to maximise long-term benefits of development and environmental objectives can be revealed and decided upon. ESIA as a planning tool shall be used to integrate environmental considerations in the decision making process in order to ensure unnecessary damage to the environment is avoided*". The key objectives of the policy are to:

- Ensure sustainability, security and equity in the use of resources;
- Prevent and control degradation of land, water, vegetation and air resources;
- Conserve and enhance the natural and man-made heritage; and
- Raise awareness and promote public participation; enhance international cooperation on the environmental agenda.

The objectives of the NEP in the water and sanitation sector are geared towards achieving the planning and implementation of water resources and other developments in an integrated manner and in a way that protects water catchment areas and their vegetation. This will be achieved by conducting ESIAs, and undertaking appropriate mitigation measures, improving management and conservation of wetlands, promoting technology for effective and safe water use, particularly for water and waste water treatment and recycling, and instituting appropriate user-charges that reflect the full value of water resources. This project is thus in line with the NEP aspirations as its principal activities are to ensure clean and safe drinking water through well engineered water treatment systems.

3.3.2 The Land Policy (1995)

The National Land Policy promotes and ensures a secure land tenure system to encourage the optimal use of land resources, and to facilitate broad-based social and economic development without upsetting or endangering the ecological balance of the environment. The Policy also advocates the protection of land resources from degradation for sustainable development. Among other things, the policy requires that project development should take due consideration the land capability, ensures proper management of the land to prevent erosion, contamination and other forms of degradation. Environmental Impact

Assessment for this project is intended to identify if there is potential for the adverse impact and to propose means for mitigating them. Land ownership and land utilization issues related to the proposed project have been addressed in the ESIA study in response to this Policy.

3.3.3 The National Water Policy (2002)

This policy is administered by the Ministry of Water and is the national policy to guide water utilization and prevention against pollution. Any planned development is required to be in line with this policy and in addition is required to maintain environmental water flow and prevent or avoid activities that cause surface or groundwater pollution. The main objective of this revised policy is to develop a comprehensive framework for sustainable development and management of the Nation's water resources, in which an effective legal and institutional framework for its implementation will be put in place. This framework promotes the optimal, sustainable and equitable development and use of water resources for the benefit of all Tanzanians, based on a clear set of guiding principles. The policy provides for beneficiaries participation in water supply schemes and addresses cross-sectoral interests in water, watershed management and integrated and participatory approaches for water resources planning, development and management. The policy provides a shift of Government roles from service provider to that of coordination, policy and guidelines formulation, and regulation.

Public consultations conducted for the cause of the ESIA for this project brought stakeholder participation in line with the policy objectives. Furthermore, Section 4.42(iii) of the Water Policy states that *"development of large water schemes including construction of dams, large rainfall harvesting schemes, water intakes, river diversion works, pumping stations, water well drilling, groundwater abstraction and use, and inter-basin water transfers must meet objectives of water resources management, and will be subject to a permit and an Environmental Impact Assessment (EIA)"*. This section implicitly emphasizes the ecological aspects of water management and the need to ensure water allocation to maintain ecosystem health. This ESIA study for the proposed construction of Farkwa Dam, Water Treatment Plant and Water Conveyance System to Chemba and Dodoma City is therefore in line with the Water Policy directives.

3.3.4 The National Energy Policy (2015)

The policy focuses on utilization of various energy resources including water, forests, gas, coal, petroleum, sun and wind in a sustainable and environmentally friendly manner. The policy states that energy is a prerequisite for the proper function of nearly all sub sectors of the economy. It is an essential service whose availability and quality can determine the success or failure of development endeavors. One major objective of the policy among others is to prevent degradation of land, water, vegetation and air, which constitute our life support systems, and to conserve and enhance our natural and man-made heritage, including biological diversity of the ecosystem of Tanzania." It also recognizes the importance of public awareness and understanding of the linkages between environment and development. The policy promotes environmental management for energy production in the sense that energy production should minimize environment impacts and adhere to environmental requirements. The MoW will adhere to the objectives of this policy.

3.3.5 The National Fisheries Sector Policy and Strategy Statement (1997)

The overall goal of the national Fisheries Sector Policy and Strategy Statement is to promote conservation, development and sustainable management of the fisheries resources for the benefit of

present and future generations. Chapter 3: page 11 of the policy states that: “to protect the productivity and biological diversity of coastal and aquatic ecosystems through prevention of habitat destruction, pollution and over exploitation: develop environmental and social impact assessment (ESIA) guidelines and ensure that ESIA is carried out and taken into consideration in all fisheries sector projects “.

The policy recognizes a need to change attitudes towards fisheries resource management and practices as well as the need to manage, conserve and develop them for the benefits of all. The proposed project will enhance economic development through efficient use of available fisheries resources enhance knowledge on fisheries resource base.

3.3.6 The National Forestry Policy (1998)

The national forest policy is based on macro-economic, environmental and social framework. Its overall aim is to manage Tanzania’s forest resources as a national heritage on an integrated and sustainable basis to optimize their environmental, economic and social and cultural values. The policy drives towards implementing the directives contained in the National Environmental Policy (1997) in regard with forest resources management. For instance, the forest policy advocates the conduction of ESIA for development projects that will affect forest reserves including services crossing them.

The National Forest Policy is relevant to this project because of the coverage of forest at the project area which can be affected by large scale water abstraction. The Policy encourages ensuring ecosystem stability through conservation of forest biodiversity, water catchments and soil fertility, and enhancing national capacity to manage and develop the sector in collaboration with other stakeholders. A cross-sectoral collaboration will ensure that the proposed project will not affect the forests downstream.

3.3.7 The National Wildlife Policy of Tanzania (2007)

The Wildlife Policy 2007 intended to better address the problems and obstacles that have plagued wildlife management in Tanzania. Protection, sustainable utilization, management and development of wildlife resources are key areas emphases by the new wildlife policy. These are considered as strategies for ensuring that wildlife in Tanzania perpetuate to benefit the current and the future generations. Further the Policy stresses the essence of managing all Protected Areas strictly according to GMPs from which Action Plans will be drawn for control, regulation, administration, development and management, for purposes of striking a balance between preservation and use of all resources.To ensure sustainable of utilization of the Wildlife, the policy requires any development close to the Protected Areas such as Swagaswaga Game Reserve to conduct an Environmental Impact Assessment in order to minimize negative impacts. The MoW by carrying out this ESIA is demonstrating its readiness to observe the objectives of the National Wildlife Policy.

3.3.8 The National Mineral Policy (1998)

At the project site the potential for clay deposits, adequate for the use as impervious core materials, is considered to be low. So materials will be extracted somewhere else and bought to the project area. The National Mineral Policy requires that mining activities are undertaken in a sustainable manner. Also the policy recommends land reclamation after mining activities. As far as this project is concerned, mining activities refer to quarrying and gravel extraction activities for dam construction and filling the project area. Therefore, extraction of construction materials from quarries and borrow pits for construction of the Farkwa Dam should be done in a manner that do not environmentally contravene the policy provisions.

3.3.9 The National Agriculture Policy (2013)

The policy objectives among others stress on ensuring food security through increased productivity, increased incomes, to promote and support private sector participation and to promote access to financial credits. Also focuses on addressing challenges accruing from the changing environment conditions and land degradation, which are serious concerns for agricultural production. The major theme is the conversion of land into an economic asset to which all citizens should have equal access, especially in response to the vulnerability of smallholders and livestock keepers who do not produce a surplus. The focus is therefore on the commercialization of agriculture so as to increase income levels and alleviate poverty.

For the project catchment area, a concern is that the future growth and expansion of areas under cultivation may accelerate shifting cultivation and further damage natural forests, upstream of the water abstraction points. The project, in the long term, would need to assist to develop more sustainable best practices in the catchment. This could include elements such as: improved land husbandry, soil erosion control, diversification of agricultural crops, minimize encroachment on public lands and wetlands, improve water use efficiency of irrigation, promote integrated approach through better land use planning. Under the current policies major water users in the basin are obliged to contribute to such as activities.

3.3.10 The National Human Settlements Development Policy (2000)

The overall goal of the National Human Settlements Development Policy (NHSDP) is to promote the development of sustainable human settlement and to facilitate the provision of adequate and affordable shelter to all people, including the poor. The policy outlines a number of objectives including environmental protection within human settlements and protection of natural ecosystems against pollution, degradation and destruction. The NHSDP recognizes the role of the NEP and other sector policies in achieving urban development. Thus the NHSDP identifies the need for co-ordination and co-operation with other sectors and stakeholders, including CBOs, and NGOs in urban development planning. The NHSDP recognizes environmental planning and management as one of the broad human settlement issues. According to this Policy; “environment means the physical, economic and social conditions in which people live, influencing their feelings and development”. In that regard, NHSDP identifies environmental protection as one of the strategic issues in human settlement planning and development.

Among the objectives of this policy that relates to the water sector are to improve the level of the provision of infrastructure and social services for the development of sustainable human settlements and to make serviced land available for shelter to all sections of the community. Such infrastructure and services constitute the backbone of urban/rural economic activities. Clean and safe water is among the basic social services for sustainable human settlements and therefore this project supports the policy’s goal.

3.3.11 The National Construction Policy (2003)

The construction project such as proposed project is among key areas embraced by the construction policy. Among the major objectives of the policy, which support sustainable construction sector include: to promote application of cost effective and innovative technologies and practices, to support socio-economic development activities such as water supply, sanitation, shelter delivery and income generating activities and to ensure application of practices, technologies and products which are not harmful to both

the environment and human health. Through this ESIA, MoW is expected to abide to the relevant provisions of the policy to ensure conformity with development.

3.3.12 The National Health Policy (2017)

This Policy emphasized on the need for an adequate supply of water and basic sanitation to minimize water borne and water related diseases, which are among the major health problems in this country, and recognizes that the health of individuals, the family, and the community at large, is dependent on the availability of safe water supply, basic sanitation and improved hygiene practices. It should also be borne in mind that water resources infrastructure, such as reservoirs and canals, can provide habitats for organisms carrying malaria and bilharzia. Further the policy encourages safe basic hygienic practices in workplaces, promotes sound use of water, promotes construction of latrines and their use, encourage maintenance of clean environment; working environment which are conducive to satisfactory work performance. MoW shall observe this policy.

3.3.13 The National Policy on HIV/AIDS (2001)

The policy provides a framework for leadership and coordination of the National multi-sectoral response to the HIV/AIDS epidemic. One of the major objectives of the policy is to strengthen the role of all public and private sectors, NGOs, faith groups, CBOs and other specific groups to ensure that all stakeholders are actively involved in HIV/AIDS issues and to provide a framework for coordination and collaboration. The policy recognizes that HIV infection should not create discrimination in relation to education, employment, health and any other social services. Pre-employment HIV screening should not be required. For persons already employed, HIV/AIDS screening, whether direct or indirect, should not be done. HIV infection alone does not limit fitness to work or provide grounds for termination. HIV/AIDS patients are entitled to social welfare benefits like other patients among the employees. HIV/AIDS information and education targeting the behaviour and attitudes of employees and employers alike shall be part of HIV/AIDS intervention in the workplace. Establishment of the proposed project will result into social interactions among workforce especially during construction and therefore MoW need to adhere to the policy.

3.3.14 The National Women and Gender Development Policy (2000)

This policy aims to improve opportunities for women and men to play their full roles in society, recognizing specific gender requirements. The policy aims to minimize shortcomings related to limited participation of women in most economic development activities, and focuses on using available resources to increase incomes, eradicate poverty and improve living standards. The policy also recognize and emphasis on creating awareness on how environmental degradation increases poor women's burden. This project will respond to the policy by ensuring equal opportunities in employment during construction phase.

3.3.15 The National Employment Policy (2008)

The major aim of this policy is to promote employment to Tanzanians. Relevant sections of this policy are (i) 10, which lays down strategies for promoting employment and section 10.1 is particularly focusing on industry and trade sectors (ii) 10.6 which deals with employment of special groups i.e. women, youth, persons with disabilities and (iii) 10.8 which deals with the tendencies of private industries to employ expatriates even where there are equally competent nationals. MoW should promote this policy. It is one of the objectives of the proposed project to have notable trickle down impact to the locals through various

means one of which is direct employment. The project will provide direct employment to the locals in the area without specifying the number as it is not known how many technical workers will be available for the technical positions. In total the project will employ about 300 workers during construction and special attention will be to the marginalised groups to include disabled, women, and youth while strictly avoiding employing children as required by the law. Thus, the project is in line with the objectives of the policy.

3.3.16 The National Transport Policy (URT, 2003)

As the project will be involved in transportation of construction materials the objective which is relevant to this project calls for sufficient emphasis on all aspect of environment protection and management at the design, development, and operation stages of transport infrastructure, to ensure sustainability. The policy mission is to develop safe, reliable, effective, efficient and fully integrated transport infrastructure and operations which will best meet the needs of travel and transport at improving levels of service at lower costs in a manner, which supports government strategies for, socio-economic development whilst being economically and environmentally sustainable. Also this policy has been fulfilled by carrying out the ESIA which is presented in this report.

3.4 NATIONAL PLANS AND STRATEGIES

In order to guide national development more effectively and systematically, Tanzania has prepared a number of strategies aiming at operationalising the various policies in key sectors. Some of the strategies that have a bearing on proposed project are:

3.4.1 The Tanzania Development Vision 2025

The Composite Development Goal for the Tanzania Development Vision 2025 foresees the alleviation of poverty through improved socio-economic opportunities, good governance, transparency, and improved public sector performance. These objectives not only deal with economic issues but also include social challenges such as education, health, the environment, and increased involvement of people working for their own development. The thrust of these objectives is to attain sustainable development among the people.

The target of the National Development Vision 2025 for water and sanitation sector is universal access to safe water by 2025 through involvement of the private sector, empowering local government and communities, and promotion of broad based grass root participation in mobilization of resources, knowledge and experiences, with a view to stimulating initiatives at all levels of society. The proposed project is in line with this policy.

3.4.2 The Third National Five Year Development Plan (FYDP III; 2021/22 – 2025/26)

This Plan is the final Plan in the implementation of the Tanzania Development Vision 2025 as the National overall development framework. The Plan is a continuation of Government's efforts in enduring exertion to further improve the standard of living for all Tanzanians. The have a theme of realising competitiveness and industrialization for human development that aims to increase efficiency and productivity in manufacturing using the resources available in abundance within the country. Areas of inspiration in the Plan include: Increasing the country's capacity for production; building a competitive economy that will stimulate the country's participation in trade and investment; and stimulate human development. By

investing on this project the project proponent is promoting the development in Tanzania which is the main focus of the FYDP III.

3.4.4 The Rural Sector Development Strategy (2001)

The strategy acts as a platform on which sector ministries' policies are coordinated, harmonised, and integrated to give rural development process a holistic view. In the case of the Water Sector, the Rural Development Policy states that;

- central government and local governments will pursue and/or promote an integrated approach to rural water supply and sanitation, productive activities and human consumption;
- central government, local governments and other stakeholders will mobilise funds and attract private resources to ensure increased supply of safe water within household proximity; and
- central government will create a conducive environment for private sector participation in developing rainwater-harvesting technology appropriate for rural areas.

The Rural Development Strategy, and the new implementation arrangements such as the proposed Farkwa project and requirements, are in compliance with the overall principles of reforms in the public sector, and the Local Government Reform Policy.

3.4.5 The National Water Sector Development Strategy (2006 to 2015)

The National Water Sector Development Strategy (NWSDS) sets out how the Ministry responsible for Water will implement the National Water Policy to achieve the NSGRP (MKUKUTA) targets. This will, in turn, guide the formulation of the Ministry's Harmonised National Water Sector Development Plan and the Water Sector Development Programme as inputs into the Medium Term Expenditure Framework financial planning process. The NWSDS support re-alignment of the water related aspects of other key sectoral policies (for example, energy, irrigation, industry, mining, and the environment) with the National Water Policy, and to provide a focus on specific roles of the various actors through clearly defining roles and responsibilities and hence the removal of duplications and omissions.

Further, the frameworks underscore separation of service delivery and regulation to ensure fair play among the various actors and sectors through measures that are in line with the National Water Policy of 2002, taking into account the provisions of the Local Government Reform Policy. The strategy further stress that water resource management practices should focus on preventing negative environmental impacts of human activity, ensuring that water is used beneficially and efficiently, and ensuring that water related activities aim at enhancing or causing least detrimental effect to the natural environment.

3.4.6 The National Water Sector Development Programme (WSDP) of 2006-2025

The main focus of this Programme is to strengthen sector institutions for integrated water resources management and improve access to water supply and sanitation services, which ultimately envisaged at attaining the Millennium Development Goals and targets of the National Strategy for Growth and Poverty Reduction MKUKUTA II. The Programme is centred on commercial service provision including private sector participation in urban areas and community ownership and management in rural areas. It also sets out to implement "demand driven approaches". Its first phase was supposed to last until 2012, but was extended. The programme "promotes the integration of water supply and sanitation with hygiene education." The WSDP has four components:

- Water resources management;
- Institutional development and capacity building;
- Rural water supply and sanitation - as part of this component comprehensive district water supply and sanitation plans are to be developed;
- Urban water supply and sanitation - which aims at the execution of utility business plans in regional and district capitals, as well as at the implementation of national and small towns water schemes

3.5 PRINCIPAL LEGISLATION

In addition to the above policies, there are a number of legal and regulatory frameworks that the proposed project must comply with and which this ESIA study has taken into consideration. The Environmental Management Act (No. 20, of 2004) is the principal legislation governing all environmental management issues in the country. Within each sector, there are sectoral legislations that deal with specific issues pertaining to the environment. Some of the relevant legislation and regulations that are relevant in the management of the environment include the following:

3.5.1 The Environmental Management Act, Cap 191

The Environmental Management Act (EMA) Cap 191 (URT, 2004) sets out a range of measures for sustainable management of the environment, prevention and control of pollution, waste management, and direct mechanisms for compliance. Section 7 (2) states that *"the Act provides a legal framework necessary for coordinating harmonious and conflicting activities with a view to integrating such activities into an overall sustainable environmental management system by providing key technical support to sector Ministries."* The act is therefore a cross-sectoral piece of legislation and supersedes other written laws with respect to environmental management. Specifically, Section 232 stipulates: *"Where the provision of this Act is in conflict or is otherwise inconsistent with a provision of any other written law relating to environmental management the provision of this Act shall prevail to the extent of such inconsistency".* All matters pertaining to environment management may be governed by sectoral legislation, as long as it does not conflict with the EMA (2004).

Part VI of the EMA deals with Environmental and Social Impact Assessment (ESIA) and other Assessments, and directs that ESIA is mandatory for all development projects. Section 81(2) states that "An Environmental Impact Assessment study shall be carried prior to the commencement or financing of a project or undertaking". Also the EMA introduces a concept of the right of Tanzanians to a clean, safe, and healthy environment and their right to access various segments of the environment for recreational, educational, health, spiritual, cultural, and economic purposes (section 4 (1) and (2). The Act imposes an obligation on developers to:

- As land user and occupier to protect, improve and nourish the land and use it in an environmentally sustainable manner, (S. 72)
- Abstain from discharging any hazardous substances, chemicals, oils or their mixture into waters or into any segment of the environment (S.110)
- Comply with environmental quality standards (S.141)
- Control, manage and dispose in a sound manner waste products including litter, liquid, gaseous and hazardous wastes (Part IX).

The functions of NEMC as per the EMA are mentioned in Sections 17 and 18, and include undertaking enforcement, compliance, review and monitoring of environmental impact assessments. NEMC shall specifically review and recommend to the Minister responsible for environment for approval of this environmental impact assessment statements. Under Section 25 of the Environmental Management Act, 2004, NEMC is empowered to exercise all necessary powers required to bring about compliance with any directive issued by it. However, under Section 24 of the same Act the powers of NEMC to direct other agencies in relation to enforcement and compliance can only be exercised after seeking and obtaining written authorisation of the Minister responsible for environment. In general, under the Environmental Management Act, 2004 the Minister responsible for environment is vested with extensive executive powers. In this ESIA for the proposed Farkwa Dam and Water Conveyance System project, Ministry of Water is the ESIA policy custodian. The ESIA has fulfilled this legal requirement. This ESIA is responding to the provisions of the Environment Management Act (Cap. 191) of 2004.

3.5.2 The Water Resource Management Act, 2009 (Act No. 11/2009)

This is a legislation that has repealed the Water Utilization (Control and Regulation) Act. The Act intends for the protection of the water resources and the user so that there is a balance between different uses. This Act states that the water shall not be polluted with any matter derived from such use to such extent as to be likely to cause injury either directly or indirectly to public health to livestock, fish, crops, orchards or garden which are irrigated by such water or to any product in the processing of which such water is used. In general, the Water Resource Management Act provides the legal basis among others for - water resources management at National and Basin levels; the administration to legalize, grant, modify and diminish water rights to the use of water by those entrusted with responsibilities for water resources management; to protect water rights for all legitimate water users, hence monitoring the quality and quantity of water sources; water use conflict management and water pollution control and other related issues like water construction

The relevant objective of this Act to the project is the one which states that “preventing and controlling pollution and degradation of water resources” (Part II 4 (1) (h)). Article 9 states that “any proposed development in a water resource area or watershed to which the Act applies, whether that development by a person, or organization in the public or private sector shall carry out ESIA in accordance to EMA”. Part VI Article 39 elaborates on the need to prevent pollution and the penalties to be taken against one who pollutes the water resources. Various types of waste produced during construction of the proposed Farkwa Dam and its conveyance system have the potential to pollute water resources. The Ministry of Water will take all necessary precautions to prevent any pollution from the project activities.

3.5.3 The Water Supply and Sanitation Act, 2019 (Act No. 5/2019)

This Act provide for sustainable management and adequate operation and transparent regulation of water supply and sanitation services; provide for the establishment of water supply and sanitation authorities, Rural Water Agency, National Water Fund and community based water supply organisations; provide for appointment of service providers, repeal of the Water Supply and Sanitation Act, 2009 and the Dar es Salaam Water and Sewerage Authority Act, 2001. The main aim of this law is to ensure the right of every Tanzanian to have access to efficient, effective and sustainable water supply and sanitation services for all purposes by taking into account among others protection and conservation of water resources and development and promotion of public health and sanitation; and protection of the interest of customers. Under this law, the Minister responsible for water affairs shall establish water authority and cluster water authorities in order to achieve commercial viabilities. The functions and existence of the Dodoma Urban

Water Supply and Sewerage Authority (DUWASA) and RUWASA the operators of this project, is therefore regulated by the Water Supply and Sanitation Act. This relationship makes it a principal Act for the Water supply project.

3.5.4 The Land Act, [Cap.113 R.E 2019]

The Act relates to land-use planning processes and land-use management and guidance to land ownership in Tanzania. One among other basic principle of the Land Act is to pay full, fair and prompt compensation to any person whose right of occupancy or recognized long-standing occupation or customary use of land is revoked or otherwise interfered with to their detriment by the State under the Land Act or acquired under the Land Acquisition Act. The main objective is to protect majority of citizen of Tanzania who have acquired land from either inheritance or village council allocation or clearing bush should not easily loose their land without full and fair compensation. The full and fair compensation is only assessed by including all components of land quality. Other important principle of the Land Act related to compensation; is to facilitate the operation of a market in land and regulate the operation of a market in land to ensure that rural and urban smallholders and pastoralists are not disadvantaged. To protect the smallholders and pastoralists the approach should not be to avoid land allocations to this group. Any disadvantaged group should get compensation of true land values of the land being held by any other group.

3.5.5 The Village Land Act, [Cap.114 R.E 2019]

The Village Land Act 1999 empowers the village council to manage village land as trustee managing property on behalf of the villagers and other person's resident in the village. The Village Land Act 1999 empowers the village assembly to divide the village land, occupied, used, available for occupation, community used and/or public used land, then to be known as communal village land. It will also identify land being occupied or used by an individual, family, or group of persons under customary law. Finally, the village council will identify land, which may be made available for communal or individual occupation and use, through allocation by the village council. The same Act provides mandate to the village assembly to further plan the land uses to be designated to the communal village land. The majority of people in the project are got land freely within their village land from inheritance, allocation from the village council, or by clearing land, purchase or special program.

3.5.6 The Land Acquisition Act, [Cap.1183 R.E 2019]

The Act gives powers to the President to take "Land" from private occupants for public purpose when in the public interest to do so. The Land ordinance declares all land in Tanzania "Public land" to be held by the state for public purposes. The laws vest all land in the President and grant occupancy rights to individuals, legal persons and territorial communities. The President is and empowered to revoke the "Right of Occupancy" of any landholder for the "public/national interest" should the need arises. The President can also acquire land for other national projects, like water infrastructure. The Act provides conditions to be taken into account, specifying requirements prior to the acquisition of the land such as investigation for the land to be taken, issuing notice of intention to take land and the mode in which notices will be served. It further defines the requirements for and restrictions on compensation.

The Act prescribes how compensation should be assessed for those whose interest on land has been violated and directs the Government to pay for all damage done. In case of dispute over the amount to be paid, either the Minister or the person claiming compensation may refer such dispute to the Regional Commissioner in which the land is situated and the decision of the Regional Commissioner shall be final.

The Minister should give notice of intention to acquire the land, to the persons interested or claiming to be interested in such land, or to the persons entitled to sell or convey the same. The Minister may by notice, direct the persons to yield up possession of such land after the expiration of a period of not be less than six weeks from the date of the publication of the notice in the Gazette. It is stated clearly that the President can also acquire land for other national projects, like water infrastructure.

3.6.7 The Courts (Land Disputes Settlements) Act, 2002

Every dispute or complainant concerning land shall be instituted in the Court having jurisdiction to determine land dispute in the given area (Section 3). The Courts of jurisdiction include:-

- The Village Land Council
- The ward Tribunal
- District Land and Housing Tribunal
- The High Court (Land Division)
- The Court of Appeal of Tanzania.

The Act gives the Village Land Councils powers to resolve land disputes involving village lands (Section 7). If the Council fails to resolve the dispute, the mater can be referred to the Ward Tribunal as established by the Land Act (1999) and the Village Act (1999). If any dispute will arise as a result of this project, the provision of this Act shall be observed.

3.5.8 The Fisheries Act, 2003 (Act No. 22/2003)

The Fisheries Act of 2003 repealed and replaced the Fisheries Act (1970) make provision for sustainable development of fisheries and aquaculture activities taking into account of their possible negative environmental implications. The Fisheries Act was enacted as a regulatory framework within which the fish resources would be managed, conserved and protected by protecting breeding/nesting sites as well as prohibiting the use of destructive fishing gears. Of importance to the proposed project, the Act highlights the strategies for protection and maintenance of the genetic and species diversity as well as protection of trans-boundary aquatic ecosystems.

3.5.9 The Mining Act, 2010 (Act No. 14/2010)

This Act states that “building material” includes all forms of rock, stones, gravel, sand, clay, volcanic ash or cinder, or other minerals being used for the construction of buildings, roads, dams, aerodromes, or similar works but does not include gypsum, limestone being burned for the production of lime, or material used for the manufacturing of cement. This act ensures that minerals are well controlled and Section 6(1) states that no person shall, on or in any land to which this act refers, prospect for minerals or carry on mining operations except under the authority of Mineral Right granted, or deemed to have been granted under this Act. The relevance of the Act to this project relates to the sourcing of building materials especially stones, aggregates and sand.

3.3.10 The Energy and Water Utilities Regulatory Authority Act, [Cap.414 R.E 2019]

The Energy and Water Utilities Regulatory Authority (EWURA) is an autonomous multi-sectoral regulatory authority established by the Energy and Water Utilities Regulatory Authority Act, 2001Cap 414 of the laws of Tanzania. The functions of EWURA include among others, licensing, tariff review, monitoring

performance and standards with regards to quality, safety, health and environment. EWURA is also responsible for promoting effective competition and economic efficiency, protecting the interests of consumers and promoting the availability of regulated services to all consumers including low income, rural and disadvantaged consumers in the regulated sectors.

3.5.11 The Local Government (District Authorities) Act, [Cap.287 R.E 2019]

This Act directs the registrar of villages to register an area as a village and issue a certificate of incorporation which enables the village council to become a corporate body with a perpetual succession and official seal; in its corporate name a village is capable of suing and being sued; and a village is capable of holding and purchasing or requiring in any other way any movable or immovable property. The Act gives authority to local governments to regulate matters that are local. The Project site is located within the Chemba and Bahi District Councils jurisdiction which was established and operated by this law. The councils have mandate to intervene on any local issues that may be related to the project.

3.5.12 The Local Government (Urban Authorities) Act, [Cap.288 R.E 2019]

This Act establishes urban authorities for the purposes of local government, to provide for the functions of those authorities and for other matters connected with or incidental to those authorities. Section 55 of the Act enumerates basic functions of the authorities. The functions that are relevant to the proposed project are to provide for the prevention and abatement of public nuisances or of nuisances, which may be injurious to the public health or to the good order of the area of the authority and to regulate any trade or business, which may be noxious, injurious to the public health or a source of public danger, or which otherwise it is in the public interest expedient to regulate, and to provide for the issue of licenses or permits to facilitate the regulation of any such trade or business, and for the imposition of fees in respect of such licenses. In that regard, the provisions under this act have bearing to this project.

3.5.13 The Land Use Planning Act, 2007 (Act No. 6/2007)

The Act provides for the procedures for the preparation, administration and enforcement of land use plans; to repeal the National Land Use Planning Commissioning Act and to provide for related matters. Among the objectives of the Act as given in Section 4 are to facilitate the orderly management of land use and to promote sustainable land use practices. Water development projects that affect land use and livelihood shall comply with the provisions of this Act. Any infringement on existing land use shall need consultation with land use planning authorities.

3.5.14 The Urban Planning Act, 2007 (Act No. 8/2007)

The law provides for the orderly and sustainable development of land in urban areas, to preserve and improve amenities; to provide for the grant of consent to develop land and powers of control over the use of land and to provide for other related matters. Expropriation of land for water infrastructure development and associated activities in urban areas shall comply with the provisions of this law. Under Section 3, among others the law seeks to improve level of the provision of infrastructure and social services for sustainable human settlement development. Provision of water to urban residents to be achieved by this project is thus in compliance with the Urban Planning Act.

3.5.15 The Contractors Registration (Amendments) Act, 2008 (Act No. 15/2008)

The Contractors Registration Board (CRB) is a government autonomous regulatory body established to register all types of contractors and regulate their conduct for the purpose of protecting consumers of construction services in Tanzania. The body is governed by the Contractors Registration Act No. 17 of 1997 which was amended and published as The Contractors Registration (Amendments) Act No. 15 of 2008. Among other things CRB is required to take legal action against unregistered contractors who undertake construction; installation, erection or alteration works; ensure that all construction sites are hoarded; and labour laws, occupational health and safety regulations in the construction industry are adhered to. Ministry of Water shall comply with the law requirement during the recruitment of contractors for project implementation.

3.5.16 The Engineers Registration (Amendment) Act, 2007 (Act No. 24/2007)

The Act provides restriction that no person other than a registered engineer shall engage in professional engineering work or services which includes professional service consultation, planning, designing or responsible supervision of construction or operation in connection with any public or privately owned public utilities, buildings, machines, equipment, processes works or projects where public interest and welfare, or the safeguarding of life, public health or property is concerned or involved, and that requires application of engineering principles and data. Furthermore, the Act stipulates that no person shall employ or continue to employ its professional engineer who is not a registered engineer. On executing its construction activities, MoW shall therefore appoint registered engineers and make sure that the provisions of the Act are adhered to.

3.5.17 The Standards Act, 2009 (Act No. 2/2009)

An Act to provide for the promotion of the standardization of specifications of commodities and services, to re-establish the Tanzania Bureau of Standards (TBS) and to provide better provisions for the functions, management and control of the Bureau, to repeal the standards Act, Cap.130 and to provide for other related matters. This act is relevant to this project as the quality of water to be produced by the two water treatment plants will have to abide to the standards set by TBS.

3.5.18 The Occupational Health and Safety Act No. 5 of 2003

This Act makes provisions for the safety, health and welfare of persons at work in factories and all other work places. It also provides for the protection of persons, other than persons at work, against health and safety hazards arising out of or in connection with activities of persons at work. Relevance of this Act is that the law requires employers to provide a good working environment to workers in order to safeguard their health. The employers need to perform medical examinations to determine fitness of employees before engaging them for work. Employers must also ensure that the equipment used by employees is safe and shall also provide proper working gear as appropriate. The contractor for this project shall address all safety issues and will form part of the contractual requirements.

3.5.19 The Employment and Labour Relation Act, 2004 (Act No. 6/2004)

Generally, the Act among other things intends to provide the legal framework for effective and fair employment relations and minimum standards regarding conditions of work. For example, it prohibits employment of children under 18 years of age; stipulated types of contracts that can be entered with employees; the maximum number of ordinary days or hours that an employee may be permitted or required to work; remuneration; leaves; unfair termination of employment; establishment of trade unions

branches in workplaces; etc. Since MoW and the project contractors will offer employment, it shall therefore observe these and other relevant provisions in this Act.

3.5.20 The Workers Compensation Act, 2008 (Act No. 20/2008)

An Act to provide for compensation to employees for disablement of death caused by or resulting from injuries or diseases obtained or contracted in the course of employment; to establish the fund for administration and regulation of worker's compensation and to provide for related matter. It applies to both workers in the private and public sector. For one to be compensated, the injury must either cause permanent incapacity or make the worker unable to earn full wages for at least three consecutive days. The employer is obliged to pay compensation irrespective of the cause of accident. It doesn't matter whether the incapacity or death was due to recklessness of the worker. Where injury occurs, an employee is entitled to recover medical expenses and lost wages resulting from the disability, be it temporary or permanent. The law allows for compensation to dependants or personal representatives where the worker is dead. The MoW respects the provisions of the Workers' Compensation Act and will therefore observe its requirements in addition to safety measures provided in this report.

3.5.21 The HIV and AIDS (Prevention and Control) Act, 2008 (Act No. 28/2008)

The Act provides for prevention, treatment, care, support and control of HIV and AIDS. Section 9 of the Act emphasizes on HIV and AIDS education in work place by demanding every employer in consultation with the Ministry to establish and coordinate a work place programme on HIV and AIDS for employees under his control and such programmes should include provision for gender responsive HIV and AIDS education, distribution of condoms and support to people living with HIV and AIDS. Section 31 prohibits stigma and discrimination on the ground of such other person's actual, perceived or suspected HIV and AIDS status. MoW will observe the provisions of this act especially during construction.

3.5.22 The Industrial and Consumer Chemicals (Management and Control) Act, 2003 (Act No. 3/2003)

The act provides for the management and control of the production, importation, transportation, storage, dealing and disposal of chemicals and matters concerned therewith. This legislation is relevant to this project as the water treatment plants utilize chemicals (i.e Chlorine, alum etc) and also produce chemical sludge for disposal. Therefore, this law will govern the importation, transportation, storage, dealing and disposal of those chemicals.

3.5.23 The Wildlife Conservation Act, 2009 (Act No. 5/2009)

This Act repeals and replaces the Wildlife Conservation Act Cap. 283 to make provisions for the conservation, management, protection and sustainable utilisation of wildlife, wildlife products and to provides for other related matters. Part VII of the Act proposes consumptive use of wildlife for example hunting, capture of live animals and Non-consumptive utilization such as game viewing and photographic tourism. Also the Act proposes for issuance of licenses and permits issued under the Act. Also the Act restricts entry into a protected area without proper permission, restricts carrying of fire arms; bow and arrow; prohibits willfully or negligently cause of bush fire, fell tree, hunting, dig, lay, or construct any pitfall, net, trap, snare or other device whatsoever, capable of killing, capturing or wounding any animal. This Act is relevant to proposed and its operations as the Swagaswaga game reserves is just close to the project boundaries and it is expected that wildlife will be frequenting the water dam. MoW therefore,

ensures that contacted Contractors are informed of these provisions and ensures that none of its worker is engaged in any of the prohibited acts.

3.5.24 The Road Act, 2007 (Act No. 5/2007)

This Act necessitate the developer of the project to ensure that, during implementation as well as operation of the project, all possible measures are taken to avoid or abate devastation of the environment and human health. The contractor of the proposed construction of the Farkwa Dam, Water Treatment Plant and Water Conveyance System to Chemba and Dodoma City will therefore be obliged to ensure safety of road users during the design and construction of the project.

3.6 NATIONAL REGULATIONS

3.6.1 The Environmental Management (Environmental Impact Assessment and Audit) (Amendment) Regulations, 2018

First schedule of this regulation lists construction of water dam among types of projects requiring a mandatory Environmental Impact Assessment. Since such project is likely to have significant adverse environmental impacts, an in-depth study is required to determine the scale, extent and significance of the impacts and to identify appropriate mitigation measures. Furthermore, the regulation specifically provides for procedures and guidelines for carrying out Environmental Impact Assessment in Tanzania. This ESIA has been carried out in accordance with these regulations.

3.6.2 The Environmental Management (Fee and charges) (amendment) Regulations, 2019

These Regulations specify the amount of environmental fees and charges for various operating projects as well as other fees for assessment. Of particular importance to this project is annual fees to enable the Council undertake monitoring and audits in ensuring the environmental obligation stipulated in the EIA report are adhered to during the all project phases. Thus the MoW shall adhere to these regulations by paying the required fees timely to the Council.

3.6.3 The Environmental Management (Registration and Practicing of Environmental Experts) Regulations, 2020

Section 83 of the EMA (2004) stipulates that Environmental Impact Assessment shall be conducted by experts or firms of experts whose names and qualifications are registered by NEMC. NEMC maintains a registry of EA and EIA experts. These regulations also set code of practice of the experts for which the Environmental Impact Assessment experts for this project subscribe.

3.6.4 The environmental Management (Water Quality Standards G. N. No. 238) Regulation, 2007

The objectives of the Water Quality Standards Regulations are to protect human health and conservation of the environment; enforce minimum water quality standards prescribed by the National Environmental Standards Committee; enable the National Environmental Standards Committee to determine water usages for purposes of establishing environmental quality standards and value for each usage; and ensure all discharges of pollutants take account the ability of the receiving waters to accommodate contaminants without detriment to the uses specified for the waters concerned.

3.6.4 The environmental Management (Air Quality Standards G. N. No. 237) Regulation, 2007

The regulations are made from the Environmental Management Act Cap. 191. The objective of the Air Quality Standards Regulations is to set baseline parameters on air and emissions based on a number of practical considerations and acceptable limits; enforce minimum air quality standards prescribed by the National Environmental Standards Committee; help developers such as Ministry of Water to keep abreast with environmentally friendly technologies; and ensure protection of human health and the environment from various sources.

3.6.6 The Environmental Management (Quality Standards for Control of Noise and Vibration Pollution) Regulations, 2015

The regulations were formulated under Sections 140, 147 and 230 of EMA for the control of noise (loud, unreasonable, unnecessary on unusual) and vibration pollution that annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and of the environment. Focus areas include:

- *Noise management by* owner of machinery or occupier of facility or premises to control noise and to install sound level meters for the measurements and monitoring sound.
- *Noise emission License issued by NEMC* Director General to owner or occupier of premises whose work or activity is likely to emit noise in excess of the permissible noise levels
- *Compliance order, protection order or stop order* issued by NEMC or any other empowered authority when any condition of any license or permit has been breached or
- Prevention orders and improvement notice issued by *Environmental inspector* to prevent noise and vibration pollution in an amount, concentration or manner that constitute a risk to human health or environment.
- The minister may provide a reward to any person who will report an incident of incidental, concealment or inadvertent emission or noise pollution or excessive vibration.

The objective of the Quality Standards for Control of Noise and Vibration Pollution Regulations are to protect both human health from noise and vibration hazards. In this case two categories have been defined by the regulations noise and vibration for public health hazards as well as for workers for occupational health and safety hazards. In this case minimum limits have been established for ambient environment for protection of public health and limits for protection of workers in the working environment. Thus the MOW shall adhere to these standards as stipulated in the ESMP and EMP.

3.6.7 The Land (Assessment of the Value of Land for Compensation) Regulations, 2001

These regulations, which were made under the Land Act of 1999 provide criteria for the assessment of compensation on land, as per market value for real property; disturbance allowance is calculated as a percentage of market value of the acquired assets over twelve months; and transport allowance calculated at the cost of 12 tons hauled over a distance not exceeding 20 km. The other criteria includes loss of profit on accommodation based on business audited accounts and accommodation allowance equivalent to the rent of the acquired property per month over a 36 month period. According to Regulation of 2001, the following are eligible for compensation / resettlement:

- Holder of right of occupancy (Section 22 of the Land Act of 1999);
- Holder of customary right of occupancy whose land has been declared a hazard land (Section 49 of the Land Act, 1999)

- Holder of customary land, whose land becomes granted to other person and is moved or relocated under Section 34 of the Land Act, 1999;
- Land obtained as a consequence of disposition by a holder of right of granted or customary right of occupancy but is refused a right of occupancy under section 54 of the Land Act, 1999;
- Urban or peri-urban land acquired by the President under Section 60 of the Land Act, 1999.

Relevance of these regulations is that the project proponent will be required to carry out compensation according to these regulations. The assessment of the value of land and un-exhausted improvements will be by Qualified Valuer and verified and approved by MoW. The compensation issues include - value of un-exhausted improvement; disturbance allowance; transport allowance and accommodation allowance and Loss of profits

3.6.8 The Water Resources Management (Dam Safety) Regulations, 2013 GN. No. 237 of 2013

These regulations provide for the comprehensive regulation and contain measures aimed at improving the safety of new and existing dams with a safety risk so as to reduce the potential for harm to the public, damage to property or to resource quality. The regulations assure proper planning, design, construction, maintenance, monitoring, and supervision of dams, including such preventative measures necessary to provide an adequate margin of safety. To reduce the risk of a dam failure, control measures require an owner to comply with certain directives and regulations, such as to submit a report on the safety of a dam, to repair or alter a dam, or to appoint an approved professional person to undertake these tasks. These measures are in addition to the owners' common law responsibility to ensure the safety of their dams. An approved professional person has a statutory duty of care towards the general public. The Regulations set out the activities and reporting requirements for dam safety and incorporates the requirements of the Water Resources Management Act for dam safety.

3.6.9 The Water Supply Regulations, GN No. 90 of 2013

These Regulations apply to any area designated and declared to be a Water Supply and Sanitation Authority, clustered water authority and any person providing water supply and sanitation services. These regulations stress that it is the obligation of a water authority, such as DUWASA who will be custodian of this project to apply for a license from EWURA. The Regulations provides that no water authority or person other than a community organization shall operate without a license from EWURA.

3.6.10 The Water Resources Management (Water Abstraction, Use & Discharge) GN No.190 2010

These Regulations sets out principles for regulating water abstraction, use and discharge. Water use is defined broadly, and includes taking and storing water, activities which reduce stream flow, waste discharges and disposals, controlled activities (activities which impact detrimentally on a water resource), altering a watercourse, removing water found underground for certain purposes, and recreation. In general, a water use must be licensed unless a responsible authority waives the need for a licence. The Minister may limit the amount of water which a responsible authority may allocate. The Minister may differentiate between different water resources, classes of water resources and geographical areas

3.6.11 The Water Resources Management (Registration of Water User Association) Regulations GN. No. 22 of 2010

These regulations deal with the establishment and powers water user associations. Water user associations operate at a restricted localized level, and are in effect co-operative associations of individual water users who wish to undertake water-related activities for their mutual benefit. A Water Users Association is an association formed by the agreement of the majority of groups of water users for the purposes of; management, distribution and conservation of water from sources used jointly by members of the water users association, acquiring and operating water permits, resolve conflicts over water use, collect water user fees on behalf of the Basin Water Board and represent special interests and values arising from water used for a public purpose, such as in an environment or conservation area or for the purpose of managing a Groundwater controlled area. The associations are legal entities registered by the Basin Water Board guided and bound by their own constitutions and are led by management committees as stipulated in these regulations.

3.6.12 The Environmental Management (Hazardous Waste Control and Management) Regulations, 2019

The Regulations requires that every person living in Tanzania shall have a stake and a duty to safeguard the environment from the adverse effects of hazardous wastes and to inform the relevant authority on any activity and phenomenon resulting from hazardous waste that is likely to adversely affect the environment and human health. Further the regulations require a generator of hazardous waste to be responsible for the sound management and disposal of such waste and shall be liable for damage to the environment and injury to human health arising thereby. Despite that the proposed project is not expecting to produce hazardous waste, the MoW shall observe the provisions of these regulations and comply in case there is any hazardous waste generated.

3.6.13 The Environmental Management (Solid Waste Management) Regulations, 2009

The regulation state that every person living in Tanzania shall have a stake and a duty to safeguard the environment from the adverse effects of solid wastes and to inform the relevant authority on any activity and phenomenon resulting from solid waste that is likely to adversely affect the public health and environment. Further the regulation requires the occupier of any premises to be obliged to use appropriate receptacles. Also regulations require the occupier to comply with the such days and approximate times for collection of waste specified by the local government authority having jurisdiction over the premises. Thus, the MoW shall comply to all these requirements during implementation of the project in all phases.

3.7 INTERNATIONAL TREATIES AND CONVENTIONS

Tanzania is a signatory to a number of conventions on sustainable development and is a member of various bilateral and multilateral organizations. Some of the relevant development partners in this project are the AfDB and a number of United Nations agencies.

3.7.1 The Convention on Biological Diversity - Adopted in May 1992 at Rio

The CBD is one of the outcomes of the United Nations Conference on Environment and Development held in Rio de Janeiro in 1992. The CBD establishes a global legally binding framework for the

conservation of biodiversity, the sustainable use of it components and the fair and equitable sharing of benefits arising out of utilization of genetic resources. The provisions of this convention should be taken into account in the conservation of various species of plants, animals and the variety of ecosystems in the project area.

3.7.2 The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

Tanzania is a party to CITES as far as the proposed development is concerned, this MEA complements the EMA, 2004 and the main concern of the proponent should be in the conservation of habitats and reporting of cases related to endangered species as the project is close to the Swagaswaga game reserve. Approximately 5,000 species of animals and 28,000 species of plants are protected by CITES against over-exploitation through international trade. They are listed in the three CITES Appendices. The species are grouped in the Appendices according to how threatened they are by international trade. They include some whole groups, such as primates, cetaceans (whales, dolphins and porpoises), sea turtles, parrots, corals, cacti and orchids. 55 species and 71 species of fish are listed in Appendices I and II respectively of the convention, meaning that they are threatened with extinction, are or may be affected by trade (Appendix I) or may become threatened with extinction unless trade in specimens of such species is subject to strict regulation, (Appendix II). Appendix III includes all species which any Party identifies as being subject to regulation within its jurisdiction for the purpose of preventing or restricting exploitation, and as needing the co-operation of other Parties in the control of trade.

The MoW is aware that in CITES listed species are identified in the area of influence of the project, appropriate measures shall be taken.

3.7.3 The Ramsar Convention on Wetlands of International Importance, Iran, 1971

The Convention on Wetlands also known as the "Ramsar Convention" is an intergovernmental treaty that embodies the commitments of its member countries to maintain the ecological character of their Wetlands of International importance and to plan for the "wise use", or sustainable use, of all of the wetlands in their territories. The convention recognizes wetlands importance to communities, cultures, governments and businesses and encourages wetland conservation and wise use of wetlands. The Ramsar convention works very closely with the other MEAs and is a full partner among the "biodiversity-related cluster" of treaties and agreements. The proposed project that is going to abstract water from Farkwa River which if not well conserved may result into their exhaustion. There is need to incorporate the objectives of this conventions into the design of the project so that the wetlands are not destroyed.

3.7.4 United Nations Framework Convention on Climate Change (UNFCCC)

The UNFCCC or FCCC is an international environmental treaty produced at the UNCED, informally known as the Earth Summit, held in Rio de Janeiro from June 3 to 14, 1992. The objective of the treaty is to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Tanzania having ratified this convention and putting into consideration the nature of the proposed project, there is an apparent need to ensure the activities live within the carrying capacity of the environment and to avoid the emission of potentially atmospheric debilitating gases.

3.8 AFRICAN DEVELOPMENT BANK GROUP INTEGRATED SAFEGUARDS SYSTEM

The AfDB's Operational Safeguards (OS) form part of their Integrated Safeguards System (ISS) and aim to provide guidance to their clients to identify, assess, and manage the potential environmental and social risks and impacts of a project, including climate change issues. Safeguards are a powerful tool for identifying risks, reducing development costs and improving project sustainability, thus benefiting affected communities and helping to preserve the environment. In addition, the Operational Safeguards provide requirements relating to different environmental and social issues, including gender and vulnerability issues that are triggered if the assessment process reveals that the project may present certain risks. The current AfDB OS (2013) are applicable to the proposed project. These include:

- Operational Safeguard 1: Environmental and social assessment – this overarching safeguard governs the process of determining a project's environmental and social category and the resulting environmental and social assessment requirements.
- Operational Safeguard 2: Involuntary resettlement land acquisition, population displacement and compensation – this safeguard consolidates the policy commitments and requirements set out in the Bank's policy on involuntary resettlement and incorporates a number of refinements designed to improve the operational effectiveness of those requirements.
- Operational Safeguard 3: Biodiversity and ecosystem services – this safeguard aims to conserve biological diversity and promote the sustainable use of natural resources. It also translates the commitments in the Bank's policy on integrated water resources management into operational requirements.
- Operational Safeguard 4: Pollution prevention and control, hazardous materials and resource efficiency – this safeguard covers the range of key impacts of pollution, waste, and hazardous materials for which there are agreed international conventions, as well as comprehensive industry-specific and regional standards, including greenhouse gas accounting, that other multilateral development banks follow.
- Operational Safeguard 5: Labour conditions, health and safety – This safeguard establishes the Bank's requirements for its borrowers or clients concerning workers' conditions, rights and protection from abuse or exploitation. It also ensures greater harmonization with most other multilateral development banks.

The following OSs apply to the proposed Farkwa Dam project:

OS 1: OS 1: Environmental and social assessment is triggered because the proposed project belongs to the category of projects that require mandatory ESIA as it may have implications on the natural environment (air, water and land); human health and safety (especially during construction) and physical cultural resources. The OS1 requires that the ESIA cover all relevant direct and indirect cumulative and associated facility impacts from the proposed project. The project has prepared a ESIA report, a detailed ESMP and a RAP that includes Stakeholder Engagement and Grievance Redress Mechanism.

OS 2: Involuntary resettlement land acquisition, population displacement and compensation is triggered because the project will have physical and economic displacement and a RAP has been prepared by the project to avoid and minimise impacts and compensate for the impacts.

OS 3: Biodiversity, Renewable Resources and Ecosystem Services - This OS 3 is relevant because the proposed project may have potential adverse impacts on adjacent the Bubu and Mkinki rivers, and forests which are located within the project catchment and immensely contribute to the sustainability of critical

ecosystems. The natural ecosystems of the wetlands, rivers and forests are known to support varying degrees of natural complexities of flora and fauna. The project has prepared a ESIA report, a detailed ESMP to avoid and minimise related impacts.

OS 4: Pollution Prevention and Control, Hazardous Materials and Resource Efficiency - OS 4 is considered relevant to the proposed project, potentially will result in the generation of e-waste, hazardous waste and solid waste. The MOW is aware and have capacity in place to deal with all project activities that might generate any air, liquid or solid waste emissions at any project stage. The project has prepared a ESIA report, a detailed ESMP to avoid and minimise related impacts.

OS 5: Labour Conditions, Health and Safety - This OS is triggered because the project will create temporary and permanent works during construction and operation phases. The ESMP includes mitigation of occupational health and safety impacts and contractor management.

The level of assessment and management should be proportional to the level of environmental risk posed by the project (AfDB 2015). The AfDB's ISS requires that Bank-sponsored projects be screened and categorized to determine the specific type and level of environmental and social assessment. The screening is carried out in accordance with the Bank's Environmental and Social Assessment Procedures (ESAPs). Projects are classed as category 1, 2, 3 or 4 following the principle of using the appropriate type and level of environmental and social assessment for the type of operation. The current Project would be classed as a Category 1 project as it is likely to induce significant adverse environmental and social impacts. Category 1 investment projects require an ESIA, as well as an ESMP. The ESIA leads to the development of a comprehensive ESMP, which contains implementable environmental and social mitigation measures. The ISS specifies requirements for community outreach and public consultation during preparation of the ESIA and requires that a summary ESMP will be made available to the public.

3.9 INSTITUTIONAL FRAMEWORK

The Tanzania ESIA practice gives different functions and responsibilities to all parties involved in the ESIA process of any proposed development undertaking to which ESIA is obligatory. Table 3.2 provides key institutions to the proposed Farkwa Dam, Water Treatment Plant, and Water Conveyance System to Chemba and Dodoma City project. The Environmental Management Act (EMA, Cap 191) give mandate to NEMC to undertake enforcement, compliance, review and monitoring of environmental impact assessment and has a role of facilitating public participation in environmental decision-making, exercise general supervision and coordinating over all matters relating to the environment.

The Act empowers NEMC to determine whether a proposed project should be subjected to an ESIA, approves consultants to undertake the ESIA study, invites public comments and also has the statutory authority to issue the certificates of approval via the Minister responsible for environment. NEMC is currently the designated authority to carry out the review of ESIA including site visit and handling TAC meeting, monitoring and auditing of environmental performance of the project (periodic and independent re-assessment of the undertaking).

Table 3.1: Key Institutions to the ESIA Process

Level	Institution	Role and Responsibility
National level	Vice President's Office (Division of Environment)	• Coordinate various environment management activities in Tanzania • Advise the Government on legislative and other measures for the management of the environment • Advise the Government on international environmental agreements • Monitor and assess activities, being carried out by relevant agencies in order to ensure that the environment is not degraded • Prepare and issue a report on the state of the environment in Tanzania; • Coordinate the implementation of the National Environmental Policy
	National Environnent Management Council (NEMC)	• Carry on environmental audit and environmental monitoring • Carry out surveys which will assist in the proper management and conservation of the environment • Undertake and co-ordinate research, investigation and surveys in conservation and management • Review and recommend for approval of environment impact statements • Enforce and ensure compliance of the national environmental quality standards • Initiate and evolve procedures and safeguards for the prevention of accidents which may cause environmental degradation and evolve remedial measures where accidents occur; • Undertake in co-operation with relevant key stakeholder's environmental education and public awareness; • Render advice and technical support, where possible to different stakeholders
	Prime Minister's Office (Regional Administration and Local Government)	• Responsible for matters relating to Regional Administration and Local Government, including giving policy guidelines necessary for the promotion, protection and sustainable management of the environment.
	Ministry of Water	• Project concept, carrying out ESIA study for the proposed project • Project implementation including mitigation measures • Ensure environmental compliance by the Sector Ministry; • Liaise with the DoE and the NEMC on matters involving the environment and all matters with respect to which cooperation or shared responsibility is desirable or required; • Oversee the preparation of and implementation of all ESIA"s required for investments in the water sector.

Level	Institution	Role and Responsibility
	Basin Water Board	• Data collection, processing and analysis for WRM monitoring and resource assessment. • Co-ordinates technical aspects of trans-boundary issues in the basin. • Co-ordinate and approve basin WRM planning / budgets. • Approve issue and revoke water use and discharge permits. • Enforce water use permits and pollution control measures. • Co-operate between sectors at the local level. • Resolve conflicts between water users. • Co-ordinate stakeholders. • Integrate district plans into WRM plans
	Ministry of Lands, Housing and Human Settlements Development	• Land use planning • Issuing of Right of Occupancy • Valuation and compensation
	Ministry of Natural Resource and Tourism (Forestry and Beekeeping Division, Wildlife Division),	• Oversee the socio-ecological conditions of the nearby Swagaswaga Game reserve • Oversee/advise implementation of national policies • Oversee enforcement of laws and regulations • Advise on implementation of development projects/activities
	Ministry of Agriculture, Food Security and Co-operatives	• Oversee/advise implementation of agricultural related projects e.g. as the project will involve in livelihood restoration program • Oversee enforcement of laws and regulations • Advise on implementation of development projects/activities related with agricultural production
	DUWASA	• Run the treatment plant and undertake or supervise all maintenance works thereafter. • Maintains the monitoring and quality assurance role for the service delivery • implement all recommendation or conditions attached to the environmental certificate of the project • carry out statutory environmental monitoring pertaining to the performance of the specific mitigations measures contained in the project.
	Water Utilities Regulatory Authority (EWURA)	• Licenses the operations of DUWASA and regulates their service delivery

Level	Institution	Role and Responsibility
	Roads Authority (TANROADS)	• Responsible for the day to day managements of trunk and regional roads network totaling about 30,000 km • Setting standards and monitoring of quality compliance in construction, rehabilitation and maintenance of Roads/Road reserves • There is a section of conveyance system falling within the Dodoma Municipal boundaries and are managed by the TANROADS Regional Manager for Dodoma
	TTCL and TANESCO	• Responsible for placing, managing and relocating utilities (telephone and electric supply lines, sewers, drains etc.) along the proposed conveyance system
Regional level	Dodoma Regional Secretariat Office	• Responsible for environmental coordination of all advice on environmental management in the region and liaises with the Director and the Director General on implementation and enforcement of the Environment Act. • A Regional Environment Management Expert appointed by the Minister responsible for Regional Administration heads the secretariat. • The Regional Environment Management Expert is responsible for advising the local authorities on matters relating to the implementation and enforcement of the Environment Act. The Expert links the region with the Director of Environment and Director General. • Advice on implementation of development projects and activities at Regional level
Municipal level	Dodoma Municipal Director Office	• Chief Executive Officer for all development activities in the Municipal level • Baseline data on social and economic conditions • Extension services • Plan and coordinate activities on community-based natural resource and environment management • Enforcement of laws & regulations • Coordinate environmental matters at the Municipal level
District level	Bahi and Chemba District District Commissioner office	• Oversee and advice on implementation of national policies at District level • Proper management of the environment in their areas of jurisdiction • Carrying out directives given to promote and enhance sustainable management of the environment and as provided under the Local Government; • Performing any functions as provided by the Local Government (District) Authorities Act, 1982. • Advice on implementation of development projects and activities at District level

Level	Institution	Role and Responsibility
	Bahi and Chemba District District Executive Director Office	• Chief Executive Officers for all development activities in the District level
	District Land Department	• Relevant permit • Land use planning; • Valuation and compensation
	District Planning/ Natural Resource/ Health/Community Development Departments etc.	• Plan and coordinate activities on community-based natural resource and environment management • Enforcement of laws and regulations • Issue license for forest/mangrove utilization • Provides guidelines for forest/mangrove use and management within project area and area of influence Baseline data on social and economic conditions • Extension services
	District Agriculture Department	• Crop production in the project area • Information on soil within the project area
	District Environmental Committee	• Coordinate environmental matters at the District level
Ward Level	Ward Development Committees – (Ward Councilor, WEO, Ward Environment Committee	• Oversee general development plans for the Ward. • Provide information on local situation and Extension services • Technical support & advice • Project Monitoring
Community level	Village Council (Chairman/ VEO, Environment Committee); Other leaders (Religious, Teachers, Elders etc), Communities groups (farmers, women, youth, etc)	• Information on local social, economic, environmental situation • View on socio-economic and cultural value of the sites and on proposed drilling operations. • Rendering assistance and advice on the implementation of the project • Project Monitoring (watchdog for the environment, ensure well being of residents and participate in project activities
	Local NGO/CBO, COSEPE Dodoma	• Monitoring and management of the Game Reserve • Forest/environment conservation • socioeconomic development in the area • Project Monitoring

4 DESCRIPTION OF PROJECT AND JUSTIFICATION

4.1 PROJECT AREA AND LOCATION

The study area covers the City of Dodoma and villages within five (5) kilometres of the selected conveyance pipeline routes (i.e conveyance to Dodoma City and Chemba District). The pipeline originates from Farkwa Dam and follows the network of existing works i.e. route from Singida to join the A10, to Dodoma city with an end connection to Kilimani Tank N°2. The pipeline total length to Dodoma City is 115 km while to Chemba District Council is 51 km. The water will be fed by gravity from the dam to a pumping station located downstream of the dam on the left riverbank. The water will then be pumped to an interim tank located approximately 14.2 kilometres from the pump station on a high point, from which the water will be conveyed to Dodoma and Chemba by gravity.

Administratively the proposed Farkwa dam will be located in Mombose and Bubutole villages, Farkwa Ward, Chemba District, Dodoma Region. Villages/Mtaa along the conveyance system to Chemba are Donsee, Tumbakose, Gwandi, Rofati and Chemba; village along the conveyance to Dodoma City are Farkwa, Donsee, Makorongo, Khubunko, Babayu (chemba), Babayu (Bahi), Asanje, Mayamaya and Zanka. All these villages along the conveyance will also be supplied with the water. Other Mtaa where the conveyer system will pass are within the Dodoma City as shown in Table 4.1 below.

Table 4.1: Project areas

Region	District	Ward	Villages/Mtaa
Dodoma	Chemba District Council	Farkwa	Bubutole, Mombose, Farkwa and Donsee
		Tumbakose	Tumbakose
		Gwandi	Gwandi and Rofati
		Chemba	Chemba
		Makorongo	Makorongo, Khubunko and Babayu
	Bahi District Council	Babayu	Babayu and Asanje
		Zanka	Mayamaya and Zanka
	Dodoma City	Makutopora	Mzakwe and Veyula
		Msalato	Msalato A; Msalato A – Chiwaga; Msalato A – Lusinde; Mivuji Kibaoni; Msalato B – Jeshini; Msalato B – Mwinyi and Msalato Sec & Bible School
		Miyuji	Mbwanga, Miyuji, Mnadani and Maili Mbili
		Kiwanja cha ndege	Oysterbay, Area C/Chamwino and Sokoni
		Majengo	Majengo
		Imagi	Chinyoya and Imagi

The main dam will be located across the valley downstream of the confluence of the Bubu and Mkinki rivers, allowing to take advantage of the additional hydrological inflow from the Mkinki river. A saddle dam will be constructed across the suspected old river bed of the Mkinki river, which forms a low topographical point approximately two kilometres North of the main dam site. The toponomy of the main dam site area is shown on Figure 4.1 below.

Area A - Middle section looking upstream

Area A - Middle section looking downstream

Area B - Looking upstream

Figure 4.1: Photos of areas A and B

4.2 PROJECT ESIA BOUNDARIES

There are three boundaries that are considered in this ESIA namely; institutional, temporal and spatial boundaries. These are briefly explained below.

4.2.1 Institutional Boundaries

Institutional boundaries refer to those institutions and sectoral boundaries in which the project rests or mandated. These can be determined from political boundaries, Acts, regulations and institutional mandates and administrative structures. The current institutional framework for the construction of the proposed Farkwa dam and provision of water supply rests largely with the Ministry of Water (MoW). Under the legislation (Water supply and Sanitation Act, 2009), the Minister responsible for water may, in consultation with the Minister responsible for local government authority establish water authority and cluster water authorities in order to achieve commercial viability. DUWASA is one of 20 Urban Water Supply and Sewerage Authorities established by the Minister in the country and will have a role to supervise this project after the construction phase.

The local governments' Authorities are ultimately accountable to the Prime Minister's Office, Regional Administration and Local Government (PMO-RALG). The Local Government Acts of 1982 for both District and Urban Authorities gives the respective authorities, powers to establish, maintain operate and control public water supplies drainage and sewerage works. In rural areas where Water User Associations or trusts have not been established under the auspices of the ministry responsible for water, responsibility for water supply rests with the district councils. From an institutional point of view, DUWASA has the responsibility of maintaining and developing the Dodoma Municipality Water Supply System. However, the performance of DUWASA in terms of service delivery is checked and regulated by EWURA.

4.2.2 Spatial Boundaries

The spatial dimension encompasses the geographical spread of the impacts regardless of whether they are short term or long term. The spatial scale considers the receptor environmental component and can be local or broader. Following this, two zones of impacts have been considered; *The Core Impact Zone:* This includes the area immediately bordering the project (local). In the case of this project local impacts will include the inundation area, construction zone, conveyance system and the immediate surrounding areas. *The Zone of Influence:* This includes the wider geographical areas that are influenced by the project (e.g. Dodoma Region).

4.2.3 Temporal Boundaries

Temporal boundaries refer to the lifespan and reversibility of impacts. For example, the impact of construction work for the proposed Farkwa dam may be short-lived, but the presence of the dam and its associated component in that area has a long term implication in terms of the physical environment. The project impacts have a time scale dimension which has been considered during impact identification and prediction discussed in Chapter 6. In this case, impacts are classified as short-term or long-term, and low, moderate or high significant.

4.3 SITE DESCRIPTION

At the Dam site, the Bubu valley is intersected by a shallow granitic hill which forces the Bubu and Mkinki rivers to pass along its Southern foot forming the main section of the valley. On the northern side of the hill the connection to the steep slopes of the Bubu Fault is formed by a flat saddle. In the main section the Bubu River flows from NE to SW. The river bed is divided in two narrow branches (Bubu and Mkinki rivers) separated by a small granitic island and has at the dam axis an elevation of 1,086.0m (a.s.l) and a total width of about 60m. The main section appears asymmetric. The right side has a relatively constant slope of about 40m/km and is almost entirely covered of Quaternary deposits of silty sands with some gravel. The left side is much steeper with an average slope of about 75m/Km and shows strong variations of slope. The Quaternary overburden is discontinuous whereas the granite outcrops frequently.

The thickness of the Quaternary overburden can be about 3.5m at the foot of the slopes, but it is usually 2.5m on the right side and 1.5m on the left. These deposits cover a huge granite massive which extends over the whole surrounding area and forms the bedrock which is heavily faulted and jointed. The riverbed deposits of well graded fine sands are thin (about 1.5m) and of small extent. Because of the steep slope of the rapids the Bubu River flows partly in a rocky bed of granite. The overburden of the saddle section is 4 to 6m thick and consists of soils with the same characteristics as in the main section. On the left side the abutment granite outcrops in huge blocks. On the right slope no outcrops of bedrock could be found.

The vegetation of the area is characterized with miombo woodland, wooded acacia, bush land and thicket as well as riverine vegetation along the river course. The vegetation of the area harbors or are being visited by different kind of species of avifauna, medium sized mammals, reptiles, small mammals, large mammals, and arthropods. Out of these the specialized flora and fauna study shows that there are significant presences of birds in the area compared to other higher levels animals. The study further indicates that none of the fauna species that are regarded as endemic or rare to Farkwa was recorded. However, fauna species that are under CITES Category or IUCN-listed species (threatened or vulnerable) was recorded.

Within the proposed area of inundation there are a number of man-made features apart from natural features. There are public and individual/household structures to mentioned notable ones there are two primary schools of Mombose and Bubutole in the respective villages, two mosques, three churches, two boreholes with the water tanks and their associated pumping stations. Along the conveyance system there are also a number of structures that will be encountered by the pipeline such as residential properties, farmlands, schools, roads, etc.

4.4 PROJECT COMPONENTS AND DESCRIPTION

4.4.1 Selected Dam Axis

The selection of the dam axis was confirmed as being optimal during the preparation of the Feasibility Study with the results of the detailed geological and geotechnical assessment and use of the terrain digital model. The axes are shown on figure 4.2 hereafter.

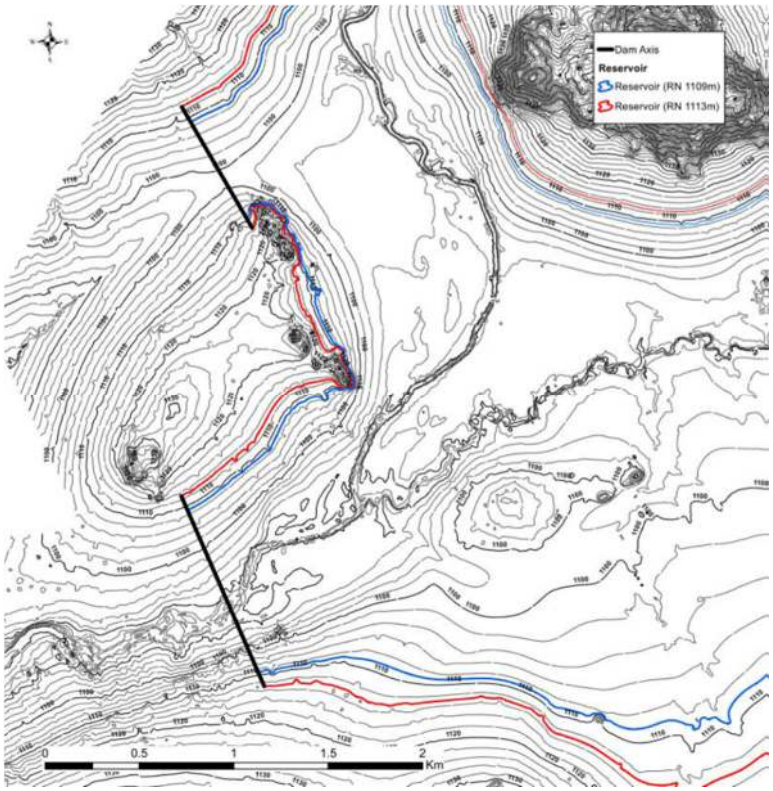

Figure 4.2: Dam Axis

4.4.2 H-V-A Curve

The Height-Volume-Area (H-V-A) curve was computed using the detailed topographical data collected and is presented in figure 4.3 and Table 4.2 below. The initial water level was taken equal to 0 in order to take into account the filling of the reservoir.

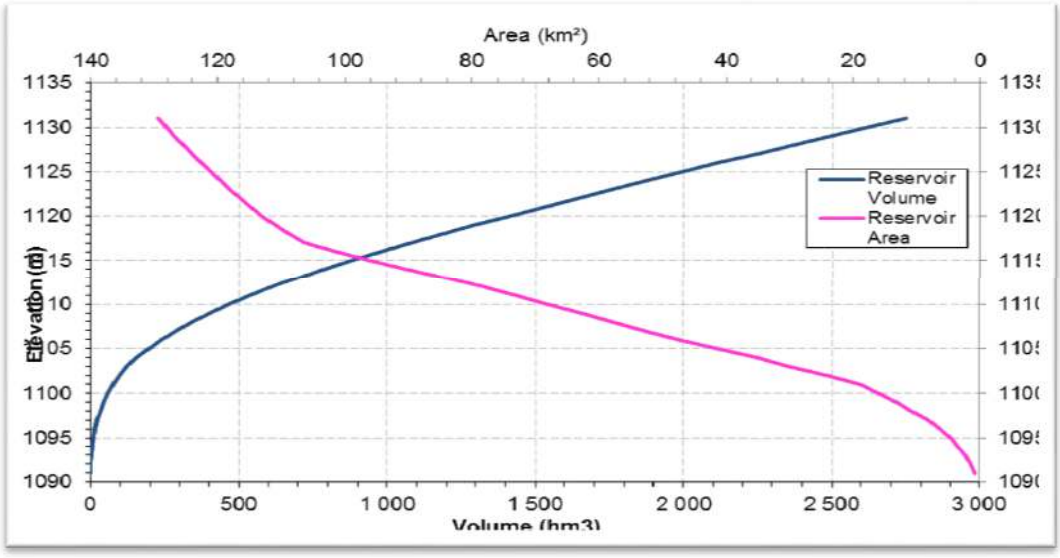

Figure 4.3: Height-Volume-Area Curve

Table 4.2: Height-Volume-Area Data

Elevation	Dam Height (m)	Reservoir Area (km²)	Reservoir Volume (hm3)
1091	0	0.79	0.00
1092	1	1.35	1.06
1093	2	2.26	2.85
1094	3	3.44	5.68
1095	4	4.65	9.71
1096	5	6.27	15.15
1097	6	8.18	22.35
1098	7	10.71	31.76
1099	8	13.12	43.66
1100	9	15.86	58.13
1101	10	18.73	75.41
1102	11	24.13	96.78
1103	12	30.19	123.89
1104	13	35.38	156.64
1105	14	41.03	194.80
1106	15	47.27	238.92
1107	16	52.87	288.96
1108	17	57.94	344.35
1109	18	62.95	404.78
1110	19	68.31	470.39
1111	20	73.36	541.21
1112	21	78.59	617.17
1113	22	84.04	698.47
1120	29	112.97	1410.61
1125	34	121.16	1996,77
1130	39	128.10	2620.24
1131	40	129.41	2749.00

Source: Feasibility Study -Interim Report N°2, 2015

4.4.3 Water demand

4.4.3.1 Water supply demand

The total gross project demand is estimated at 47 MCM/year (128,156 m3/day), taking into account the existing water supply from Makutopora field. The latter supply is being upgraded by DUWASA at the time of the study to supply 61,000 gross m3/day i.e. 48,800 net m3/day with a provision of 20% loss as per the MOW guidelines. The total gross project demand was computed taking into account the following:

- the Dodoma demand assessed by the present study;
- the rural demand assessed by the present study accounting for the rural populations located within 5 kilometres of the pipeline;
- the rural demand provided by the MOW on the 25th of November 2014 to account for three additional districts: Bahi, Chemba and Chawino.

The results of the water demand assessment for 2034 are shown in the table hereafter with the rural demand provided by the MOW.

Table 4.3: Total Water Demand –2034

Demand	Input	Volume (m^3/d)	Volume (%)
Dodoma Net Demand	Domestic	68,207	49
	Commercial	1,111	1
	Industrial	57,593	41
	Institutional	7,110	5
	Livestock	5,449	4
	Subtotal	139,470	100
	Supply from Makutopora-net	48,800	
	Project net demand for Dodoma Supply	**90,670**	
Rural Net Demand	Demand covered by present assessment Domestic	826	
	Institutional	182	
	Livestock	654	
	Sub Total	**1,662**	
	Additional Net Demand provided by the MOW		
	Bahi	3,949	
	Chemba	2 618	
	Chamwino	7 898	
	Sub Total	**14,465**	
Project Total Demand	Project Total Net Demand	106,797	
	Project Total Gross Demand	**128,156**	

Source: Feasibility Study -Interim Report N°2, 2015

The rural demand, incorporating the additional demand provided by the MOW, represents 15% of the Project Total Demand. The main demands are the domestic demand given the population data and industrial demand given the high level of consumption of this sector.

4.4.3.2 Downstream mitigation flows

While Farkwa Dam is designed to meet the Dodoma water demand, it shall accommodate requirements in downstream flows to mitigate the environmental and social impacts. The total flow to be released downstream is estimated to be 43 MCM/year (117,756 m3/day) and includes a flow dedicated to the river ecology, irrigation activities and livestock. These flows shall be released following the natural seasonal flow of the river.

Table 4.4: Downstream Mitigation Flows

Flow	Volume (m^3/day)	Volume (%)
Irrigation	76,192	65%
Livestock	1,044	1%
Ecological Flow	40,521	34%
Downstream Total Flow	117,756	100%

Source: Feasibility Study -Interim Report N°2, 2015

4.5 DAM DESIGN

This section describes and compares the different options for an FSL of El. 1105m. The present chapter presents the main design criteria for the options considered.

4.5.1 Water Levels: FSL, MWL, Freeboard

4.5.1.1 Full Supply Level (FSL)

The Full Supply Level is taken at El. 1110 m according to the results of the simulations. This level was set to meet the water demand for the conveyance system including downstream mitigation flows.

4.5.1.2 Minimum Operating Level (MOL)

The Minimum Operating Level is taken at El. 1098 m according to the results of the simulations. This level gives a dead storage of 30 hm3 corresponding to 100 years of sediment yield. The dead storage volume represents 12% of the total volume of the reservoir at El. 1110 m.

4.5.1.3 Design Flood

The 1 in 10,000 years' flood was selected for the design flood. The peak flood is: Qp (10,000 years) = 1204 m3/s as documented in the Hydrology Study report of the project.

4.5.1.4 Maximum Water Level, Freeboard and Dam Crest Level

The dam crest is set at El. 1114 m i.e. four meters above the Full Supply Level (FSL) with a Maximum Water Level at El. 1112.7. The computations of the freeboard and dam crest level were made following the USACE and USBR recommendations for a spillway width of 60 m. Several combinations of flood frequency and earthquake event were considered. The results of the computations are shown in the Table 4.5 hereafter.

Table 4.5: Dam Crest Level Computations

Design requirements			**Configuration**			
Condition Flood frequency Earthquake			**Extreme PMF** **-**	**Extreme MCE** **-**	**Unusual 1:10 000** **-**	**Normal FSL** **-**
Data	**Notation**	**Unit**				
Average depth of the reservoir	D	[m]	14.00	14.00	14.00	14.00
Design wind velocity	V	[km/h]	0.00	0.00	80.00	160.00
Fetch (km)	F	[km]	6.64	6.64	6.64	6.64
Spillway Length	LSpillway	[m]	60.00	60.00	60.00	60.00
Results	**Notation**	**Unit**				
Run up + Wind tide considered for design	E	[m]	0.00	0.00	1.25	3.01
Crest elevation	Z	[m]	1109.00	1109.00	1109.00	1109.00
Water level elevation (Routing computations)	N	[m]	1108.90	1105.00	1107.70	1105.00
WSL + E (mASL)	N	[m]	1108.90	1105.00	1108.95	1108.01
Earthquake - Vertical displacement	N	[m]	0.00	3.00	0.00	0.00
Computed freeboard (m)	f	[m]	0.10	1.00	0.05	0.99
Required freeboard (m)			**OK**	**OK**	**OK**	**OK**

4.5.2 Stability requirements

The dam design shall satisfy the following stability requirements:

- The dam shall be safe against overturning at any plane within the dam and at the base between the RCC dam and the rock foundation;
- The dam shall be safe against sliding on any plane or combination of planes within the dam and at foundation level;
- The dam shall cope with the design seismic load;
- The unit stresses in each material of the dams shall not exceed permissible values.

Stability analyses were carried out to meet the above requirements at the stage of feasibility.

4.6 APURTENANT AND DIVERSION WORKS

4.6.1 Intake

4.6.1.1. Design Criteria

The intake design flow is set according to the results of the water demand assessment. The design flow corresponds to the maximum flow, which equals to the water demand of 1.66 m3/s accounting for a design factor of 1.3 as per the MOW guidelines. The velocity limit of the water at the intake is conventionally set at 1 m/s. The intake level is set at El. 1094 m i.e. four metres below the minimum operating level as per Knauss criteria.

4.6.1.2. Design Features

The intake will consist of a 1.5 m diameter metal pipe installed in one of the diversion culverts. A transition to a 2 x 2 m square section will be made at the inlet. Two bends ensure the connection of the intake at El. 1094m to the pipe at El. 1088 m. The intake tower will be integrated into the RCC block. The intake will be protected by grids and the outflow regulated downstream via a radial gate. The downstream end of the intake will be fitted with a tee junction for the release downstream of the dam (downstream mitigation flows). This flow will be regulated by a butterfly valve and released via a hollow jet valve.

4.6.2 Bottom Outlet

4.6.2.1. Design Criteria

The bottom outlet is designed to draw down the dam reservoir to meet the following criteria:

- Reduction of the hydraulic pressure against the dam by a factor 0.5 within 21days,
- Empty the reservoir within 30 days. These criteria correspond to international practice.

4.6.2.2. Design Features

The bottom outlet consists of one 3 by 3 m culvert installed in one of the three diversion culverts (other fitted with the intake and last one plugged). The bottom outlet will be regulated downstream of the dam by a radial gate and the flow released via a hollow jet valve. The bottom outlet will be steel lined. This bottom outlet will also be used to flush the sediments. The results of the hydraulic simulations are shown in the figure 4.4 hereafter.

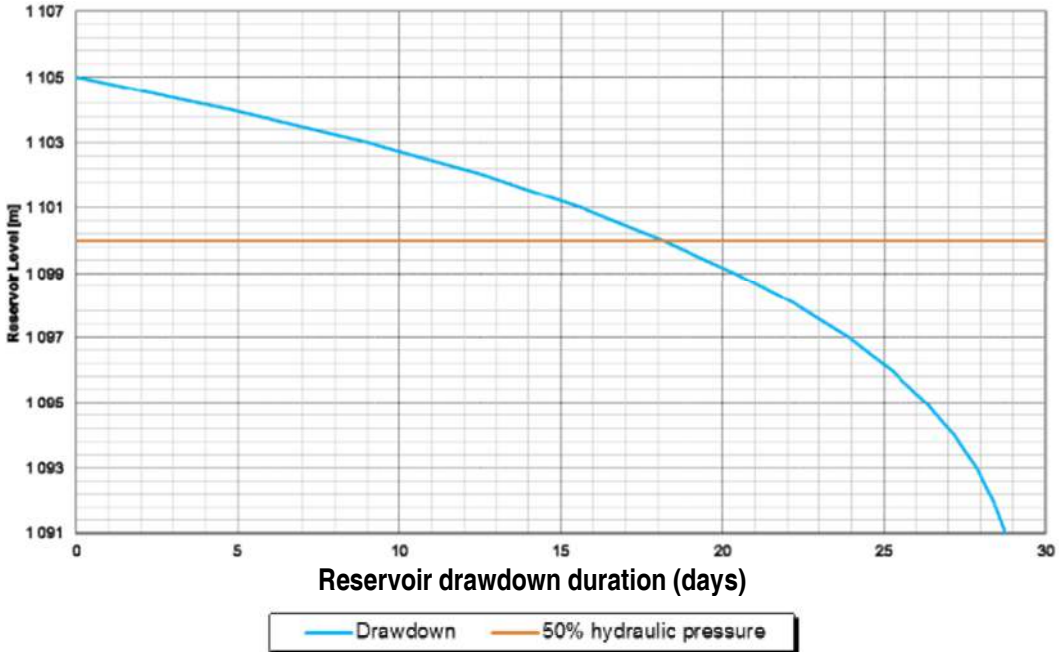

Figure 4.4: Bottom outlet simulation

Source: Farkwa Dam, Feasibility Study Interim Report No 2

4.6.3 Spillway

The spillway is designed to safely pass the 1 in 10,000 year's peak flood estimated at 1,204 m3/s (Design Flow).The designed spillway has for main features:

- A 60 metres long free overflow spillway placed on the RCC block.
- A water head of 2.7 metres corresponding to a Maximum Water Level at El. 1107.7.

The peak overflow discharge corresponding to the 1 in 10,000 years flood event is estimated at 500 m^3/s. It corresponds to a flood between the 1 in 100 and 1 in 1,000 years flood.

4.6.4 Diversion Works

4.6.4.1 Design Criteria

The diversion works are designed to protect the works during construction from a 1 in 100 years flood estimated at 335 m3/s. This flood event is usually taken as reference for earthfill dams during construction, while smaller return period floods are considered for concrete dams.

4.6.4.2 Design Features

The diversion works consist of diversion culverts installed across the dam and cofferdams built upstream and downstream of the dam. Three 4 x 4 m culverts are assessed as required to pass the construction flood with an upstream cofferdam set at El. 1095 m. The inlet level of the culverts is set at El. 1087 m and the culverts are installed with a longitudinal slope of 1%. Two of the three diversion culverts will be rehabilitated: one to form the intake and a second to form the bottom outlet. The third culvert will be plugged prior to the filling of the reservoir. The cofferdams for the composite RCC will be smaller and tis will represent a cost saving. The upstream cofferdam for the Earth-fill option will be made permanent and integrated to the dam body.

4.6.4.3. Implementation Phases

The diversion works will allow for a continuous construction. The following phasing of the diversion works is foreseen:

- **Phase 1 – Construction of the diversion works**

The construction works will be started in the dry season when the river is dry allowing for works to be undertaken in the riverbed without protection. The first phase of construction will consist in the construction of the diversion works i.e. two cofferdams: one upstream and another on downstream of the dam footprint in the river bed; and the three diversion culverts placed perpendicularly to the dam axis on the left inside of the river bed. Works on the dam foundation will also be started.

- **Phase 2 – Use of the diversion works**

During the rainy seasons the river will be diverted across the construction site via the diversion culverts allowing for the works to be carried out continuously.

- **Phase 3 – Rehabilitation of the diversion culverts and first filling of the reservoir.**

Phase 3 will correspond to the time when the dam is completed and the spillway is operational. Two of the three diversion culverts will then be rehabilitated to take their permanent function of intake and bottom outlet. The third culvert will be permanently plugged off.

4.7 SADDLE DAM

4.7.1 General arrangement

A saddle dam is required across the suspected old river bed of the Mkinki river to close the reservoir approximately two kilometres North of the main dam site. The Saddle Dam is founded on a layer of fairly permeable compacted sand and layers of weathered rocks with a bed rock dipping from 10m below the natural ground on the left abutment to 43m on the right abutment. This geological feature makes any rigid dam not suitable for this foundation and leads to the consideration of an earthfill embankment. The Saddle Dam features a total length of 1150 m and a maximum height of 10 m above foundation.

4.7.2 Typical cross section

The Saddle Dam (SD) is a homogenous earthfill embankment with a vertical filter as shown on the figure here below.

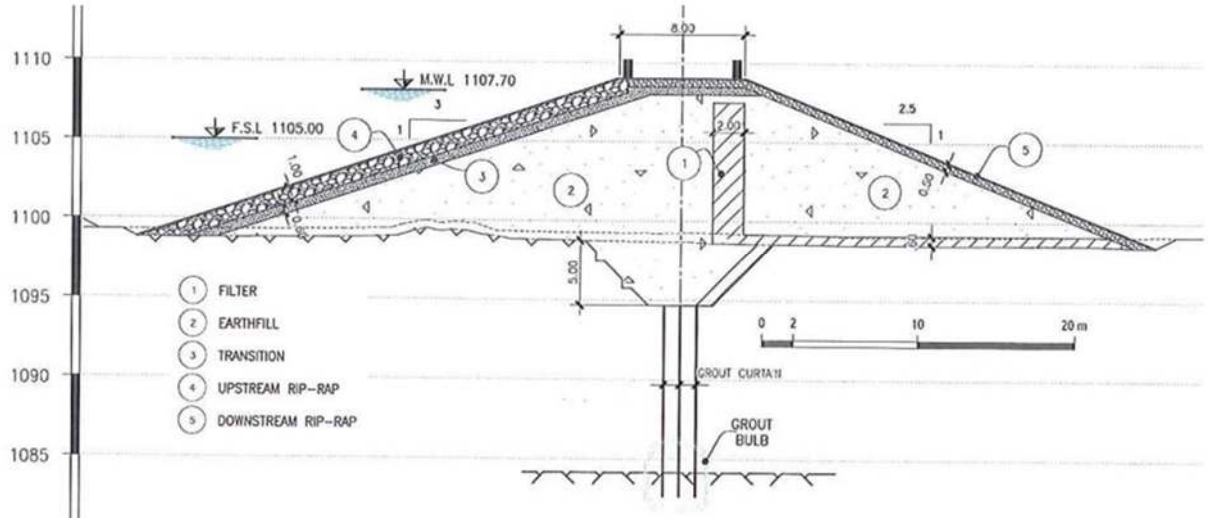

Figure 4.5: Saddle Dam Typical Section
Source: Farkwa Dam, Feasibility Study Interim Report No 2

The main dimensions are as follows:

- 8 m wide dam crest at EL.1109m;
- 3H:1V slope for the upstream batter;
- 2.5H:1V slope for the downstream batter;
- 2 m wide central vertical filter.

4.7.3 Construction materials

The same construction materials used for the Main Dam Earthfill option will be used.

4.7.4 Foundation and treatment

The Saddle Dam will be founded on a layer of fairly permeable compacted sand and layers of weathered rocks with a bed rock dipping from 10 m below the natural ground on the left abutment to 43 m on the right abutment. The foundation excavations and treatment will be designed to meet the recommendations made by the design consultant. The foundation excavations are as follows:

- 5 m deep trench centered over the dam axis,
- 1.5 m stripping across the dam body.

The foundation will be treated by grouting the contact zone between the soils and sound rock.

4.7.5 Dam volume

The total volume of the Saddle Dam is estimated at 110,000 m^3.

4.8 MAIN DAM

4.8.1 Presentation of dam options

Three dam types were studied for the Main Dam. They form the three dam options of the Project with a unique design for the Saddle Dam.

- Option 1 – "Earthfill" i.e. earthfill embankment,
- Option 2 – "Composite RCC and Earthfill" i.e. Composite RCC central block and earthfill abutments,
- Option 3 – "Concrete Face Rockfill Dam (CFRD)" i.e. rockfill embankment sealed by upstream concrete slabs.

Option 2 – Composite RCC and Earthfill Dam was considered to be an optimization of the Earth-fill option (Option 1) and therefore of interest for Farkwa dam.

4.8.2 General Arrangement for the RCC and Earth-fill Dam

The composite dam is made of a rolled compacted concrete (RCC) dam in the central valley/riverbed and earthfill embankments on each bank. The dam is 910 m long with a 230 m long RCC section. Its maximum height on foundation is 22 m. The main hydraulic structures or appurtenant works i.e. spillway, bottom outlet and intake are incorporated into the RCC central block.

4.8.3 Dam Geometry

4.8.3.1 RCC Typical Cross Section

The RCC (Roller Compacted Concrete) section is placed across the riverbed where sound rock is surfacing. The typical section of the RCC central block features:

- A 8 m wide crest,
- A 0.3H:1V upstream slope and 0.8H:1V downstream slope, both slopes are set from the MWL;

- A vertical layer of conventional Concrete (CVC) or GERCC (Grout Enriched RCC) (about 1 m wide) on the dam faces to form an impervious barrier.
- A 3 x 3 m gallery in the lower section of the upstream section and across the full length of the RCC section. This gallery will be used for monitoring as well as for the drainage and grouting the foundation.

Vertical construction joints will be made every 15 metres in the dam body. A double water stops with a drain between will be installed in the CVC section through the joints between consecutive RCC blocks. Figure 4.6 shows the typical section of the RCC central section through the spillway section.

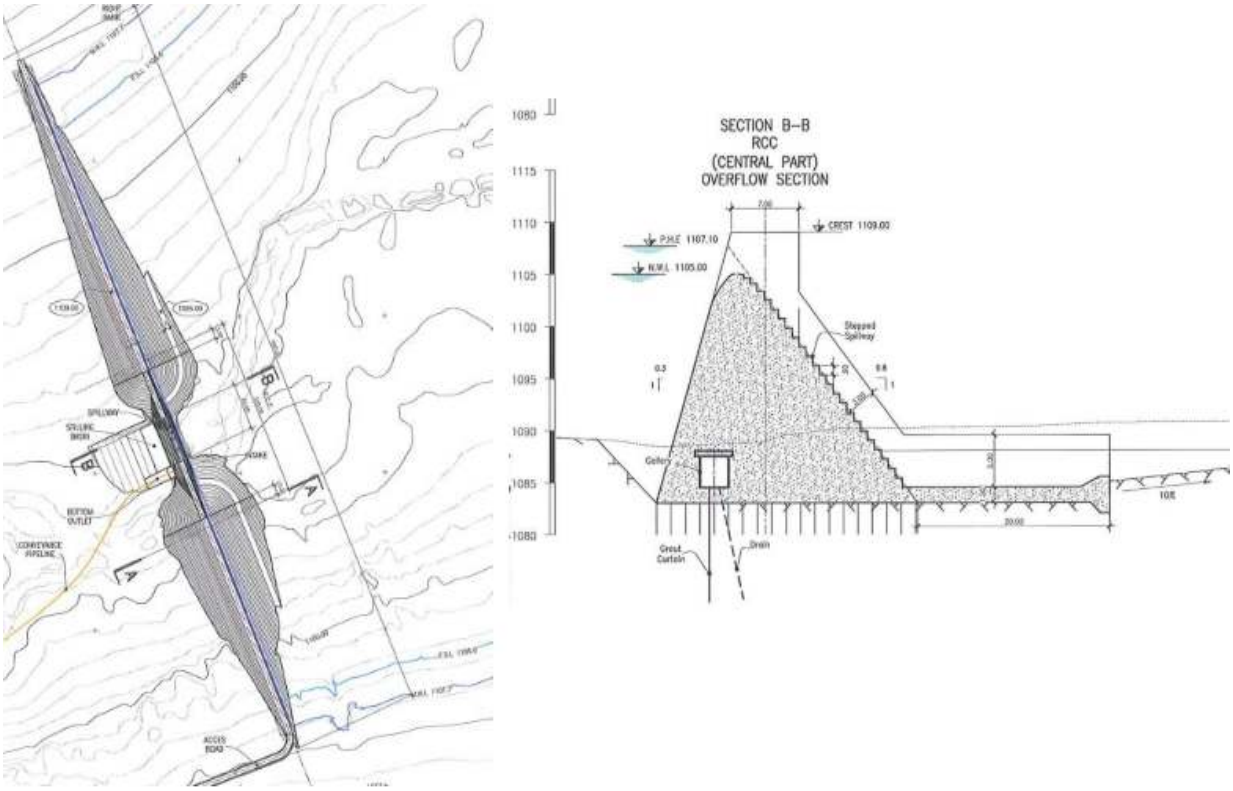

Figure 4.6: Main Dam Typical Section – RCC
Source: Farkwa Dam, Feasibility Study Interim Report No 2

4.8.3.2 Earthfill Embankments Typical Cross Section

The earthfill embankments form the abutments of the RCC central block. Their typical cross section is composed of a central impervious core with a downstream filter; a drain downstream of the filter at the faulty zones of the foundation with a 0.6 m thick drainage blanket leading to the downstream toe; and shoulders on both sides of the central core/filter/drain that are protected by surface layers of transition and riprap for the upstream batter. The upstream shoulder has a berm to provide more stabilization strength. This berm corresponds to the upstream cofferdam used for the diversion works, which will become a permanent structure. The main dimensions are given here below:

- 8 m wide dam crest at EL.1109m;

- 3H:1V slope for the upstream batter;
- 2.5H:1V slope for the downstream batter;
- 4 m wide impervious core at the crest with 0.25H:1V batter slopes and top level at El. 1108.1 m i.e. 0.4 m above the MWL;
- 2.5 m wide filter with top level at El. 1108.4 m;
- 2.5 m wide drain with top level at FSL m;
- Upstream berm with 8 m wide crest at El. 1095 m

The right abutment crest is 430 m long and the left abutment 310 m. The transition between the RCC section and earthfill abutments will be made via concrete walls, which will be designed to allow for an adequate placement of the earthfill material against them. Figure 4.8 above shows the layout of the composite dam option.

4.8.3.3 Interface between RCC and Earthfill

The interface between the RCC and earthfill sections constitute a delicate point. Stability issues could be encountered at this location due to incompatibility of deformations of the materials during seismic events for example. Those problems are well known for interface between RCC and earthfill as well as between earthfill and rock banks or spillways training wall. At this stage the following measures were taken to ensure satisfactory stability:

- The RCC section in contact with the earthfill section is slopped to 0.5H/1V to allow for satisfactory compaction of the eathfill material onto the transition phase.
- The RCC section in contact of the earthfill section is adjusted to have the same section than the earthfill dam core.
- The filter and drain continue beyond the transition section to the downstream RCC section batter.

4.8.3.4 Construction Materials

The construction materials will be sourced within the vicinity of the dam site as per the results of the geological assessment. Earthfill and core material will be sourced from the three investigated borrow areas. It is estimated that approximately 19 Mm3 could be sourced from these areas, which largely meet the required volume. The material will have to be conditioned prior to placement and put in place according to a strict quality plan. As per the results of the geological assessment, good quality rock is readily available in the vicinity of the dam site. The rock was tested and presents adequate mechanical and mineral properties for use as filter, drain, rockfill, rip-rap and concrete aggregates.

A specific process will have to be developed to produce the adequate rock sizing according to the function of the material. Rock will be quarried from Quarry R2 (Figure 4.7), which is assessed as the most advantageous quarry amongst the three investigated quarries. The material put in place is a lateritic earthfill including silty-sandy clays and fine sands. Those materials are more clayey and non-liquefiable. Moreover the material used is revamped and compacted; there will be no sand lens in the embankment.

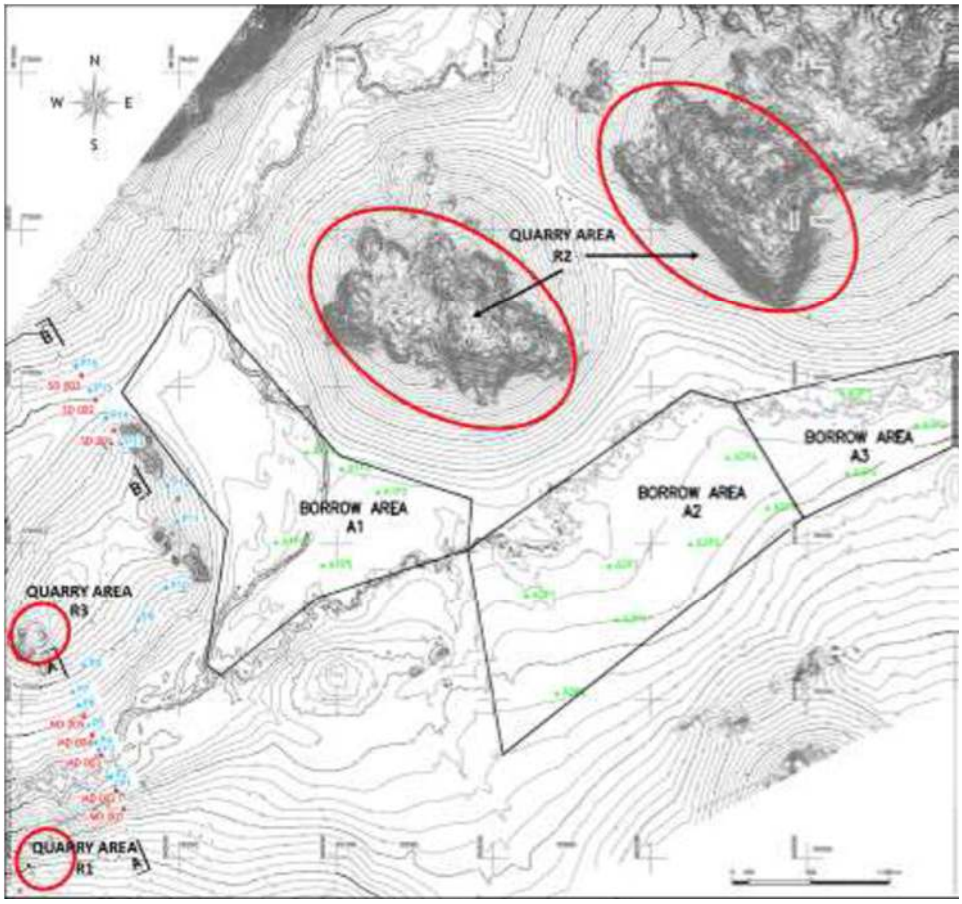

Figure 4.7: Location of potential borrow and quarry areas

4.8.3.5 Foundation and Treatment

The foundation excavations for the RCC central block were designed as follows:

- 5 m deep excavation for the impervious core foundation except if moderately weathered rock is encountered above e.g. at the riverbed section;
- 1.5 m stripping for the shoulders foundation.

An excavation volume of 125,000 m^3 is estimated at this stage of the study for the dam foundation. The foundation will be treated along the centreline of the dam/impervious core via consolidation injections and a grout curtain from the top of the moderately weathered profile down to 10 m. The consolidation injections for the RCC central section will be extended across the full width.

4.8.4 Dam Volume

The total volume of the main dam is estimated at approximately 400,000 m^3 with:

- A 75,000 m3 RCC central block and,
- A 350,000 m3 earth-fill embankment, which breakdown by type of material is given in the table hereafter.

Table 4.6: Dam Volume – Earthfill Embankments in RCC

Zone	Volume
Core	55,000
Filter, drain, transition and loamy materials	42,000
Shoulders	222,000
Rip rap (including transitions)	33,000
Total	**352,000**

Source: Farkwa Dam, Feasibility Study Interim Report No 2, 2015

4.8.5. Spillway Design

The RCC and earth-fill dam option features a free flow spillway placed over the RCC central block. A free flow spillway was selected over a gated spillway given the seismic context of the site and the ease of operation in a remote area. The spillway weir is a standard Creager profile followed by the stepped chute on the downstream face of the RCC structure ending in a stilling basin controlled by a downstream sill. The Creager profile and the stepped chute will be made of conventional concrete and framed on both side by 3 m high concrete walls. The stilling basin will be anchored and drained. The sill at the upstream side of the stilling basin will be in reinforced concrete.

4.9. CONVEYANCE SYSTEM TO DODOMA CITY

The draft design of the conveyance system and associated structures was prepared considering the existing operation and maintenance conditions in Dodoma. The change in pipeline diameters was kept to a minimum at the Feasibility stage.

4.9.1 Conveyance Pipeline

4.8.1.1 Route Selection

Three routing options were studied and one route selected. The main feature of the selected route was that it follows the existing network of roads, which presents the advantages below:

- No need to build a road for the construction and later for the maintenance and operation of the pipeline;
- No need to allow for provision for the maintenance of the service road (given that it initially serves another purpose);
- Placement of the pipe within the service corridor along the road for the section of pipeline within Dodoma City, which implies a minimized land and social disturbance;
- Placement of the pipe along a road being frequently used, which minimizes the risk of vandalism compared to an area with low development.

4.9.1.2 Route Description and System Arrangement

The pipeline originates from Farkwa Dam and follows the network of existing works i.e. route from Singida to join the A10, to Dodoma City with an end connection to Kilimani Tank N°2. The pipeline total length is 115 k. The water is fed by gravity from the dam to a pumping station located downstream of the dam on

the left riverbank. The water is then pumped to an interim tank located approximately 14.2 kilometres from the pump station on a high point, from which the water is conveyed to Dodoma by gravity. The treatment of the water is recommended to be done upstream of the pump station. The treatment plant will be integrated to the pump station infrastructure. The detailing of the routing for the draft design was based on the LIDAR topographical data and ESIA recommendations regarding the population settlement. The main following criterion was used for the design the route was detailed such as to minimize high and low points along the route; Routes and connection points were located such as to reduce river crossings, swamps, and railway and road crossings; and all the components of the pipeline system were located in a way that they are accessible at any time for operation and maintenance purposes wherever possible;

The pipeline was placed outside the road reserve and the routing was designed to follow the main roads in a 10 m corridor from the road reserve all the way to Mzakwe. From Mzakwe, the pipeline follows the existing pipeline way leave to the airport round about in Dodoma City in accordance with ESIA recommendations. From the Airport Junction, the route is set to follow the new Iringa Road to the Kilimani Tank No.2. The layout of the conveyance system is shown on figure 4.8 presented on the following page.

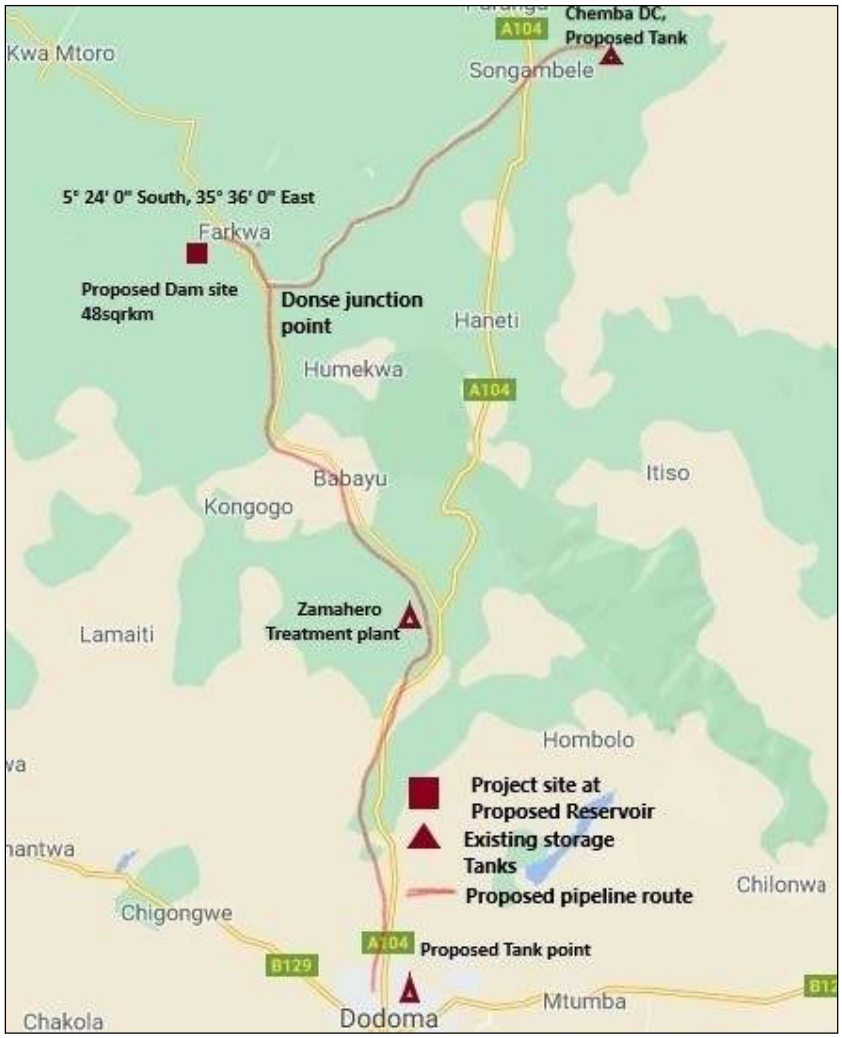

Figure 4.8: proposed conveyance system layout
Source: TRES Field Data, 2021

4.9.1.3 Crossing of Villages

The pipeline passes through villages, which are listed in the table hereafter for reference.

Table 4.7: Name and location of Villages where the pipeline passes

Kilometer Number	X	Y	Village
0+150	790052.307	9399496.141	Mombose
0+250	790052.307	9399496.141	Farkwa
05+900	792048.458	9394592.588	Donsee
07+350	792034.387	9393142.659	Khubunko
13+000	792805.507	9387729.55	Makorongo
28+400	799021.14	9377055.904	Babayu Chemba
29+150	799373.325	9376434.677	Babayu Bahi
46+600	809301.022	9363054.986	Asanje
53+150	809752.563	9356862.882	Mayamaya
56+950	807125.044	9354221.081	Zanka

4.9.2 Pipe material and sizing

4.9.2.1 Design Criteria

The conveyance system was designed to meet the water demand estimated for the design horizon of the year 2034. In accordance with the Maji design Manual, the flow adopted in sizing the conveyance/transmission main is the Maximum Day Demand defined as follows:

Qdim = Kd x gross demand
where Kd is a peak day factor that depends on use characteristics.
The design flow Qdim was calculated as follows.

Gross supply by Farkwa	m^3/day	110 789
Kd	-	1,3
Qdmax	m^3/day	144 038
Qdim	m^3/hr	6001
Qdim	m^3/s	1,66

4.9.2.2 Pipe Material

For ease of construction and economy, the proposed pipeline consists of a single material: steel pipeline with an epoxy or concrete inner lining and external coating. The pressure class of the pipe is PN 25. DUWASA was consulted regarding the selection of the pipeline material. According to their comprehensive experience in operating and maintaining pipeline network, DUWASA recommended the use of steel pipes over concrete and ductile cast iron pipes.

4.9.2.3 Pipe Sizing

The conveyance pipeline consists of two sections:

- A pumping main from the dam to the interim tank located approximately 14 k from the dam of 1500 mm diameter;
- A main fed by gravity from the interim tank to Kilimani tank N°2 with 1200 mm diameter pipe for the first 80 k tapping down to a 1100 mm diameter pipe to the end connection.

The pipe sizing was computed through an iterative process with the aim to produce an economic sizing taking into account the pipe material, head loss and velocity. The Hazen Williams formula was used with a roughness coefficient of 125. The design velocity was kept below 2 m/s in order to minimize surge.

4.9.3 Fittings

Every high point of the pipeline is prone to air accumulation inside the pipe, which often results in the disturbance of operation (air locks). At those high points the pipelines will be fitted with aeration - and de-aeration devices or "air valves". Air valves are also foreseen before steep dropdowns to avoid occurrence of vacuums due to increased velocity and reduced flow sections.

Washout devices are designed for O&M purpose to enable drainage and flushing of the pipeline at low-points of the pipeline. The standard installation is a gate valve mounted on a T-piece and a piped outlet that discharges into a receiving watercourse or gully. Gate valves shall also be installed at points of convenience to enable maintenance and shall be operable by hand wheels. The numbering of the air valves and wash out devices was estimated to prepare the cost estimate requested at the Feasibility stage. The appurtenant fittings as an integral part of the pipeline system will be designed to fulfil the same requirements and standards as the pipes in terms of pressure.

4.9.4 Provisions for Off-takes

The MOW is considering supplying water to rural villages located along the conveyance pipeline as part of the project. The sizing of the main allows for additional head losses related to such off-takes to the villages along the conveyance system. It is important to note that the present ESIA report is for a conveyance system i.e. a transmission main to Dodoma City.

4.9.5 Pipe Installation

All the pipes constituting the conveyance pipeline will be buried in order to protect the pipe from damages and vandalism. A marking system will be established in anticipation to the operation and maintenance works to localize the pipeline as well as associated fittings such as bends and valves. All the air valves and washouts will be housed in concrete chambers as per the recommendations of DUWASA. Road and river crossings will be individually designed in accordance with recognized standard.

4.9.6 Connection to Kilimani Tank N°2

The pipeline will be connected to Kilimani Tank No.2 in Dodoma. Consultations with DUWASA showed that the capacity of the Tank No.2 is sufficient to accommodate the flows from the Farkwa pipeline. Also note that Tank No.2 and No.1 are interconnected and both tanks are currently operating below capacity giving DUWASA a range of options in designing the distribution system.

4.10 CONVEYANCE SYSTEM TO CHEMBA DISTRICT COUNCIL

4.10.1 System Layout

The draft design of the conveyance system and associated structures was prepared considering the existing operation and maintenance conditions in Dodoma. The change in pipeline diameters was kept to a minimum at the Feasibility stage. The pipeline will emanate at Donsee Village from the main pipeline to Dodoma City from Farkwa Dam. From Donsee the pipe will follow the existing route to Chemba District Council through three villages of Tumbakose, Rofati, Gwandi and eventually Chemba CBD. The pipeline will be 1.4 meters' diameter requiring a 10 meters' wayleave for a total distance of 43.6 kilometers. It will largely lie outside of the road reserve, just after road reserve except few areas with diversion to avoid properties and hence reduce negative social impacts to the population along the route. The coverage of the pipeline in each of the mentioned village is covered in table 4.8 below.

Table 4.8: Pipeline route and distance coverage

Village	Ward	Pipeline length in km	Percentage
Donsee	Farkwa	6.6	15
Tumbakose	Tumbakose	12.1	28
Rofati	Gwandi	9.6	22
Gwandi	Gwandi	8.7	20
Chemba	Chemba	6.6	15
	Total	**43.6**	**100**

Figure 4.9: Profile for Transmission Route from Farkwa to Chemba

Since the villages along the route will be supplied with water from the pipeline, provisions for taping have been considered in each village. The design flow rate of 1,887 litres per second have been considered from the Farkwa to Chemba. There will be reservoir tank in Chemba for onward distribution and no reservoir tank have been considered along the route. Water will be pumped from the pumping station downstream of the Dam to both Chemba Reservoir Tank and to interim Tank for Dodoma conveyance system. Water will be treated before pumping at the pump station downstream area of the Dam.

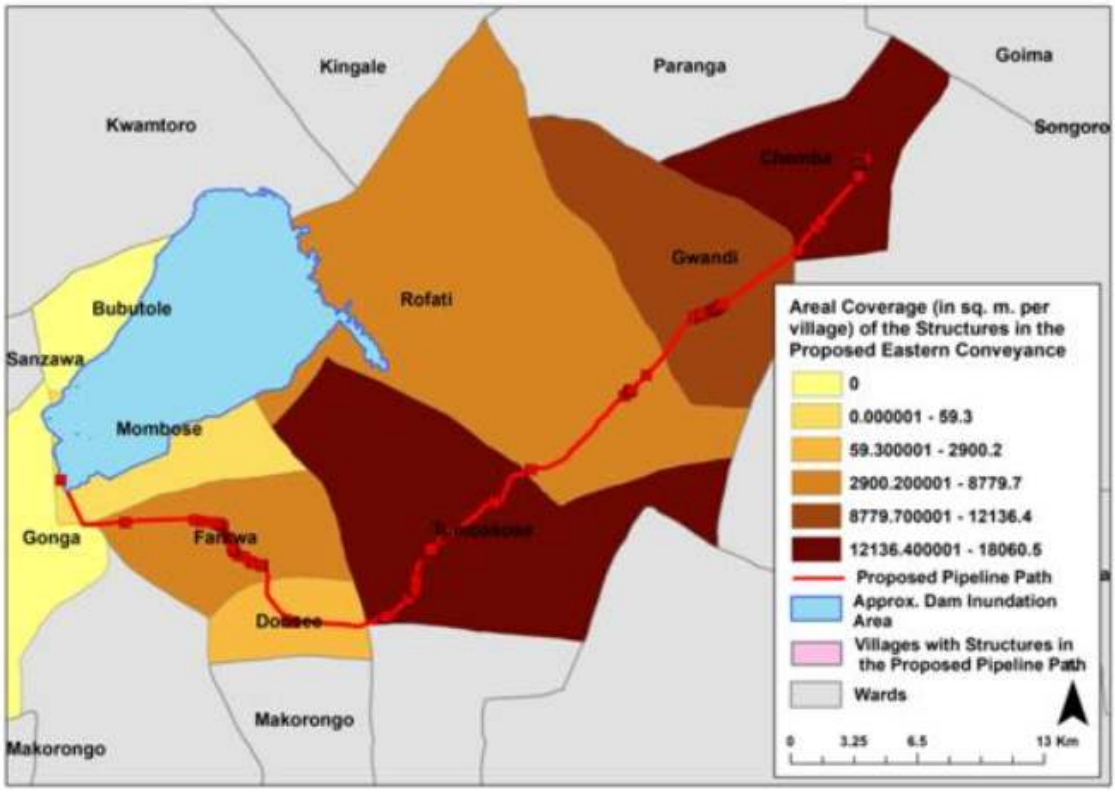

Figure 4.10: Map showing Donsee to Chemba pipeline route

4.11 WATER TREATMENT PLANT

The water treatment plant will be located near the pumping station downstream of the dam. The plant will be fitted with a complete physico-chemical treatment unit, including a complete filter wash water recycling system, sludge dewatering facilities and a sludge storage site. The treated water pumping station forwarding water to Dodoma City will be located inside the WTP perimeter.

4.11.1 Water Treatment process

The water treatment process will be done to meet the requirements of the TZS 789:2003 - Drinking (potable) water and the requirement of the Water Supply and Sanitation Act, 2009 (Act No. 12/2009). The water treatment process will be comprising following steps (i) pre-oxidation, (ii) re-mineralization, (iii) coagulation, (iv) flocculation, (v) sedimentation, (vi) filtration and (vii) disinfection. The pre-oxidation will be done by ozonization (see appendix 17). Because the pH of the raw water is lower than the aspired equilibrium pH, the raw water is corrosive and the pH has to be adjusted. This will be done in a re-mineralization process using CO_2 and lime. Aluminium sulphate will be used as coagulation agent to remove suspended matter and colloidal particles. The coagulation process will also require the use of a polymer. In addition, Powdered Activated Carbon (PAC) will be added in order to remove any harmful substance in the water. The flocks resulting from the coagulation process will be sedimented in clarifiers. Rapid sand filters (non-pressure type) with automatic counter-current washing will be used for filtration of the water and chlorine is used for final disinfection.

4.11.2 Residues from water treatment process

Aim of the technology to be used is to recover water from filter washing and concentrate the solid wastes for disposal to reduce the waste amount as much as possible. All water from filter washing will be recycled, thus the water loss is insignificant. The raw water flow will be nearly equal to the nominal flow. The generated back wash water will be re-sent to the raw water treatment process. This is the reason why liquid effluents to the environment will not occur during the operation phase. That means under normal operation the plant will have zero liquid effluents. Only in case of emergency the incoming water can be discharged via an emergency outfall to the Bubu River.

The production of sludge during the water treatment process is mainly depending on the amount of total suspended solids (TSS) in the raw water and the corresponding amount of needed flocculants (aluminium sulphate and lime). The sludge from the purges of clarifiers will be passed to an equalization sludge tank. From there the sludge is pumped to the gravity thickeners. At the thickener entrance a specific polymer is added, for the purpose of increase the capture of the sludge solids in suspension.

The supernatant from gravity thickeners is returned to the equalization basin existing in the filter washing water recovery circuit. The thickened sludge, with a concentration of about 3%, is pumped to the filter press feeding chamber, where lime and polymer are added for chemical conditioning, in order to increase the filter press efficiency. The dewatered sludge will have a minimum concentration of 30% what eases considerably its transportation and storage. The sludge will be transported by means of shovel excavators (eventually a conveyor will be used, final decision is not done yet) to a storage site located in the area proposed for the water treatment plant in order to reduce transportation needs. In addition, it is planned to create a drying bed of about 1 ha also at the water treatment site for intermediate storage and further drying purposes.

The overall needed area for the sludge storage site and drying bed will be around 3 ha. The sites will be designed and implemented in order to prevent a possible pollution of the soil and the groundwater aquifers. They will be lined with a plastic UV resistant membrane and fitted with a drainage and leachate detention system. The sludge storage site will have four cells (around 1 ha each) starting the storage with the installation of one cell. Possible further uses of the sludge could be as soil conditioner for agricultural purposes or to use the dried sludge for co-incineration in e.g. cement or steel factories.

4.12 PUMPING SYSTEM

4.12.1 Design criteria

The pumping system was designed based on the dam and pipeline design. The main design criteria are recalled hereafter:

- Dam minimum operating level at elevation 1098m;
- Positioning of the interim tank (to which the water is pumped and from which the water is conveyed by gravity) at elevation 1334.5 m;
- High point of the pipe profile in between the pump station and interim reservoir at elevation 1285.0m at 9.2 km downstream of the pumping station;
- Water inlet into the interim reservoir through the top of the reservoir (by overflow).

4.12.2 Pumping system

4.12.2.1 Arrangement and Operating Mode

The pumping system sizing was based on a water demand of 1.66 m3/s. The arrangement of the pumping system is as follows:

- three pumps will be installed in parallel ensuring the normal operation
- one pump will be installed as back-up

This arrangement was designed given the geometric head range imposed by the site topography and after consultation of several pump suppliers. The geometric head ranges between 233 and 243 metres, which is considered to be relatively high in the industry.

4.12.2.2 Pumps Selection

a) Sizing criteria

Given the high pressure value, steel material was selected for the pipeline operated in charge i.e. from the pump station to the interim tank. The pump sizing was carried out based on the following technical parameters for the waterway:

- A minimal roughness coefficient of 0.045 mm for start of operation,
- A maximal roughness coefficient of 0.15 mm to take into account the ageing of the waterway.

The pump sizing was made with for aim to minimize the number of pumps. A target velocity of 1 m/s was taken in the pipeline downstream of the pumping station. The pump total dynamic head was computed taking into account linear and singular head losses. The singular head losses were taken as 1% of the linear head losses.

b) Pump specifications

The supplier specifications of the selected pumps are given here below:

Pump type	:	Axial horizontal split case pumps
Unit flow	:	0.55 m3/s
Total Dynamic Head	:	234-250 m
Number	:	3+1
Motor power	:	2 MW
Rotational speed	:	1485 rpm

The specific speed value n_q is estimated at 18.

Pump suppliers provided an inertia value of 17 kg.m2. For transient calculation purposes, a total pump-motor inertia value of 60 kg.m2 was assumed. In addition to the isolation valves required for maintenance purposes, check valves or flow control valves are required downstream of the pumps to protect the pumps against reverse back-flow.

4.12.2.3 Protection against water hammer

a) Methodology

The most severe transient case was chosen for the feasibility calculations i.e.: power failure of all pumps leading to stoppage of flows, and roughness coefficient of 0.15 mm. The pumping main was modeled for the exercise into two distinct sections:

- Section A – starting from the dam at El 1086 m and ending at the high point between eth pumping station and interim tank at El 1285.0 m and 9.2 km downstream of the pumping station;
- Section B – starting from the profile high point at El 1285.0 m and ending at the interim tank at El. 1334.5 m and 13.9 km downstream of the pumping station.

The results are sensitive to the waterway assumptions and a second series of calculations will therefore be carried out during the detailed design on the basis of the final pipeline routing/alignment.

b) Anti-hammer tanks specifications

As a result of the transient calculations, two anti-hammer tanks plus one back up are considering required with for main features a diameter of 3.5 m and a height of 10 m. The anti-hammer reservoirs will be equipped with swing check valves with a hole in clapper at the outlet of reservoirs to limit overpressures. There are two types possible for anti-hammer accumulators: bladder accumulators and compressed air accumulators. Both are considered at this stage. Compressed air accumulators require a compressed air system to balance the pressure level within air accumulators. Bladder accumulators require less maintenance, but there is a slight risk of bladder damage.

4.12.3 Pump Station

The pump station will be located downstream of the dam on the left riverbank at elevation 1092. This positioning allows for space to locate a treatment plant upstream of the pump station. Provision shall be made to provide power supply to the pump station in order to operate the pumping system. A diesel generator shall be foreseen as back-up.

4.12.4 Interim Tank

4.12.4.1. Design Criteria

The interim tank will be a roof top reservoir to avoid water contamination. Its main design parameters are as follows:

- A target operating water level at 1340 m with a variation in water level of +/-1m,
- An active storage volume of 1,250 m3,
- A dead storage between El. 1,334.5 m (bottom level of interim tank) and El. 1335.0 m,
- A freeboard of 1 m.

The volume of the interim reservoir is estimated with regards to the time it will take for the regulating valve at the Kilimani Tank N°2 to close when Kilimani Tank N°2 is full and there is no need to pump additional water that will be lost. This design criterion is taken in order to avoid having air coming into the pipe.

Kilimani Tank N°2 is taken as the reservoir, from which the water distribution to the users will be managed by DUWASA. The tank structural draft design accounts for the following loads:

- loading under the condition when the tank is full,
- effects of hoop tensile stress, which is predominant,
- bending stress from the cantilever action,
- cracking as well as deflection requirements.

4.12.4.2 Design

The interim tank is designed as a ground circular reinforced concrete structure of 21m diameter and overall height of 5.0 m. The depth of water in the tank at full supply is 4.0 m.
Other dimensions are given here below:

- 400 mm thick wall,
- 400 mm thick bottom slab,
- 250 mm thick roof slab supported by 13 symmetrical square columns of 400 x 400 mm in dimension and overall height of 5.0m.

4.12.5 Regulation System

A control system will be designed to regulate the flow through the conveyance system in order to:

- Keep the target level in the interim tank at 1340.0 m +/-1 m,
- Allow the switching from normal operating mode to special operating mode with
- For instance, the startup of the back-up pump.

A regulating valve will be installed at the Kilimani Tank N°2 for this purpose. The necessary means of telecommunications between the interim tank, the pumping station and the regulating valve will be studied during the Detailed Design phase. Considerations will be made to account for power supply reliability. A diesel generator will be foreseen at Kilimani Tank N°2 to allow closure of the control valves.

4.13 OTHER INFRASTRUCTURES

Construction and operation infrastructures associated to the main infrastructures were accounted for in the draft design and related cost estimates. These infrastructures include:

- Access roads to the main infrastructures i.e. the dam, the pumping station and the interim tank;
- Paving and drainage works of the area surrounding the pumping station and interim tank;
- Office and residential building including sanitation facilities at the pumping station and interim tank;
- Securing of the pumping station and interim tank with the installation of fencing and guardhouse.

4.13.1 Access roads

The proposed access road will follow the existing earth road from the junction of Farkwa – Mombose road to Gonga Village. The road is approximately 4 km and is also used as a cattle track. The exisiting road is of poor quality due to lack and/or inadequate regular maintenance and rehabilitation. The dominant land use within the general area is agriculture. The original vegetation has been cleared through

anthropogenic activities mainly farming and grazing of livestock. Where the area has not been cultivated, there remains occasional acacia and big baobab trees. Few mature trees could be counted; the rest is highly disturbed grass with scattered acacia bushes and other secondary vegetation.

Soils on the general area are loamy with a thin cover of sand probably due to the closeness of the road. Patches of black clay soils are found at points where the water has been abstracted from the seasonal stream.

Access roads will be designed to provide access to the dam and pumping station from the existing track leading to the dam site. The general approach foreseen for the design is based on the following:

- Classify the type of road according to its function of access to infrastructures and taking into account that the roads are located in a remote area;
- Meet the requirements of the geometric standards and design parameters for the
- type of road selected
- Refer to the Road Geometry Design Manual of Works, Tanzania – 2011 Edition.

The design features the following:

- Access roads classified as collector roads reefing to the Road Geometry Design Manual of Works;
- 6.5 m wide carriageway with 1.5 m wide shoulders on both sides;
- Surface dressing for the carriageway and shoulders on the basis of economic consideration and given that the existing access road to the project site is unsealed.
- Design speed of 50 km/h;
- Roadway normal cross-fall of 4% and right of way over 100 m;
- Minimum radius of 100 m for the horizontal alignment, 90 m in critical conditions.

4.13.2 Campsite and laydown yards

The construction phase will have a prefabrication yard area which will act as a main workshop/camp for the construction work. Also for different purposes laydown yards will be needed, as for storage of parts and construction material, storage of pipes, parking of trucks and construction machines etc. For this, parts of the future pumping station and the water treatment plant site can be used at least for some time of the construction activities. Knowing the impact of human activities to environment, there will be no camping along the conveyor system; temporary labours from the nearest area will shuttle to the site and go back to their homes. For few skilled labours (technicians), they will be living in the guest houses at the nearest Town.

4.14. CONSTRUCTION MATERIAL

4.14.1 Materials and sources

The types of materials and respective estimated amounts necessary for the construction of the two dams and appurtenant structures are:

- Fine grained materials for the impervious core or for a homogenous embankment maximum 1 Mm^3
- Fine and coarse aggregates for filters, drains, rock fill and concrete – maximum 100,000 m^3

4.14.2 Core and earth-fill materials

As indicated by the field inspections and confirmed by the results of geotechnical tests, soil and alluvial deposits in the proximity of the dam site are found to have the adequate properties to be used as fine grained materials required for an embankment dam, including silty-sandy clays and fine sands be available in large quantities.

For the soils investigated in the borrow areas, the average content of combined clay and silt (fraction <0.063 mm) is 30%. If the only Borrow area A1 is considered, the range of variation for cumulated clay and silt fraction is 28 to 73. For the three areas, this parameter varies from 4 to 73. In case of using all borrow areas, the high variability might call for mixing materials from different zones. Systematic pitting, sampling and testing at the beginning of the construction phase (at an approximate rate of 1 pit for 10 000 m^3) is recommended in order to reduce the potential treatment for homogenizing the fine grained materials and the impact of such treatment on cost and planning. The depth of the test pits ranged between 3.0 and 4.1 m. Considering stripping of the top soil on one hand, and possible deeper excavation with mechanical means (whereas the test pits were excavated by hand, a depth of 3.5 m is estimated to be a conservative average value for the thickness of the useful horizon. For this value of 3.5 m, Table 4.8 presents the estimated amounts available for the three borrow areas.

Table 4.8: Estimated available amounts of fine grained materials (for 3.5 m thickness)

Borrow Area	Surface (x 106 m^2)	Volume (x 106 m^3)
BA1	2,18	7,63
BA2	2,435	8,52
BA3	0,865	3,03
Total Volume		**19,18**

Source: Farkwa Dam, Feasibility Study Interim Report No 2

4.14.3 Filter, drain, rock-fill, rip-rap and concrete aggregates

Natural deposits of clean coarse sands and gravels are scarce. For this reason, the sourcing of coarse grained materials for filters, drains, rock-fill and concrete aggregates will require crushing of quarried rocks. The investigated quarry R2, located on the hills at the western extremity of the Kumbaku Ridge is recommended for the extraction taking into consideration the following characteristics: Short hauling distance (about 4 km), far enough from the dam sites so that to avoid interference with the dam construction works, adequate quality large amounts available (more than 10 Mm^3, to be compared with the needs of less than 100,000 m^3), location within the reservoir area.

4.14.4. Material properties

The definition properties of the construction materials proposed to be used for the design for the dam body materials is based on the analysis of the data collected during the geotechnical investigations. The proposed characteristics for the filter and drain materials, which will be obtained by crushing of rock materials extracted from a quarry, are within the standard ranges used in the dam engineering practice. Table 4.9 hereafter shows the properties to be used for the various type of construction material.

Table 4.9: Material Properties for Design

Material	Unit Weight (kN/m^3)		Cohesion (kPa)	Friction Angle (°)	Permeability (m/s)
	Dry	Sat			
Fill	14	19	19	20	5x10-7
Core	14	20	19	20	10-8
Filter	20	22	0	40	10-4
Drain	20	22	0	40	10-2

Source: Source: Feasibility Study Interim Report No 2, 2015

The average values of the optimum compaction parameters according to the results of fifteen Proctor tests are as follows:

- Maximum dry density: 1.67 g/cm^3, which is about 15% higher than the corresponding value for soils in situ (1.47 g/cm^3);
- Optimum water content: 16%, which is more than two times the average natural water content (7%).

The natural water content values are very low. They could probably increase during the wet seasons. However, special care will have to be taken for the treatment of the materials during construction in order to approach the optimum values

4.15 UTILITIES

4.15.1 Water Requirements

Water will be required for dust control, and the proponent plans to take advantage of the sites' proximity to the Bubu River by acquiring water for this purpose. Dust control will be performed using tanker trucks with spray attachments or other approved methods. Potable water will be required on-site for domestic purposes, including drinking and washing for the workers. In addition, water will be required for toilet flushing. Potable water will be obtained from drilled borehole and in case of shortage will be brought in by water trucks. Bubu river water will also be used in the case of fire.

4.15.2 Electricity

Electricity will be required on-site for the crusher, pre-cast yard including batching plant, the onsite offices and for other needs including night lighting. For lighting, light towers will be installed and used. For other power needs, this will be derived from the standby generators as currently Farkwa does not have TANESCO electricity. For the site offices approximately two 500kVA generators will be required whilst three 150kVA generators will be required for the pre-cast yard.

4.15.3 Solid waste

During the construction activities following main type of wastes will be generated:

- surplus of soil after having buried the pipeline;
- plastics from packaging;
- wooden platforms for transportation of material;

- small amount of wood and iron from concreting activities at construction sites of the treatment plant, the pumping station and interim tank site;
- organic material (including wood) from removal of vegetation along the pipeline corridor and at the sites of associated installations;
- sanitary waste from workers (during construction around 200-300 workers will be employed);
- solid domestic wastes from workers.

An estimate about the quantities of produced solid wastes will be done during the detailed engineering design. Within this design study also a Waste Management Plan will be developed which shall be incorporated into the HSE Plan to be elaborated by the Construction Contractor. This Waste Management Plan shall also follow the Environmental (Solid Waste Management) Regulations, 2009 which requires waste generating entities to minimize waste production and ensure that the "elimination of waste inside and outside the production site has no negative impact on the environment or on public health and safety"

4.15.4 Sewerage

During the construction works, portable toilets will be required for the workers. In addition, toilet facilities will also be provided in the office complex at the workers campsite. Resultant waste water will be collected in septic tanks and will be intermittently trucked off-site to the Municipal Sewage Stabilization Ponds. There will be no discharges of sewage on site during the construction activities.

4.16 FINANCIALS

An economic and financial analysis was carried out for the Project with for aim to assess the project profitability. The capital cost is estimated to $ 284.7 Million and the operation and maintenance costs to $ 17.9 Million.

4.17 PROJECT IMPLEMENTATION

The construction is estimated to take four years and start in 2022/2023. The infrastructures life span starting at the end of the construction (4 years' duration) to 2041/2042. It was assumed that the conveyance system will be commissioned during the fourth year of the construction.

Table 4.10: Life span of the project

Infrastructure	Life span
Dam	40 years
Conveyance system	20 years

5 DESCRIPTION OF THE PROJECT ENVIRONMENT

5.1 INTRODUCTION

This chapter provides a description of relevant environmental, economic and social characteristics of the project core area (site specific), and areas in the immediate vicinity of the project which is Mombose and Bubutole Area as well as broad description of the area of influence i.e. Farkwa Ward, Chemba District, Dodoma Region for the proposed project. The Consultant relied on secondary data and information found in literature covering the project area particularly the Feasibility Study -Interim Report N°2 and observation at the site. The level of details in the various sections depends on the interactions between the project activities and the particular environmental or socio-economic aspect.

5.2 PHYSICAL CHARACTERISTICS

5.2.1 Climatic Conditions

The climate of the Dodoma region is largely controlled by the movement of air masses associated with the Inter Tropical Convergence Zone (ITCZ). From November to March, the ITCZ moves southward resulting in the rapid increase of humidity. About 80% of the total annual rainfall occurs during this period. In April, the ITCZ moves to the North and the region enters in a long dry season. During this period, only a very few tropical storms may cause sporadic showers in isolated spots in altitude in the northern part of the catchment. In general, there is no rain after May until the end of October. With a mean annual rainfall of approximately 700 mm, the climate of the region is semi-arid. The rainfall pattern is characterized by a strong variability both in space and in time. Rainfall is slightly higher in the upper parts of the catchment (Mbulu Highlands). The region experiences often severe droughts due to consecutive years with below average rainfall with dramatic consequences for human activities, natural vegetation and groundwater recharge. The mean annual temperature of the region is 22.7°C and relative humidity is 67%.

5.2.2 Rainfall

The rainfall database provided by the Internal Drainage Basin (IDB) was processed to assess the rainfall pattern over the Farkwa Dam catchment. Daily rainfall data at Singida District Office, Katesh, Bereko, Kwapakacha, Haubi Mission, Kondoa, Karkwa Mission, Mbuyuni, Parangara Primary School, Babati, Gwandi, and Dodoma Airport were found to be relevant for Farkwa Dam. The rainfall stations main characteristics are summarized in Table 5.1 below. It should be noticed that the rainfall stations are well distributed in and around the catchment.

Table 5.1: Rainfall stations main characteristics

Station Name	Station Id	Elevation (m)	Latitude (South)	Longitude (East)	Start	End
Singida District Office	9434001	1484	4°48'	34°45'	1922/23	2008/09
Kateshi	9435008	1720	4°32'	35°23'	1939/40	2001/02
Bereko	9435013	1516	4°27'	35°45'	1972/73	2007/08
Kwapakacha	9435018	1401	4°55'	35°48'	1963/64	1980/81

Haubi Mission	9435022	1720	4°47'	35°56'	1956/57	2003/04
Kondoa	9435025	1382	4°55'	35°48'	1960/61	2006/07
Farkwa Mission	9535002	1240	5°24'	35°35'	1944/45	2002/03
Mbuyuni	9535009	1132	5°24'	35°50'	1965/66	1983/84
Parangara Primary School	9535017	1216	5°09'	35°52'	1981/82	1990/91
Babati	9435030	1347	4°13'	35°45'	1970/71	2008/09
Gwandi	9535004	1150	5°19'	35°43'	1962/63	1998/99
Dodoma Airport	9635001	1128	6°10'	35°46'	1935/36	2009/10

Source: Feasibility Study -Interim Report N°2, 2015

The main findings of the rainfall record at Farkwa station where the project is located are given in Table 5.2 below.

Table 5.2: Main characteristics of rainfall records at Farkwa rainfall station

Record	Start	End	Missing data	Max (mm)	Date of Max
Daily	01/08/1943	31/10/2005	11.3%	183.5	9/03/1999
Monthly	Jan-43	Dec-05	11.4%	336.3	Apr-44
Yearly	1943	2003	34.8%	1 192	1997/98
Seasonal	1943	2003	27.5%	1 113	1997/98

Source: Feasibility Study -Interim Report N°2, 2015

5.2.2.1 Rainfall long-term changes

The rainfall long-term changes in the region were assessed using the long-term availability of rainfall records at Singida District Office and Dodoma Airport (respectively 76 and 75 years of yearly total rainfall values). Because of its position in the very close vicinity of the dam site, the Farkwa station was also included in the analysis. The 3-year moving average is also represented for each station. This average is commonly used to highlight long-term trends or cycles in time series data. The main observations are as follows:

- For 3 stations, there is no clear longterm trend showing an increase or decrease of the total rainfall.
- Dry and wet years are relatively evenly distributed over the long observation period.
- The annual variability is high with total rainfall varying between 250 and 1 200 mm from a year to another.
- The long-term rainfall evolution may be partly described by cycles of dry and wet periods. This feature is pretty well observed at Singida District Office after 1961 and at Dodoma Airport and Farkwa for the entire period. For example, at Farkwa, the drought from 1952/53 to 1956/57 is followed by an above average rainfall period till the early seventies. After that, the mid-seventies is again a drier period. Yet the characteristic duration of this cycle is barely legible and not common with the other stations.

Annual variability is very high and the region experiences severe drought which may last a few years.

5.2.2.2 Areal and seasonal rainfall patterns

The rainfall seasonal distribution is represented in Figure 5.1 below. Only seven rainfall stations evenly located within the study region are represented. The main observations are as follows:

- The rainfall regime is unimodal with one rainy season from November to April. Between 91% (Katesh) and 98% (Dodoma Airport) of the yearly total rainfall occurs within this period.
- The rainfall season tends to last a bit longer in the upper parts of the catchment. At Haubi Mission and Katesh stations, with elevation around 1,720 m, the mean monthly rainfall in May is respectively equal to 41 and 52 mm, which represents. a contribution of 5 and 7% of the yearly total rainfall.
- In the Southern part, the rainfall regime is more pronounced that in the Northern part of the region.
- For all stations, the rainy season shows a slight decrease of rainfall amounts in February. Mean monthly rainfall is maximal in January for Dodoma Airport, Farkwa and Singida District Office and in March for Gwandi, Kondoa, Katesh and Haubi Mission.

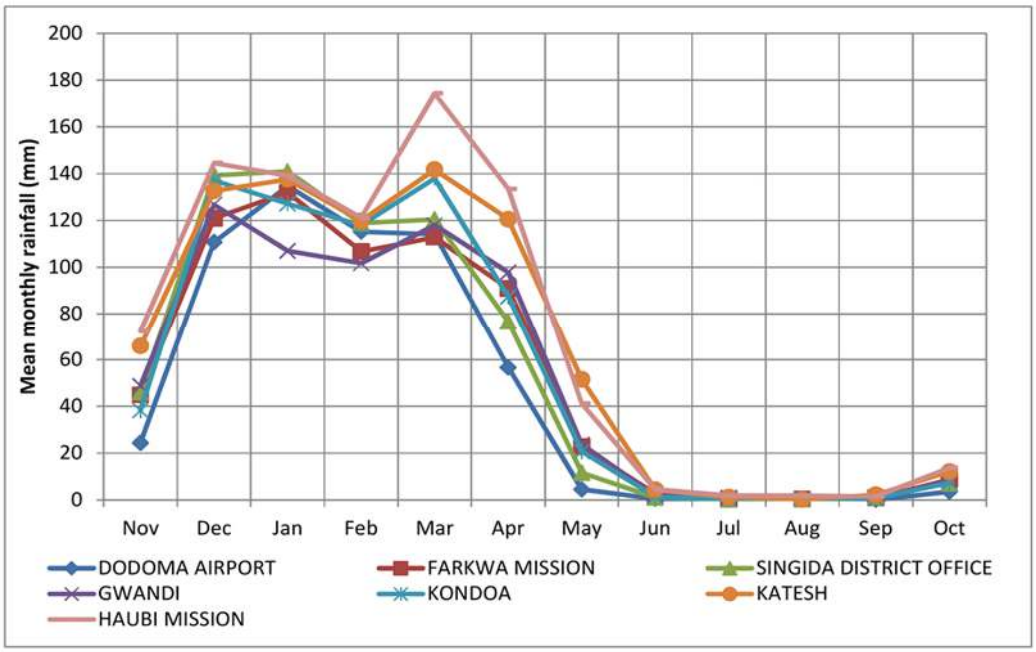

Figure 5.1: Seasonal rainfall pattern
Source: Feasibility Study -Interim Report N°2, 2015

The main characteristics of the yearly total rainfall at selected rainfall stations are as follows:

- Mean total rainfall is in the range 577 – 854 mm with the minimum at Dodoma Airport station and the maximum at Bereko station, located on the Northeaster limit of Farkwa catchment.
- Maximum yearly rainfall ranges from 934 mm (Dodoma Airport in 1997/98) to 1,558 mm
- Minimum yearly rainfall ranges from 261 mm (Dodoma Airport in 1952/53) to 526 mm (Bereko in 1996/97).
- As previously observed at specific rainfall stations, the variability of yearly total rainfall is very notable. The coefficient of variability (Cv) is defined as the standard deviation to the mean. It is in the range 0.27 – 0.36 with a minimum at Dodoma Airport, Farkwa, and a maximum at Gwandi and Parangara.

The relation between the mean yearly rainfall and stations'elevation is analysed in Figure 4.2 below. The correlation is rather well defined with a correlation coefficient R^2 equal to 0.6. It can be noted that Babati and Bereko stations do not fit well with the other stations. This is due to their position in the North-East part of the study region.

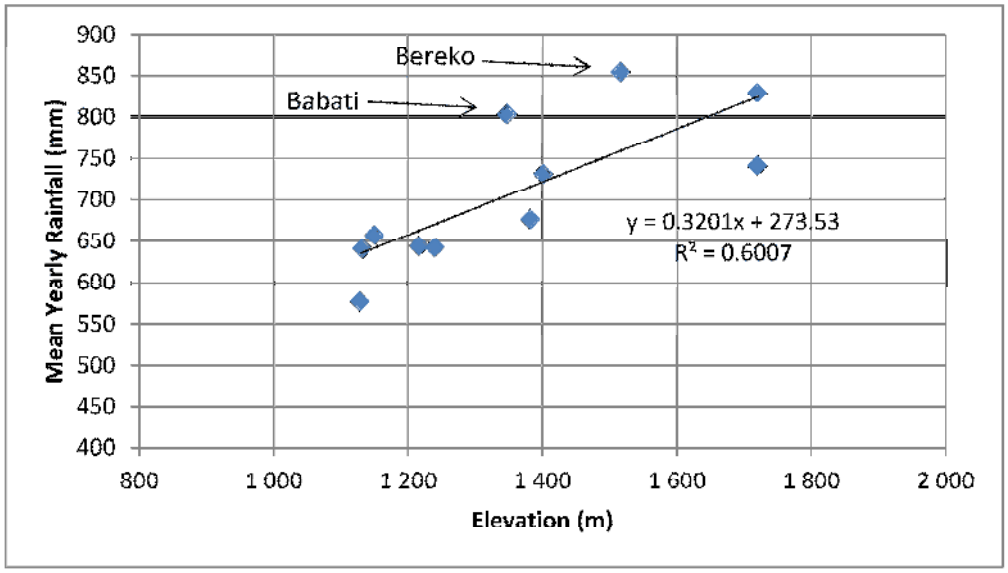

Figure 5.2: Relation between mean yearly rainfall and elevation
Source: Feasibility Study -Interim Report N°2, 2015

5.2.3 Temperature, Relative Humidity and Evaporation

Temperature, relative humidity and evaporation are generally used in addition to rainfall to characterize the climate of a region. For the Bubu River Catchment at Farkwa, relevant data was found in the IDB database for Dodoma Airport and Kondoa for the period 1970-2010. The main results are presented in Table 5.3 below. The main observations are as follows:

- Pan evaporation is maximum between October and March (> 200 mm at Kondoa) with a peak in October (217 mm) corresponding more or less to the rainy season. Pan evaporation is minimum in June (95 mm in Kondoa and 185 mm in Dodoma Airport)
- Annual pan evaporation is bigger in Dodoma Airport with a total of 2,872 mm per year against 1,970 mm in Kondoa. This can be explained by the lower relative humidity, respectively equal to 60% and 74%. Such a low relative humidity is characteristic of a semi-arid region.

Table 5.3: Temperature, Relative humidity, pan and potential evaporation at Dodoma Airport and Kondoa for the 1970-2010 period

Period 1970-2010			Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Annual
Dodoma Airport	Temperature	(^{0}C)	24.8	24.6	24.1	24.1	23.8	23.3	22.4	20.8	20.1	20.8	22.2	23.8	22.9
	Relative Humidity	(%)	55	60	62	62	64	66	64	61	59	58	55	52	60
	Pan Evaporation	(mm)	288	255	231	213	242	185	187	185	195	264	300	327	2872
	Potential Evaporation	(mm)	210	164	143	132	146	141	148	146	156	190	201	232	2007
Kondoa	Temperature	(^{0}C)	23.3	23.3	22.5	22.5	22.0	21.7	20.3	18.9	18.4	19.2	20.9	22.3	21.3
	Relative Humidity	(%)	69	71	75	75	78	78	80	76	75	74	73	69	74
	Pan Evaporation	(mm)	212	191	207	203	209	136	106	95	99	125	170	217	1970
	Potential Evaporation	(mm)	150	138	125	116	123	115	108	106	113	124	140	158	1515

Source: Farkwa Dam, Feasibility Study Interim Report No 2, 2015

5.2.4 Topography

A topography study was undertaken in order to determine the potential environmental direct and risks/impacts to receptors and propose mitigation measures for identified significant risks /impacts. To undertake this topography study a desktop literature review was undertaken to collect available baseline information and existing regional topographical maps; a site investigation to include the appropriate use of mapping to define the geographic area of influence of the project in relation to impacts on geological resources; and a physiographic map was prepared to adequately support the interpretation of the information. In general, the principal morphological trend in the project area is NE-SW. This is the overall direction followed by the Bubu and Mkinke rivers, as well as that of the main ridges. From NW to SE, the main morphological units are:

- The Bubu ridge, whose SE boundary corresponds to the outstanding scarp of the Bubu Fault. The dam site lies within the
- The Bubu depression, actually the downthrown compartment of the Bubu Fault, sheltering the Bubu River and the hypothetical paleo-Bubu river channel
- The Kumbaku ridge, comprising a range of inselbergs some 200 m high, separating the Bubu River from the Mkinke River just upstream of their confluence. In the SW extension of the Kumbaku ridge, the 'Central Hill' separates the Bubu River from the assumed paleo-channel. The Central Hill is much less prominent than the aforementioned inselbergs.
- The Mkinke depression with the Mkinke River
- The Mkinke ridge
- At the north east, the flat low lands including the swamp areas Bubu 1, Bubu 2 and Mkinke.

The proposed layout includes one main dam (MD), on the Bubu River downstream from the confluence with the Mkinke River, and a saddle dam (SD) on the hypothetical paleo-Bubu. The main morphologic units are outlined on Figure 5.3 below.

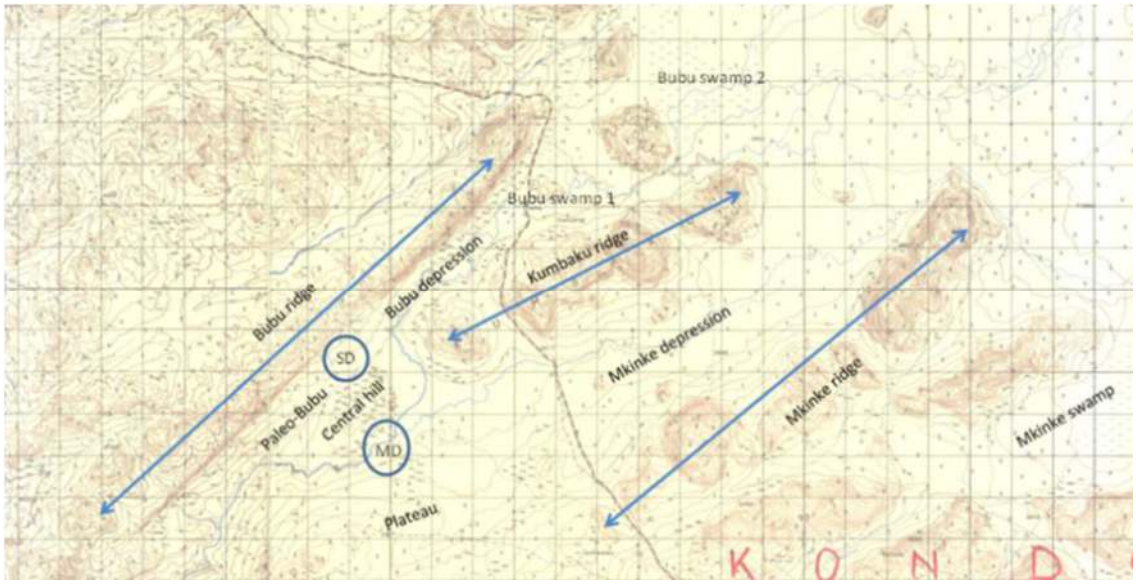

Figure 5.3: Topographic map of the project area

Farkwa Dam, Feasibility Study Interim Report No 2, 2015

As discussed above for the regional setting, swamps develop along the NE boundary of the Kwamtoro Block, which forms a natural barrier for the SW-running rivers. The potential reservoir includes some such

swamp areas at the upstream end, identified as Bubu swamp 1, Bubu swamp 2 and Mkinke swamps. Bubu and Mkinke valleys comprise flat alluvial filling from the central part down to the proposed dam site, approximately 1 km downstream of the confluence of the two rivers.

Downstream from the dam site, the river bed narrows, exposing often the granitic bedrock. The fractures transversal to the river channel control successive steps and associated rapids. The cumulated chute is approximately 100 m over 8 km.

Slope instabilities and dynamic erosional processes related with the recent rifting tectonics could explain local meanders or shifting of the river channels from the straight tectonic lineaments. In particular, in the area of the projected Saddle Dam, the former river bed (paleo-Bubu) could have been dammed by massive rock-falls from the Bubu Fault escarpment. Several assumptions can be advanced for the former location of the confluence Bubu-Mkinke confluence. The accumulation of fine alluvial deposits observed between the dam site and the current confluence could also be a result of the shifting of this confluence in the recent past. Further filed work and analysis of data from subsurface investigations are foreseen in order to clarify the nature of the substratum and the foundation conditions of the Saddle Dam, below the granitic sands.

5.2.5 Geology

5.2.5.1 Regional Geology

The project area is located within the Tanzanian Craton and on the edge of the Eastern African rift, namely the Gregory rift system, which runs in an NNE-SSW direction. More precisely, the project area lies within the Precambrian granitoid block of Kwamtoro. This regional unit forms a NW-SE oriented ridge. The geomorphologic setting is controlled by the regional fracturing pattern, dominated by two discontinuity sets: NW-SE and NE-SW. In the project area, the network of NW-SE and NE-SW valleys separating rocky hills result from the combination of these discontinuities.

One of the faults related with the rift system, the Bubu Fault, runs through the project area. Two main branches were identified: (i) the northern branch, which forms an outstanding escarpment, the toe of which is located at 700 m away from the Right Bank extremity of the Saddle Dam and (ii) the southern branch, which runs in the Right Abutment of the Main Dam.

5.2.5.2 Project Geology

i) Geomorphology

The main morphological trend in the project area is orientated NE-SW. This is the overall direction followed by the Bubu and Mkinki rivers, as well as the main ridges. The favorable location of the Main Dam was selected 1 km downstream from the confluence of the Bubu and Mkinki rivers. The abutments have overall very gentle slopes, approximately 7% in the left bank and 4% in the right bank.

The building of a secondary embankment is needed in the flat saddle area located to the S of the Bubu fault escarpment. The actual dam site is remarkably flat, the slopes forming the abutments being hardly visible. The Right Abutment of the dam is at a distance of about 700 m from the toe of the fault scarp. The hill between the Main Dam and the Saddle Dam sites, identified as the Central Hill, is also characterized by smooth topography, with variable slopes and local residual pinnacles from the granitic basement.

ii) Lithology and overburden

The predominant rocks near the proposed dam area are syn-oregenic and late orogenic Precambrian granodiorite and migmatite. The rocks are generally coarse grained. While granodiorite with massive texture appears to be the predominant rock, oriented texture could be observed as for instance in borehole MD002. In addition, the mafic rock found in MD005 suggests that other mafic dykes could be found elsewhere in the area of the dams.

Colluvium covers large parts of the area. Their thickness rarely exceeds five metres. Talus deposits composed of mixed pebbles, cobbles, boulders and soils mantle the lower slopes of the hills. These deposits grade progressively into the soils, mostly sandy, which cover the flat valley floors. Alluvial sediments are found along the Bubu River and in the lower stretches of the Mkinki River. Their thickness can exceed locally 10 m. The type of sediments is very variable, including silty, fine to coarse sand, clay and lime layers.

iii) Weathering sequence and vertical zoning

The vertical zoning of the materials in the foundation of the dams comprises the following layers:

- Layer 1: Soil and completely weathered rock,
- Layer 2: Highly weathered rock predominant, locally completely weathered,
- Layer 3: Moderately weathered rock predominant, locally highly weathered along fractures,
- Layer 4: Mainly slightly weathered rock, locally moderately weathered,
- Layer 5: Fresh rock, generally sound or with widely spaced joints.

At the site of the Main Dam, the bedrock is generally weakly weathered near the surface. The weathering develops mostly along discontinuities in densely fractured areas as observed in boreholes MD002 and MD005. The thickness of soils and highly weathered rocks is varies from 0 to 10 m. The weathering sequence is more peculiar at the Saddle Dam site. The top of the slightly weathered rock plunges progressively from about 6 m in the Left Abutment to about 43 m in the Right Abutment.

iv) Tectonic setting

The tectonic setting of the project area reflects at small scale the main regional features. The most relevant feature in the project area is the Bubu Fault. It is related to the recent rifting phase, striking ENE-WSW with steep dip to the SSE. According to the seismic hazard assessment, this fault is seismogenic and considered capable of seismic rupture during the lifetime of the Farkwa scheme.

v) Hydrogeological conditions

At the Main Dam site, the superficial loose soils susceptible to be highly permeable are generally thin. Permeability tests carried out in the boreholes indicated that the permeability decreases from 7x10-6 to 1x10-6 m/s in the upper 5 m and from 5x10-7 to 1x10-7 m/s from 5 to 10 m.

The aquifer related with fractures of the granitic bedrock is connected to the top with the superficial soil layers. At the site of the Main Dam highly fractured sub-vertical or steeply dipping zones were found in places, in particular in boreholes MD002 and MD005. However, as a general trend, the results of the permeability tests indicate that the permeability decreases considerably below 30 m depth. Even between the top of the bedrock and the depth of 30 m, the permeability values are not systematically high. The results of the permeability tests carried out in bedrock at the Main Dam site are consistent with the high seismic velocities recorded, indicative of relatively compact rock mass.

At the Saddle Dam site, the thickness of the soil and weathered rock layers reaches up to 43 m. Based on the results of the permeability tests, the permeability of soils and highly weathered rocks is inferior to 8x10-7 m/s below 20 m depth. No specific treatment is therefore foreseen for watertightness. However the contact zone between soil/weathered rock and sound bedrock is expected to be highly permeable, as indicated in particular by heavy loss of drilling water. A treatment of this contact for water tightness should therefore be considered.

vi) Construction materials

Suitable materials for impervious core and earthfill materials were identified in the proximity of the project site. On the contrary, natural deposits of clean coarse sand and gravels are scarce in the project area. The materials for filters, drains, rock-fill, rip-rap and coarse concrete aggregates will be principally obtained by crushing of quarried materials. A suitable quarry was identified within about 2 to 4 km of the dam site.

vii) Geology of the reservoir area

The reservoir splits into two branches upstream from the confluence between the Bubu and Mkinki rivers: Bubu branch to the North and Mkinki branch to the South. These branches are separated by the Kumbaku Ridge, which dominates the riverbeds by up to 300 metres. The shape of the reservoir is controlled by the main structural trends of the project area. The two branches are aligned with regional ENE-WSW fault lineaments. The widening of the reservoir in the upstream part could be related to the influence of NW-SE faults overriding the influence of ENE-WSW faults. The bedrock at the dam site and in the hills dominating the reservoir rims is mainly made of granitoid rocks of the Kwamtoro block.

5.2.6 Seismicity

The seismicity of the eastern Africa is related to the tectonics of the region controlled by the East African Rift System (EARS). The dam site is located in the vicinity of the Eastern Branch of the EARS, which is reputed to be the most extensive and currently active zone of continental rifting. The Eastern Branch reaches North Tanzania where it forms the North Tanzania Divergence. Near Arusha, it splits into three segments, one of which heads southwards through the Lake Manyara and further towards Dodoma. In the region of Dodoma, this rift segment has induced relatively small scarps -200 to 300 m high-, moderately warm thermal springs, and high seismicity despite the moderate morphological print.

In the area of Dodoma, seven active faults are considered related to the EARS tectonics. Among them, the Bubu Fault is credited with the highest estimated maximum magnitudes. It is also the closest to the project area (Figure 4.4). For these reasons, the Bubu Fault was taken as reference source to assess the design earthquakes.

As shown on the illustrations below, two branches of the fault are estimated to pass through the dam project area: One branch passes to the North of the Saddle Dam at a distance of approximately 700 m from the extremity of the embankment. This branch corresponds to the outstanding escarpment and is considered to be the main fault. Another branch passes through the Right Abutment of the Main Dam, roughly parallel to the Bubu River valley in these reaches.

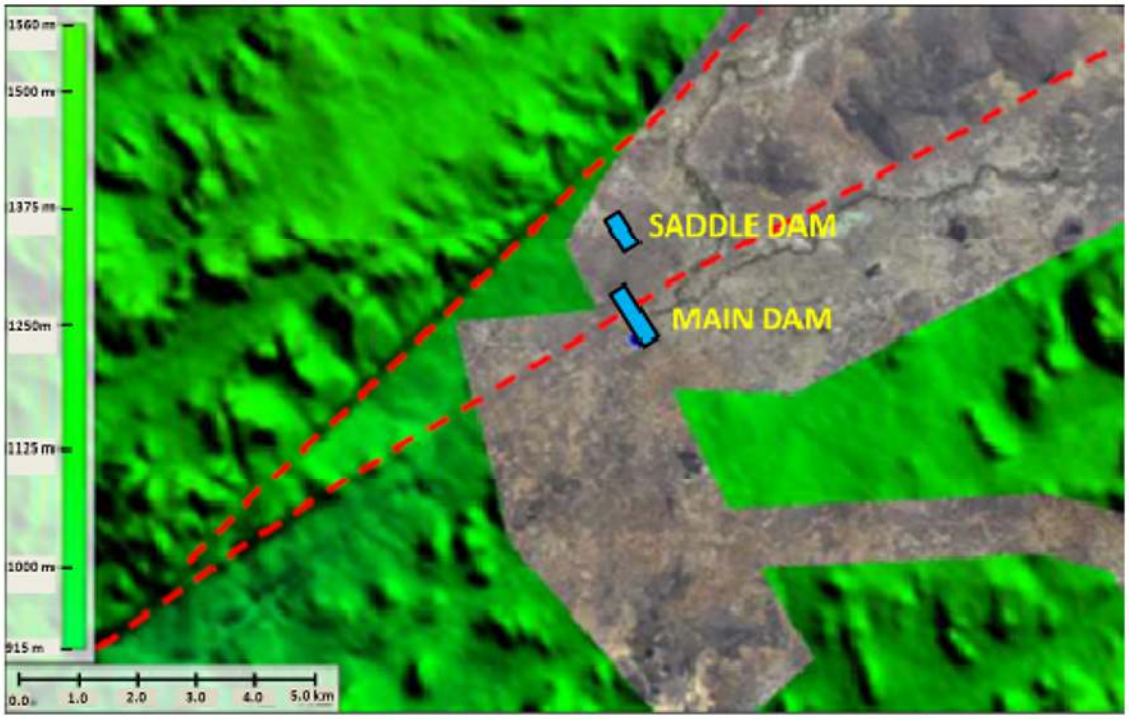

Figure 5.4: Location of Bubu fault segment near the dam site project in LANDSAT satellite imagery

The seismic hazard assessment concluded that the Bubu Fault is seismogenic and its co-seismic rupture during the lifetime of the scheme's structures cannot be ruled out. The reference earthquake is the Mw 7.2 generated on the northern Bubu Fault segments. The hypocentre is considered to be underneath the site at 10 k depth. The recommended horizontal Peak Ground Acceleration (PGA) values for rock foundation corresponding to the Maximum Credible Earthquake, Maximum Design Earthquake and Operating Basis Earthquake are respectively 0.38g, 0.34g and 0.29g. The maximum potential co-seismic displacement of these fault branches was evaluated at about 1 m for the Maximum Design Earthquake.

5.2.7 Hydrology

The Bubu River Basin is the major catchment within the Bahi Swamp drainage basin (Figure 4.6). It is part of the central Tanzania internal drainage system. This area, also called Internal Drainage Basin (IDB), is the second largest basin of the country after Rufiji River Basin with an area of about 143,100 km². The Bubu River Basin is the major catchment within the Bahi Swamp drainage basin. The Bubu River takes its source from the Mbulu Plateau on the border between Arusha and Manyara regions. All rivers within Arusha and Manyara Border flow into Lake Manyara

The catchment area of the Bubu River Basin is about 12,660 km² as recorded in a technical note of hydrology of the Bahi wetland. It represents 54% of the total catchment area of the Bahi Swamp. The official river gauge inventory of the MoW indicates 13,161 km² to the river gauge at Bahi (station ID 2R4) on the shore of the Swamp. This discrepancy is mostly due to the flat topography of the catchment, which makes the definition of the drainage system difficult. Furthermore, the drainage system is not well defined, due to the ephemeral character of the streams, ceasing to flow during the dry season, which goes from May/June to end of October (it is difficult to classify the month of May strictly under the dry or rainy season given that the rainfall records for this month). The major part of the basin shows altitude ranging from

1,000 to 1,700 m (Figure 4.5). The highest point of the basin is located at Mount Hanang (3,420 m) at the North Western boundary of the catchment.

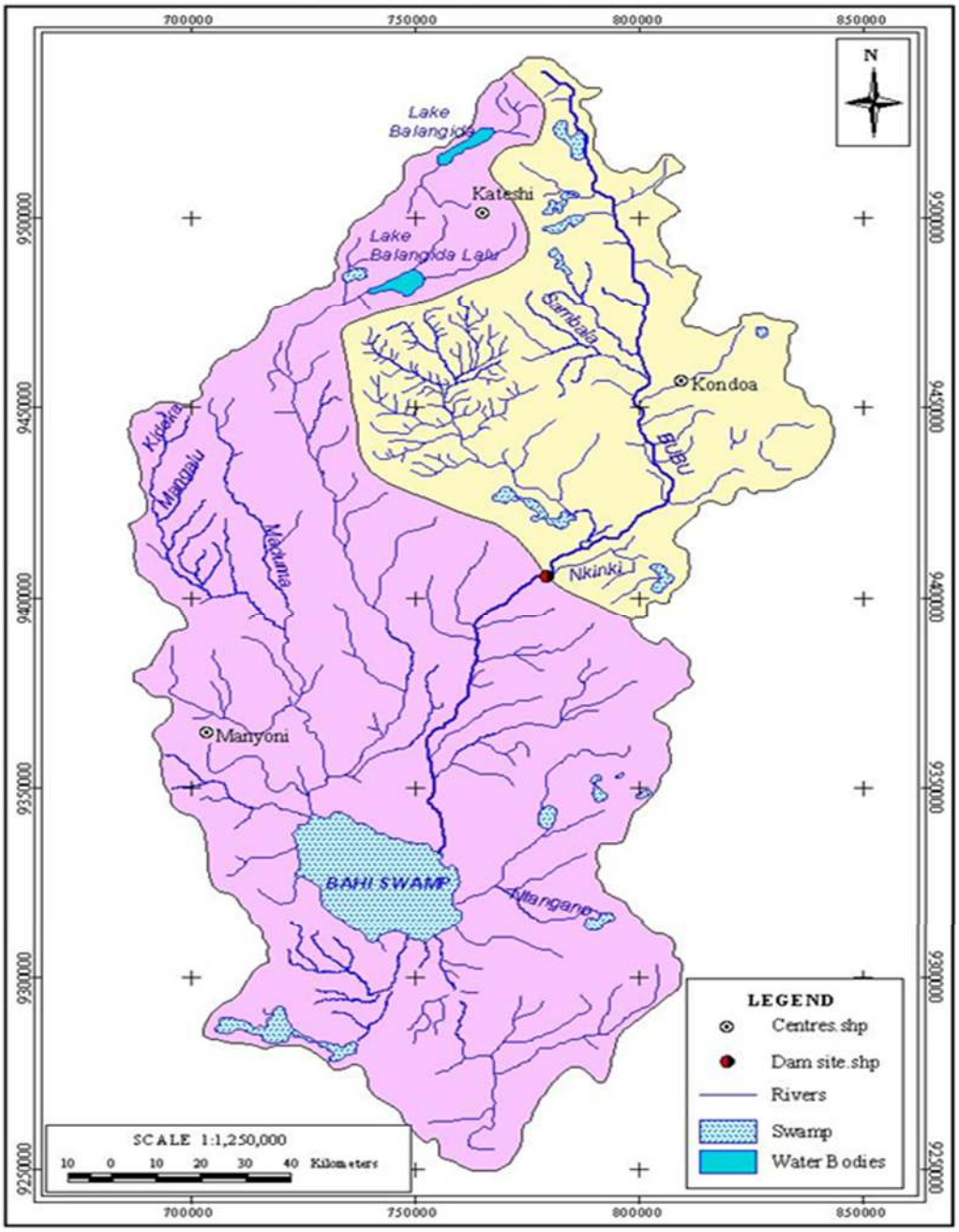

Figure 5.5: Bubu River Drainage Basin
Source: TRES Fied Data, 2021

5.2.8 Hydrography

From the Mbulu and Babati highlands, the Bubu River flows southwards in a well-developed river valley. Swampy flat areas along the water course induce retention. The river slope is moderate, while the slopes on both sides of the valley are relatively steep, especially on the Eastern side. Several tributaries join the Bubu River with high suspended sediment content due to the extensive erosion from the Kondoa area.

After the confluence with the Kondoa River, the Bubu River reaches Lake Serya, a permanent swamp in the broad river valley. At the outlet of the latter swamp, the Kelema River, a tributary on the left side, joins the Bubu River. As the Kondoa River, it takes its source from the highly eroded Kondoa area and is characterized by high suspended sediment content. The Bubu river flows towards the southwest and passes through tight rock outcroppings, such as the Bubu Gorge, and enters a large flat area extending to the Farkwa dam site. The silt and flood retention capacity of this depression area is considered to be relatively high. The Bubu River flows following the direction of the Bubu Fault Line and cuts through the Kwamtoro Block, which is characterized by a landscape of rocky hills and steeply incised valleys. The hills rise above the valley floors by some 200 to 300 m.

The confluence with the Mkinki River is located about one kilometre upstream of the dam site. Both parallel riverbeds are separated by a northeast striking range of hills. Downstream of the dam site, the Bubu enters the rapids. Within an eight km length section, the River drops of about 150 m. After the confluence with the Mambo River from the East and the Kamese River from the West, the Bubu leaves the fault and continues towards the South. Eventually, the Bubu river enters the open plains north of the Bahi Swamp. The slope decreases and the river flows in its own alluvium. South of Bahi Town, the river spreads through the Bahi Swamp at an altitude of about 820 m above sea level. Overall, the river channel network tends to follow a dendritic formation. The bottom is covered by coarse sandy sediments. The Kondoa and Kelema Rivers have very broad shallow sandy beds along their downstream reaches. This is due to a high sediment load, carried from the highly eroded Kondoa area, which occupies the upper and middle parts of their subcatchment, in the East of the total Bubu River catchment.

Figure 5.6: The confluence of Bubu (East) and Kondoa (West) River
Source: Feasibility Study -Interim Report N°2, 2015

5.2.8 Sediment Transport

In Farkwa Dam catchment, the Kondoa district is well known for being a classical example of important soil erosion. Erosion processes led to the formation of spectacular gullies at Haubi and broad sand rivers

flooding agricultural land and forcing people abandon their fields. Erosion was so serious that a national conservation programme known as HADO programme or Dodoma Soil Conservation Project was launched in 1973.

Soil erosion is worsened by high rainfall intensity prevailing over the region with tropical storms delivering about 50 mm in a couple of hours. These cloud-bursts hit down upon an unprotected soil. After the dry season, some of the vegetation has died off, and what remains has been intensively grazed so that both cleared and un-cleared land is often equally dangerously erodable. The soils are washed away in rills which can easily develop into gullies because of their sandy nature. Soil erosion results in increased sediment load in stream and rivers, leading to rapid siltation of water reservoirs. Thus sediment yield prediction is important when new dams are to be built for water impoundment.

The sediment curve was used by the feasibility consultant to derive suspended sediment yield from the daily discharge record at Farkwa gauge station. Annual sediment loads are the deducted and shown to be in the range of 16,000 to 1,316,000 tons. The mean annual load is 287,834 tons.

The total load includes suspension load and bed load transport. The bed load transport is taken as 15% of the suspension load. The total volume is deducted from the total load by considering a sediment density equal to 1,300 kg/m3, which is a representative value for the sandy deposits observed in the Bubu River. The results of the computation are presented in Table 5.4.

Table 5.4: Sediment transport at Farkwa dam site

Dam	Area	Rainfall	Runoff	Suspension Load	Sediment Yield (in suspension)	Total Load	Total sediment Volume
	(km^2)	(mm)	(mm)	(t/year)	(t/km^2/year)	(t/year)	(m3/year)
Farkwa Dam site	7680	650	17.2	287,834	37	331,009	254,622

5.2.8 Global warming

Climate change could affect project operation through, for example, higher temperatures and therefore higher water demands, or more intense rainfall and therefore more intense floods, or reduced rainfall and lower water availability. A number of studies projecting the impacts of climate change on water resources in Tanzania have been undertaken, ranging from Mwandosya et al. prepared in the 1994-1998 to the most recent by the University of Cape Town Climate System Analysis Group, completed in 2010. Most studies used multiple General Circulation Models (GCM) and generally concluded that temperature would increase in the range of 1.5 to 2.0°C for the first half of century and around of 2 to 4°C for the second half. Changes in rainfall patterns, total amounts and rainfall intensity are expected but are much uncertain and may differ greatly from one region to another. For study region, UNDP Country Profiles suggests that there may be a moderate increase in annual rainfall, while Mwandosya et al. and the University of Cape Town Climate System Analysis Group project a decrease of 5-15% for the first and 10-50% for the latter. Impacts on extreme rainfall events are even more uncertain.

The possible impacts of climate change on the hydrological characteristics of the Bubu River at Farkwa were assessed. Given that the long-term rainfall record at Dodoma (1930-2010) does not show any significant trend, projections were made based on the climate projections and on the previous studies in Tanzania. Three possible scenarios of future rainfall (-15%, 0%, +15%) and, two possible scenarios of

future temperature (+1°C, +3°C) were derived from the observed series. The hydrological modeling was applied on these scenarios to calculate the impacts on runoff. The results are presented in Table 5.5 below.

Table 5.5: Results of possible impacts on runoff

		Rainfall	Temperature	Runoff (mm)
	Reference (1957-2012)	**-**	**-**	**20.1**
Scenarios	1	-15%	+1°C	-58%
	2	0%	+1°C	-9%
	3	15%	+1°C	68%
	4	-15%	+3°C	-62%
	5	0%	+3°C	-17%
	6	15%	+3°C	54%

The main observations is that the impacts on runoff are ranging from -62% to 68%. The most severe impact on runoff is observed for the combination of a 15% decrease in rainfall and a 3°C increase in temperature in comparison to the reference. The combination of a 15% increase in rainfall and a 1°C increase in temperature results in a 68% increase in runoff. The impact on runoff is mostly driven by the rainfall. This is consistent with the high runoff variability, which is observed since 1957. A small increase in rainfall produces a high increase in runoff. Conversely a small decrease in rainfall produces a high decrease in runoff. The range of possible impacts on runoff is consistent with the runoff evolution observed in the 20th century for several rivers in Africa (White Nile, Senegal River).

Nevertheless, it should be borne in mind that the feasibility study for this project analysis averages the outputs of a number of General Circulation Models (GCM), some of which *do* predict an increase in annual runoff in the region. This prediction is also made in other reviews, such as de Wit and Stankiewig, (2006) who projected a rise in perennial drainage to a total of 136% in Central Tanzania. There is also a suggestion in some models of a slight increase in flood flows and risks. In relation to floods, the feasibility study weighted scenario predicts a slight increase in high flow levels in rivers (specifically, the flow which is exceeded 10% of the time will increase by 15 to 20%). The project itself will greatly increase the security of water supply to farmers and improve flood control, thereby mitigating against the potential impacts of climate change.

5.3 BIOLOGICAL CHARACTRISTICS

5.3.1 Flora

The project area is endowed with variety of vegetation and habitat types with the area supporting a great diversity of plant species found both within and adjacent the proposed project area. It supports species ranging from grasses to trees. The area comprises of various vegetation and habitat types both disturbed and undisturbed. During ESIA survey the vegetation and habitat types identified were disturbed miombo woodland, acacia woodland, acacia-commiphora, savannah, bushland, thicket on low land areas and riparian vegetation while undisturbed vegetation was only thicket surrounding the mountains near Bubutole village. Vegetation assessment was carried out and 130 plant species were recorded (Appendix 20). The area was dictated by trees (45.38 %), followed by shrubs (38.46 %). Herbs, grasses and fern

accounted for 10.76 %, 4.61 % and 0.76 % respectively (Table 5.6, Figure 4.7). Out of the 45.38 % trees and 38.46 % shrubs recorded, majority are used for building and construction purposes.

All of 130 plant species recorded belongs to 50 families / sub-families (Appendix 20). The families / sub-families that had the highest frequency of occurrence of plant species include Mimosoideae, Caesalpinioideae, Moraceae, Euphorbiaceae, Malvaceae, Proteaceae, Compositae and Gramineae. Plant species with frequencies of occurrence of 50 % and above within the proposed project area were; Trees / shrubs*: Tecoma stans, Grewia tenax, Grewia bicolor, Acacia seyal, Acacia abyssinica, Acacia kirkii, Commiphora africana, Adansonia digitata, Pteliopsis myrtfolia, Strychnos spp. Dichrostachys cinerea* Herbs: *Bidens pilosa, Berkheya echinacea, Commelina benghalensis* Grasses: *Phragmites mauritianus, Hyperrhenia rufa, Panicum infestum, Panicum maximum* and *Hyperrhenia cymbaria.*

Since it was during dry season, herbaceous layer was poorly dominated by herbs and grasses. No any species regarded as rare or endemic recorded within the area. Most of the species recorded here are of low conservation concern except *Pterocarpus angolensis and Dalbergia melanoxylon* (IUCN – near threatened) and *Brachystegia spiciformis* (CITES Appendix II category). Majority of the plant species recorded in the proposed project area is represented elsewhere in the adjacent miombo woodland, acacia woodland, bushland and thicket.

Table 5.6: Percentage distribution of plant habits / life forms of Farkwa area

Plant life forms / habits	Percentage (%)
Trees	45.38
Shrubs	38.46
Herbs	10.76
Grasses	4.61
Fern	0.76

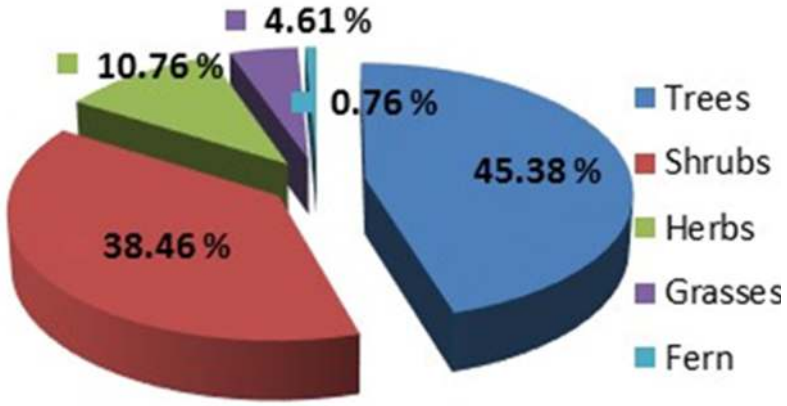

Figure 5.7: Pie chart showing percentage distribution of vegetation cover of the project area

During site visit a consultation with local people, farmers and government staffs indicates that illegal harvesting (logging), bush fires, charcoal burning, fuel and fire wood collection are currently threatening vegetation of the proposed project area. According to interviewees illegal harvesting threatens *Pterocarpus angolensis, Brachystegia spiciformis, Acacia abyssinica, Acacia tortilis, Acacia sieberiana, Acacia lahai, Acacia seyal and Anona senegalensis.* The threatened species are used by local people for

poles, timber, charcoal making, fire and fuel wood (Figure 4.8 and 4.9). Bush fires and farm clearance threaten miombo and acacia woodland habitat in the proposed action area.

Figure 5.8: Tree cut down by local people to be used as poles, fire and fuel wood.

Figure 5.9: Fire effect on the acacia woodland during farm preparations at Bubutole village within the proposed project area

The vegetation in the project area varies, depending on soil characteristics. Woodlands (miombo and acacia), *acacia-commiphora*, savannah, bushland and thicket, grassland with groups of scattered trees like baobabs *(Adansonia digitata)* characterizes the uncultivated project areas. Along the rest of the project area, the natural vegetation has been replaced more or less by human activities, mainly livestock grazing and crop production, mostly scattered cultivation with maize, millet, sorghum, beans, sunflower etc., intertwined with human settlement. Riverine vegetation can be seen along the Mkinki and Bubu rivers within the project area while swamp vegetation dictates Bahi swamp / flood plain (recipient of Bubu River) outside project area.

5.3.2 Fauna

5.3.2.1 Large, medium sized and small mammals

Results from the interview, animal calls; and dung and sign survey showed that the area harbours about 19 large and medium sized mammal species from 8 orders and 13 families (appendix 7). Lion (*Panthera leo*) and ground pangolin *(Manis temminckii)* only occasionally visit the study area during wet season. Apart from the baboons, warthog, vervet monkey, mongoose and honey badger the other species were

not directly encountered because they are shy due to human disturbances and thus are nocturnal. Commonly encountered species by villagers in the area include the Warthog (*Phacochoerus africanus*), Bush pig *(Potamochoerus porcus)*, Vervet monkey (*Chlorocebus aethiops*), Aardvark (*Orycteropus afer)*, Crested porcupine *(Hytrix cristata),* Rock hyrax (*Procavia capensis*), Scrub hare (*Lepus saxatalis)*, Eland (*Tragelaphus oryx*), dik dik *(Madoqua kirkii)*, Klipspringer (Oreotragus oreotragus), Black backed jackal (*Canis mesomelas*), Wild dog (Lycaon pictus), Hyena (Crocuta crocuta) and Leopard *(Panthera pardus)*.

5.3.2.2 Small mammals

Farkwa area harbours about 8 small mammal species in 5 families (Table 5.7). Species that were captured and listed through the interview include the Four-toed hedgehog *(Erinaceus albiventris)*, one species of elephant shrews; Four-toed Elephant shrew (*Petrodromus tetradactylus*). Others were Slender mongoose (*Herpestes sanguineus),* Striped grass rat *(Lemniscomys striatus)* figure 4.10, Woodland thicket rat (*Grammomys dolichurus)* figure 4.11, Multimammate rat *(Mastomys natalensis)* and Black rat *(Ratus rattus)*.

Table 5.7: Small mammals recorded during the study

Common name	Scientific name	Order	Family	IUCN status	Evidence / Method		
					Trap	Direct observ	Other
Black rat	*Rattus rattus*	Rodentia	Muridae	Least concern		×	Interview
Woodland thicket rat	*Grammomys dolichurus*	Rodentia	Muridae	Least concern	×		
Common/ Typical striped grass rat	*Lemniscomys striatus*	Rodentia	Muridae	Least concern	×	×	
Multimammate rat	*Mastomys natalensis*	Rodentia	Muridae	Least concern	×		
White toothed shrew	*Crocidura hirta*	Eulipotyphla	Soricidae	Least concern	×		
Slender mongoose	*Herpestes sanguineus*	Carnivora	Herpestidae	Least concern		×	Interview
Four-toed Elephant shrew	*Petrodromus tetradactylus*	Macroscelidea	Macroscelididae	Least concern		×	
Four-toed hedgehog	*Erinaceus albiventris*	Erinaceomorpha	Erinaceidae	Least concern		×	Interview

Figure 5.10: Striped grass rat

Figure 5.11: Woodland thicket rat

5.3.2.3 Birds

A total of 77 bird species (Appendix 8) were recorded both on site and the areas adjacent to the proposed project (miombo woodland, riparian vegetation, wooded acacia-grassland and thicket). The riverine forest was the most species rich with 40 species followed by the wooded acacia-grassland with 27 species, whereas the dry miombo woodland was the most impoverished with 10 species. The most well represented avian family in the area is family Columbidae with four species while the remaining families are represented by either two or single species.

In wooded acacia-grassland the most abundant species were African mourning dove, red eyed dove, ring-necked dove and emerald spotted wood dove while in the riverine forest common bulbul dictated the habitat. Francolin and crested guinea fowl dominated the habitat that boarders the wooded acacia-grassland, miombo woodland and thicket.

Some of the species encountered in the study area include the Black-headed heron (Figure 4.12), African mourning dove, Emerald spotted wood dove, Ring necked dove, Red eyed dove (Figure 4.13), Cardinal wood pecker, Common bulbul, Collared sunbird, Red-cheecked cordon bleu, White browed Coucal, Crested guinea fowl, Common buzzard, Crested Francolin, Speckled mouse bird, Crowned Eagle, Malachite Kingfisher, Green wood hoopoe, Red-billed hornbill, Forked tail drongo and Brown headed Parrot.

Figure 5.12 Black-headed heron

Figure 5.13: Red eyed dove

5.3.2.4 Reptiles

A total of 23 species in 12 families were encountered or identified through the interview in the study area (appendix 9); some of the species include the Black mamba (*Dendroaspis polylepis*), Gaboon viper (*Bitis gabonica*), Black-necked spitting cobra (*Naja nigricollis*), Puff Adder *(Bitis arientans)*, Southern African Rock Python (*Python sebae natalensis*), African burrowing snake- Cape centipede-eater *(Aparallactus capensis)*, Common egg-eater (*Dasypeltis scabra,* Boomslang *(Dispholidus typus)* Brown-house snake *(Lamprophis fuliginosus),* Rufous Beaked snake *(Rhamphiophis rostratus),*Striped skink *(Mabuya striata),* Tropical house gecko *(Hemidactylus maboui),* Yellow-throated plated lizard *(Gerrhosaurus flavigularis),* Red-headed rock agama *(Agama agama),* Green snake *(Philothamnus sp).*

5.3.2.5 Amphibians

One amphibian species belonging to the Order Anura, family Ptychadenidae and genus Ptychadena (*Ptychadema mascariensis*) was identified in the study area, both within proposed project area (Bubu and Mkinki rivers) and outside in the recipient Bahi swamp/flood plain. The species dictated the small water pools and wells dug by the villagers for cattle drinking.The rivers (Bubu and Mkinki) and the recipient Bahi swamp were all dry, except in few stretches of Bubu which had some amount of water (stagnant shallow pools).

5.3.2.6 Fish

With respect to aquatic fauna two fish species in the family Clariidae (*Clarius spp.*) and Cichlidae (*Oreochromis spp.*) were recorded during interview and sampling (figure 4.14). It was not easy to account for species abundance, because the rivers were dry and hence few individuals recorded. The species were recorded in shallow pools and in few stretches of Bubu River. No any shellfish species identified in Bubu, Mkinki Rivers or Bahi swamp/flood plain.

Figure 5.14: *Clarius spp.* recorded during the study.
In this picture, a local fisherman displays his catch at Bubu River.

5.3.3 Animal species of conservation importance at Farkwa

5.3.3.1 Threatened animal species

Four mammal species recorded during the study are in the IUCN Red List of Threatened Species (2007 IUCN) – Wild dog (*Lycaon pictus*) and Ground pangolin *(Manis temminckii*) are Endangered; Leopard (*Panthera pardus*) is near threatened while Lion (*Panthera leo*) is Vulnerable. There are no threatened fish, birds or herptiles species in the study area (Table 5.5).

5.3.3.2 Animal species in CITES list

Four animals are in the CITES Appendices (CITES 2011). One large mammal, Leopard (*Panthera pardus*) is in Appendix I, while in Appendix II are the reptiles notably South African rock python (*Python sebae natalensis*) and Monitor lizard (*Varanus niloticus*); and one avian species Brown-headed Parrot (*Poicephalus cryptoxanthus*) (Table 5.8).

Table 5.8: List of species of conservation concern recorded during the study

Species	Common name	IUN Status	CITES Appendix
Mammals			
Panthera pardus	Leopard	Near threatened	III
Panthera leo	Lion	Vulnerable	
Lycaon pictus	Africa wild dog	Endangered	
Manis temminckii	Ground pangolin	Endangered	
Reptiles			
Python sebae natalensis	South African rock python		II
Varanus niloticus	Monitor lizard		II
Bird			
Brown headed parrot	*Poicephalus cryptoxanthus*		II

5.4 SOCIO-ECONOMIC PROFILE

5.4.1 General Population Characteristics

Based on the 2012 national census, the Dodoma Region had a population of 2,083,588, which was lower than the pre-census projection of 2,214,657. According to the the National Bureau of Statistics (NBS) projections, the region was supposed to have a population of 2,312,141 by 2017 (ESRF, 2019). The number of people within the study area also was estimated using for base data the results of the 2012 national population census, which was published by the Tanzania Bureau of Statistics in March 2013. The results of the 2012 official national census and projected populations as 2021 within the project area s are presented below in table 5.9.

Table 5.9: 2012 Population Data

Area/Locality	Ward	Village	Population as per 2012	Projected pop as 2021
Dodoma City			410,956	
Chemba DC			235,711	274,327
	Farkwa	Bubutole	1,419	1,651
		Mombose	1,294	1,506
		Farkwa	2,096	2,439
		Donsee	482	561
		Bugenika	1,668	1,941
		Gonga	1,726	2,009
		Gonga Chini	1,305	1,519
	Tumbakose	Tumbakose	1,771	2,061
		Hawelo	1,247	1,451
		Humekwa	1,430	1,664
	Gwandi	Gwandi	1,412	1,643
		Rofati	1,230	1,432
		Muungano	882	1,026
	Chemba	Chemba	1,471	1,712
		Chambalo	1,902	2,214

		Kambi ya Nyasa	1,517	1,766
	Makorongo	Maziwa	3,304	3,845
		Makorongo	2,104	2,449
		Khubunko	1204	1,401
	Babayu	Babayu	2,410	2,805
		Chase	2,251	2,620
		Masimba	1,926	2,242
		Chinyika	1964	2,286
Bahi District			**221,645**	
	Zanka Ward		9,886	
		Mayamaya	4,008	
		Zanka	1,901	

5.4.2 Number of household and average family size of the area to be affected

At the core project area the project will basically affect two villages Mombose and Bubutole which consist of six Sub Villages. A total of 567 households (Table 5.10) would be affected by the rise of the water level to its maximum level (i.e 1110 masl) and this number also includes households found within its buffer zone of 250 m, or within the buffer zone of 500 m along the main and saddle dam. These households will be relocated before start of mobilization and construction of the project. The household distribution of the households to be affected from each sub-village is indicated in Table 5.10.

Table 5.10: Village and sub village household distribution for the area to be affected

Villages	Sub village household						Total
	Kichangani	Mombose	Bubutole	Sawe	Malanga	Mombose Shuleni	
Bubutole	173		7	106	10		295
Mombose		152		34		85	272
Total	173	152	7	140	10	85	567

5.4.3 Cultural heritage, aspirations and traditions

Ethnic group

The main ethnic group for the project area residents are Sandawe 54.59%, Sukuma 24.2%, Maasai (5.65%), Mang'ati 5.48%, and Mbulu (4.06%). Others are Rangi, Nyamwezi, Gogo, Ziguo, Nyaturu and Msegeju. The indigenous people are Sandawe while others are migrants from Tabora, Arusha, Manyara, Singida etc. Sandawe have traditionally been hunters and gatherers of food, moving their portable shelters wherever there was game.

In the past generation, the village-based development program of the Tanzanian central government has encouraged the Sandawe to develop a more sedentary lifestyle based on farming. As a result the Sandawe lost their hunting areas and their sources of food diminished. Today many people own cattle and farms where they cultivate food and cash crops. At the project site hunting-gathering lifestyle do not exist, people are farmers and livestock keepers. Also it is estimated that about one-fourth of the Sandawe have migrated to the areas around the towns of Arusha and Dodoma.

Music plays an important part in the social life of the Sandawe people. Each area of life is celebrated with its own style of music. Stories of the past are told to the children by the elders, conveying their history, traditions, and wisdom. In many of the traditional stories the Sandawe identify with the small animals whose cunning and intelligence gives them victory over their more powerful enemies. Cave spirits living in the hills, ancestor worship, and divination form part of the Sandawe religion.

Religion

The dominant religions in the area includes paganism followed by Islamic and Christianity. Most Sandawe still practice their animistic faith which includes the reverence for the moon. The moon is seen as a symbol of life, fertility and good will. Their traditional beliefs emphasize living in harmony with nature.

5.4.4 Land Use

The main land use activities within the project area are settlements, subsistence agriculture, grazing, and forestry. Cropland is generally located adjacent to or near the homestead. At the village centers like Mombose and Bubutole there are petty business (small shops, kiosks cafe etc) as well as local institution (village government offices etc). All people have permanent homes in the villages and most dwellings are mud houses with grass roofs (see Table 5.11 below). There are a considerable number of tin-roofed mud brick houses. The village governments are responsible for the management of the land and planning for land use within their jurisdiction. Also as a perpetuation of the patriarch system, the main owner of the houses in the project area is male husband.

Figure 5.15: Very common housing structures in Mombose and Bubutole village

Table 5.11: Housing characteristics in the project area

Sub-village	Houses Roofing (%)				
	Corrugated iron	Grass	Tiles	Sticks	Concrete
Kichangani	21.8	61.8		15.9	0.6
Mombose	39.2	47.3	0.7	12.8	
Bubutole	14.3	57.1		28.6	
Sawe	27.2	50.7	0.7	20.6	0.7
Malanga	10.0	60.0	.0	30.0	
Mombose Shuleni	25.0	26.2	1.2	46.4	1.2

Kitchen Characteristics

The size of the kitchen in the project area is between 0-20m^2 (58%) and those which are between the average of 21-31m^2 are 22.2%. In some areas kitchen are included in dwelling houses are not built separately. Most of kitchen in all villages are thatched with grasses, few corrugated iron and others with sticks roofs (see Table 5.12).

Table 5.12: Characteristics of the kitchen in the project area

Sub Village	Kitchen Roofing (%)		
	Corrugated iron	Grass	Sticks
Kichangani	5.2	71.4	23.4
Mombose	13.6	67.8	18.6
Bubutole		75.0	25.0
Sawe	4.5	68.2	27.3
Malanga		66.7	33.3
Mombose Shuleni	12.1	63.6	24.2

Sanitation facilities characteristics

The average size of the facility is between 10 - 20m^2 (87.4%) of the total surveyed households. Other households have no facility they used bushes around their homestead. Most of the facilities in the study area were roofed by thatch, few by corrugated iron and others by sticks, bamboo and wood pole in some villages as shown Table 5.13. There are considerable numbers of household with no facility in the study area and use the bushes around their homestead as toilets that may cause eruption of disease during rainy season.

5.4.5 Economic base and activities

5.4.5.1 Tanzania Human Development Report

Livelihood insecurity, poor social service provision, and gender inequality are factors that contribute significantly to poverty. Pressing socio-economic issues identified by stakeholders in Tanzania include rural income poverty, unemployment among youths and women, child labour and out-of school children aged eleven years and above. These issues are also reflected in the priorities for the Dodoma region. Dodoma Region is ranked comparatively well in terms of socio-economic indicators. According to 2017 Tanzania Human Development Report (THDR), the region's Gross Domestic Product (GDP) was Tsh 2,635,574 millions in year 2015 and its GDP per capita was Tsh 1,188,343. With regard to Human Development Index (HDI), Dodoma scored HDI of 0.479 ranking 17 out of 26 regions of Tanzania Mainland. The average HDI score for Tanzania Mainland was 0.614. Dodoma's life expectance was 64.4 years higher than 61.7 years for Tanzania Mainland.

The average economic growth for Dodoma Region over the past 17 years or so has been steady but yet below the national average of around 7 percent. Recently tremendous developments have taken place to support the capital transfer programme by the central government. As a result, regional economic growth has increased over the recent past two years to match the national average, with acceleration on per capita income and poverty reduction. Dodoma City is blossoming at an unbelievably high collection rate of own revenue resources. The challenge is to sustain such growth momentum and through it builds a formidable foundation for self propelling growth. The proposed project will contiribute to the sustainable growth of the region and the city of Dodoma.

5.4.5.2 Employment

Dodoma Region has surplus labour due to low employment. While some of the labour is unskilled, there are efforts to build skilled labour force especially through vocational colleges. The employment base of the Mombose and Bubutole people is mainly small-scale / subsistence agriculture and livestock keeping. More than 98% of people living in area depend largely on these two economic activities. Sub-sectors like employment in public institutions (Teachers etc), trade and commerce, and some other small enterprises play an insignificant role in the economy of the area.

5.4.5.3 Agriculture

Agriculture dominates the livehood and economy of the Dodoma Region. The region is found in the Central Plateau zone, which is famous for production of fruits such as grapes, mango, papaya, guava, baobab, tamarind and dates (Ministry of Agriculture and Food Security, 2006). Among the fruits produced, grape is the major cash crop produced by farmers. In addition, grape production is the mainstay for many farmers in Dodoma City and the nearby districts of Chamwino and Bahi. About 70 percent of grapes in the region are produced in Dodoma District. Chamwino and Bahi produce 30 percent (SNV Tanzania, 2005). This crop is a multi-usage such that it can be eaten raw or can be used for making jam, juice, jelly, wine, grape seed-extracts, raisins, vinegar and grapeseed oil. Grape production in Dodoma is dominated by smallholder farmers, who produce grapes in their own farms.

On average, each smallholder produces 1,630 kilogrammes of grapes per annum on average of 0.83 hectare of land. However, sunflower and groundnuts as oil seeds are also used as income generating cash crops in Dodoma. The two cash crops are produced in all districts of the region even though they are produced on a small-scale level (Match Maker Associates, 2010). With the rapid increase in the Dodoma population, caused by the coming of Government offices, investment in large-scale production for cash crops is imperative.

About 98% of people in the villages within the project area are farmers and their livelihoods depend on those farm. Farming in this area is seasonal and limited by generally poor soil conditions and insufficient rains. Also traditional small hand hoe is the major implement used by farmers (97.9%). Therefore flooding of farm crops has a very big impact to their lives. The main food crops are maize, cassava, millet and pigeon pea. Other economic crops include mangoes, and groundnuts. This type of crops provides indications of types of crops that will need to be compensated. Due to low agricultural production, sometime annual yields are insufficient to feed the villages population and, hence, depend on the government donation of maize.

5.4.5.4 Others economic activities

Livestock keeping
Livestock keeping in project area is very minimal as the customs and practices of the communities living in the area are not of animal husbandry. The main livestock most people in the area keep are cattle, goat, sheep and indigenous chicken for subsistence and income generation. Also livestock development may temporarily be affected by flooding and clearance of the vegetation on the project area.

Figure 5.16: Livestock keeping within the project area

Assets available in the project area

The dwellers in the area depend on agriculture and the major asset available in every household is hand hoe (97.9%). The analysis of this category was taken in generalization and every asset available in the project area is indicated in the Table 5.13 below.

Table 5.13: Assets available within the project area

Type of asset	Frequency	Percent (%)
Hand Hoe	555	97.9
Couch/Chair/Stool	373	65.8
Bed	529	93.3
Tables	169	29.8
Cupboard	23	4.1
Radio	270	47.6
Panga	362	63.8
Cell Phone	272	48.0
Hand Tools	434	76.5
Private Vehicle	10	1.8
Farm Vehicle	68	12.0
Mosquito Nets	478	84.3
Wood Stove	408	72.0
Bicycle	257	45.3
Sewing Machine	29	5.1
Cattle	1990	35.1
Goats	2970	52.4
Sheep	155	27.3
Pigs	16	2.8
Chickens	4410	77.8
Ducks	55	9.7
Guinea Pigs	11	1.9
Beehives	166	29.3
Rabbits	2	0.4

5.4.6 Social Services

Water Supply

The scarcity of clean and reliable water to the project area seems to be a major constrain for its residents. Most of people get water from unprotected sources such as seasonal streams, shallow wells and hand dug ponds, and thus suspected to water borne diseases. Use of traditional water sources is unsafe due to being prone to contamination. Consultations at Village levels indicate that water availability is a problem. Water is ranked higher to priority need of the community.

Table 5.14: Availability of water to the project area

Sub Village	Water presence in HH (%)	
	Available	Not available
Kichangani	2.4	97.6
Mombose	13	87
Bubutole		100
Sawe	9.8	90.2
Malanga		100
Mombose Shuleni	22	78

Table 5.15: Compound tap distance from HH in km

Sub village	Compound tap distance from HH (km) (%)			
	0.5-1km	1-1.5km	1.5-2km	2.5-3km
Kichangani	100.0%			
Mombose	77.9%	7.8%	10.4%	3.9%
Sawe	66.7%	33.3%		
Mombose Shuleni	50.0%	12.5%	25.0%	12.5%

Health Services

The project area (Mombose and Bubutole Villages) has no hospital or the health centre. There is one government owned dispensary at Farkwa with a total of 3 workers. Most of health workers in the area have primary school education and one year professional training in Nursing. It was reported that the health services available including medicine are not sufficient for the growing number of people and emerging diseases such as HIV/AIDS.

The main health hazards in the project area are vector-borne tropical diseases especially malaria, intestinal schistosomiasis and soil-related intestinal helminths. At this Latitude, the elevation ranging between 1,091m and 1,150 m asl is compatible with the cycles of transmission of all these diseases, and they are widely observed in the population. They are the principal diagnosis done in the health facilities, and the origin of the major part of the prescriptions. The top ten causes of morbidity (illness) reported by the WEO and Health Officer in Charge at Farkwa Dispensary in 2013 - 2014 are listed in figure 5.17.

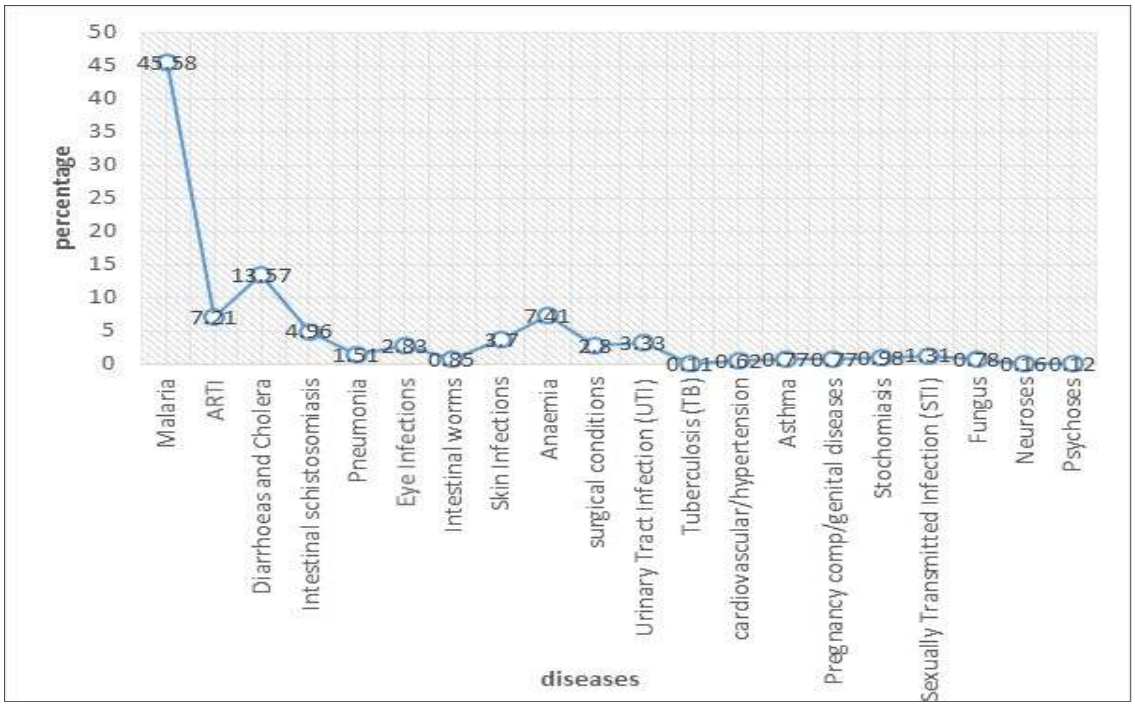

Figure 5.17: Ten most commonly reported causes of morbidity in the project area
Source: Farkwa Ward Executive Officer, 2015

According to information from the WEO, malaria has been leading, diarrhoea stands second among the most important health problems in the project areas. The number of cases is probably higher than reported because everywhere in the world diarrhoeas are often treated at home by traditionally practices, or neglected. Intestinal schistosomiasis or bilharziasis (Schistosoma mansoni infection) is present around project area, as elsewhere throughout much of the country. Cases of intestinal schistosomiasis were reported by Farkwa health officer. In the project area and in their surroundings, acute respiratory tract infections (ARTI), including bronchitis and pneumonia, rank among the top three causes of morbidity together with malaria and diarrhoea. Low temperatures, especially during the night, the poor housing conditions, the indoor fires of cow dung and wood without evacuation of the smoke are cumulative elements contributing to a high incidence of ARTI.

Further voluntary testing registers have been proven to be a reliable source of HIV /AIDS infection information in the area. During the year 2013, a study of HIV / AIDS prevalence among family blood donors showed that for every 100 blood samples, there were six blood samples which were HIV positive in the area.

Waterborne diseases caused by protozoa, bacteria or viruses are common in the Farkwa areas, as elsewhere in the world where there is no access to abundant clean water and no safe disposal of human waste and wastewater. However, these infections are rarely a direct result of dirty water. Most often they result from contamination of food by traces of stools from dirty hands or from flies flying from animal and human faeces to human food. In fact, these diseases are a result not of an excess of water but of a too little access to clean water, a lack of hygiene (especially of soap and washing hands), and inadequate protective food storage.

Education Services

Mombose and Bubutole villages each have one primary school with pupils walking short distances of around one kilometre to reach the school. The nearby secondary school is located at Farkwa Village about five kilometers from Mombose village centre. Within the project area about 59.9% of people interviewed attended formal education while 32.7% of the respondents have not attended formal school. Also 2.7% attended secondary school and just few of them are formally employed.

5.4.7 Infrastructure

Roads

The project area is about 130km from the Dodoma Municipal center and is accessed by a road branching from the Dodoma - Kondoa highway at Mayamaya and by-passes a number of villages up to Kwamtoro. This road from Mayamaya to Kwamtoro is all weather murram surfaced road and can be used during the heavy rainy season. Feeders' roads in the project area are earth surfaced with the implication that they are generally impassable during the rainy season. Even during the dry season they are used with difficulty as the ESIA study was forced to use motorcycle to access all the Sub Villages within the project area. According to responsibility, maintenance of the roads (feeder roads) in the project area is the responsibility of the district authority.

Air service

The airport near to the project area is located in Dodoma City about 130 km and can accommodate small jet aircrafts. Currently is been used mainly by private ones especially the Military Aircraft Flights and government planes.

Energy

There is no electricity supply to all villages located within the project area. However, some people have electric generator and solar electricity. The main sources of energy for communities are wood and charcoal. Fuel wood and charcoal constitute 100% of total energy required for cooking and other domestic uses in the area. The source of fuel wood and charcoal is mainly from the nearby forests.

Solid waste management

There is no formal system for collecting or managing solid waste, or hazardous waste in the villages within the project area. Littering is common in most villages and combustible wastes are disposed of by burning.

Police, security and fire services

In the project area there is no Police Post. Security measures available within the villages include security and safety committees such as Mgambo and sungusungu committees as well as committee of culture and tradition, which has a role of containing the crime and upholding norms and values in their villages.

Hygiene and Sanitation

The majority of households use pit latrines. The area has a problem of the water scarcity that makes it difficult for the people to have maintained good hygiene, especially during the dry seasons.

6 STAKEHOLDER ENGAGEMENT PLAN

6.1 INTRODUCTION

This chapter outlines the stakeholder engagement activities that have been undertaken to date and describes the stakeholder identification process highlighting: stakeholders identified and consulted; the consultation methodology used; identified stakeholder issues and concerns regarding the proposed construction of Farkwa Dam and Water Conveyance System to Chemba and Dodoma City; and concluded by a review of how the issues raised have been addressed. The overall purpose of the stakeholder engagement is to provide how Ministry of Water will engage with stakeholders through the course of development of the proposed project. The ESIA engagement activities provide an opportunity for all interested and affected parties to air their opinions and concerns about impacts and mitigation measures associated with the proposed project and allow the project to consider and respond to these in undertaking the ESIA. Also input from engagement activities provide the authorities and MOW an opportunity to ensure that concerns and comments raised by other stakeholders are included in developing a Social and Environmental Management Plan and Environmental Monitoring Plan for the project. Stakeholder consultation will continue during the disclosure of the ESIA report and throughout implementation of the proposed project.

6.2 REQUIREMENT FOR PUBLIC CONSULTATION

The Environmental Management Act Cap 191, Environmental Management (EIA and Audit) (Amendment) Regulations, 2018 and AfDB Operational Safeguard 1: Environmental and social assessment requires public consultation and disclosure to be part of the project planning and implementation and to use the results of the consultation to inform the project design. The ESIA and Environmental Management (EIA and Audit) (Amendment) Regulations, 2018 call for public consultation and specify the timing and process for notification of the public at key steps in the ESIA process. Public consultation is called for at the ESIA Scoping Stage and following completion of the impact analyses. The project proponent is also required to notify the public upon commencement of the scoping activities and on submission of the Draft ESIA to NEMC.

The AfDB requirements with respect to public consultation in environmental assessments. The project has been planned as a Category A project under AfDB Operational Safeguard 1: Environmental and social assessment as it will have the potential for significant adverse environmental effects. For such projects, project sponsors are required to consult with stakeholders on the preparation and results of their ESIA and to disclose to the public the results of the ESIA process. On-going consultation is also required during construction and operation phases of the project. Essential AfDB requirements regarding public consultation and disclosure include:

- At least one round of public consultation at each of the “scoping”, ESIA review, and construction/operation stages of the project, to be conducted in culturally appropriate ways;
- Careful documentation of all public consultation activities and issues;
- Public disclosure of ESIA documentation both at the AfDB Infoshop and in the country where the project is proposed for specified periods of time;
- Circulation of local language summaries of ESIA results; and
- Demonstrated responsiveness by project sponsor to issues raised during consultation.

The overall goal of the consultation process is to disseminate project information and to incorporate the views of PAP in the design of the mitigation measures, management plan and Resettlement Action Plan. It is done to ensure the quality, comprehensiveness and effectiveness of the Impact assessment to ensure that various groups' views are adequately taken into consideration in the decision making process. Consultation with the stakeholders was aimed at positively conveying information about the proposed Farkwa Dam, Water Treatment Plant and Water Conveyance System to Chemba and Dodoma City project development, clear up misunderstandings, allow a better understanding of relevant issues and how they will be dealt with, and identify and deal with areas which are controversial while the project is still in its design stage. Stakeholders and public involvement were therefore aimed at assisting the consultant in:

- Improve Project design and, thereby, minimize conflicts and delays in implementation;
- Determining the scope of the ESIA
- Deriving specialist knowledge about the site
- Improve project design and, thereby, minimize conflicts and delays in implementation;
- Facilitate the development of appropriate and acceptable entitlement options;
- Increase long term project sustainability and ownership;
- Reduce problems of institutional coordination;
- Gather the information needed to complete the assessment.
- Make the resettlement process transparent; and
- Increase the effectiveness and sustainability of income restoration strategies, and improve coping mechanisms.

6.3 OBJECTIVES OF STAKEHOLDER ENGAGEMENT

The overall objective of the Stakeholder Engagement Plan (SEP) is to ensure that a consistent, comprehensive, coordinated and culturally appropriate approach is taken to stakeholder engagement and project disclosure. It is intended to demonstrate the commitment of MOW to an 'international best practice' approach to engagement. In line with current international best practice, the stakeholder engagement for this project aims to ensure engagement that is free of manipulation, interference, coercion and intimidation. MoW is committed to full compliance with the Tanzania's national environmental policy and legislation. This stakeholder engagement identifies key stakeholders and provide adequate mechanisms for stakeholder feedback and information sharing; outlines the approach to be adopted to engagement, showing how this will be integrated into the rest of the ESIA process; ensure issues raised by key stakeholders are addressed in the ESIA as well as in project decision-making and design phase; serves as a way to document the process; and identifies proponent responsibilities with respect to Tanzania legislative requirements and international best practice. With this contextual the overarching specific objectives of this stakeholder engagement are to:

- Provide relevant, timely, accessible and appropriate information regarding hydroelectric power plant related developments, in an appropriate manner and understandable format to all stakeholders. Information will be disclosed as early and as comprehensively as possible,
- Identify structures through which information can be disseminated to stakeholders;
- Consult stakeholders on their opinions, concerns, preferences and perceived gains and risks with respect to the project planning and implementation, including the design and proposed management and mitigation measures to reduce potential impacts and to enhance possible benefits.

- Build mutually respectful, beneficial and lasting relationships with stakeholders (i.e. including regulators, communities, workers and shareholders), thereby securing and maintaining the project's social warrant to operate and to ensure compliance with both local regulatory requirements and international best practice, and
- Provide all stakeholders with the means to address concerns and grievances with the project, in a structured, reliable and responsive manner.

6.4 STAKEHOLDER ENGAGEMENT AND DISCLOSURE METHODOLOGIES

A variety of communication methods are used during stakeholder engagement. Essentially, the methods for public involvement are public notice and, public hearings and community meetings. They are used for raising initial awareness and soliciting involvement and serving long-term information sharing. However largely the methods are determined by the level and objective of engagement, as well as the target stakeholder group. ESIA Consultants utilized the following methods for engaging the public in the ESIA process.

6.4.1 Advertising/Public notices

This is the appropriate method used by MoW to provide initial information to the public about a proposed development in order to solicit public reaction, comments and suggestions. Advertisements were used to provide official notification at key stages in the project as required by the EIA and Audit Regulations. Posters advertisements, and postings on relevant office notice boards, were used to inform potentially interested parties with information about the project and invite attendance at public meetings; and advertisements and notices were provided in both English and Kiswahili in the newspapers

6.4.2 Formal public and community meetings

This is the method which serves for long-term information sharing between developer and the concerned public, including women and disadvantaged and vulnerable groups. Formal public meetings were held to provide information to potentially affected persons, and to collect their comments and questions; and formal public meetings consisted of a presentation followed by a question and answer period. The objectives were to explain the project and solicit opinions about the projects positive and negative effect.

6.4.3 Informal meetings with elected officials and Agency representatives

Informal meetings with elected officials and agency representatives were used to provide information on the status of the project, to collect relevant existing information, and to identify issues of concern. Informal meetings were typically held at Government/Agency Offices during normal working hours;

6.4.4 Formal Agency Meetings

Formal meetings with elected officials and government functionaries were held to provide information about the project to agency representatives, and to solicit their comments and questions. The meetings consisted of a short formal presentation followed by a question and answer period.

6.4.5 Disclosure

- The Ministry of Water will provide public access to this ESIA report, as well as other relevant project documentation;

- The full documentation will be made available in hard copy at local libraries, project offices, and selected government offices. Electronic copies will be available on the MoW's website; and
- Summary information will be made available in Villages and Ward offices located around the project area.

6.5 STAKEHOLDER ENGAGEMENT ACTIVITIES

6.5.1 Consultation activities scoping consultations for the EIA Terms of Reference

The Scoping Report was prepared in November and December 2013. During the preparation of this report, informal meetings were held with relevant authorities at national, district and local levels to obtain background information and to seek views on potential route corridors and on the draft Terms of Reference for the ESIA. With respect to the proposed project the principle entities concerned are various government ministries, departments or agencies at national, Municipal/district and local levels; private organizations; NGOs and CBOs involved in community development or environmental conservation and management; user groups, individual community members, and those intimately involved in the proposed Farkwa Dam, Water Treatment Plant and Water Conveyance System to Chemba and Dodoma City project. Their comments were primarily concerned with the impacts of the project on the local community and on gathering background information. Their comments were used in the development of the final Terms of Reference (TOR) and the selection of the alternative routes and sites.

Upon completion of the Scoping Report and approval of the same by NEMC, the Consultants issued a public notification of ESIA commencement that included ways interested parties could obtain more information.

6.5.2 Consultations on results of the ESIA

A second round of consultations was conducted from 09th March to 20th March 2014. The process was completed based on the findings of the draft ESIA, consisting of further informal agency meetings, formal public meetings and formal agency meetings. In the meetings, the ESIA Team explained the scope of the project and after the presentation the Consultants solicited views from the audience. Key issues considered during consultations include land use of the project site, involuntary resettlement, any conflicts, envisaged negative environmental impacts, negative social impacts, positive impacts of the project, management aspects of the identified negative impacts, enhancement mechanism of positive impacts and aspects to be considered for sustainable project operations. In all cases Stakeholders' views were sought on their acceptance of the project.

The setup and attendance at the meetings can be seen in figure 6.1 – 6.3 below. To ensure that the consultations included as many PAPs as possible, during scheduling the meetings, an ESIA Consultant went to villages personally, using written letters and messengers to schedule village meetings through the Village Executive Officers. The public meetings were conducted in Kiswahili, and the ESIA team was available to answer questions. Maps and diagrams were used to illustrate key aspects of the project, including the proposed locations of the dam and conveyance system. Stakeholder consulted during phase one and two included:

- Central Government: Ministries, Departments and Agency. These include Vice President's Office (NEMC, Division of Environment), Prime Minister's Office (Regional Administration and Local Government), Ministry of Water, Ministry of Lands, Housing and Human Settlements Development,

Ministry of Agriculture, Food Security and Co-operatives, Ministry of Fisheries and Livestock, Ministry of Natural Resource and Tourism (Forestry and Beekeeping Division, Wildlife Division).

- Regional Secretariat - mainly Dodoma Regional Commissioner, Regional Administrative secretary, and Regional Natural Resource Officers. Key people met include the Dodoma Regional Administrative Secretary (RAS), and Mr. Bazil Mwiserya (Regional Water Engineer),
- Project Proponent – Ministry Of Water and Dodoma Urban Water Supply and Sanitation Authority (DUWASA) are the project proponent. Key people met include Eng. Peter A. Mokiwa (the Managing Director), Eng. David T. Pallangyo (Technical Manager), Eng. Mayunga Kashilimu (Planning and Designing Engineer) and Eng. Emmanuel C. Mwakabole (Planning and Designing Engineer).
- Local Government Authorities responsible for land ownership and road reserves, current land uses, neighbouring activities and developments along the proposed project route include Capital Development Authority, Dodoma Municipal Council, Chemba District Council, and Bahi District Council. Key people met include Engineer Paskasi D. Muragili (Ag. Director General, CDA), Mr. Mtemi John G.L. (Ag. Director of Planning CDA), Mr. Robert M. Kitimbo (Dodoma Municipal Director), Ms. Akengarami Urassa (Dodoma Municipal Environmental Engineer), Mr. Amede Amani (Acting-Bahi District Executive Director (DED) 2nd Visit), Mr. Michael Y. Mkunya (Acting- Bahi DAS), Mr. Jovin Bararata (Bahi District Agricultural Officer), Mr. Solomon R. Chapah (Agricultural Officer), Ms. Kulwa S. Mkwama (Livestock officer), Dr. W.D Mafwele (Chemba DED), Mr. Ernest N. Kabohola (Chemba District Administrative Secretary), Mr. Gervas A Amata (Ag DPLO Chemba DC), Mrs. Bernadetha K. Kijanvary (Bahi Acting District Executive Director); Sylivanus B. Kashaga (Head Agricultural and Livestock Department Bahi DC), and Mr. Nicholaus Lupindu (Bahi DC).
- Roads Authority (TANROADS) is a key stakeholder who is managing both trunk roads and regional roads. Key personnel met include Eng. Leonard S. Kapongo (TANROADS Regional Manager).
- Utilities Supply Authorities (telephone, Electricity Supply, Water and Sanitation) – Responsible for placing, managing and relocating utilities (telephone and electric supply lines, sewers, drains etc.) along the proposed conveyance system. Important people met include Mr. Leornard S Kapongo (Dodoma TANESCO Regional Manager), Mr. Stanslaus M. Malima (TANESCO Dodoma - Senior Engineer), Mr. Zakaria Kilomele (TRL Dodoma).
- Communities in the direct impact zone and area of influence of the project area. Key people met include the Mr. Suleyman A. Gawa (Farkwa Ward Councillor), Mr. Gregory Khumany (Farkwa Ward Executive Officer), Mr. John L. Wenga (VEO Mombose Village); Mr. Paskali D. Marini (Mombose Village Chairman); Mr. Shabani R. Tota (Bubutole Chairman); Mr. Bira M. Bira (Bubutole VEO), Mr. Mohammed Ally Itaso (VEO Tumbakose), Mr. Ramadhani Sogoi (Gwandi Ward Councillor), Mr. Herman Pagaza (Chairman Gwandi), Mrs Amina H. Tifa (VEO Rofati) and Mr. Jairos Daniel (VEO Zamka). Others include Mr. Simon John Nkalu (VEO Ihelela - Bahi), Mr. Ahmed Ngajeni (WEO Mpamantwa Bahi); Mr. Talitha Njamasi (VEO Mpamantwa); Mr. Juma M. Kwela (VEO Bahi Makulu), Nicholaus D. Kossy (Chairman Bahi Makulu), and Mr. John W. Makasi (VEO Bahi Sokoni).
- Other stakeholders include the nearby Game reserve, local NGOs and CBOs. Key people met include Mr. Said H. Mnkeni (SwagaSwaga Game Reserve - Project Manager), Mr. Augustin P. Kasela (Game Warden for Swagaswaga Game reserve), CESOPE (Civil Education is the Solution for Poverty and Environmental management)

6.5.3 Consultative stakeholders meeting in Dodoma

A one day consultative stakeholders meeting for the Environmental and Social Impact Assessment (ESIA) for the proposed Construction of Farkwa Dam, Water Treatment Plant and Water Conveyance System to Chemba and Dodoma City, Dodoma Region, Tanzania was organized by Ministry of Water at the Dodoma Hotel, Dodoma City, Dodoma Region, Tanzania, on 19th September, 2014. The meeting was attended by 72 people including the Minister - Ministry of Water, Deputy Minister - Ministry of Information,

Youth, Culture and Sports; Honorable MPs of all Districts found within the project area; District Commissioners; District Council Chairpersons; District Administrative Secretaries; District Executive Directors; District Water Engineers; Honourable Councilors; Ward Executive Officers; Vice President's Office (Environments) (VPO) representative; Capital Development Authority (CDA) representative; Ministry of Land, Housing and Human Settlements representative; Irrigation Zone Office representative; Ministry of Minerals and Energy representative, Chairperson of Internal Drainage Basin Water Board (IDBWB), Government and Public Agencies representatives, Ministry of Water the IDBWB and DUWASA officials,.

The main aim of the meeting was to involve key stakeholders in the ESIA process and to ensure that relevant key environmental and social economic issues are identified before the ESIA is conducted to ensure that ESIA study is focused and covers all important issues.

6.5.4 NEMC review and consultations on draft EIA

Section 88 (1) of the Environmental Management Act Cap 191, provides that *"the council may, during the review process, visit for purposes of inspecting or verification any site or place associated with the proposed project or undertaking at the proponents' Cost.* To fulfill this legal and procedural requirement, two officers on behalf of the Technical Advisory Committee visited the project site from 01st to 04th, July 2015. The team comprised two NEMC staffs – Mr. Emmanuel Salyem (Team Leader) and Mr. Milton Mponda. NEMC team was accompanied by Mr. Modestus Zachariah (MOW), Eng. Hamza Singano (MOW), Eng. Simlizy Kissina (MOW) and one member from Internal Drainage Basin Water Board Office who represented the proponent. During that visit, NEMC requested that MOW and ESIA Consultant to organize a series of meetings for verification purpose which took place in the project area. The meetings included public meeting in the Mombose and Bubutole Village areas and meetings with Government Officials and representatives of local government. Following completion of the field activities, NEMC convened a meeting of the Technical Advisory Committee ("TAC") on 20th September, 2015 to deliberate their findings. The TAC is an inter-ministerial committee that is convened by NEMC to provide comments on draft EIA Reports that have been submitted for review. Representatives from MOW and ESIA consultants were invited to attend to make a brief presentation and to clarify as well as answer member's questions. The meeting was positive about the project and concluded that the project is supported by the Regional, District Authorities and communities due to the expectations that it will boost economic development in the Region.

6.5.5 Updating ESIA Consultation Activities

The Environmental Impact Assessment certificate with application number 2225 and registration number EC/EIS/2333 was issued to MOW on 09th March 2016. Since the issuance of the EIA Certificate there was minor changes of some project aspects to include additional of conveyance system to Chemba District and relocating the Water Treatment Plant. Due to that the environmental assessment was conducted and the updated Environmental Impact Assessment Report was produced. During updating the ESIA report, a series of formal and informal meetings with entities of the government at regional and local level were held directly by Environmental and Social Safeguards Consultant appointed by MOW as a complimentary of the public consultation process described above.

The formal consultative meetings were held from 02nd August to 06th August 2021. The objective was to obtain their interpretation with regard to the underlying factors of the trends already observed. Also the aim was to inform interested parties about the changes of the project and to receive views on the potential

impacts and the scope of the Updated ESIA report. This therefore formed a part of the public consultation exercise. Name and signatures of stakeholders consulted for the updating ESIA report are attached as appendix 3. In general, there was strong support for the project expressed by consulted officials, agency staff, and the general public. For the most part, the support appears to be related to the acceptance amongst stakeholders that the project will improve the reliability and accessibility of water supply in the area.

6.5.6 Extent of stakeholder engagement

It is evident that stakeholder engagement activities have been undertaken as part of the previous studies. The activities undertaken to date for the proposed project in general are in compliance with Tanzanian legislation as well as with international standards and best practice guidelines as described in the AfDB documentation. The stakeholder engagement process was planned and developed during the ESIA for the proposed project and during updating the ESIA report. These process allowed the creation of a channel of communication between the project and the public from the local and regional project areas of influence. Consultation with the stakeholders was aimed at positively conveying information about the project, clear up misunderstandings, allow a better understanding of relevant issues and how they will be dealt with, and identify and deal with areas which are controversial while the project is still in its early stage.

National and regional authorities and the population living in the area of influence of the project have been involved in the development of the ESIA. The public meetings were conducted in Swahili language, and the ESIA team was available to answer questions. The process afforded opportunity to the stakeholders to express their views and concerns to be included in the ESIA study. All views and concerns were documented and considered during the evaluation of potential impacts and risks associated with the project.

Generally, the consultation process for the proposed project had a positive perception by all the stakeholder groups. In each of the meetings held, the public expressed the wish that future projects be carried out in the same way, with a transparent information dissemination with respect to the project to be developed. The stakeholders also showed special interest since they could verify that their concerns and recommendations were taken into account and were reflected on the identification of the potential impacts and on the management plans. The consultation process has already started, and it will continue in future at relevant stages.

6.5.7 The Stakeholders' Concerns

The scoping and ESIA study provided a wide variety of views and opinions on what are considered to be the main concerns and issues of different stakeholders. Issues raised during the stakeholder consultation process were compiled and summarized below and have been elaborated in more detail and considered in proceeding chapters for impact assessment and incorporation in the Environmental Management Plan.

Perceived Negative Impacts

(a) Environmental

Destruction of natural resource: The stakeholders were concerned that the potential areas for dam inundation are rich in wildlife and plant resources. They were worried about the potential loss of and

disturbance to the natural environment from construction activities at the dam area and along the conveyance system, from earthmoving equipment's and machines, noise and vibrations from machinery, etc. If construction work is not properly conducted they may affect those natural resources.

Water quality degradation: Stakeholder pointed out that the water quality of the Bubu River will be affected negatively by the proposed dam construction activities. This is due to the transport and sedimentation of materials re-suspended by backfilling activities. Also stakeholder were of opinion that human activities upstream may cause water contamination due to the use of improper sanitation facilities and poor farming methods (improper use of fertilizers; increased water treatment costs.

Pollution of the Bubu River: During interviews, stakeholders were quick to associate the project with the negative impacts likely to affect the Bubu river. One of the commonest negative impacts mentioned is the pollution of the river from fuels, lubricants and oil spills during construction phase.

(b) Social

Loss of land-based resources and properties: Stakeholder were of concerns that the project activities will affect some of the land-based resources and properties in the project area which people depend on for their livelihoods. These could include loss of farmland and crops, medicinal plants, trees for construction poles, residential houses, grazing area, burial sites, sacred sites etc.

Low compensation: - Concern that Ministry of Water will not pay sufficient compensation if the proposed project activities affect farmland, crops, grazing areas, woodland resources, houses and property which people depend on for their livelihoods, or burial sites and sacred sites of cultural importance. The commented that the compensation rates for the affected crops and houses which are stipulated by Tanzanian law are outdated. Stakeholders are of the opinion that these rates are very minimal and not sufficient for replacement of affected resources and property.

Effects of loss of social contacts in case of resettlement: If residents need to be resettled, the affected person/individual and their family will be moved from their relatives and friends contacts to a new area. Stakeholders suggested that the Ministry of Water should engage in an open dialogue with Farkwa Ward authorities and village governments to ensure the compensation process is implemented fairly in order to avoid conflicts. Village governments should be involved in compensation process to avoid complaints. Transparency should be guaranteed and information on who will be involved should be disseminated appropriately.

Impacts on downstream users: Stakeholder mentioned that one of the most important effects of dam construction and operation is the deprivation of water to downstream users and living organism. However the level of deprivation will depend on amounts of water that will be allowed to flow from the dam back into the river and supplemented with amounts from the catchments.

Restricted access to natural resources: the project areas have natural resources, cultural sites and access roads from one village to another. The inundated area and project infrastructures could restrict access to natural resources and other uses of the area and this may cause nuisance and disturbance to current users.

Increased flooding tendencies: The negative impact mentioned is the probability of the over flooding of the dam thus causing destruction to the environment, the community and their properties downstream.

Increased diseases incidences: Interaction due to increased people after construction of the dam, may increase susceptibility to health problems especially HIV/AIDS and Sexual Transmitted Diseases.

Diminishing of forest commodities and loss of current land: Communities consider the project area as a source of poles for house construction, medicinal plants, grass land for livestock and dry season cattle fodder, firewood, households' settlements, provides outlets to other sub villages and sources for indigenous fruits and juices. Some people had proposed planting trees of different types as a mitigation measure although others could not agree to that, as they thought that the new trees would be exotic and not indigenous leading into fruits and juices becoming exotic.

Road destruction: The roads within the project area are in poor condition and no regular maintenance is scheduled by the Regional/District Authority. As the number and volume of the vehicle load is expected to increase during mobilization and construction phases, the roads may deteriorate further.

Drowning incidences: Communities were worried of human drowning cases due to increased water. It was suggested that by laws should be enacted to protect the dam from those who would have wanted to use it carelessly.

Loss of infrastructure: As a result of the construction of the proposed dam some areas in the vicinity of the site will be cut off from others through submergence of roads and bridges. The proposed project should consider alternative routes to link the different areas that will be affected and construct roads preferably tarmac and associated infrastructure such as bridges.

iii) Economic impact

Small holder farming: Communities who are currently using the area for settlements and agriculture had the opinion that the project will take up their valuable land that has been the source of livelihoods for years. Commenting on the mitigation measures to the impact on these communities, it was suggested that those to be affected should be compensated before their land is taken up. This will enable them to start new homes and agricultural activities elsewhere.

Perceived Positive Impacts

Increased water supply: Currently Dodoma City is experiencing water rationing due to the fact that water demand is higher than the water supplied. The proposed construction of Farkwa Dam, Water Treatment Plant and Water Conveyance System to Chemba and Dodoma City will improve water supply capacity of the existing infrastructure to a large extent.

Enhanced household food security and improved livelihoods: Food and vegetable production will be enhanced and permanently produced due to availability of water throughout the year. Increased production of food and readily available source of protein i.e. fish, will increase the nutrition status of the villagers. Farmers will be able to produce enough for consumption and sale thereby raising their income which would result into improved livelihoods.

Employment opportunities: It is expected that during dam construction, the project will employ both skilled and unskilled workers. However, a concern was expressed that the project proponent/contractor might

probably bring in outside labourers. Where skilled labour is concerned, this will almost certainly be the case. Employment in dam related activities will provide a source of income to a number of people.

Improved village economic status: Communities are anticipating that their village status will be improved as many people will have money, new houses will be constructed, people will buy transport like bicycles, parents will pay school fees for their children and development feeling in general will be enhanced among communities.

Availability of clean and safe water: Currently the villages of Farkwa Ward lack reliable sources of clean and safe water. The problem becomes more acute during the dry season. Local stakeholders are optimistic that the dam will help to combat this chronic water shortage and hence improve the health and sanitation status of the villagers.

Saving productive time: People travel over long distances in search of water, particularly during the dry season. Improved access to water will save the villagers' time in terms of the time spent on fetching water and trekking their livestock to watering points. The saved time will be allocated to other economic/productive activities and contribute to the community well-being.

Health and safety hazards: Village reports on the health status indicate that malaria is apparently the leading disease for all age groups especially during the rain season. The presence of stagnant fresh water might exacerbate the situation. Further mentioned that, if there will be no adequate security measures e.g. fencing, there are possibilities of accidents, with vulnerable groups being children and livestock falling into the dam.

Induced development: The quantity of water that will be reserved exceeds the villagers' day-to-day requirements. In this situation, water from the dam will as well be used for other development activities such as construction of residential houses which are in a poor state, a cattle dip, a dispensary (they currently have none at Mombose and Bubutole) and expansion of a primary school.

Figure 6.1: Group photo for the consultative stakeholders meeting in Dodoma

Figure 6.2: Community meetings at Mombose village (August 2021)

Figure 6.3: Community meetings at Bubutole village (August 2021)

Figure 6.4: Stakeholder consultation meeting with CESOPE members at Bahi

Figure 6.5: Interview with local people at Mombose shuleni

6.6 LEVEL OF STAKEHOLDER ENGAGEMENT

The level of stakeholder engagement is based on the extent of the envisaged impacts (national, regional, local, area or in situ level) of which various criteria are considered such as ecological (biophysical attributes), social issues, visual exposure and cumulative impacts. However, the level of advertising and participation mechanism is determined by the extent of impacts. Table 6.1 below gives an extent of stakeholder engagement.

Table 6.1: Level and methodologies for stakeholder engagement

Level of Impact	Impacts	Level of advertising	Possible engagement mechanism
National	Impacts of international and or national significance	• National newspapers, newsletters and Government Gazette • Radio and TV • Website, if available	• Public meeting, notices and hearing • Conference • Press release • Questionnaire, interview and survey • Information desk or info-oline (help line) • Meetings /Workshops with constituencies (e.g. national Standing Committees, national NGOs/CBOs) • Telephone 'hot -line' and email

	Impacts affecting a number of towns or more than one local authority area	• Regional and local town newspapers • Notice on site • Notice in libraries and or community halls • Website if available	• Public meeting, notices and hearing • Workshops/focus groups • Conference • Press release • Questionnaire, interview and survey • Information desk or info-line (help line) • Meetings /Workshops with constituencies (e.g national Standing Committees, national NGOs/CBOs) • Telephone 'hot -line and Email
Local	Limited to a local authority area	• Local newspapers/radio programmes • Written notice to neighbors as well as with user rights on site and property • Notice on site and or community notice board where appropriate • Website if available	• Public meeting, notices and hearing • Telephone 'hot -line' • Email • Conference • Press release • Questionnaire, interview and survey • Information desk or info-line (help line) • Meetings /Workshops with constituencies (e.g. national Standing Committees, national NGOs/CBOs)
Area	Limited to a localized area within a town council or rural area (e.g. an agricultural area extending over several properties)	• Local and community newspapers/radio programmes • Written notice to neighbors as well as with user rights on site and property • Written notice to local community and environmental organizations • Notice on site • Notice on community note board	• Public meeting • Posters • Emails • Telephone 'hot -line' • Liaison with community and or traditional leaders and institution • Open days • Press release • Workshops and / focus group • Interview or discussions with NGOs and CBOs • Brochures • Pamphlets
Internal stakeholders	Limited workers and the employees of contractors	• Newspapers/radio programmes • Written notice to workers • Notice on site • Notice on community note board	• Staff meetings • Posters • Emails • Telephone 'hot -line' • Liaison with Human Resource • Press release • Trainings, workshops and / focus group • Discussions on Labour Laws, • Brochures

			• Pamphlets
Site specific (in situ)	Limited to an individual property	• Written notice to neighbors as well as with parties that may have rights of use • Notice on site optional • Notice in Community newspaper • Advisory groups (committees) and task forces	• Workshops/meetings and conferences with neighbors, local CBOs and NGOs • Telephone 'hot -line'

6.7 ROLE AND RESPONSIBILITIES OF KEY STAKEHOLDERS

For effective stakeholder engagement process, various stakeholders, proponent, consultant, relevant environmental authority and, interested and affected parties should fulfill their respective roles and responsibilities as have been stipulated thereafter, so that, the views of any person who is or is likely to be affected by the project are taken into account during the implementation of pproposed projects.

6.7.1 Roles and responsibilities of MOW

The MOW is responsible for ensuring that stakeholder engagement is undertaken and thus, obliged to include stakeholder engagement in the brief to the environmental consultant. The MOW should publicize the project and its anticipated effects and benefits by:

- Posting posters in strategic public places in the vicinity of the site of the proposed project informing the affected parties and communities of the proposed project.
- Publishing a notice on the proposed project in a newspaper that has a nationwide circulation
- Whenever need arise making announcement of the notice in both Kiswahili and English languages in a radio with a nationwide coverage.

The MOW should hold, where appropriate, public meetings with the affected parties and communities to explain the project and its effects and to receive their oral or written comments. Also MOW should ensure that appropriate notices are sent out at least one week prior to the meetings and that the venue and time of the meetings are convenient for the affected communities and the other concerned parties. Further the MOW is responsible for enabling an adequate stakeholder engagement process in terms of the project timeframe and milestones as well as in terms of financial provision.

While many MOW staffs interact with external stakeholders, the designated Safety, Health and Environment Team is responsible for documenting these interactions, and in particular, recording key

meetings and consistent issues. The following are core tasks of the MOW environmental department team:

- Incorporate all stakeholder engagement activities into the overall environmental and social management systems;
- Develop an internal system to communicate progress and results of stakeholder engagement to the senior management and staff members;
- Ensure stakeholder engagement is understood by all MOW staff members, contractors and consultants;
- Manage Public Participation Meetings and other events related to public disclosure of information;
- Ensure that all meetings, including meetings conducted by other project staff are documented;
- Track "follow on tasks" or commitments made during all meetings, including meetings conducted by other project members through a commitments register;
- Coordination of all verbal and written communication from stakeholders, particularly comments solicited from the Project Brochure and formal grievances;
- Management and coordination of external messages, including written materials (Project Brochure, Grievance Mechanism and others, as needed);
- Frequent coordination with external consultants and contractors to ensure technical, environmental and other studies are summarized appropriately for all stakeholders;
- Support to other staff that may have interaction with stakeholders, especially if other staff members become aware of problems with local communities or other stakeholder groups.

6.7.2 Roles and Responsibilities of Consultant

- The consultant is responsible for ensuring that the stakeholder engagement process meets the requirements of the Environmental Management Act Cap 191 and the Environmental Management (EIA and Audit) (Amendment) Regulations, 2018.
- The consultant is responsible for planning and implementing a stakeholder engagement process that allows reasonable opportunity for interested and affected parties:
- To raise environmental issues and concerns
- To provide input into the stakeholder engagement process and into the scope of EIA
- To provide feedback/comment on documentation relating to the proposal
- The consultant is responsible for ensuring that appropriate measures are put in place to deal with the range of cultural and language requirements of interested and affected parties.
- The consultant is responsible for placing the concerns, input and comments from interested and affected parties on record. This needs not involve the taking of detailed minutes, but a comprehensive and fair record of public input must be included in scoping reports and Environmental Impact Statement.
- The consultant is responsible for ensuring that the issues raised by interested and affected parties are addressed in the EIA process in an objective manner. Where issues are not addressed the reasons for this must be provided.
- The consultant is responsible for providing clear information about the stakeholder engagement process, their role, and commenting opportunities during the process and timeframes.
- During the process, consultants must be objective information professionals. They must not play the role of a service professional acting in the interest of the investors or client.

6.7.3 Roles and Responsibilities of NEMC

NEMC is responsible for reviewing the stakeholder engagement process which is proposed in the plan of study for scoping. This review must be aimed at establishing that adequate measures are being proposed in relation to the following:

- Identification of interested and affected parties
- Opportunities for consultation with interested and affected parties
- Provision for language and cultural requirements of interested and affected parties
- NEMC is responsible for taking the outputs from the stakeholder engagement process into account in the decision-making process
- Concerns raised by interested and affected parties about environmental impact
- Concerns raised by interested and affected parties about the EIA process itself
- Local knowledge about environmental conditions and impacts.
- NEMC is responsible for showing how the outputs from the stakeholder engagement process have been taken into account in the decision-making process. This must be included as part of the Record of Decision.
- NEMC is responsible for making informed decisions about development proposals which are in the interests of the environment as reflected in the principles of the EMA, 2004 and the policy and strategic objectives of the ministry of minerals and energy.
- NEMC is responsible for making-decisions in an objective and independent manner, that decision is not made on the basis of individual interests- all factors and impacts must be taken into account.

6.7.4 Roles and Responsibilities of Interested and Affected Parties (I &APs)

The following are the main responsibilities of the Interested and Affected Parties;

- Are responsible for choosing whether to take the opportunity to participate in the stakeholder engagement process or not.
- May choose to comment, provide information and other input that will be of value to the EIA process.
- Are not responsible for making decisions about development but may influence decision making
- Can influence the outcome of EIA process by changing the project design or the outcome of a decision about a project through taking part in the stakeholder engagement process.
- Are responsible for providing inputs in into the EIA process as agreed in the context of the EIA process timeframe/programme.
- Are responsible for raising concerns about the project and or the EIA process on time (i.e. in accordance within the agreed EIA programme).
- Representatives of organizations are responsible for keeping their members informed about meetings held, issues discussed, and findings reported (i.e. the outcome of the respective stages of the EIA process).

6.8 CONSIDERATIONS FOR THE ENGAGEMENT PROCESS

With the on-going stakeholder engagement focused efforts will be made to engage with directly impacted stakeholders, including vulnerable groups at the local level. Affected individuals will be consulted directly and via their representatives including elected leaders and other influential people within communities. In addition, special efforts will be made to meet with representatives of potentially vulnerable groups who

may not be reached through traditional/local leadership structures. MoW will also ensure that meetings are culturally appropriate allowing stakeholders to openly voice their opinions and / or concerns. All meetings to be conducted will follow local practices and norms. Meetings with the local administration and with influential leaders will be held prior to any wider communication in the villages in order to respect local structures. All affected communities and groups will be made aware of the project feedback and grievance mechanism.

6.9 FUTURE STAKEHOLDER ENGAGEMENT PROGRAMME

6.9.1 Proposed stakeholder engagement activities

On completion of the ESIA regulatory procedure, the project will move forward into the implementation phase. A full programme of stakeholder engagement will continue during detailed engineering and construction and then throughout the lifetime of the project. Details of this will be provided in an update of the Stakeholder Engagement Plan during construction phase and this will be regularly updated thereafter. During construction of the proposed dam the MOW will participate in disclosure and consultation for the planned development. In addition to disclosure and consultations, during construction the MOW will also:

- Inform affected communities about any preparatory and construction activities that may influence them. Information will be provided at least a week in advance of such activities;
- Update affected communities on the progress of construction;
- Implement a Grievance Procedure (Refer 6.10 below).

Provision of information to affected communities will include use of the MOW project website. Information to include:

- A description of the construction works with indication of scheduled start and finish dates for each type of the works;
- Project descriptions including the project components and design life of the project (duration)
- publication of regular reports on project progress, implementation of mitigation measures, compliance with the SEMP and overall performance;
- Sharing of monitoring results and consultation on responses to unforeseen impacts that may occur.
- The type and duration of anticipated impacts;
- Studies and documentation related to or affecting residents of adjacent
- Progress photos of the worksite.

In addition, where access to internet is not available information leaflets are intended to be used. Meetings with community potentially affected by the project will be organized. In case deemed appropriate press releases in the local newspapers may be published. Besides, meeting with Chemba District Executive Director at least quarterly, or more frequently if communities are being directly affected will be held, in order to update officials on progress. They can then pass information along to the community.

MOW is committed to stakeholder engagement as an ongoing process and plans to continue its stakeholder engagement efforts throughout the life of the project. As the project progresses from feasibility into construction, operations and closure phases, MOW's message will change to reflect the issues and concerns specific to these phases. Different iterations of the SEP will be developed so as to ensure that MOW's future engagement is relevant and appropriate to project phases. Throughout the life

of the project MOW will continue to update stakeholders via the website, District, Ward and Village Authorities and other means, as specified above. The grievance procedure will also remain in place throughout the project's lifespan.

6.9.2 Monitoring stakeholder engagement activities

The Stakeholder Engagement Plan will be periodically revised and updated during construction and operation stages of the project. It is important to monitor the on-going stakeholder engagement process to ensure that consultation and disclosure efforts are effective, and in particular that stakeholders have been meaningfully consulted throughout the process. Stakeholder engagement monitoring is managed through the designated Environmental Department at MOW. Monitoring will include:

- review of engagement activities in the field by assess meetings using a feedback evaluation form or asking questions to participations, depending on the stakeholder group, to ensure that messages are being conveyed clearly
- use engagement tools developed through the ESIA engagement including stakeholder database; issue log or issues and response table; and keep meeting records of all consultations.
- monitoring formal and informal consultation activities conducted with communities and government authorities;
- monitoring the effectiveness of the engagement processes in managing impacts and expectations by tracking feedback received from engagement activities and recording and tracking commitments made to communities; and
- monitoring any grievances received and their resolution.

6.9.3 Reporting stakeholder engagement activities

Performance will be reviewed following the engagement sessions conducted in the field. In addition, there will be opportunity for the ESIA engagement team to review and assess performance in between the engagement sessions depending on the level of feedback received from stakeholders during these periods. Evaluation of performance will assess the extent to which the engagement activities and outputs meet those outlined in the SEP. In assessing performance, the following will be considered:

- materials disseminated: types, frequency, and location; place and time of formal engagement events and level of participation including by specific stakeholder groups (e.g. women, youth, cultural leaders);
- number of comments received assessing the topic, type of stakeholder and details of feedback provided;
- numbers and type of stakeholders who come into contact with the project team by mail, webpage and any other means of communication;
- meeting minutes, attendance registers and photographic evidence;
- comments received by government authorities, village leaders and other parties and passed to the project;
- numbers and types of feedback and / or grievances and the nature and timing of their resolution; and
- the extent to which feedback and comments have been addressed and have led to corrective actions being implemented.

Quarterly reports will summarize all activity for the period, and provide a summary of issues raised and how they have been addressed, including timeliness of responses and remedial, compensation and mitigation measures to address grievances, and analysis of trends in key performance indicators (KPIs). These will include:

- total numbers of stakeholders engaged in each group;
- geographic location of stakeholders across the Project footprint and elsewhere;
- numbers of comments and queries received and responses given;
- issues raised and levels of support for and opposition to the Project;
- numbers of grievances lodged; and
- time to resolution of grievances.

6.9.4 Annual Reporting

On an annual basis, a Stakeholder Engagement Report will be published including social and environmental performance, a summary of issues raised by stakeholders, numbers and subjects of grievances, a summary of key actions taken to address concerns, analysis of trends in KPIs, and plans for engagement in the next period.

6.10 Grievance Redress Mechanism

Stakeholder engagement is a two-way process. It is therefore important to ensure that there is a feedback mechanism to ensure stakeholders affected by or interested in the proposed Project can present their input (e.g. opinions, requests, suggestions and grievances) for consideration and, if required, seek redress. It should be noted that, even where not all feedback or grievances are deemed 'valid' or applicable to the context of the proposed Project, the feedback mechanism needs to function in a non-judgmental manner and record all feedback received.

A Grievance Mechanism Procedure will ensure that grievances are recorded and considered fairly and appropriately. MOW work to continually improve this process. Affected parties were notified of the Grievance Mechanism during the public consultation meetings. The MOW designated Grievance Officer (GO) is responsible for maintaining the Grievance Register. Grievances are received in writing or verbally by the GO directly from the complainant or via MOW employees, Chemba district authority, consultants and/or contractors.

7 PRESENTATION OF THE ALTERNATIVES CONSIDERED

6.1 INTRODUCTION

In analysing the environmental impacts, there are usually two or more development alternatives to consider for each issue. The alternatives may encompass a wide range of consideration and can represent a choice between the construction and operation of a development and the non-development option. With this in mind, the general principle involved in identifying the option(s) of the proposed project is to ensure that the option chosen would result in optimal social, economic and environmental returns. In effect the option chosen should corroborate well not only for the developer, but also for the environment and stakeholders in the area. The option with the highest cost benefit factor, the most technically feasible and with least residual impact is identified as the preferred option.

7.2 ALTERNATIVE SITE

7.2.1 Options Considered

The main dam site area can be classified in three distinct sub-areas considering the valley morphology and foundation conditions. To gain an idea of the extent of the studied area, the downstream boundary is located approximately 800 meters downstream of the upstream boundary. The computation of the Height-Volume-Area showed that the reservoir capacity for a given dam height will vary of less than 0.5% across the studied area. The criteria of the reservoir capacity are therefore not considered as a dominant selection criteria compared to the criteria of the valley morphology and foundation conditions. The three studied sub-areas are described below in terms of morphology of the valley and foundation conditions.

- Sub-area A1
  - The morphology of the valley is the least favorable with a long slope on the left abutment, which will lead to a longer dam axis for a given dam height
  - The foundation conditions are assessed as suitable however the presence of silty and sandy alluvial materials in the riverbed was noted during the preliminary site visit. The closer the dam is located to the rivers confluence the more likely such deposits are to be found.

- Sub-area A2
  - The morphology of the valley is at its narrowest at this location leading to the shortest dam axis feasible for a given dam height.
  - The foundation conditions are assessed as suitable and advantageous over the two other sub-areas with very shallow overburden on the left abutment and good rock basement condition. Coarse and shallow alluvial materials were observed in the riverbed.

- Sub-area A3
  - The valley is transiting to a wider valley at this location leading to a morphology assessed as not very favorable on the right abutment.
  - The foundation conditions are also not assessed as favorable with the observation during the preliminary site visit of two densely fractured axes.

7.3 PRESENTATION OF MAIN DAM OPTIONS

Three dam types were studied for the Main Dam. They form the three dam options of the project with a unique design for the Saddle Dam. The following paragraphs give the main reasons for considering the three options above.

- Option 1 – "Earthfill" i.e. earthfill embankment,
- Option 2 – "Composite RCC and Earthfill" i.e. Composite RCC central block and earthfill abutments,
- Option 3 – "Concrete Face Rockfill Dam (CFRD)" i.e. rockfill embankment sealed by upstream concrete slabs.

The following paragraphs give the main reasons for considering the three options above. A draft design was prepared for each option.

7.3.1 Option 1 – Earthfill Dam

Option 1 consists in an earthfill embankment with a central impervious core and vertical filter and drain. This option is considered of interest for Farkwa dam for the following reasons: the requirements on the foundation are less stringent than for rigid dam types; the construction materials can be sourced in the vicinity of the dam site and be efficiently placed without formworks; and this dam type can undergo deformations due to seismic movements.

7.3.2 Option 2 – Composite RCC and Earthfill Dam

Option 2 consists in a RCC central section with earthfill embankment as abutments. This option is considered to be an optimization of the Earth-fill option (Option 1) and therefore of interest for Farkwa dam. The main reasons are: the central RCC block allows the placement of the spillway over the dam minimizing the works and facilitating the river diversion during construction allowing for overtopping during the construction; the total dam volume is less than for an earthfill dam given the steeper slopes of the RCC section; and the appurtenant works, in particular the intake, can be integrated in the dam structure.

7.3.3 Option 3 – Concrete Faced Rockfill Dam (CFRD)

Option 3 consists in a concrete Faced Rockfill Dam (CFRD). This option is considered of interest for Farkwa dam for the following reasons: the use of rockfill instead of earthfill (Option 1) allows for a reduced amount of fill and therefore construction material; the requirements on the foundation are less stringent than for rigid dam types; the construction materials can be sourced in the vicinity of the dam site and from the spillway excavations, and be efficiently placed without formworks; this dam type can undergo deformations due to seismic movements and the use of rockfill instead of earthfill (Option 1) allows for reduced amount of fill and therefore construction material.

7.3.4 Option 1 –Earthfill Dam

7.3.4.1 General Arrangement

Option 1 consists of an earthfill dam. The dam crest is 994 m long with a left abutment curved towards the downstream to accommodate the spillway. The spillway is excavated in natural ground and evacuates

the overflow via a 330 m long spillway chute. The maximum height of the dam above the foundation is approximately 25 m. The intake tower is dissociated from the dam type and accessible via a footbridge from the dam crest.

7.3.4.2 Dam Geometry

(i) Typical cross section

The earthfill dam typical section is composed of:

- a central impervious core with a downstream filter;
- a drain downstream of the filter at the faulty zones of the foundation with a 0.6 m thick drainage blanket leading to the downstream toe;
- shoulders on both sides of the central core/filter/drain that are protected by surface layers of transition and riprap for the upstream batter.

The upstream shoulder has a berm to provide more stabilization strength. This berm corresponds to the upstream cofferdam used for the diversion works, which will become a permanent structure.
The main dimensions are given herebelow:

- 8 m wide dam crest at EL.1109m;
- 3H:1V slope for the upstream batter;
- 2.5H:1V slope for the downstream batter;
- 4 m wide impervious core at the crest with 0.25H: 1V batter slopes and top level at El. 1108.1 m i.e. 0.4 m above the MWL;
- 2.5 m wide filter with top level at El. 1108.4 m;
- 2.5 m wide drain with top level at FSL m;
- Upstream berm with 8 m wide crest at El. 1095 m

The dam typical section is shown on the figure 6.1 below:

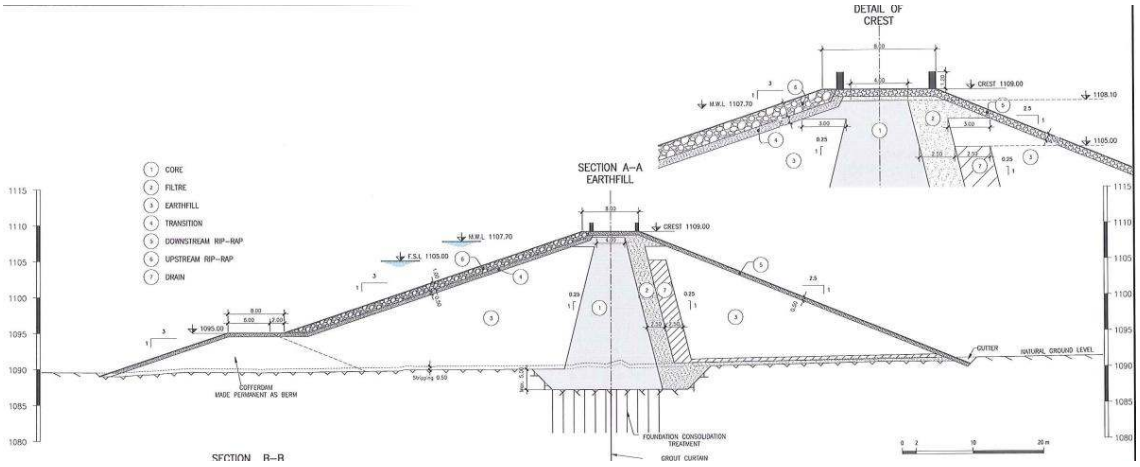

Figure 7.1: Main Dam Typical Section - Earthfill

7.3.4.3 Construction materials

The construction materials will be sourced within the vicinity of the dam site as per the results of the geological assessment. Earthfill and core material will be sourced from the three investigated borrow areas. It is estimated that approximately 19 mm^3 could be sourced from these areas, which largely meet the required volume. The material will have to be conditioned prior to placement and put in place according to a strict quality plan. As per the results of the geological assessment, good quality rock is readily available in the vicinity of the dam site. The rock was tested and presents adequate mechanical and mineral properties for use as filter, drain, rockfill, rip-rap and concrete aggregates. A specific process will have to be developed to produce the adequate rock sizing according to the function of the material. Rock will be quarried from Quarry R2, which is assessed as the most advantageous quarry amongst the three investigated quarries.

Technical specifications will be prepared during the Detailed Design for the selection, processing and placement of the construction materials. The material put in place is a lateritic earthfill including silty-sandy clays and fine sands. Those materials are more clayey and non-liquefiable. Moreover, the material used is revamped and compacted; there will be no sand lens in the embankment.

7.3.4.4 Foundation and treatment

The foundation excavations were designed to meet the recommendations made in the Geological report issued as part of the Interim Report N°2. The foundation excavations were designed as follows:

- 5 m deep excavation for the impervious core foundation except if moderately weathered rock is encountered above e.g. at the riverbed section;
- 1.5 m stripping for the shoulders foundation.

An excavation volume of 25,000 m^3 is estimated at this stage of the study for the dam foundation. The foundation will be treated along the centreline of the dam/impervious core via consolidation injections and a grout curtain from the top of the moderately weathered profile down to 10 m. The foundation treatment will be detailed during the Detailed Design.

7.3.4.5 Dam volume

The total volume of the earthfill main dam is estimated at approximately 600,000m^3. The breakdown by type of material is given in the table hereafter.

Table 7.1: Dam Volume – Earthfill Dam

Zone	Volume
Core	95,000
Filter, drain and transition	60,000
Shoulders	396,000
Rip rap	52,000
Total	**603,000**

7.3.4.6 Spillway design

The earthfill dam option features a free flow spillway excavated in the natural ground. The spillway will be founded on rock and is placed on the dam left abutment which features overburden cover less thick than on the right abutment. The spillway is made of the following main components:

- a wide inlet channel leveled at El. 1102 m conveying the waters to the control structure
- a Creager profiled weir set at FSL functioning as a control structure;
- a basin downstream of the weir with a low slope keeping the water velocity down upstream of the dam axis. The basin level averages El. 1104 m
- a 20 m wide and 330 m long chute starting at the dam axis and conveying the waters down the river bank towards the river bed. The chute starts at El. 1104 and follows the topography. The average longitudinal slope is 1.2%. The chute is terminated by an end sill to draw the overflow away from the riverbank.
- A 30 m wide and 20 m long stilling basin downstream of the spillway chute to protect the river bed and banks from erosion.

All the spillway except the inlet channel will be founded on slightly weathered rock and made of conventional concrete. An excavation volume of 140,000m^3 is estimated at this stage of the study for spillway with a concrete volume of 40,000m^3. The spillway weir is curved in order to meet the overflow length criteria of 60 metres while limiting the excavation works.

7.3.5 Option 3 – Concrete Faced Rockfill Dam (CFRD)

7.3.5.1 General arrangement

Option 3 consists in a Concrete Faced Rockfill Dam (CFRD). The dam crest is 930m long. The maximum height of the dam above the foundation is approximately 22m. The spillway is excavated in natural ground and evacuates the overflow via a 430m long spillway chute. While the dam alignment was curved for the earthfill dam to accommodate the spillway, the CFRD is kept as a straight dam given the difficulty to curve the concrete upstream face. The intake tower is dissociated from the dam type and accessible via a raft from the dam crest.

7.3.5.2 Dam geometry

(i) Typical cross section

The CFRD typical section is composed of:

- a dam body made of rockfill, which will be segregated to have larger rockfill towards the dam downstream face,
- an upstream concrete face forming an impermeable barrier with a plinth at the upstream toe;
- two transition layers (fine and coarse) in between the concrete face and the rockfill;
- a concrete plinth at the upstream toe of the dam supporting the concrete face.

The main dimensions are given herebelow:

- 8 m wide dam crest at EL.1109m;

- 1.8H:1V slope for the upstream batter;
- 2H:1V slope for the downstream batter;
- 25 cm thick concrete slab;
- 3 m wide concrete plinth.

The upstream concrete face is made of 15 metres long concrete slabs that are connected together via double waterstops. The thickness of the slabs is set at 25 cm at this feasibility stage. Another waterstop joint will be placed between the plinth and the slab. The plinth will be founded on rock; therefore, a trench will be excavated. The trench will be filled with loamy material and earthfill in order to protect the plinth. A filter material will be placed downstream of the plinth. The figure 7.2 hereafter shows the typical section of the dam for the CFRD option.

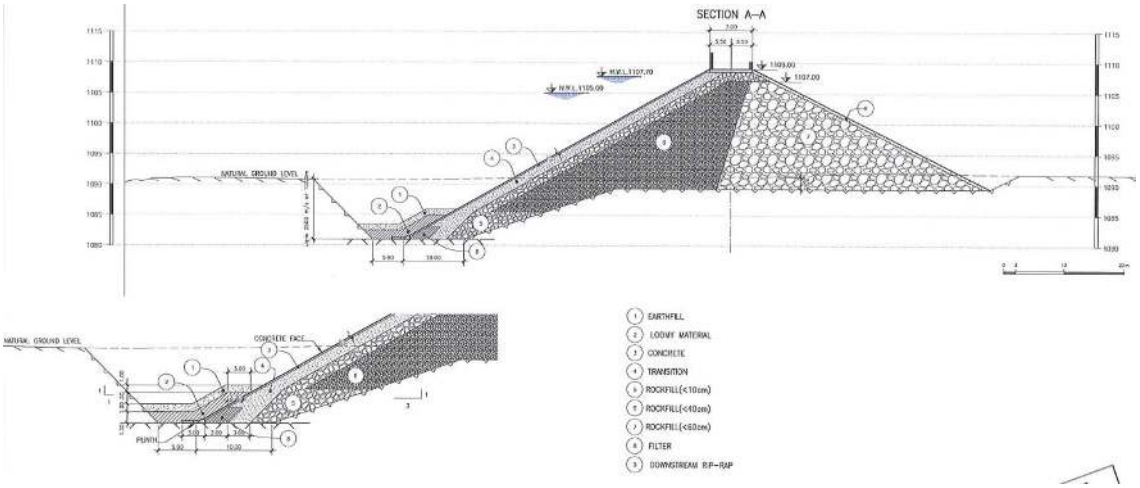

Figure 7.2: Main Dam Typical Section – CRFD

7.3.5.3 Construction material

As per the results of the geological assessment, good quality rock is readily available in the vicinity of the dam site. The rock was tested and presents adequate mechanical and mineral properties for use as concrete aggregates as well as rockfill. Rock will be quarried from Quarry R2, which is assessed as the most advantageous quarry amongst the three investigated quarries. Refer to the Geological Report issued as part of the Interim Report N°2 for details.

7.3.5.4 Foundation and treatment

The foundation excavations were designed to meet the recommendations made in the Geological report issues as part of the Interim Report N°2. The foundation excavations were designed as follows:

- 2 m deep stripping for the rockfill foundation;
- 5 to 10 m deep excavation for the concrete plinth except if moderately weathered rock is encountered above e.g. at the riverbed section;

An excavation volume of 300,000 m^3 is estimated at this stage of the study for the dam foundation. The foundation will be treated along the centreline of the concrete plinth with the construction of a grout curtain from the top of the moderately weathered profile down to 10 m. The foundation treatment will be detailed during the Detailed Design.

7.3.5.5 Volumes

The total volume of the CFRD dam is estimated at approximately 380,000 m3, which breakdown by type of material is given in the table 7.2 hereafter.

Table 7.2: Dam Volume – CFRD

Zone	Volume
Earthfill	15,000
Rockfill	260,000
Filter, drain, transition and loamy materials	80,000
Riprap	15,000
Slab and plinth	10,000
Total	380,000

7.3.5.6 Spillway Design

The CFRD option features a free flow spillway excavated in the natural ground as per Option 1 (all earthfill). The spillway will be founded on rock and is placed on the dam left abutment which features overburden cover less thick than on the right abutment. The spillway is made of the following main components:

- a wide inlet channel leveled at El. 1102 m conveying the waters to the control structure
- a Creager profiled weir set at El. 1105 (FSL) functioning as a control structure;
- a basin downstream of the weir with a low slope keeping the water velocity down upstream of the dam axis. The basin level averages El. 1104 m
- a 20 m wide and 430 m long chute starting at the dam axis and conveying the waters down the river bank towards the river bed. The chute starts at El. 1104 and follows the topography. The average longitudinal slope is 0.9 %. The chute is terminated by an end sill to draw the overflow away from the riverbank.

A 30 m wide and 20 m long stilling basin downstream of the spillway chute to protect the river bed and banks from erosion. All the spillway except the inlet channel will be founded on moderately weathered rock and made of conventional concrete. An excavation volume of 150,000 m^3 is estimated at this stage of the study for the spillway with a volume of concrete of 45,000 m^3. The spillway weir is curved in order to meet the overflow length criteria of 60 metres while limiting the excavation works.

7.4 PIPELINE ROUTE FROM THE FARKWA DAM TO KILIMANI

Three options were considered for the pipeline route (Table 7.3 and figure 6.3 below):

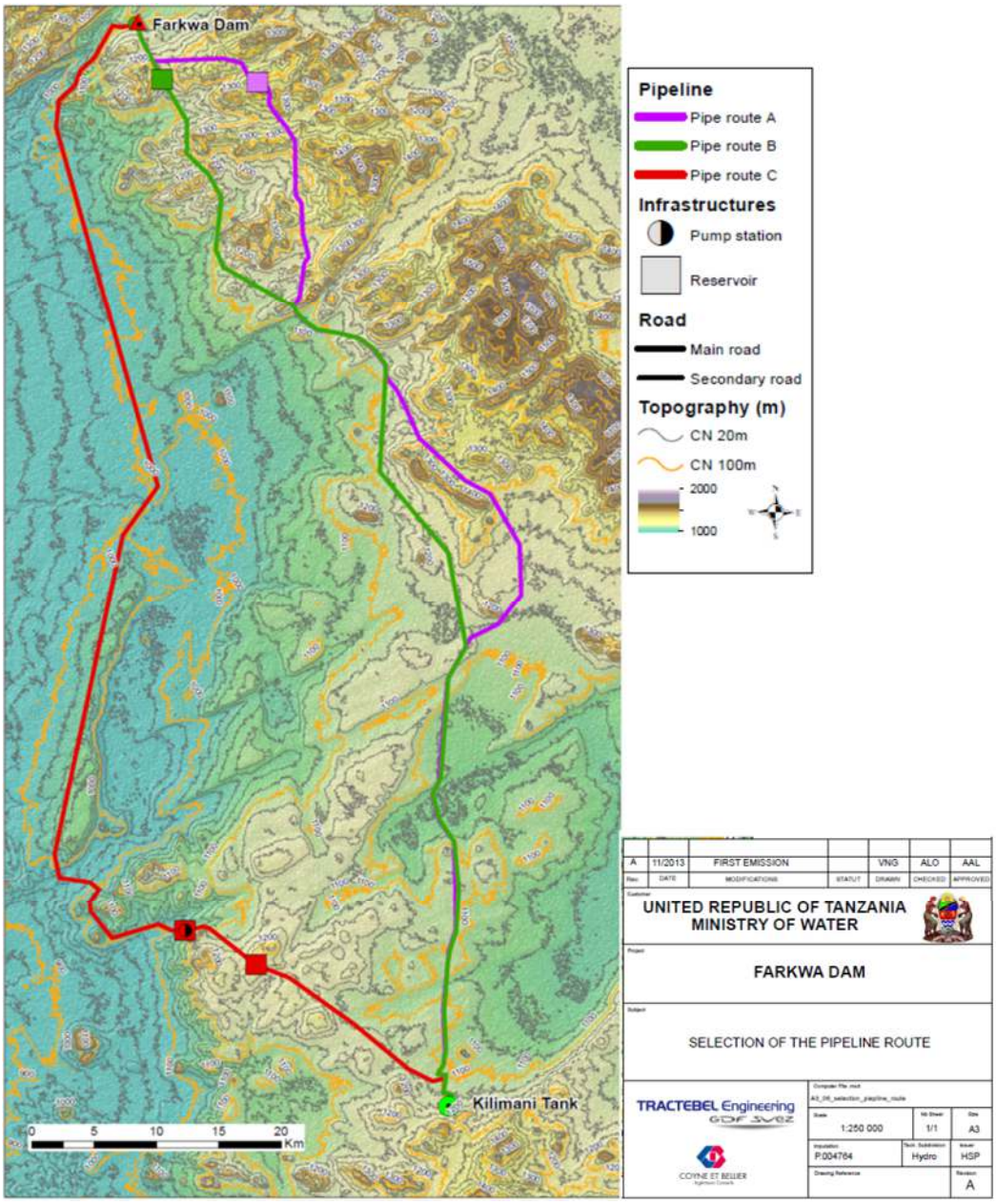

Figure 7.3: Selection of the Pipeline Route

(i) Option A – Purple:

The pipeline route follows the existing network of roads. The pump station is located downstream of the dam and pumps the water to a reservoir located on a close-by high point. From this reservoir the water transfer is made by gravity to Dodoma City. Benefits from following such roads include - no need to build a road for the construction and later the maintenance and operation of the pipeline; no need to allow provision for the maintenance of the service road (given that it initially serve another purpose); placement of the pipe within the service corridor along the road, which implies a minimized land and social disturbance; placement of the pipe along a road being frequently used, which minimise the risk of vandalism compared to an area with low development.

The Ministry is considering to allow provision for the supply of the rural populations. Placing the pipeline along the main roads is a strategic plan as populations tend to settle close to roads to benefit from commodities brought by transfer between towns and cities.

(ii) Option B – Green

The pipeline route follows the shortest route to Dodoma. The pipeline route follows more or less Option A route with an offset to the East side along two sections. The pumping arrangement is similar to Option A: pumping at the dam site to a close high point and then supply by gravity.

(iii) Option C – Red

The pipeline route targets the closest point to Dodoma City, which is reachable by gravity from the dam site. The pipeline passes through the plain following a North-South direction to join the B104 road to Dodoma. The water is transferred by gravity from the dam to the closest point to Dodoma City, which is reachable by gravity from the dam site. All the options are presented below in figure 7.3 below

Table 7.3: Routes advantages and disadvantages

Pipeline Route	Advantages	Disadvantages
Option A – Purple Along the existing network of roads	• Its topographical location allows a supply of water by gravity to the rural population settled along the pipeline route and East of the pipeline to greater distance • Pumping station will be located close to the dam site. • No construction and maintenance of an access road specifically built for the pipeline will be required. • No or low land compensation will be required along the pipeline. • No or low resettlement of the population will be required along the pipeline.	
Option B – Green Shortest length	• It has the shortest pipeline length - approximately 110 k (against 115 k for Option A and 125 k for Option C) • Its topographical location allows a supply of water by gravity to a the rural population settled along the pipeline route • Pumping station will be located close to the dam site. • No construction and maintenance of an access road specifically built for the pipeline will be required for approximately 70% of its length.	• 30% of the pipeline length will pass through private properties that may require compensation. • - About 30% of the pipeline pass through an area located away from the main road, access road construction will be required for this portion of the road.

	• No or low land compensation will be required along 70% of the length of the pipeline. • No or low resettlement of the population will be required along 70% of the length of the pipeline.	
Option C – Red Pump close to Dodoma	• Follow roads approximately 20% of the pipeline length.	• It has the longest pipeline distance – approximately 125km (against 115 k for Option A and 110 k for Option B) • The pipeline does not pass through the dense rural areas for possible supply of water • Land compensation will be required along most of the pipeline length. • Over 70% of the pipeline length passes through an area located away from the main road, access road construction will be required for this portion of the road. • Pumping station not located close to developed area (such as Dodoma town) or to the dam site

The performance of each option against the above criteria was discussed and the outcomes of this discussion are documented below.

7.5 RESULTS OF THE COMPARISON OF ALTERNATIVES

7.5.1 Introduction

The discussion and analysis of alternatives in Environmental Impact Assessments should consider other practicable strategies that will promote the elimination of negative environmental impacts identified. This section is a requirement of the Environmental Management (Environmental Impact Assessment and Audit) (Amendment) Regulations, 2018, and is critical in consideration of the ideal development with minimal environmental disturbance. The following alternatives have been identified and have been discussed with project proponent as means of reducing environmental effects. They are discussed in further detail below:

7.5.2 Alternative site

Sub-area A3 is considered to present features adverse to the positioning of the main dam at this location without offering advantages over the other two options. Sub-area A3 is therefore considered to be not adequate. Sub-area A2 presents a more favorable topography and foundations conditions than Sub-area A1. Sub-area A2 is therefore considered to define the best suited location for the dam axis.

7.5.3 Comparison of dam alternatives and conclusions

Three dam type options were studied for Farkwa Dam as documented. A comparison based on technico-economic parameters was carried out in order to recommend the best option for Farkwa Dam. The results of this exercise are presented in the present paragraph.

7.5.3.1 Technical evaluation

All three options were designed to provide a technical solution of same level of performance responding to the main following criteria:

- The dam shall cope with the design loads under various scenarios including the seismic load;
- The dam shall safely contain the PMF;
- The dam shall be fitted with appurtenant works to meet is function of water supply;
- The dam spillway shall safely evacuate the design flood i.e. the 1:10,000 flood;

All the options are therefore fairly competitive on a technical point of view. However, the composite RCC and Earthfill option presents several technical advantages over the two other options, which have a positive impact on the construction implementation as well as cost:

- The placement of the spillway over the central section of the dam (section in RCC) allows the reduction of the amount of works: the two other options requires the excavation and concrete lining of a separate structure for the spillway and associated 330 m to 430 m long spillway chute.
- This spillway arrangement will also facilitate the river diversion during construction allowing for overtopping during the construction. This will have an impact on the construction implementation as well as the cost.
- The appurtenant works, in particular the intake, are integrated in the dam structure leading to a reduction of the works: the two other options require an independent structure. This integration will have a positive impact on the construction implementation as well as the cost. Moreover, this integration is preferred in a seismic context.
- The dam volume is smaller than for Option 1 given the steeper slopes of the RCC section. The dam volume for the CFRD (Option 3) is the smallest of the three options, however this volume is to be considered with the large volume of excavation required for the construction of the plinth and civil works associated to the plinth and slab.

These advantages can be quantified when comparing the volume of works, which in practice represents the main cost of the dam.

7.5.3.2 Economic Evaluation

Option 2 is taken as reference for the comparison exercise. The difference of costs of Options 1 (Earthfill) and 3 (CFRD) in comparison with the costs of Option 2 for the main work items are represented in USD and percentages. The following statements can be made:

- The composite RCC and Earthfill option (Option 2) presents the lowest price with 35 MUS. Its cost is approximately 15% lower than the cost of the Earthfill option and 65% lower than the cost of the CFRD option.
- The main cost differences concern the main dam, the spillway and intake costs.

- The cost of the saddle dam is the same for the three dam options given that the design is identical as documented previously in the present report.
- The spillway cost for the Earthfill (Option 1) and CFRD (Option 3) options is relatively high in comparison to the total cost. It represents approximately 30% of the total cost for the CRFD option and 30% for the Earthfill Option. No direct cost is allocated to the spillway for the composite RCC and Earthfill option as the spillway is incorporated into the dam structure itself (under Main dam civil works global cost item).
- The composite RCC and Earthfill option features a much lower cost for the intake than the other two options given that the structure is integrated in the dam body. Intakes and bottom outlet structure are 90% and 65% higher respectively for Option 1 and Option 3.
- There are other cost differences, which although their impact on the total cost is negligible, they are to be mentioned as they correspond to fundamental technical differences:

    - The cost of the diversion works, which is lower for the composite RCC and Earthfill option given the opportunity to allow spillage over the dam during construction. The cost of the diversion work for the CFRD option is higher than the one for the Earthfill option as the upstream cofferdam will not be integrated as a permanent section of the final dam as for the Earthfill option.
    - The cost of the foundation treatment, which is higher for the composite RCC and Earthfill option as the foundation requirement for the RCC section are stricter.

In conclusion of the economic evaluation, it can be seen that the technical advantages brought by the composite RCC and Earthfill dam option have a significant impact in term of cost: its cost is approximately 15% lower than the cost of the Earthfill option and 65% lower than the cost of the CFRD option. This main cost difference is found to be in the spillway cost with the undertaking of a large amount of work independently of the dam works for the spillway. In addition to the direct cost of these works, additional costs in terms of plant mobilization and construction duration will apply (under installation item).

7.5.3.3 Environmental Evaluation

The main environmental impact of the project is associated to the dam reservoir extent and mitigation flows. These parameters are identical whatever the dam option considered, and therefore do not promote an option over the other. However, at the smaller scale of the dam, differences are notable in the volume and type of construction materials and footprint of the dam. Table 7.4 quantifies those parameters.

Table 7.4: Material evaluation

	Option 1 - Earthfill	**Option 2 RCC and Earthfill**	**Option 3 - CFRD**
Quantity of materials	600 000 m^3	430 000 m^3	380 000 m^3
Quantity of concrete	80 000 m^3	80 000 m^3	80 000 m^3
Quantity of excavations	190 000 m^3	160 000 m^3	500 000 m^3
Project footprint	40 000 m^2	33 000 m^2	30 000 m^2

The first option “earthfill dam” has a substantial impact due to the volume of materials needed. On the other hand, the option 3 “CFRD” has also a worthy impact owing to the excavations. The footprint of the project is higher for Option 1 because of the spillway. The quantity of concrete is more or less the same for the three options. On the basis of these considerations, Option 2 appears to be the more ecofriendly.

7.5.4 Results and recommendations

The technico-economic comparison shows that the composite RCC and Earthfill Dam option (Option 2) presents non negligible technical and economic advantages. The main advantage is brought by the incorporation of the spillway and intake in the dam body, which reduce as well as facilitate the construction works. From an environmental point of view, Option 2 also appears to be friendlier due to a smaller amount of construction materials, excavations and footprint than the other two options. Regarding the FSL of the dam, a FSL at El. 1110 m is recommended:

- The reservoir simulations show that the total water demand (including the additional rural demand provided by the MOW) is satisfied;
- An increase of 1 metre of the FSL leads to evaporation losses greater than the gain in water supply;
- A higher FSL may have impacts on the Swagaswaga Game Reserve;

An increase of 1 metre of the FSL has a cost to be taken into account. It is estimated that the cost increase by approximately 7% every meter. On this basis it is recommended to select the composite RCC and Earthfill Dam Option with a FSL at El.1110m for the Farkwa Dam project.

7.5.5 Pipeline route

Three pipeline routes were considered based on the available topographical data at the time. These routes were initially defined considering the three pumping arrangements feasible i.e.:

- Option A: Pumping from the vicinity of the dam to a close-by high point, from which point the water will be conveyed by gravity to the Kilimani tank.
- Option B: Conveyance by gravity from the dam to a point located in the vicinity of Dodoma, from which point the water will be pumped to reach the Kilimani tank.
- Option C: Pumping from the vicinity of the dam over the full length of the pipe.

The three pipelines associated to these pumping arrangements are as follows:

- Option 1: The pipeline route follows the network of roads to the West side in order to avoid the high points located within the mountainous range in the vicinity of the dam site. The pump station is located downstream of the dam and pumps the water to a reservoir located on a close-by high point. From this reservoir the water transfer is made by gravity to the end point.
- Option 2: The pipeline route avoids the mountainous range to the West to then cross the plain towards the B104 road. The pump station is located to the point reachable by gravity the closest to the end point (in order to minimise the pumping length). The water is then pumped to a reservoir located on a close-by high point, from which point the water is conveyed by gravity to the end point. A second stand pressure reservoir is required to be installed upstream of the pump station for operation purpose.
- Option 3: The pipeline route follows the network of existing roads over most of it length promoting good accessibility and limited amount of works on river crossings. The pump station is located downstream of the dam and pumps the water all the way to the end point.

The three pipelines routes were compared on the basis of the following criteria:

- a maximised use of the existing natural (topography) or man-made infrastructures (roads and tracks)

- a minimised distance to be covered by the pipeline
- a minimised pumping height and length
- an acceptable level of complexity of the equipment i.e. a minimised number of stand pressure reservoirs, a minimised number of booster stations if any
- an access to a close-by power supply
- a good accessibility to the pipeline, infrastructures and equipment in order to facilitate the operation and maintenance
- a minimised number of crossings (river, road, flood plain)
- a minimised requirement for population resettlement along the pipeline

The performance of each option against the above criteria was discussed and the outcomes of this discussion are documented in Table 7.5 below.

Table 7.5: Comparison of the pipeline route options

Criteria	Option A	Option B	Option C
Provision for the supply of rural population	✓ The pipeline-target the denser rural area by following the existing road. The pipeline is positioned along a regional high point allowing provision for supply by gravity of rural population distant from the road	~~ Two sections of the pipeline are located away from the existing road and at a lower topographical point. Compared to Option A, this option is less performant requiring the implementation of secondary pumping system to supply the rural population located along the road at those two sections.	× Over 70% of the pipeline length is located in a remote area away from the settlement of the rural population
Good access to the pipeline (and protection against vandalism)	✓ The pipeline follows existing roads along all its length. No need to construct and maintain an access road specifically built for the pipeline.	~~ The two sections mentioned above will require the construction and maintenance of an access road	× Over 70% of the pipeline length is located in a remote area
Minimized population and land disturbance	✓ The pipeline follows existing roads along all its length where there is a service corridor for such pipeline	~~ As per above	× Over 70% of the pipeline length is located in a remote area

Option A is considered to be the best suited route to serve the project with for main strength the fact that it follows the existing network of roads.

7.6 THE "NO ACTION ALTERNATIVE"

The “no action” alternative is required to ensure the consideration of the original environment without any development. This is necessary for the decision-makers in considering all possibilities. The selection of the “No Action” alternative would mean the discontinuation of project designs and result in the site being retained in its existing form.

The “No-action” alternative is difficult to consider as a viable option due to the pre-existing investments which have been incurred by the Ministry of Water. One of the costliest investments that have been incurred prior to project approval is the design costs (feasibility study) and Environmental Assessment costs.

The implication of this means the status quo remains i.e. the current water shortage in Dodoma City, chemba district and Village along the conveyance and the associated problems will persist. This option would mean that the local and regional/national benefits would not be realized. The “No Action” Alternative is likely to have the greatest implications on the socio-economic environment of the area and surrounding communities and the country at large. Due to the proposed quality of the development it is anticipated that it would provide a major opportunity for employment, benefits associated with the construction industry, access road and potentially significant business opportunities for existing and new induced support businesses.

8 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF ALTERNATIVES

8.1 ASSESSMENT METHODOLOGY

This section of the report assesses the significance of the environmental impacts that have been identified by the specialists that formed part of the team, which conducted the environmental impact assessment process. The team members conducted literature reviews of available information related to the site conditions and with respect to similar project operations prior to visiting the site. During the site visit, the team spent the time on site gathering information through field studies, including the gathering of samples for identification at their offices in Dar es Salaam. The combined site visits by all specialists assisted in integration of ideas and findings between the specialists. The EIA team undertook a social survey through conducting interviews with a broad spectrum of community members. The role of each specialist was to collect sufficient data to assess the environmental impacts. In order to achieve this, the EIA team assessed the environment as it existed at the project area and secondary data from published and unpublished sources. The specialist team consisted of the following members (Table 8.1):

Table 8.1: Environmental impact assessment team

SN	Name of specialists	Position/Area of Expertise	Institution
1.	Mr. Bashiru Abdul Hassani	Social Economist, Stakeholder Consultations and ESIA Expert	TRES Consult (T) Limited
2.	Mr. Abel Sikaona	Environmental Management Specialist and Ecological Assessor	TRES Consult (T) Limited
3.	Mr. Ezekiel Matondo	Stakeholder Consultations and ESIA Expert	TRES Consult (T) Limited
4.	Mr. Stanley Alex Mrope	Environmental Planning and Management	TRES Consult (T) Limited
5	Mr. Julius M.S. Shilungushela	Dam Construction Assessment, Integrated Water Resources Management and Environmental Management	Water and Land Centre Consult Company Limited
6	Mr. Yusuf Ramadhani	Social impact assessment along the conveyor system	Tanzania Research and Career Development Institute – Dodoma (TRCDI)
7	Mr. Mghase Imanuel	Social impact assessment	TRCDI - Dodoma
8	Mr. Bildad Imanuel	Social impact assessment	TRCDI - Dodoma
9	Mr. Filbert Mushumbwa	Social impact assessment	TRCDI - Dodoma
10.	Mr. Harun Makandi	Geo-informatics in Environmental Research, GIS Expert	Commission for Science and Technology (COSTECH)
11.	Mr. Moses Joel Shimba	Aquatic resource, fisheries, biodiversity impact assessor	University of Dar es Salaam, Department of Fisheries and Aquatic sciences
12	Mr. Israel Maricky	Vegetation, Reptiles and amphibians	University of Dar es Salaam, Department of Fisheries and Aquatic Sciences

The team members conducted literature reviews of available information related to the site conditions and with respect to similar dam construction prior to visiting the site. Most of the members of the team (i.e. Environmental Impact Assessment experts, Hydrology, Flora and Fauna, and Socio-economic) visited the Farkwa site from 03rd to 17th November 2013. Another round of the site visit was conducted from 09th March to 15th March 2014. The site visit for review of the ESIA report was conducted from 02nd August to 06th Aaugust 2021.

8.1.1 Environmental impact rating scale

To ensure a direct comparison between various ESIA team studies, a standard assessment methodology was used to assess the significance (i.e. the importance of the impact in the overall context of the affected system) of the identified impacts. The criteria that were considered in the determination of the impact significance are:

- Severity/Benefit: *the importance of the impact from a purely technical perspective;*
- Spatial scale: *extent or magnitude of the impact (the area that will be affected by the impact);*
- Temporal scale: *how long the impact will last:*
- Degree of certainty: *the degree of confidence in the prediction;*
- Likelihood: *an indication of the risk or chance of an impact taking place;*

In order to ensure integration of social and ecological impacts, to facilitate specialist assessment of impact significance, and to reduce reliance on value judgments, the severity of the impact within the scientific field in which the project takes place (e.g. vegetation, fauna) is assessed first. Thereafter, each impact is assessed within the context of time and space, and the degree of certainty in the prediction is indicated.

The impact is then assessed in the context of the whole environment to establish the "significance" of the impact. This assessment incorporates all social, cultural, historical, economic, political and ecological aspects of the impact. Thus, the severity or benefit of an impact within a specialist discipline is assessed first before the significance of the impact is evaluated in a broader context. Consequently two rating scales are required, one to determine the severity or benefit, and one to determine environmental significance.

8.1.2 Severity / benefit

Severity is based on the professional judgement of the various specialists to evaluate the extent to which negative impacts would change the current conditions, or how beneficial positive impacts would be on a particular affected system (for ecological impacts) or a particular affected party (for social impacts).

Table 8.2: Severity rating scale

Negative impacts	Positive impacts
Very severe An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated. For example, change in topography.	***Very beneficial*** A permanent and very substantial benefit to the affected system(s) or party (ies), with no alternative to achieve this benefit. For example, the creation of a large number of long-term jobs.
Severe Long-term impacts on the affected system(s) or party(ies) that could be mitigated. However, this	***Beneficial*** A long-term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of

mitigation would be difficult, expensive or time consuming or some combination of these.	achieving this benefit would be difficult, expensive or time consuming, or some combination of these. For example, an increase in the local economy.
Moderately severe Medium- to long-term impact on the affected system(s) or party(ies), that could be mitigated. For example, constructing a narrow road with an area with low conservation value.	***Moderately beneficial*** A medium- to long-term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising are equally difficult, expensive and time consuming (or a combination of these), as achieving them in this way.
Slight Medium- to short term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary. For example, a temporary fluctuation in the water table due to water abstraction.	***Slightly beneficial*** A short- to medium-term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these. For example, a slight increase in the amount of goods available for purchasing.
No effect The system(s) or party(ies) is not affected by the proposed development.	***Don't know/Can't know*** In certain cases it may not be possible to determine the severity of the impact.

The severity of impacts can be evaluated with and without mitigation order to demonstrate how serious the impact is, when nothing is done about it. The word mitigation means not just “compensation”, but also ideas of containment and remedy. For beneficial impacts, optimisation means anything that can enhance the benefits. Mitigation or optimisation must be practical, technically feasible and economically viable.

8.1.3 Spatial scale

The spatial scale defines the extent or area over which the impact will take place.

Table 8.3: Spatial scale

Individual	Individuals in the area could be affected
Household	Households in the area could be affected
Localised	Land earmarked for construction of Farkwa Dam and Conveyance system project. The specific area to which this scale refers is defined for the impact to which it refers.
Study Area	Includes the entire project Area
District	Includes areas around the project area, such as Chemba, Bahi and Dodoma City
Regional	The nature of impacts shows that it may affect the whole of Dodoma Region
National	The nature of impacts shows that it may affect the entire country of Tanzania.
International	The impact would affect resources and processes outside the border of Tanzania

8.1.4 Temporal scale

The temporal scale defines the times over which the impacts would continue to occur.

Table 8.4: Temporal scale

Temporal scale	Explanation
Short term	Less than 5 years.
Medium term	Between 5 and 20 years
Long term	Between 20 and 40 years, and from a human perspective essentially permanent
Permanent	More than 40 years, and resulting in a permanent and lasting change.

8.1.5 Criteria and Significance Rating

Significance is an indication of the overall importance of the impact taking into account all the above mentioned assessment criteria. Significance was assessed in the relevant context, as an impact can be relevant to the ecological environment, the social environment or both. By ensuring that all specialists adhered to the abovementioned objective criteria, subjectivity was reduced as far as possible. There is, however, always an element of judgment that cannot be completely removed from the assessment of significance.

Significance of an impact is not always directly proportionate to severity, despite the fact that one would expect a direct relationship, i.e. a severe impact would be expected to be of *high significance*. However, this is not always the case. For example, changes to the geology might be *severe,* but the significance is regarded as *low,* since the change in the environment is considered by the society as being not important.

Table 8.5: Significance of an impact

Significance	Explanation	Examples
High	These impacts will usually result in long-term effects on the natural and/or social environment that will only be mitigated over very long periods of time.	• The loss of a diverse vegetation type, which is fairly common elsewhere, would have a significance rating of HIGH over the long term, as the area could be rehabilitated. • The change to soil conditions may have a severe impact on the natural system, and the impact on the affected parties would therefore be HIGH. However, if no land available elsewhere, this impact could be classified as VERY HIGH.
Moderate	These impacts will usually result in medium to long term effects on the natural and/or social environment. These impacts do exist but not substantial, and usually result in moderately severe effects or moderately beneficial effects.	• The loss of a sparse, open vegetation type may be regarded as very severe by the specialist, but due to the nature of the vegetation and habitats, its significance could be regarded as only being of MODERATE significance. • The provision of an efficient health service in a rural area would be regarded as being moderately beneficial, and result in a benefit of MODERATE significance.
Low	These impacts will usually result in medium to short term effects on the natural and/or social environment. These impacts are considered to cause fairly unimportant and usually short term	• The temporary change in the water table of a wetland would be defined as slight. These systems are adapted to fluctuating water levels. The significance of this impact is therefore LOW. • The increased earning potential of people employed as a result of development would only be slightly

	change to the (natural and/or social) environment. These impacts are not substantial and are likely to have minor effect.	beneficial to people who live some distance away, resulting in a benefit of LOW significance.
No significance	There are no primary or secondary effects at all that are significant to scientists or the public.	A loss of Species of Special Concern (SSC) will not take place, since none occur in the study area, resulting in NO significant impact.

8.2 PREPARATION/MOBILIZATION PHASES

Main impact sources under this phase include clearance of the project site and if necessary access routes and sites for support facilities (storage, crew), transportation of construction equipment's, materials and labour, setting up and operation of construction base camp/workshop and construction works.

8.2.1 Proposed dam and its components

8.2.1.1 Loss of /disturbance of biodiversity (flora, fauna and ecosystem)

In general, damage to habitats and contained flora and fauna may occur as a result of vegetation clearance to give way for re-aligning of the proposed dam. The vegetation in the core impact area will be cleared for example when preparing for construction of the dam embankment, laying the pipes, pumping station, interim tank, crew camp (including site offices, workshops, stores, vehicle parking, and staff residential building). Although the project area is disturbed by human activities the main vegetation cover on the active project area and along the conveyance system is natural and opulent. The project area clearly contains a highly heterogeneous and diverse assemblage of plant communities, including species of conservation concern (IUCN and CITES) with no rare or endemic species.

Figure 8.1: Part of Acacia-commiphora (left) and wooded acacia (right) which will be inundated by the proposed dam.

However, the affected species are represented elsewhere in the adjacent woodland (miombo and acacia), acacia-commiphora, savannah, bushlands and thickets. Hence the impacts on flora will be negligible with continued implementation of the proposed mitigation measures and successful reclamation activities including re-vegetation and monitoring in all areas outside the project footprint. Also the area is a home to many bird species and a total of 77 bird species (Appendix 8) were recorded both on site and the areas adjacent to the proposed project (miombo woodland, riparian vegetation, wooded acacia-grassland and

thicket). The loss in riparian trees may mean a loss in bird breeding/ roosting. The vegetation so cleared will lead to loss of valuable biodiversity especially of organisms that are prevalent in the areas. The cutting of indigenous trees may interfere with some cultural values of the local community as some trees have medicinal value and have been used for treatment purposes. *The impact is considered to be negative, long term and of high significance*

8.2.1.2 Deterioration/impairment of local air quality

Construction materials such as cement, steel, wood, sand, stones, and aggregates etc. will be brought from different sources in Dodoma Region and as far as Dar es Salaam. The trucks and earth moving equipment will emit dust, noise and exhaust fumes which are unwanted atmospheric pollutants. Atmospheric pollutants from engines of vehicles include oxides of nitrogen, hydrocarbons, carbon monoxide, SO_2, NOx, CO_2 and particulate matters. The quantity of pollutants emitted and the environmental impacts depend on the numbers of vehicles, function speed, condition of the road, application, the quantity of plant/machinery and the state of maintenance. The major impact is deterioration of local air quality, the extent of which will depend on quantities emitted, duration and prevailing atmospheric conditions. The general guidelines for air quality standards for Tanzania and as recommended by the World Health Organization (WHO) are listed in Table 8.6 below:

Table 8.6: Air quality standards

Pollutant	Tanzania	WHO/IFC
PM_{10}	Annual mean of 60 to 90µg/Nm^3 (0.05 – 0.116 mg/kg)	• 24-hour mean of 150 µg/m^3 • Annual mean of 50 µg/m^3
SO_2	• 24 – hour average 100 µg/Nm^3 (0.129mg/kg) or • Annual mean of 40 – 60 µg/Nm^3 (0.05-0.08 mg/kg)	• 24 – hour average 150 µg/m^3 / • Annual mean of 50µg/m^3
NO_2	• 150 µg/Nm^3 for 24-hours average value or • 120µg/Nm^3 for 8 hours	• 150 µg/m^3 for 24-hours average value • Annual 100 µg/m^3
CO	Time-weighed exposures at the following levels: • 100 mg/Nm^3 for 15 minutes • 60 mg/Nm^3 for 30 minutes; • 30 mg/Nm^3 for 60 minutes • 10 mg/Nm^3 for 8 hours.	

Mobilization of the project equipment and machinery will be a one – off event, requiring limited number of trucks. With the low forecast number of vehicle movements, the limited quantity of equipment/machinery, and adoption of good maintenance regimes, the emissions of air pollutants from these sources will be limited. Additionally, from the above standards and based on the location and duration of works on the project site, it is unlikely that the above threshold value will be exceeded. It can be concluded that the emissions may affect local air quality but will have no significant impact on global air quality. *The impact is predicted to be negative, cumulative, short-term duration and of moderate significance*.

8.2.1.3 Nuisance and disturbance on/offsite receptors from noise pollution

During the mobilization phase for the construction of the Farkwa dam, large quantities of rock-fill and concrete aggregates will need to be transported to the site, as well as other construction materials and

people/equipment. The coarse grained materials for filters, drains, rock-fill and concrete aggregates will be sourced on the hills at the western extremity of the Kumbaku Ridge. Throughout mobilization phase, noise levels would be relatively higher than normal because of use of a variety of heavy equipment, machinery and vessels. The access road to Kumbaku Ridge passes through Donsee, Farkwa, Mombose villages and people living along that access road will be affected by increased noise level. At the project site quipment to be used includes cement mixer, crane, crawler crane, push-dozer, road roller, mixing plant, loaders, trucks, engines (generator), vibrators and concrete mixers, etc.

The impact of noise from the source of these activities could have effects on the population living around these areas especially from Gonga Village. This means a continuous generation of noise may be a nuisance/ affect the health of nearby villagers, and close-by staff residence and construction offices. Noise is measured in decibels and is considered to be a nuisance when the combined expected maximum noise level exceeds 70dB (A); the relevant noise is at least 1.0dB above the prevailing noise level and the contribution to the increased noise level of the new or altered development is at least 1.0dB (A). Tanzania Standard TZS 932:2007 stipulates maximum permissible day time noise levels of 70 dBA for industrial area and 60dBA for residential and industry/small scale production and commerce. Likewise, the stipulated WHO/IFC guidelines require noise emission levels in the working areas should be less than 70dBA.

Table 8.7: Maximum permissible noise levels for general environment

FACILITY	NOISE LIMITS in dBA (L_{eq})	
	DAY	**NIGHT**
Any building used as hospital, convalescence home, home for the aged, sanatorium, and learning institutions, conference rooms, public library, and environmental and recreational site.	45	35
Residential building	50	35
Mixed residential (with some commercial and entertainment)	55	45
Residential and Industry/small scale production and commerce	60	50
Industrial area	70	60
TIME FRAME	**6:00am-10:00pm**	**10:00pm-6:00am**

Source: Environmental Management (Quality Standards for Control of Noise and Vibration Pollution) Regulations, 2015

Albeit annoying, this negative impact will be short-term (limited to the duration of the mobilization works and is not considered to be a significant threat to the health or well-being of humans. Distance from settlement will help to ameliorate noises especially at the proposed dam embankment, crew campsite, substation, water treatment tank site and interim tank site. *The potential impact associated with increased noise, is predicted to be negative, short term and of moderate significance.*

8.2.1.4 Air pollution due to dust

Dust pollution is expected during excavation and earth movement from borrow pits. Other sources of dust during mobilization include mobilization vehicle movements and other project related traffic on unpaved roads, handling, storage, stockpiling, and site preparation. Also transportation of aggregates will be through the established access road which passes through the villages, though most houses are located far from the envisaged route the dust plume during windy conditions generated from this source might

have high impact to the residents. Such pollution can be divided into dust and fine particulate matter (PM_{10}). Dust comprises of large airborne particles of material, which are resident in the atmosphere for short periods of time after release, as they are heavy enough to fall out of suspension in the air relatively quickly. Therefore, effects of these emissions will be localized and they do not cause long-term or wide spread changes to local air quality but their deposition on nearby properties causes soiling and may therefore result in complaints of nuisance, which is usually temporary.

The majority of the dust emissions are likely to occur during the working hours of mobilization activity. The precise behavior of the dust, its presence in the atmosphere, and the distance it may reach would depend upon a number of factors. These include wind direction and strength, local topography and the presence of screening structures (buildings, trees etc.) that may intercept dust before it reaches sensitive locations. However, residential properties or sensitive receptors are situated more than 4 kilometres of the project site and provided that site specific mitigation measures are implemented, no significant dust effects are predicted. *On the overall dust pollution is considered to be negative, long term and of low significance*

8.2.1.5 Depletion /degradation at points of source of construction materials

The project will require bulk standard materials for construction, specifically earth for embankments, clay for the use as impervious core materials, stone for stone pitching, stonework and rip-rap (bank protection)), and various grades of aggregates (sand, gravel, crushed rock) for access road, pumping station, interim tank, crew camp construction and concrete. The amount of materials needed for impervious core or homogenous earth-fill is estimated at less than 1 Mm^3. The Borrow area A1, which is the closest to the dam sites and credited with available volume of 7.6 Mm^3 shall be used as the main source. Borrow area A2 and A3 could be used if additional amounts of fines are needed.

It is expected that the contractor will obtain materials for construction purposes such as aggregates, stones, sand, etc. from the areas specified in the Feasibility Study of the proposed project or from authorized areas. Extractions of materials from authorized borrow pits and quarries on government land, communal land and from private-owned land are associated with rampant degradation at points of source with no efforts of restoration/re-vegetation. Most exploited borrow pits are found on private owned /communal land of natural vegetation or planted with crops which have been cleared/disturbed. In some instances, sand in the project area is extracted from riverbeds.

Pollution risks associate with extraction of materials from unauthorized sources include sediment overload into the stream during rains, air pollution, and contamination by oils from excavators and loaders. Most of unauthorised areas are declared by the government as a danger zones and exploitation is prohibited. The MoW shall not encourage suppliers of these materials to use closed down burrow pit or sand extracted from river bed. Instead it shall use licensed suppliers. Also some construction activities require the use of water. Typically these include making concrete, curing concrete, combating dust etc. In addition, the contractor and his workers require water for cooking, drinking, bathing, washing clothes, etc. Therefore additional water abstraction is expected during construction phase when concrete works are required. However, it should be noted that resources extraction is open to all contractors/users, thus, the project will be adding on to existing problems (cumulative impacts). Thus, impacts associated with resource extraction from off-site locations are predicted as: S*econdary or indirect negative impacts, cumulative, short to medium-term and of moderate significance.*

8.2.1.5 Erosion of the top soil and reservoir sedimentation

The nature of the project site demands use of heavy machinery during site preparation and mobilization mainly for earth movement and leveling for dam. This may lead to instability of the soil in the area and as a result cause soil erosion mainly of top soil. The earth works and site clearance will expose the soil to erosion factors such as wind and rain. The potential for sediment transfer will be more pronounced if construction is done during the rains. Also owing to the nature of the borrow pit, heavy machinery will be required for earth movement and excavation. This would lead to instability of the soil in the area and as a result cause soil erosion mainly of top soil. Consequently this may lead to siltation and sedimentation of rivers/ reservoirs in the catchment if not controlled. However sound design and construction practices can minimize, if not eliminate, this impact. *The impact is considered to be negative, long term and of moderate significance.*

8.2.1.6 Disruption of traffic flow during mobilization

Based on the nature and size of the proposed project, it is anticipated that there will be an addition of contractor trucks. It is expected that 10m^3 trucks (6-wheel and articulated dump trucks) will be used to mobilize material and it is estimated that there will be 1 truck movement each way every 10 minutes, for up to 12 hours per day, Monday to Saturday. Also trucks waiting to turn into the site could block through traffic. Potential traffic and transport related impacts include: disruption to road users from vehicles entering and leaving the project site; disruption to pedestrians from vehicles entering and leaving the site; disruption of other road users along the transport routes; damage to road infrastructure by heavy construction vehicles; and accidents on or off project area resulting in spilled loads and/or release of hazardous materials (e.g., oils, concrete, asphalt).

However, the intersection will be located on straight part of the road and there is clear vision for at 50 metres to the left and right. This should allow merging into the traffic with minimum impact. Also the traffic flow along the road is not very high along the Mwamtoro – Mayamaya road and in case it is found out that during construction there is a need to plan for transporting fill material during low traffic flow, the transport contractor will be instructed accordingly. *This impact is predicted to be negative, cumulative and of short-term duration and of moderate significance.*

8.2.2 Conveyance system to Dodoma City and Chemba

8.2.2.1 Damage /disturbance to habitats and species

Potential impacts to flora and fauna biodiversity could arise due to the physical and behavioural disturbance during excavations, trenching, pipe laying, backfilling and operation of base camp. In general, damage to habitats and contained flora and fauna may occur at several places along the conveyance system. Impacts of significance will be those areas along the route which are not disturbed by the anthropogenic activities. Areas with mature vegetations are found between the intake area at Mombose to Farkwa village, some part of Farkwa to Donsee, Donsee to Chemba, Donsee to Zamahelo and Makorongo. These areas differ significantly from the village centres which are much affected by anthropogenic impacts from human activities and the flora and fauna remains are not indigenous. So impacts from flora and fauna are expected to be negligible because of the multi-stage approach that will be employed in installing the pipeline. *The potential impacts are considered to be negative, short term and of moderate significance.*

8.2.2.2 Disruption of economic and subsistence (livelihoods) due to clearance of farmland/crops

The estimated 130 km x 30 m (Dodoma City) and 30m x 51m (Chemba) of the terrestrial land for way-leave for the pipeline could fall on farmland, natural capital (terrestrial forested areas) or other sensitive human settlement features. Agricultural activities form an important part of the livelihoods of the population residing in the project area and forests are source of firewood, charcoal, building poles and materials for construction. If clearance happens before the harvest is done, crops and fruits trees un-harvested will be lost causing constraining effects on subsistence and programmed family income. However it was stated that the pipeline route will be trenched at the edge of the road reserve to avoid taking up a big farmland / forested area henceforth will cause minimal environmental disturbance to surrounding agricultural land and community areas. If this will be implemented the magnitude of impact is going to be low since trenching will as much as possible be confined to small area. *The impacts are considered to be negative, short term and of moderate significance.*

8.2.2.3 Deteriorated/impaired air quality

Conveyance system equipment will be transported to the work areas using trucks from Dar es Salaam. Vehicles and equipment's with internal combustion engines have potential to emit noxious gases such as CO_2, CO, NOx, SO_2, VOC and CH_4. Emission levels, however, is a function speed, condition of the road, application etc. The conveyance is estimated to take place for a period of twelve months. During this period transportation of staff, equipment will constitute the major sources of emissions. Assuming that about 10 vehicle trips will be made per day covering about 10 km per day, and average fuel consumption about 6 litres per km the amount of emissions generated will be as shown in Table 8.8

Table 8.8: Emissions from vehicles mobilization

	CO_2 (tonnes)	**CO (tonnes)**	**NO_x (tonnes)**	**N_2O**	**SO_2 (tonnes)**	**VOC (tonnes)**	**CH_4 (tonnes)**
Vehicles	1152	9.64	13.68	0.08	1.4	0.083	1.94

This impact is considered negative, short to transient medium term and of low significance.

8.2.2.4 Erosion of the top soil and reservoir sedimentation

The proposed pipeline route crosses various potential natural impediments such as streams, gullies and swamps of various sizes and durations. Vegetation clearance, trampling by people and machines, vehicle and equipment movement will result in wide spread land disturbance and increased erosion. Also the nature of the project area may demands use of heavy machinery during site preparation and mobilization mainly for earth movement and leveling for the conveyance system area. This may lead to instability of the soil in the area and as a result cause soil erosion mainly of top soil. The earth works and site clearance will expose the soil to erosion factors such as wind and rain. The potential for sediment transfer will be more pronounced if construction is done during the rains. Also owing to the nature of the borrow pit, heavy machinery will be required for earth movement and excavation. This would lead to instability of the soil in the area and as a result cause soil erosion mainly of top soil. Consequently this may lead to siltation and sedimentation of rivers/ reservoirs in the catchment if not controlled. However sound design and construction practices can minimize, if not eliminate, this impact. *The impact is considered to be negative, long term and of moderate significance.*

8.2.2.5 Increased cases of STDs, HIV/AIDS

Conveyance installation activities will be conducted in the populated villages along the road and social interactions among workers and locals is inevitable especially on the construction areas, transportation routes etc. Results of these interactions could be increased incidences of health impacts such as spread of HIV/AIDS. Also influx of people in the project area may results into attitudes and behaviour change to indigenous villagers. The obvious relative wealth of the project workers may lead to exploitative behaviour on the hosts' side. Also the economic, cultural and technological changes may significantly contribute in social structure, cultural heritage, attitudes / behaviour change. *This impact is considered negative, long term and of moderate significance.*

8.2.3 Access road

Access roads will be designed to provide access to the dam and pumping station from the existing track leading to the dam site. The access roads will be classified as collector roads reefing to the Road Geometry Design Manual of Works. The road will be 6.5 m wide carriageway with 1.5 m wide shoulders on both sides. The design speed will be 50 km/h with roadway normal cross-fall of 4% and right of way over 100 m.

8.2.3.1 Deterioration aesthetics due to extractions of natural materials

Borrowing of natural gravels from the identified by the feasibility study potential sites, will obviously involves further excavation and so clearance of vegetation around, especially miombo woodland at the borrow sites. Removal of vegetation will amount to further degradation of land and landscape, making the area susceptible to water and wind erosion. In addition, quarrying and excavation will destroy the economic and aesthetic value of the site. *The impact is considered to be negative, cumulative, short-term duration and of low significance.*

8.2.3.2 Deterioration of ambient air quality

It is anticipated that mobilization for the access road construction may lead to deterioration of ambient air quality due to generation of dusts from excavation and compaction at the project area and extraction of materials at material borrow sites. Deterioration of ambient air quality will also arise from transportation and stockpiling of construction materials at the access road. In addition, the transport trucks may produce clouds of dust as they move across settlements. *The impact is considered to be negative, short-term duration and of low significance.*

8.2.3.3 Increased noise and vibrations

Pollution due to noise and vibrations will result from construction equipment and trucks during transportation and delivery of construction materials at the access road. Increased traffic movement across and along villages is likely to cause considerable noise and vibrations. This is likely to interfere with audio communication. The impact is likely to be eminent if the equipment and trucks are poorly maintained. Nevertheless, since there are no settlements in the neighbourhood of the proposed access road and sources of construction materials, the impact due to noise and vibrations will only be felt by-construction workers. The negative impact due to noise and vibrations is *considered to be negative, cumulative, short-term duration and of low significance.*

8.2.3.4 Generation of solid wastes

Generation of wastes will result from accumulation of construction material wastes such as concrete, nails, timber, steel, iron sheets etc, and material packing such as cement bags etc. The wastes generated will cause loss of aesthetics quality as they will create eye sore to the by passers. *The impact is considered to be negative, cumulative, short-term duration and of low significance.*

8.2.3.5 Road traffic accidents due to construction of the access road

Mobilization phase for the construction of the access road will increase the traffic volume and movements. This is likely to increase the likelihood of accidents, especially along materials stock/ source routes and specifically at road crossings, especially at the settlement centres of Farkwa Centre and Mombose. The impacts due to pressure on traffic and road safety are anticipated to be *negative, cumulative, short-term duration and of low significance.*

8.3 CONSTRUCTION PHASE

6.3.1 Proposed dam and its components

8.3.1.1 Deteriorated / impairment of local air quality

During construction of the dam embankment, laying the pipes, access road, pumping station, interim tank, crew camp, vehicles and equipment's with internal combustion engines have potential to emit noxious gases such as CO_2, CO, NOx, SO_2, VOC and CH_4. Emission levels, however, is a function speed, condition of the road, application etc. Main impact is impairment of local air quality, the extent of which will depend on: number of vehicles operating at a particular time; prevailing atmospheric conditions - wind regime, temperature and rainfall; atmospheric pressure and duration of earthworks. Table 8.9 below shows the emission factors of the various construction equipment and vehicles. Table 8.10 shows the approximated emissions.

Table 8.9: Emission factors of construction equipment's and vehicles

Sn	Type	Quantity	Emission factors				Duration
			CO g/hp-hr	NOx g/hp-hr	PM_{10} g/hp-hr	$PM_{2.5}$ g/hp-hr	
1	Excavator	1	0.75	4.31	0.101	0.093	12 months
2	Wheel loader	1	0.94	4.67	0.087	0.88	12 months
3	Trucks	5	11.24	15.27	0.3338	0.3071	12 months
4	Motor grader	1	0.75	4.31	0.101	0.093	12 months
5	Compactor	1	0.94	4.67	0.087	0.88	12 months

Table 8.10: Total emissions from construction equipment's and vehicles

S/N	Type	Total Emission			
		CO tons	NOx tons	PM_{10} tons	$PM_{2.5}$ tons
1	Excavator	0.268	1.539	0.036	0.033
2	Wheel loader	0.597	2.965	0.055	0.051

3	Trucks	0.007	0.0095	0.002	0.0002
4	Motor grader	0.597	2.965	0.055	0.051
5	Compactor	0.597	2.965	0.055	0.051

The greatest potential for impacts on air quality from traffic associated with construction of the proposed project would be in the areas immediately adjacent to the principal means of access for construction traffic and at the quarry site. Table 8.6 under section 8.2.2 above, presents the general guidelines for air quality standards for Tanzania and as recommended by the World Health Organization (WHO). From these standards and based on the location and duration of works on site, it is unlikely that the above threshold value will be exceeded. It can be concluded that the emissions may affect local air quality but will have no significant impact on global air quality issues. *The impact is considered to be negative, cumulative, short-term duration and of moderate significance.*

8.3.1.2 Noise pollution

In a general context, heavy machinery will be required during construction of the proposed project. Mechanical equipment which is planned to be involved in the construction of the proposed Farkwa dam and its associated components, but is not limited to: track loader, excavator, electric grinders, bulldozer, vibrators and concrete mixers, hydraulic hammer and breaker, mobile crane, air compressor, dump trucks, generators, concrete pump, etc. Source of the noise is also expected from the workshop area i.e. prefabrication yard. The table 8.11 below gives an overview of the noise levels at a reference distance of 16m from the source for various machines that will be most frequently used in construction. The values in the table are based on data from the available literature.

Table 8.11: Noise levels from construction equipment

Noise during construction	Level of noise (dBA) at 16 m from the source
Compressor	81
Excavator	80
Ballast equalizer	82
Compactor	82
Concrete mixing	85
Pump for concrete	82
Vibrator for concrete	76
Mobile crane	83
Bulldozer	85
Generator	81
Machine for flattening	85
Circular saw (metal cutting)	76
Woodcutter	84
Truck loader	85
Truck	88

Tanzania Standard TZS 932:2007 stipulates maximum permissible day time noise levels of 70 dBA for industrial area and 60dBA for residential and industry/small scale production and commerce. Likewise, the stipulated WHO/IFC guidelines require noise emission levels in the working areas should be less than 70dBA. Noise is considered to be a nuisance when the following conditions are all met: - the combined

expected maximum noise level exceeds 70dB (A); the relevant noise is at least 1.0dB above the prevailing noise level and the contribution to the increase in noise level of the new or altered development is at least 1.0dB (A). Noise has the potential to cause a temporary but potentially significant impact on sensitive receptors during the construction works. Noise Sensitive Receptors (NSRs) are normally taken to be places where people may be exposed to noise over a period of time and/or during sensitive times of the day, such as the night time. NSRs typically include residential areas, schools, hospitals, cultural areas, recreational/tourist areas, etc.

The NSRs in the study area were identified to be none as the actual area where the embankment will be constructed there are is no residential houses, schools, hospitals, cultural areas, recreational/tourist areas, churches and mosque. The nearby churches and school - Mombose Primary school will be relocated as they are within the dam area. Also it is anticipated that, the temporary effect on the living and foraging area including birds, mammals and fish, will be slight and no permanent effects will occur as many species have a large action radius, and there are ample alternative locations in the surrounding area.*The potential impact associated with increased noise, is predicted to be negative, short term but of moderate significance.*

8.3.1.3 Air pollution due to dust

During construction work, concrete batching plant will be used and such plant has the potential to emit dust, in the form of cement, sand and aggregates dust. Dust pollution is mostly likely to occur during the delivery of raw materials in trucks, trailers and tankers. Also the sourcing of coarse grained materials for filters, drains, rock-fill and concrete aggregates will require crushing of quarried rocks. Any quantity of dust emissions will have the potential impact on the air environment and affect sensitive receptors in the proximity areas, such as the site workers, users of the nearby road and nearby residents. Fine dust particles (PM_{10}) from concrete batching operations can enter neighboring premises and adversely affect amenity as well as adverse health impacts. If the batching plant is positioned near the river, then any dust fines could settle on water and could potentially be washed into the river.

However, the government authorities of Tanzania (TBS Standards) have published the maximum tolerable emission of particulate matter for industrial plant as 250mg/Nm^3, a value unlikely to be reached or exceeded during construction works. Given the relative large scale of the project area and its location, the level of pollution is very unlikely to be above the normal tolerable level. *The impact of dust pollution is therefore predicted to be negative of short-term duration and of moderate significance.*

8.3.1.4 Increased vibrations

Planned construction activities and use of equipment and machinery will be a source of vibration. The response of people to vibrations on the ground is influenced by many factors. Some of those factors are physical, like amplitude, duration and frequency content of vibrations, while other factors like the type of population, age, gender and expectations are physiological. This means that people's reaction to vibrations is subjective and differs for different people. It is generally accepted that for the majority of people, vibration levels in excess of between 0.15 and 0.3 mm/s peak particle velocity are just perceptible. The table 8.12 below presents distances at which vibration may be perceptible for certain types of construction activity. These figures are based on historical field measurements and information available in literature.

Table 8.12: Distances at which vibration may be perceptible

Construction activity	distances at which vibration may be perceptible [m]
Excavation	10-15
Vibratory compaction	10-15
Heavy vehicles	5-10

Due to the fact that there are no residential properties in the immediate vicinity of the proposed construction site, it is highly unlikely that vibration from the construction of the proposed dam and conveyance system would be perceptible. *The impact is considered to be negative, short term and of low significance.*

8.3.1.5 Increased soil and water pollution downstream

The project site is located within the Mkinki and Bubu River and the project shall involve soil excavation and shifting, activities associated with dust emissions, capable of causing significant air and water pollution. Dust deposition into the river water will significantly raise the water turbidity levels although for a short time. Increase turbidity levers might impair water quality and affect downstream users. Construction activities may also result into soil and water pollution by emissions, spillage or surface runoffs. Movement of vehicles and the use of machines at site may result in accidental oil spillage. Pollutants on the soil could be washed into the river with surface runoffs. Water pollution may also result from the ex-filtration from the workers constructed toilet pit, whereby, nutrients and pathogens may be transported with subsurface flows into the river. Water pollution may result into serious health problems to downstream users. Examples of diseases caused by consumption of contaminated water include diarrhoea, dysentery, cholera etc. *The impact is considered to be negative, short term and of moderate significance*

8.3.1.6 Contamination/impaired quality of receiving body – land, water from construction wastes

The construction works will require careful management to ensure that volumes of imported materials are in balance with the requirements. If there is an over estimation on the amount of material required for the construction works, then there could be excess material that which would need to be disposed of. Excess material expected will include metal cuttings, rejected materials surplus soil, excavated materials, paper bags, empty cartons, empty paint and solvent containers, broken glass among others. Also there will be solid and liquid waste generation of different types from construction camp. Non-organic wastes such lead batteries as well as plastic, glass, chemicals and oils if not properly disposed of, may be a potential source of health hazards not only to the workers but also to the villagers as they may contaminate both surface and ground water.

Solid wastes if not well managed and disposed of at an approved dumpsite would negatively impact the site and the surrounding environment. In addition, have a potential of causing disease outbreaks due to their presence providing suitable breeding conditions for vectors of certain diseases such as cholera and typhoid. Outbreak of diseases such as Malaria could also be exacerbated by the presence of open water ditches for breeding of anopheles mosquitoes. Other impacts include increased bird and wildlife population (attracted by food waste). *This impact is considered to be negative and of high significance due to the fact that contamination of water sources may have pronounced health implication regardless of the size of the source*.

8.3.1.6 Contamination of soil and ground water quality from the batching plant

The batching plant to be used during the construction phase of the project will be located on site, although the exact location is unknown. Regardless of location, waste water from the batching plant is usually generated from truck wash systems, washing of the central mixing plant, contaminated storm water runoff and from water sprayed as a dust control measure. Such waste water may contain dissolved solids such as sulfates and hydroxides from cement, chlorides from the use of calcium chloride as an admixture, oil and grease from the equipment, and small quantities of other chemicals associated with hydration of cement and derivatives from chemical admixtures. If the waste water will be allowed to drain on land or in case of accidental spillages, such water could contaminate the soil and subsequently groundwater, negatively impacting on local soil, surface and groundwater conditions. The disposal of waste water from these processes will therefore need to be controlled. *The impact is considered to be negative, short-term duration and of moderate significance.*

8.3.1.7 Contamination of river waters from accidental spillages/discharges

Accidental spillages or other releases that may cause pollutants to be discharged into waters during construction works could originate from on-site refueling operations; vehicle/machinery maintenance work in the project area; fuel storage area; pre-cast unit, including the batching plant waste water discharges; and temporary toilets and septic tanks releasing sewerage form the workers camp. Any accidental spillages or leakages from the above sources or from fuel storage areas have the potential to impact either directly on local water quality or indirectly, if such spillages result in contamination of water. The extent of any subsequent impacts would be proportional to the nature of the contaminant and the quantity entering the soil and/or the river water. The potential impacts of such accidental discharges, especially when directly released into the environment are potentially serious, and all necessary measures will need to be taken to minimize this risk.

Discharge of sewage directly into river shall not ordinarily occur, since portable contained toilet facilities shall be provided for the workforce during the construction activities, as good construction practices. The provision of these facilities is adequately maintained and their waste is properly handled and disposed. There shall be no impacts from this source on water quality. Another potential source of sewerage water is from the on-site worker camp, if one is established for the project. *This impact would only be short-term if it did occur, and if the right measures are undertaken and the right equipment is provided i.e. spill kit), then any water quality impact shall not be of high significance.*

8.3.1.8 Soils damage/disturbance to surface and sub-surface organisms

Access road and dam construction involves compaction to stabilize the base in so doing surface and sub-surface organisms e.g. arthropods and earthworms etc. will be impacted. Furthermore, heavy earth-moving equipment's have tendency to exert pressure on the ground causing soils to create hard pans. This activity will have similar impacts to compaction. However, the mentioned organisms are equally found distributed in the whole area. *The impact is considered to be negative impacts, of short-term duration and of moderate significance.*

8.3.1.9 Injuries to the general public due to road accidents

The principal means of transport proposed to service project construction is by road. Transportation and delivery of the materials for conveyance and dam construction would be made using standard vehicles

and, therefore no specialized vehicles which would have non-standard dimensions are required. The construction phase of the proposed project will necessarily increase the volume of traffic in the vicinity of the project site, as well as change the nature of the traffic due to increased number of heavy motor vehicles. The mere presence of construction traffic may also result in an increased safety risk. However these effects would be discontinuous, limited to the duration of the construction works and with moderate magnitude, and would be controlled through traffic management measures where appropriate. *The impact is considered to be negative, short term and of moderate significance.*

8.3.1.10 Public health hazards/safety due to social interactions

Construction works of the proposed project components will be associated with availability of employment opportunities and hasty generation of income. People with different social background will immigrate in the project area to access opportunities created. This influx of people in the project area and resultant social interactions among workers and locals is inevitable, especially on the construction areas, transportation routes, etc. The obvious relative wealth of the project workers may lead to exploitative behaviour on the hosts' side. Consequence of these interactions could be increased incidences of health impacts such as spread of STDs, HIV/AIDS, breaches of security as well as attitudes and behaviour change to indigenous people. The local people especially youth and women are the most venerable group to that social interaction due to their social economic background. The prevalence of HIV infection among adult's blood donors in Dodoma Region is in the range of 5% to 10%. However, the proposed project is one among several construction works and other investments taking place in Dodoma region. *The impacts are predicted to be negative, cumulative, long-term, and of moderate significance.*

8.3.1.11 Health hazards associated with construction work

Safe working environment is normally assured when code of practices in the working place are instituted. Failure during the design to provide for and integrate health and safety (e.g. providing health and safety training to workers, putting in place emergency plan, providing first aid, providing proper personal protective gear and ensuring suitable working conditions) and ensuring there is a clear distribution of responsibilities and accountability for health and safety management activities to all employees at all levels may lead to accidents, injuries to workers, loss of lives and/or of property.

Construction activities are rife with activities that may cause risk to serious injuries and/or fatalities to workers including use of motored/sharp edged equipment's. Construction works for project will be using various noise-emitting heavy power equipment's and tools and engines including compressors, generators and mixing machinery. Noise is expected to be generated from dredging vessels, vehicles and trucks transporting equipment and materials. Noise levels from vehicles are about 65 dB. Fire risk may also exist at the base camp, offices, and storage and maintenance areas handling flammable materials. According to the Occupation Health and Safety Act of 2003, the causes of accidents in construction sites includes but not limited to poor site layout, poor erection and improper use of scaffolds, falling objects from high level, improper method of lifting, sharp edges, improper use of personal protective equipment (PPE), inadequate provisions of PPE, and falling through uncovered openings especially at upper floor levels and carelessness of workers. Occupational health hazards may also be promoted by lack of procedures that mitigate negligence at work, fatigue due to understaffing and long working hours, employing wrong people on particular jobs and low morale, etc. *The impacts are predicted negative, short term and of high significance.*

8.3.2 Conveyance system

8.3.2.1 Disruption/ disturbance/ damage of local ecology and resources

Much of the open area within the project area is essentially extensively developed. It is expected that there will be little bio-environmental impacts to be caused by the proposed construction of the conveyance pipeline largely because much of the area already experiences cultivation and construction activities of similar or higher magnitude to the one being proposed with only pockets of undisturbed natural ecosystems. *The impact is considered to be negative cumulative and of low significance.*

8.3.2.2 Disruption of the various users of the highway and road reserve

There are a number of existing infrastructures close-by/ within/in the vicinity of the road reserve under which the pipeline will be laid. The Highways Act [CAP 167 R.E. 2002), section 52 allows the placement of telegraph, telephone and electric lines and posts, pipes, drains, and sewers on, over, along or under any highway (defined to include the road reserve). In this regard, placement of the water pipeline alongside or close the other infrastructures are allowable. However, the existing infrastructures may require routine maintenance, repair or replacement, the activities of which may cause unintentional damage to the pipeline. There is a great possibility that laying down the pipeline may raise conflicts with the other users of road reserve. The distribution networks for utility services such as water and sewage infrastructure have been located underground in pipes or ducts at varying depth, some without a warning layer on top.

The utilities pipe in for e.g. Dodoma City are laid at 60 – 100 cm deep. Therefore the trench for the pipeline going down to 100 cm may encounter and cause damage to the existing systems. In addition, owners of infrastructures on the road reserve make access to them during repairing or replacement, particularly in areas congested with traffic and buildings (e.g. from Mnadani to Kilimani area in Dodoma City). In some areas, laying of the pipeline may necessitate “open cut” of the road which may cause diversion/disrupt traffic flow and rehabilitation costs.

This is envisaged particularly at the Dodoma - Singida Road and when moving the pipeline from the right hand side of the Iringa road to Imagi area. It was reported that compacting of 30cm width backfilled trench is not technically easy; hence cutting a trench across the road may weaken the road. The disruption of the services within the road reserve are considered temporary but may have considerable cost implications to the MoW which will have to meet the costs for rehabilitation/repair. During installation especially over a stretch in Dodoma City where the road is more congested, disruption of vehicle movements may be severe. *This impact is considered to be negative, cumulative and of short-term duration and of high significance.*

8.3.2.3 Pollution of land and water resources from waste

Solid and liquid wastes could be generated during the construction work of the pipeline or at the campsite. This may include wood chippings, metal strips cut from the pipeline, cement bags, PVC pipes, plastics, paint cans, lubricants domestic waste and plumbing accessories among others. Plastic waste is of particular concern especially if ingested by livestock, and for its environmental pollution effect. Waste oils and petroleum used by the vehicles may spill or leak on/into the ground, hence polluting the soil or water system within the project area. This may degrade water quality and affect livestock and domestic water

users in the project area. Liquid effluent will also be generated at the camp site's sanitation facilities. *The impacts are considered to be negative, short term and of high significance*

8.3.2.4 Obstruction of local hydrological patterns and underground water resources

The project will potentially impact on water resources during construction phase. The impact will be in the form of obstructing local hydrological patterns particularly during the trenching period. However, it is expected that impact on ground water resources will be minimal as a result of a shallow trench that will be dug. Ground water resources are likely to be found at depths greater than the 1 m trench to be dug. However, siltation will occur particularly during rains and this will have negative impact on water quality and aquatic primary and secondary productivity. *These impacts are considered to be negative, short term but of low significance.*

8.3.2.5 Increase in erosion/susceptibility to erosion due to inadequacies in backfilling/compaction

It is expected that excavations and trenching for laying the conveyance pipeline will be done. If backfilling and resurfacing will be inadequate it will result into soil erosion which in turn may damage the pipeline and may result in siltation of receiving water resources and henceforth blockage of drainage systems. *These impacts are considered to be negative, short term but of low significance.*

8.3.2.6 Impaired air quality

Trucks transporting construction material for the conveyance system, and construction machines will emit dust, noise and exhaust gases (containing CO_X, NOx and hydrocarbons), which are unwanted atmospheric pollutants. Also oil spill may occur from vehicles and construction equipment which may contaminate land and water. The major trucks that will be used are those transporting the water pipes. The short term, transient nature of the pipeline construction activity is unlikely to create any specific nuisance to the project area environment. The movements of the vehicles and the operational activities are in each area for no longer than 24 hours hence the activity is not expected to create levels of dusts that exceed those created by the daily movements of livestock, commercial and personal transport vehicles across the project area. *This impact is considered to be negative, short term of low significance.*

8.3.2.7 Disturbance and nuisance to sensitive public facilities from increased traffic (noise and dust)

Operation of seismic heavy equipment's and trucks will emit dust, noise and exhaust fumes (containing COX, NOx and hydrocarbons) which are unwanted atmospheric pollutants. However, regarding the number of equipment's and trucks that will be used in the seismic activities the overall dust and noise pollution expected are considered to be small. In additional the overall noise produced from dynamite and air gun shorts are considered to be also small and of temporary nature. *This impact is considered to be negative, short term of low significance.*

8.3.2.8 Impact on the archaeological, historical and cultural sites

From the public consultation, site assessment and as per the literature available, there is no area of interest in terms of archaeological, historical and cultural sites along the pipeline. There is no paleontological evidence recorded in the area. However an archaeologist can be engaged during the construction phase to monitor excavated areas and any features or artifacts unearthed. If features are encountered, then it will be necessary to re-route the pipeline to avoid damage to the features. This also

applies to features found outside the ROW. *This impact is considered to be negative, short term of low significance.*

8.3.3 Access road

8.3.3.1 Impairment of ambient air quality

Vehicular emissions are one of the major sources of air quality impacts of road construction projects. Air quality deterioration will be the major direct negative impact during the construction phase of the proposed access road. Pollution of ambient air by dust will arise from transportation and stockpiling of construction materials. Natural gravel and fill materials will produce dust as they are being transported in uncovered trucks or being off loaded at the site. In addition, the transport trucks may produce clouds of dust as they move across village settlements. Although dust is a permanent feature along the current road within the project area, especially during dry season, it is likely to increase beyond the current levels. Production of dust by transport trucks near settlements along the road is likely to affect human health. The dust is likely to cause bronchial problems, including URTI (Upper Respiratory Tract Infection) to the villagers and workers, let alone being a nuisance to the environment.

Pollution of ambient air will also occur at materials borrow and quarry sites. This will be due to emission of SO2 NOX, CO, and CO2 from exhaust fumes from material extraction equipment and stone crusher at quarry site. Dust generation is a residual impact it cannot be avoided completely. *The impact is considered to be negative, cumulative, short-term duration and of low significance.*

8.3.3.2 Deterioration of scenic and visual quality

Borrow pits left after extraction of construction materials will impair aesthetics. Dust produced by construction equipment, machinery, and vehicles will impair visibility making the construction site prone to traffic accidents. In addition, stockpiles of construction materials on access road sides will impair scenic and visual quality. Discolouration of buildings and vegetation along the construction site will occur due to the dust blown by wind. The impact due to deterioration of scenic and visual quality is *considered to be negative, cumulative, short-term duration and of low significance,* since it will occur during the construction phase of the project.

8.3.3.3 Production of noise and vibrations by machinery, equipment and vehicles

Earth moving, compaction, and other construction activities will produce noise and vibrations due to reactions between earth and the equipment. In addition, movement of the machinery, equipment, and dump trucks will also produce noise and vibrations. The noise and vibrations produced will agitate and impair audio communications at settlements along road. The noise impact will also be felt by construction workers. Important areas likely to be significantly affected are schools and resident at Mombose and Farkwa village. Noise can cause symptoms such as elevated blood pressure and a decreased rate of wound healing. Noise has an even greater impact on patient safety when it hinders care givers' ability to do their jobs properly if they can't hear a colleague or become distracted by noise. Noise and vibrations impacts are considered to be residual impact since they cannot be avoided. The management of the impact is indicated in the impact mitigation sub-section. *The impact is considered to be negative, cumulative, short-term duration and of low significance.*

8.3.3.4 Impact on surface water quality

The proposed access road is not expected to alter the existing water quality on a permanent basis during construction phase. There are only very few water bodies along the section of the proposed access road which are seasonal streams and valley drainage channels. However minor impacts are anticipated on the surface water drainage in the area due to the diversion of waterway. Silt load in the streams and valley drainage channels may increase and the spillage of oils and fuels during accidents may pollute the waters thereby affecting the ecosystem. Precautions need to be taken during the construction work of culverts across these streams such that the flow in these water bodies is not obstructed thus affecting the cross drainage. In addition, any embankment work in low lying areas shall have provisions for cross drainage for natural drains to ensure that flow is not affected during construction phase. *This impact is considered to be negative, short term of low significance.*

8.3.3.5 Impact on ground water quality

No activities of the proposed access road construction are expected to have any impact on the ground water quality of the general project area and hence the impacts on the ground water quality are not anticipated. *This impact is considered to be negative, short term of low significance.*

8.3.3.6 Soil contamination

Soil contamination during construction stage is primarily due to construction and allied activities. The areas where construction vehicles are parked and serviced are likely to be contaminated because of leakage or spillage of fuel and lubricants. Further refuse and solid waste from workers can also contribute to soil contamination. Contamination of soil during construction might be a major long-term residual negative impact. Unwarranted disposal of construction spoil and debris will add to soil contamination. This contamination is likely to be carried over to water bodies in case of dumping being done near water body locations. *This impact is considered to be negative, short term of low significance.*

8.3.3.7 Disruption of community access

During construction, disruption of community access to their business activities and residential places at almost all village centres along the road will occur due to creation of barriers. One of the potential barriers is the construction of road side drainages. The impact of these barriers would be an increase travel time for local residents to their business activities/residential areas. *This impact is considered to be negative, short term of low significance.*

8.4 OPERATION PHASE

8.4.1 Proposed dam and its components

8.4.1.1 Sediment loads transported into the dam and degradation of water quality

Sediment is a naturally occurring material that is broken down by processes of weathering and erosion, and is subsequently transported by the action of wind, water and/or by the force of gravity acting on the particle itself. The suspended sediments in the Bubu River is the major problem in lowering the in water resources potentials (appendix 21). The sedimentations in the rivers are contributed by the natural phenomena such as erosion and human activities such as agricultural activities, and animal grazing along

the river course. In Farkwa Dam catchment, the Kondoa district is well known for being a classical example of important soil erosion. The upstream catchment areas originate in the northern part of the catchment in the Mbulu and Babati highlands. Erosion processes led to the formation of spectacular gullies at Haubi and broad sand rivers flooding agricultural land and forcing people abandon their fields.

Soil erosion is worsened by high rainfall intensity prevailing over the region with tropical storms delivering about 50 mm in a couple of hours. These cloud-bursts hit down upon an unprotected soil. After the dry season, some of the vegetation has died off, and what remains has been intensively grazed so that both cleared and un-cleared land is often equally dangerously erodable. The soils are washed away in rills which can easily develop into gullies because of their sandy nature.

Soil erosion results in increased sediment load in stream and rivers, leading to rapid siltation of water reservoirs. Thus sediment yield prediction is important when new dams are to be built for water impoundment. Further due to population increase, these activities are increasing and intensifying with time to the extent that during the rainy season sediments from those areas are carried into the river. This may result into reduction of river flow, quantity, change the river course and change of water color of the river to brown and thus affecting the natural hydrology of the river. Figure 6.2 below shows the sedimentation effect in the Bubu River.

Figure 8.2: The sedimentation effects in the Bubu River

The Consultant made use of historical measurements sheets of gauging's and sediment load at Farkwa gauge station, which was found to be the only station providing sufficient records for the analysis. It is to be noted that the catchment of this station represents over 98% of the overall catchment, and therefore geographically represents very well the catchment. The main characteristics are presented in table 8.13 below.

Table 8.13: Sediment load database main characteristics

First measurement	**17/03/1972**		**03/02/1976**		**07/01/1977**		**29/12/1983**	
Last measurement	**21/05/1973**		**23/02/1976**		**14/04/1977**		**23/01/1984**	
Number of gauging's	**42**		**10**		**21**		**16**	
	Sediment load (mg/l)	Sediment Yield (ton/day)	Sediment Load (mg/l)	Sediment Yield (ton/day)	Sediment Load (mg/l)	Sediment Yield (ton/day)	Sediment Load (mg/l)	Sediment Yield (ton/day)
Min	269	13	1200	35	980	201	840	34
Max	7,930	2,273	4,250	7,453	9,040	19,739	6,088	5,478
Mean	1 703	612	2 645	2 295	3 012	5 207	2 361	2 299

The sediment curve was used to derive suspended sediment yield from the daily discharge record at Farkwa gauge station. Annual sediment loads are the deducted and shown to be in the range of 16,000 to 1,316,000 tons. The mean annual load is 287,834 tons. The total load includes suspension load and bed load transport. The bed load transport is taken as 15% of the suspension load. The total volume is deducted from the total load by considering a sediment density equal to 1,300 kg/m3, which is a representative value for the sandy deposits observed in the Bubu River. The results of the computation are presented in Table 8.14. The main observations are:

Table 8.14: Sediment transport at Farkwa dam site

Dam	Area	Rainfall	Runoff	Suspension Load	Sediment Yield (in suspension)	Total Load	Total sediment Volume
	(km^2)	(mm)	(mm)	(t/year)	(t/km^2/year)	(t/year)	(m3/year)
Farkwa Dam site	7680	650	17.2	287,834	37	331,009	254,622

The sediment rate was assessed by applying the trap efficiency to the annual sediment yields. As sediment is trapped, the reservoir storage capacity is decreased and in turn, the trap efficiency decreases. For practical purposes, the initial trap efficiency can be used as a constant up to 50 percent storage depletion. Sediment yields and mean annual inflows are taken from Table 8.14 above. Reservoir capacities are taken in the range of 150 to 450 MCM. Results are given in Table 8.15 below.

Table 8.15: Annual sedimentation rate

Storage Capacity (C)	Mean annual inflows (I)	Capacity Inflow Ratio (C/I)	Trap efficiency (Brune)	Annual sedimentation rate	50-Year Sediment Volume	100-Year Sediment Volume
MCM	MCM	-	-	-	MCM	MCM
150	132	1.14	95%	0.16%	12	24
300	132	2.27	98%	0.08%	12	25
450	132	3.41	99%	0.06%	13	25

Furthermore construction of the dam at the area will attract some human activities that can lead to soil erosion at and around the Farkwa dam area. The possible human activities within the catchment leading to degradation can be due to agricultural activities (improper farming practices on the slopes within the catchment, increased use of pesticides and fertiliser); deforestation; etc. *This impact is considered to be negative, long-term and high significance.*

8.4.1.2 Impacts on the downstream ecosystem due to delayed and reduced flow

Impacts on the downstream ecosystem depends much on the actual magnitude of the river change and on so many variables, such as climate, sediment supply, human use of the system, in-stream flows, etc. Bubu River will not be completely impounded but will allow Environmental Flows for both the ecosystem and any other activity that may be undertaken downstream at any given time. The Environmental Flow (EF) for this particular project is defined as the amount of water that are to be allowed to flow downstream of the Farkwa dam to sustain riverine ecosystem, Bahi swamp ecosystem as well as livelihoods that depends on the river flows and the ecosystems services. In the course of the study it was noted that the studied Bubu River is seasonal in the project site and further downstream to Bahi swamp area (recipient of Bubu River). Also it was leant that the River originates from Manyara Region and traverses two distinct

climatic areas which are wet tropic in higher altitude and semi-arid in central regions of Tanzania. Thus major contribution (>80%) of this River to the project site and further downstream is mainly from wet tropical areas upstream other than from within the semi-arid areas. Further, it was leant that the Bubu River catchment is 54% of the entire Bahi catchment area and among of the two main inflows to the Bahi Swamp the other being Mponde River, both of which originates from northern highlands i.e. wet tropic areas (M. McCartney, 2007).

Based on the study it was leant that, generally the area have low aquatic species diversity some of the notable ones include fish species in the family Clariidae *(Clarius spp.)* and Cichlidae *(Oreochromis spp.)* and amphibian *(Ptychadema mascariensis).* These species were found in shallow pools in the few stretches of Bubu River and dug ponds within Bahi Swamp area during dry season period. The features of Clariidae fish family have enabled them to survive and live in this environment as they can live long period out of water. With conditions of flow during wet season and total zero flow during dry season no any other fish family species without these features can survive in this environment. Out of the recorded fauna aquatic species none was recorded as Threatened (IUCN, 2011). However, the area is having a good number of terrestrial fauna which also depends on the remaining pools within the river stretches for drinking water during dry season. Within these pools during dry season residents depends for protein through subsistence fishing. Commercial fishing though in small scale is practiced in Bahi swamp during wet season.

Riparian vegetation studied have a linear and narrow form as they are paralleled the stream channel of Bubu River, and are either diffuse or sharp edges attributable to the nature of species interactions across the ecotone and disturbances. The dominant species recorded include *Ficus sycomorus, Ficus thoningii, Ficus lutea, Ficus sur, Kigelia africana, and Acacia spp*. The Bahi swamp was noted to be covered by an extensive area dominated by *Cyperus spp.* During the study, the entire swamp was dry and composed mainly of remnant patches of *Cyperus spp.* Among of these, no any species is regarded as rare or endemic as per IUCN – near threatened list and CITES Appendix II category. Most of the species that were recorded are of low conservation concern; however they form important part of the riverine vegetation and through river bank protection against erosion. Reduced flow if is significant might threaten ecosystem which depends on the flowing water downstream which in turn might results into disappearance of some species on these areas. The riverine vegetation and aquatic life may be permanently affected by inadequate water flow. *This impact is considered to be negative, long term and of high significance.*

8.4.1.3 Reduced water quality due to pollution

During operation, the project is likely to have significant adverse effects on water quality unless mitigated. The principal areas of concern are pesticides, fertilisers, and waste, both solid and liquid. Crop pests and diseases are serious problems in the catchment area at present and will become worse with the intensification of agriculture due to the availability of permanent water. Horticultural crops are at especial risk. In response, farmers will increase their use of pesticides for crop protection. Pesticide types, methods of application and associated practices such as cleaning equipment are such as to ensure multiple, frequent entry of pesticides and pesticide residues to water. Once in the water, the active ingredients of the various products will either be adsorbed onto soil particles, or break down at various rates or, if stable, will maintain their toxicity and move into the food chain. The proximity of the command area to the River and direct connections from the fields through the drainage system suggests that contaminants will find their way rapidly to River. This is especially true of crops grown in water and with a high requirement for protection, such as rice. Contamination of surface water by pesticides will have direct negative effects on

a variety of aquatic organisms, depending on the product in use and related factors, and indirect effects if the material enters the food chain and bio-magnifies. Of most concern are (i) fish, (ii) amphibians important as natural pest control agents (e.g. frogs), and (iii) birds. Some herbicides, such as atrazine, have a very high potential for contaminating groundwater and are highly persistent; atrazine is registered for use in Tanzania in combination with other herbicides for control of weeds in maize.

Availability of permanent water will intensify agriculture practices and will result in a significant increase in the use of fertilizers due to (i) the use of improved seeds and crop varieties which require and respond to high nutrient levels, (ii) increased ability of farmers to purchase inputs, and (iii) a possible reduction in soil fertility if flooding and livestock are controlled (less silt, less scattered manure). Crops vary in their ability to take up nutrients from fertilisers according to growth stage, soil conditions, temperature etc., and is inevitable that a significant proportion of the nutrients in the fertilisers will be removed from fields in soluble form in drainage waters. The two elements of concern are P and N (as soluble nitrates NO_3), since these act as accelerants on aquatic weeds which will (i) choke drainage channels, causing very high maintenance requirements, (ii) possibly cause anoxic conditions during low-flow periods (due to use of all dissolved oxygen in the water by weeds and especially by algae), and (iii) bring these problems to the waters of the lake with potential cumulative effects.

The wider catchment area for the Farkwa dam is generating variety of wastes, both solid and liquid and most of wastes generated are biodegradable since poverty results in low consumption of plastics, glass etc. As incomes increase there will be increased acquisition and disposal of plastic bags and other non-biodegradable debris. In the absence of any system for solid waste management, much of this will find its way into the nearest drainage channel, creating a health hazard and hydraulic blockage. In the absence of preferred sanitation facilities, drainage and possibly irrigation channels in and near settlements will be used for defecation, creating a health hazard. As the scheme develops, small-scale agricultural service industries will be established. Some will produce biodegradable wastes, e.g. husks and liquids from crop processing. If not useful locally, these waste materials may enter drains and affect water quality. Other small-scale facilities will produce potentially toxic liquid wastes with the potential to contaminate both surface and groundwater, e.g. used engine oils and solvents. *This impact is considered to be negative, long term and of high significance*

8.4.1.4 Impacts related with climate change

Climate change could affect project operation through, for example, higher temperatures and therefore higher water demands, or more intense rainfall and therefore more intense floods, or reduced rainfall and lower water availability. A number of studies projecting the impacts of climate change on water resources in Tanzania have been undertaken, ranging from Mwandosya et al. prepared in the 1994-1998 to the most recent by the University of Cape Town Climate System Analysis Group, completed in 2010. Most studies used multiple General Circulation Models (GCM) and generally concluded that temperature would increase in the range of 1.5 to 2.0°C for the first half of century and around of 2 to 4°C for the second half. Changes in rainfall patterns, total amounts and rainfall intensity are expected but are much uncertain and may differ greatly from one region to another. For study region, UNDP Country Profiles suggests that there may be a moderate increase in annual rainfall, while Mwandosya et al. and the University of Cape Town Climate System Analysis Group project a decrease of 5-15% for the first and 10-50% for the latter. Impacts on extreme rainfall events are even more uncertain.

The possible impacts of climate change on the hydrological characteristics of the Bubu River at Farkwa were assessed. Given that the long-term rainfall record at Dodoma (1930-2010) does not show any

significant trend, projections were made based on the climate projections and on the previous studies in Tanzania. Three possible scenarios of future rainfall (-15%, 0%, +15%) and, two possible scenarios of future temperature (+1°C, +3°C) were derived from the observed series. The hydrological modeling was applied on these scenarios to calculate the impacts on runoff. The results are presented in Table 8.16.

Table 8.16: Results of possible impacts on runoff

		Rainfall	Temperature	Runoff (mm)
	Reference (1957-2012)	**-**	**-**	**20.1**
Scenarios	1	-15%	+1°C	-58%
	2	0%	+1°C	-9%
	3	15%	+1°C	68%
	4	-15%	+3°C	-62%
	5	0%	+3°C	-17%
	6	15%	+3°C	54%

The main observations is that the impacts on runoff are ranging from -62% to 68%. The most severe impact on runoff is observed for the combination of a 15% decrease in rainfall and a 3°C increase in temperature in comparison to the reference. The combination of a 15% increase in rainfall and a 1°C increase in temperature results in a 68% increase in runoff. The impact on runoff is mostly driven by the rainfall. This is consistent with the high runoff variability, which is observed since 1957. A small increase in rainfall produces a high increase in runoff. Conversely a small decrease in rainfall produces a high decrease in runoff. The range of possible impacts on runoff is consistent with the runoff evolution observed in the 20th century for several rivers in Africa (White Nile, Senegal River).

Nevertheless, it should be borne in mind that the feasibility study for this project analysis averages the outputs of a number of GCM, some of which *do* predict an increase in annual runoff in the region. This prediction is also made in other reviews, such as de Wit and Stankiewig, (2006) who projected a rise in perennial drainage to a total of 136% in Central Tanzania. There is also a suggestion in some models of a slight increase in flood flows and risks. In relation to floods, the feasibility study weighted scenario predicts a slight increase in high flow levels in rivers (specifically, the flow which is exceeded 10% of the time will increase by 15 to 20%). The project itself will greatly increase the security of water supply to farmers and improve flood control, thereby mitigating against the potential impacts of climate change. *This impact is considered to be negative, long term and of high significance*

8.4.1.5 Change in local ecosystem /stimulate of vegetation growth/change in species composition

The implementation of the proposed project inflicts a permanent irreversible loss of impoundment area which composed mainly of miombo woodland, wooded acacia, bushlands and thicket. The big portions of these habitats (miombo woodland, wooded acacia, thicket and bush land) are presently undisturbed or are natural in terms of plant composition or maturity. Also according to the study results, development of the proposed dam and water conveyance system will affect some fauna species of conservation concern such as important bird nesting or nursery areas. Some bird nesting or nursery areas were observed within the proposed development site. Further continuous presence of water will attract various types of fauna and avifauna and change the local species composition. Some new fauna species will emerge while some of plants will be cleared or die because of continuous flooding of the area. *This impact is considered to be negative, long-term and high significance.*

8.4.1.6 Human wildlife conflicts

As noted in preliminary consultation with some stakeholders, the nearby area is somehow visited by wildlife from the Swagaswaga Game Reserve which normally invades and destroys the crops of the community around. With the proposed damming the wildlife are believed will be attracted to the water body for drinking which in turn might increase the visitation as well as inversion into the community farms. Thus, it is expected that the human wildlife conflict will be exacerbated in the area. *This impact is considered to be negative, long term and of high significance.*

8.4.1.7 Flooding hazards

The flooding hazards may occur if the dam is overfilled or there is embankment collapse. Should this happen, with a dam holding capacity of about 400,000m^3 of water, then a significant of water may be released causing considerable hazards downstream. *This impact is considered to be negative, long term and of high significance.*

8.4.1.8 Contamination/impaired quality of soils and water from poorly controlled agricultural activities

The upstream catchment areas originate in the northern part of the catchment in the Mbulu and Babati highlands. The upstream catchment areas comprised of the Bubu River as the Main River and streams flowing into the Bubu River as tributaries. Several tributaries containing high suspended sediment join the Bubu River. These tributaries have high suspended sediment load because of extensive and intensive soil erosion from surrounding areas resulting from haphazard land use activities particularly vegetation exploitation, agriculture and livestock rearing. The villagers depend on the land alongside the river and the river itself for various socio-economic water uses. The majority of the rural populations within the catchment area are small-scale farmers and agro-pastoralists. Their semi traditional farming system is characterized by low use of farm inputs. Traditional agricultural production in the area is coming under pressure from market forces; with the result that high-input agriculture is increasingly coming to play a major role in the economies of rural communities. The use of pesticide in combating pests and diseases is widely encouraged among the farmers in these communities to promote production.

The use of pesticides in the catchment area is common in horticultural crops for controlling common plant and animal diseases which include early and late blight, root knot and yellow mottle virus in tomato and grey leaf spot in maize. Important pests in onions are cutworms, aphids, red mites, nematodes and white flies. In tomatoes are aphids, bollworms, ladybirds, white flies, red mites and elegant grasshopper. Beans production is highly affected by bean leaf beetle, aphids, and bollworms. Animals are dipped in pesticides mixtures to control ticks and protect against tickborne diseases.

The mixing of more than one type of pesticide in a tank is common with the aim of increasing the killing effects of the pesticides. The mixing process is mostly done in respective farms in drums without safety precautions, and the containers and equipment used were washed and rinsed in the irrigation canals. It is also common to find the empty pesticide containers disposed in the farmers and public areas such as market places. The use of ULV formulations (e.g Durban 24ULV and Fenom C 170 ULV) in water spray was a common practice among farmers. Poorly controlled agricultural activities and application of pesticides upstream can lead to accumulation of the pesticide residues (Organ chlorates and Carbonates), in the dam and cause water contamination and the product of hydrolysis or the action of micro – organisms will result into a more toxic creation than the original products. *This impact is considered to be negative, long-term and high significance.*

8.4.1.9 Increased water and soil pollution

The chemicals to be used include chlorine (for pre-chlorination), aluminium sulphate for coagulation and caustic soda for pH adjustment. The quantity and the concentration of the chemicals to be used will be defined by the laboratory staff, on the basis of the results of the raw water analysis. The proposed water treatment plants will produce significant amount of treatment plant residuals, or sludges. For the type of treatment facilities to be installed, the main process sludges will include filter backwash wastewater and sludge drawn off from the clarifiers. The composition of the sludge produced at treatment plant is not known since laboratory analysis is not yet performed.

However, in general such sludge will typically contains aluminium hydroxide compounds with colloidal and suspended matter removed from the raw water. When polymer is dosed as the primary coagulant, the sludge will comprise residual polymer also with colloidal and suspended matter removed by the treatment process. The sludge typically has a neutral pH. Sludges produced during water treatment contain colloidal iron and alum hydroxides (alum and iron are the most used coagulant), (Conio et al. 1994), colloidal or dissolved organic matter, clay, silt and microorganisms. Table 8.17 reports the average typical chemical composition of coagulation sludges (Navazio et al., 1990).

Table 8.17 Average typical chemical characteristics of sludge

Sludge	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	SO_3	Fe_{2+}	Metals
Alum (mg/l)	9.3	0.26	23.3	27.2	1.31	0.33	18.6	Absent	Trace
Iron (mg/l)	33.6	13.9	5.8	15.1	3.16	0.16	13.9	Absent	Trace

Disposal of the water treatment plant sludge back into the River tends to increase turbidity levels (locally), as well increasing the depth of the river bed due to deposition, and changing the river's chemistry. Disposal of the sludge relies on achieving adequate dilution in the river. *This impact is considered to be negative, long-term and high significance.*

8.4.1.10 Exposure to chemicals, hazardous or flammable materials

The normal operation activities with respect to the project are mostly related to the water treatment plant where permanent staff is deployed. During operation of the Water Treatment Plan different chemicals have to be applied. From the chemicals being used chlorine shows the biggest potential to be harmful to human health if released. Chlorine is a serious agent and a contact with the skin or respiration tract could lead to major injuries requiring immediate medical assistance. In the worst case and considering a significant exposure to chlorine, fatalities could occur. Such exposure could occur in case of traffic accidents with trucks transporting chlorine to the treatment plant. *This impact is considered to be negative, long term and of high significance.*

8.4.2 Conveyance system

Activities relating to the bio-environment will be low during the operation phase and will relate to maintenance of the conveyance system. By the second year of post-construction the re-fill will have hardened and fused into the rest of the soil and vegetation will have recovered to the extent that the untrained eye will not be able to detect the difference between the trenched and surrounding areas. Thus much of the impacts depicted during the construction phase will now be low or negligible. If the

conveyance is damaged, excavation is to be carried out at the location where the damage has occurred. The excavation will have impact on ecology.

8.4.2.1 Damage to dam and conveyance system due to effects of natural factors and processes

This relates to possibilities of natural factors e.g. flooding, landslides, earthquakes, climatic elements and earth movements etc. to have effects on the project components. Earth quakes may results in land slide of failure of the dam. The geological aspect considered to be determinant for the design of Farkwa dam site is the proximity of the Bubu Fault. This fault is considered to be an active seismogenic source. As such, its rupture during the lifetime of the Project cannot be ruled out. Accordingly, one branch of this fault crosses the foundation of the Main Dam in the upstream-downstream direction. Another secondary branch with similar orientation could be assumed in the foundation of the Saddle Dam, obliterated by thick overburden. The fault and its branches are of normal type involving down throw of the hanging wall. They are sub-vertical or steeply dipping towards SSE and so is the principal component of displacement. The attitude the faults and the direction of potential co-seismic displacement are important parameters for the appropriate design of the filters and drains, as further discussed.

Two major geological faults run parallel from north to south in Tanzania, forming the country's major earthquake-prone belts with one running from Mount Kilimanjaro to Dodoma via Arusha and the other from Kigoma to Mbeya. The Bubu Fault, which is, among the noticeable faults, the closest to the project area, is a branch of this rift system.

Both geological faults are part of the East African Rift Valley system that is a zone of 50-60 km wide with active volcanoes. The locale of Dodoma has experienced several minor and major earthquakes in the past. According to seismologists, the last earthquake that occurred in Dodoma had a magnitude between five and six on the famous Richter scale. So Dodoma is subject to earthquakes which if occurs may have detrimental effect on the erected dam structures, human and general environment. However, Tanzania's ever-recorded strongest earthquake was a 7.4- magnitude jolt that occurred in 1910 in Lake Tanganyika, followed by the second strongest quake of 6.8 on the Richter scale on December 5, 2005.

Further Dodoma is known to sometimes experience heavy rains in the months of March - May. Over flooding of the dam may result in failure of dam embankment. The flood hydrographs give discharges for several floods with return periods from T = 10 years to T = 10,000 years. The Probable Maximum Flood (PMF) is also presented. It was computed from the PMP using the runoff coefficient derived from the 10,000 years flood, which is equal to 8.5% (Source: Feasibility study, 2014). The rains sometimes cause soil movements on slopes of hilly areas and flooding in lowland areas and consequent damage to buildings, farms and other built infrastructures. According to the local villagers, the area experiences heavy runoffs during heavy rains. *This impact is considered to be negative, long-term and high significance.*

8.4.2.2 Damage to conveyance system due to inadequacies in monitoring and operations

Lack of regular maintenance procedures or inadequate resources (human, financial) for periodic checks on security from vandalism, disruption by other users and damage from natural processes will inevitably affect the smooth operations of the conveyance facilities. *The impacts are considered to be negative, long term and of high significance.*

8.4.2.3 Occupational health and safety hazards

During operation the maintenances activities along the ROW, the workers, and the local communities may be exposed to occupational and health hazards. Workplace hazards in the field like accidents and incidences as a result of use of vehicles may also occur. Occupational health hazards may also be promoted by lack of procedures that mitigate negligence at work, fatigue due to understaffing and long working hours, employing wrong people on particular jobs (e.g. employing an unskilled person to handle dynamite explosives), lack of protective gear, low morale etc. *The impacts are considered to be negative, long term and of high significance.*

8.4.3 Access road

8.4.3.1 Road Safety Risk - Increase in road accident

The 2002 vulnerability assessment report shows that accidents in Tanzania account for 3.4% of the hazard occurrences in Tanzania (PMO, 2002). The most accident-prone groups are the pedestrians and cyclists (Lerise et. al., 2004). The main causes for accidents are poor road conditions due to lack of maintenance, reckless driving, defective vehicles, drunkenness, poor road facilities for the pedestrian and cyclists and unqualified drivers. The proposed project access road might lead to an increase in accidents due to increase in traffic volume and speed, unless precautionary measures are taken. The problem of road accidents will most likely be more pronounced in village centres located along the road especially at Mombose and Farkwa village centre.

It was reported that in the village centres along the proposed project access road people have the habit of strolling along the road. Therefore, improved access road will increase the risk of accident to pedestrians and cyclists due to over speeding unless effective measures to reduce the risk are put in place. Rate of cattle kills will also most likely to happen with constructed access road for the same reason unless cattle crossings are provided for. At the moment, there are no enough designated cattle crossing points along the proposed access road and as such cattle cross the area at any convenient point. *The impacts are considered to be negative, short term and of moderate significance.*

8.4.3.2 Increased noise, vibration and air pollution at operation phase

Noise is one of the most obvious negative impacts of daily road use. The discomfort caused by noise includes auditory fatigue and temporary lessening of hearing ability. However, perceived noise is related to background noise level, so that new access road in quiet areas or noisy trucks at night are often perceived as worse than higher levels of noise in a busy area during the work day. For the proposed access road, the noise and vibration impacts will be reduced due to improved road surface.

In addition, since the vehicular density is expected to be relatively small on the access road, the perceived traffic noise and vibration effects will likely be low. Air pollution will be necessarily prevailing during the operation life of the road due to vehicular emissions of particulates and fumes into air or atmosphere. However, the effect on air quality of the increased traffic flow is considered to be significant if no maintenance programme will be installed. *The impacts are considered to be negative, short term and of moderate significance.*

8.4.3.3 Reduce water quality due to runoff

In the operation phase, the motor vehicle emissions and contaminants carried by the tires may participate and stay on the roads. Surface run-off formed during rain will carry the contaminants and dispose them on land or water sources. *The impacts are considered to be negative, short term and of moderate significance.*

8.5 NEGATIVE SOCIAL IMPACTS FOR ALL PROJECT COMPONENTS

8.5.1 Relocation/resettlement of people, farms, properties and disruption of economic activities

Results from the Resettlement Action Plan (appendix 22) indicated that approximately 566 people from Bubutole and Mombose Villages use certain areas within the proposed dam area for farming and livestock grazing. Also a number of people along the conveyance system owns the land and properties which will be affected by the project. All these people and property will need to be completely vacated from the project area. Some of Bubutole and Mombose villagers claimed that there are no nearby alternatives to resettle and/or to continue with their normal lives and further more they contend that compensation process is slow and rates are low. However, District, Ward and village leaders counteracted these claims saying there is plenty of alternative farming and grazing land in the Farkwa Ward. If alternative land is not provided to affected people, it may result in social conflicts between the villagers and project proponents.

Also during consultations, inadequate compensation for displaced properties particularly cash crops was one of the most frequently mentioned concerns raised by consulted PAPs. People were concerned about inappropriate/delayed compensations for the government financed project. By august 2021 a total of 2,779 entitlements have been compensated and 89 entitlements are expected to be compensated and acquired in the financial year 2021/2022. The sum of estimated costs for building, land, crops, transport allowance, accommodation allowance, disturbance allowance and RAP implementation, monitoring and evaluation will be 8,628,059,493. *This impact is considered to be negative, long term and of moderate significance.*

8.5.2 Increased conflicts over local water resources (communities downstream)

During the consultations with downstream water users it was observed that already the downstream water users are water stressed as they depend on the Bubu river water. Their concern and worry were that the dam might exacerbate the problem by reducing further the flows or delaying the flow which might not enable the wetlands to recharge water which they entirely depend on during dry season. It was further leant that the physical presence of the dam might stir the downstream community to have a fear and feeling that the dam is depriving their water downstream which might cause chaos in the area.

The paddy irrigation is one of the livelihoods that depend on the Bubu river flows and thus this was studied upon in the Bahi area. The study reveals that the area under irrigation in Bahi area is more than 10,000 hectares however a small part of it is directly depending on the Bubu River. Based on the data from the Central Zonal Irrigation Office under the Ministry of Agriculture and Food Security, the total area that is directly depending on Bubu River is 3,658 hectares under seven schemes with 7,316 farmers. The part which is directly depending on Bubu River is located upstream of the actual Bahi Swamp/flood area and thus water is diverted from the river directly to the farms before reaching the Bahi swamp area (Figure 8.2 below).

Figure 8.2: Diversion channels/infrastructures in the Bubu River

According to Central Zone Irrigation Office, the water consumption for paddy irrigation in Bahi area is 2.2 l/Ha/s with the irrigation practice of 2 days for the rest of 4 days. Thus, based on this the water required per day and per month as well as per entire irrigation period of wet season (4 months of the year i.e. from Mid-December to Mid-April) was obtained, and is estimated to be 27,812,505.6 m^3/year.

Likewise, the livestock keeping is one of the livelihoods that depend on water resources in terms of drinking water as well as fodder. In this respect the livestock drinking water was taken on board by the study as one of consumptive water users of the Bubu River in the villages just along the river upstream of the Bahi swamp area. The data obtained from the Bahi District Council office shows that in 2006 Livestock Census there were 95,151 cattle, 18,328 Goats and 183 Sheep in the villages along the Bubu River. Based on this, the present livestock data was obtained and the water demand was also calculated. The Water design manual suggests a livestock growth rate of 50% after 20 years (Section 4.6.4.1 of the design manual). Thus from 2006 to 2014 a 25% livestock growth rate was used in this case to come up with the present livestock population in the area. From that number the livestock water requirement was estimated to be 381,901.5m^3/year. The year was calculated based on the river flowing period which is six months of the year (i.e. from mid - December to mid - June), see appendix 17 on environmental flow.

Downstream of the dam site water is also being used for domestic purpose e.g. drinking, washing and cooking. However it is used in small amount, almost negligible as there is no water supply scheme. Residents along the river are individually fetching directly from the river. Currently, water is an issue during dry season as wells and shallow boreholes tend to dry out, while during the wet season some wells and borehole contain water. Thus, domestic water requirements have been left out due to its negligible amount to the river flow which can simply be covered by the recommended environmental flow without impacting other water uses/users.

Off-take of water for supply in Dodoma City will result in reduced stream flows especially during the dry season. If the reduced flow is significant might result into comparative insufficient flows downstream compared when the dam did not exist. This might create water scarcity to the community depending on the water of the river flow, which might bring about social stress and possible chaos in the area. However, the calculation made shows that the dam will be able to meet the water requirements for Dodoma City as well as the environmental flows. *This impact is considered to be negative, long term and of high significance.*

Figure 8.3: The dig pits and pockets water in the Bubu River downstream

8.5.3 Increase conflict with people living in the upper catchment

The upstream catchment areas originate in the northern part of the catchment in the Mbulu and Babati highlands. Human activities such as agricultural activities and animal grazing are carried out along the river course. These activities are increasing and intensifying with time to the extent that during the rainy season sediments from those areas are carried into the river. This may result into a) increased sediment loads to the river caused by reduced soil cover and loosened soils through inappropriate farming methods which will accelerate siltation of Farkwa Dam; b) increased demand due to population growth and irrigation schemes upstream which may result into reduced flow coming to the dam downstream, c) the use fertilizers and agrochemicals resulting into eutrophication of Farkwa Dam and increased treatment costs, and d) the water pollution caused by improper sanitation systems increase the bacteriological content of the water hence endangering health of the water uses downstream and also the water treatment costs. Due to that social friction may develop between DUWASA and the people living in the catchment zones on the Bubu and Mkinki Rivers. *This impact is considered to be negative, long term and of high significance.*

8.5.4 Damage or loss of project structures due to anthropogenic activities

There are a number of human activities that may intentionally or otherwise cause damage to the laid water pipeline including vandalism and sabotage; expansion, rehabilitation, maintenance, repair or replacement of existing infrastructure as well as trampling by livestock. There are a number of existing infrastructures close/within/in the vicinity of the road reserve under which the pipeline will be laid. However, the existing infrastructures may require routine maintenance, repair or replacement, the activities of which may cause unintentional damage to the water pipe. A number of roads and utility authorities (water supply, power, sewerage etc.) along the conveyance route have plans for expansion /rehabilitation of infrastructure within/in vicinity of respective road reserve. If the plans are implemented after the pipeline has been laid down and if there is no formal notification on the route of pipeline, it may be damage or cause disturbance. *This impact is considered to be negative, long term and of high significance.*

8.5.5 Public health hazards due to Water-borne and water-related diseases

Malaria is endemic in the area and a major cause of disease and death. The project is likely to change the pattern of malaria infections during the year, with an extension into the dry season. Permanent (year-round) malaria is less dangerous than short, intense seasonal transmission, but malaria will continue to

have a very high impact on human health, especially for children. Health interventions are essential to ensure that the project's social and economic objectives are reached, and reducing malaria morbidity and mortality in the region is a battle to be fought every day for a very long time.

Intestinal schistosomiasis is also endemic in the area. The project has the potential to increase the risk of infections by creating additional habitat for the snail vector, increasing exposure of the population, especially children, to water, and increasing opportunities for completion of the parasite's life cycle from humans to snails. The increase in contact between humans and still or stagnant water will probably lead to a more intense transmission of *S. mansoni*. The new, permanent water body may be favourable snail habitat and create a snail outbreak; if the snails are infected with *Schistosoma*, transmission could increase significantly. Medical opinion considers this the most important hazard to public health associated with project operation. Urinary schistosomiasis is not present, but could be introduced.

The presence of a stagnant water body (the dam) may increase populations of vectors of these diseases. This may threaten public health if no special attention and mitigation measures are put in place. However, the spread of the waterborne diseases may be limited due to the fact that the dam will be confined in the area afar from the settlements. *This impact is considered to be negative, long term and of moderate significance.*

8.5.6 Disruption of existing infrastructure and services (blocked access road, water supply)

There will be diminishing of natural forests, shrubs, green grass and loss of current land which will be destroyed or submerged under water. The area had been a source of poles for house construction, medicinal plants, grass land for livestock and dry season cattle fodder, firewood, households' settlements, sources of indigenous fruits/ juices and outlets to sub villages. Blockage of the existing road (Farkwa to Kwamtoro road and other small footpath) due to dam construction will also deny villagers access to the neighboring village and their agricultural farms. *This impact is considered to be negative, long term and of moderate significance.*

8.5.7 Increased population influx

Permanent water body and improvement of water supply system will attract more people in the area due to availability of water, employment opportunities as well as opportunities for other income generating activities. The population influx into the areas would also increase pressure on both resources and social services due to increased demand on the services and resources. This may lead to extra demands for resources which might cause conflicts in the community. *This impact is considered to be negative, long term and of moderate significance.*

8.5.8 Public health hazards/safety due to social Interactions

Construction works and increased business opportunities at the dam will be associated with availability of employment opportunities and generation of income. People with different social background will therefore immigrate in the project area to access opportunities created. This influx of people and resultant social interactions among workers, farmers and members of the community water users association is inevitable. Consequence of these interactions could increase incidences of health impacts such as spread of STDs and HIV/AIDS. *This impact is considered to be negative, long term and of high significance.*

8.5.9 Conflicts among workers and the local population in the project area

Projects involving major works include, often, the potential for the occurrence of social conflicts between workers who temporarily settle in the local and community residents. Such behaviours are generally related to socially unacceptable behaviour according to local social standards and can be seen, for example, cases of drunkenness and disregard/lack of respect for local customs. This impact should be considered even though an important part of the manpower to be recruited locally. *This impact is considered to be negative, long term and of high significance.*

8.6 POTENTIAL POSITIVE SOCIAL IMPACTS

8.6.1 Improved water quality and quantity

For a long time Dodoma Region had a problem of shortage of clean and safe water due to poor climatic conditions, together with absence of reliable water sources like permanent rivers and lakes. The expected tangible output of this project is improved clean and safe water availability and accessibility in the Dodoma City and along the conveyance system. Construction of Farkwa Dam will improve the quality of water reaching the consumers to meet the water quality standards. The project aim is also to complement the present water supply provided by the Makutupora well field and plan for the supply of a growing population. A water demand assessment study was carried out with for aim to estimate the present and future water demand of Dodoma City, and later assess the capacity of Farkwa Dam project to meet this demand.

Further the assessment was extended to account for the rural population located along the existing road network leading to the project area from Dodoma. It was concluded from the study that the project will guarantee supply of water throughout the year assuming adequate water availability in the source. Taking into account the water supply from Makutopora field being planned to be upgraded to 61,000m3/day, the water demand to be considered for Farkwa Project was estimated to be 141,916m^3/day (in 2034), including irrigation demand at the Bahi swamp. So this project will improve health and alleviate poverty of the rural population through improved access to adequate and safe water. The project will provide adequate, affordable and sustainable water supply services to the rural and Municipality population. *This impact is considered to be positive, long term and of high significance.*

8.6.2 Improved health and sanitation status within the Region

Improved health and sanitation as a result of adequate safe water supply for the serviced communities is anticipated. This will reduce occurrence of some of the water borne diseases (e.g. typhoid which is prevalent in Dodoma City and Villages along the conveyance system. This is a positive key impact to accrue from the project implementation. From the baseline chapter it can be observed that out of top 10 diseases facing Dodoma City, 4 are caused by inadequate water quantity and quality. Also out of top 5 diseases in the Municipality, 3 are caused by inadequate water quantity and quality. This project will definitely improve the sanitation of the area and In turn reduce the incidence rate of water borne diseases.

Also acute respiratory tract infections (ARTI) are largely a consequence of bad housing conditions, cool temperatures, the frequent presence of smoke in houses, and the lack of warm clothes. The proposed project will not, by itself, reduce the incidence of ARTI. However reduced ARTI will only be achieved through the improved living conditions associated with the higher incomes, better education, and improved health services which, hopefully, will result from the project. Further logically, malnutrition should decrease

with an increase in food production and an improvement in family incomes and food security. *This impact is considered to be positive, long term and of high significance*

8.6.3 Increased revenues and stimulation of industries

Water is considered a key factor in the socio-economic development and the fight against poverty. Water supply improvement will be a precursor for other development activities, which will cause the DUWASA and Dodoma City to advance and increase revenues. Currently DUWASA is using a huge some of its revenue collected to pay for electricity used to pump water from the boreholes. As a result of this project, DUWASA will increase the revenues by more than 90% of the existing collections. Also the project will encourage water demanding industries (like food processing industries) and other services like clinic and schools to be located in Dodoma City as industrial performance depends, among other factors, on reliable water supply. *This impact is considered to be positive, long term and of high significance*

8.6.4 Increased income to locals from employment opportunities

During operation phase of this project there will be an employment opportunities pertaining to improved water supply system especially at the new treatment plant including treatment plant operators, laboratory technicians, cleaners, drivers etc. For this project DUWASA will expand and it is expected that not less than 10 more people will be employed during the operational phase. Such employment would contribute to poverty reduction, especially for women.

Further during construction phase labour force comprising skilled and unskilled labours will be needed for construction works of the Farkwa Dam and conveyance system. Employment opportunities will increase the income, skills and knowledge to local labour force. It is estimated that a good number of personnel will be involve with the project development (including designers, architects, contractor crew, and other related workers). Recruitment of skilled labour is mostly of Contractor's choice. If the required workers are deployed from the project area and taking cognizant of the fact that most of these have dependants, then the number of people benefiting directly and/or indirectly will be of high significance. In order to maximize the project's positive impact among local communities, particularly vulnerable groups (such as women and youth) should be given preference during mobilization of workers for the project. By using local workers, the other impacts associated with construction workers such as influx of people, spread of HIV/AIDS and other diseases are reduced. *The potential impact is predicted to be positive, cumulative, long term and of high significance.*

8.6.5 Benefit to local producers and suppliers of construction materials

Procurement of materials from local sources will be a positive aspect of the project, as it will reduce the cost of the project and benefit local producers and suppliers. Part of the operating cost of the project will be in Tanzania shillings, particularly on freight and transportation of equipment and machinery to the project site, goods and services, consumables and labour. Some of the project services such ESIA have been already contracted to Tanzanian suppliers and contractors. *The potential impact associated with this impact is predicted to be positive, cumulative, short term and of moderate significance.*

8.6.6 Increase of government revenue collections

Through the use of locally available materials during the construction phase of the Farkwa project such as cement, structural steel, concrete, timber, sand, gravels etc, the project will contribute towards growth

of the economy by contributing to the gross domestic product. Businesses supplying consumables such as diesel, oil and lubricants for the site machinery will benefit from increased turnover due to the demand increase on account of the dam. The consumption of these materials, fuel oil and others will attract taxes including VAT which will be payable to the government hence increasing government revenue while the cost of these raw materials will be payable directly to the producers. *The impact is predicted to be positive, cumulative, short term and of high significance.*

8.6.7 Improved living standards

There are usually several opportunities which come up during construction work and implementation periods of such projects. The increase in revenues for locals and influx of immigrants into the project surroundings improves money circulation within the project area. This in turn will leads to the initiation of several businesses by entrepreneurs within or around the project area. These are the businesses such as shops, hotels and entertainment spots where businessmen benefit directly from the construction workers. This will promote the informal sector in securing some temporary revenue and hence livelihood. *The impact is predicted to be positive, cumulative, short term and of high significance.*

8.6.8 Skills transfer to locals

When the local people are employed during construction, they will have to be trained in operation of heavy machinery and equipment. Thus they will acquire skills in operation and maintenance of the equipment and machinery which they can use later in future. Further when the local people are employed during dam wall construction, they will acquire skills in construction which they can use later in future. By employing as many local people as possible skill transfer will be enhanced thus building human capacity in the area. *The impact is considered to be positive, long term and of high significance.*

8.6.9 Increased fish production

Relative to the current productivity of the river, the construction of the dam may significantly increase the productivity of aquatic organisms particularly fish. Though fish mortality may be high initially, fish production is expected to increase significantly with time in the reservoirs. *This impact is considered to be positive, long term and of high significance.*

8.6.10 New market for agricultural produce from the villages

The project will most likely construct staff quarters, which may provide an avenue for selling of agricultural produce by the villagers. This may contribute to incomes of the villagers. *The impact is considered to be positive, long term and of high significance.*

8.6.11 Increased market base for local products

The engineers/contractor will source equipment for use in the construction work from third parties who will be paid. Filling material (soil and rock) will be purchased from quarries which will therefore benefit from an increased market base for their products and sale of rumble. Also it is expected that the project will attract more investment to the Farkwa area hence leading to accelerated business and market growth. The value of land in the project area also will increase. More importantly the project may present an opportunity for tourism, training and skills acquisition. *The impact is predicted to be positive, cumulative, short term and of high significance.*

8.7 DECOMMISSIONING PHASE

In the event of decommissioning, at some time in the future, some infrastructure will be required to remain, such as access across the dam wall and spillway for local traffic and/or pedestrians. In the event the dam is no longer required, the spillway or dam wall may be opened to let normal river flow. At this time, a full socio-economic impact should be undertaken, as it is expected that local communities will rapidly adopt their livelihood patterns around the existence of the dam and reservoir (i.e. for irrigation, domestic and livestock water, etc). They may wish the dam to remain.

If emptied, there will be a large area of bare soil, prone to erosion from wind and rain. To prevent this, the reservoir should preferably be emptied in stages, to enable vegetation to reestablish. Once empty and river flow patterns resumed, soil sediments deposited at the head/inflow end of the reservoir will begin to be carried down the Bubu River. This may have an undesirable impact, and need to be stabilized using embankments or by placing rock gabions. However, if at this time, it is decided to upgrade the dam, to a larger storage capacity, this would require a separate ESIA report.

8.7.1 Loss of vegetation cover and plant diversity

The removal of the dam facilities and the pipeline during the decommission phase may require the re-opening of temporary access roads and workers camps in which vegetation may have recovered. This impact will cause loss of biodiversity and fauna habitat. Also the removal and destruction of infrastructures such as water treatment plants and water storage systems will cause changes to the landscape of the affected area, causing a visual impact. Further levelling activities and excavations to remove the water pipeline require the removal of some vegetation. This activity will lead to a loss of native vegetation and open access to sites with intact vegetation. *This impact is considered to be negative, long term and of high significance.*

8.7.2 Contamination and impaired water quality

In the event decommissioning of the dam and associated facilities may need to be demolished necessitating disposal of demolition waste. Removal and demolition activities will employ the use and circulation of vehicles and machinery which may cause spillage of fuels and chemicals. Besides this, workers may also contaminate the soil with waste and sewage. Haphazard disposal may cause contamination/impaired quality of receiving body, especially land and water resource. *This impact is considered to be negative, long term of high significance.*

8.7.3 Loss of employments

The employee and their family will be depending directly or indirectly on the project for their living. Decommissioning of the project means they will lose their means of generating income and this may result into social stress/unrest to the community and may give rise to conflict with investor. *Loss of job is considered negative, long-term duration and since survival of the people is very important here the impact are considered of high significance.*

8.7.4 Noise pollution

In closure of the project, MoW may decide to demolish or abandon the constructed dam. The decommissioning related activities such as demolition works will lead to significant deterioration of the

acoustic environment within the project site and the surrounding areas. This will be as a result of the noise and vibration that will be experienced as a result of demolishing the proposed project buildings and related components. *This impact is considered to be negative, long term of high significance.*

8.7.5 Dust and exhaust emissions

Large quantities of dust will be generated during demolition works. Particulate matter pollution is likely to occur during demolition and transportation of the waste to the dumpsite. There is a possibility of suspended and settle-able particles affecting the site workers and the water within the river. Consequently this may lead to siltation and sedimentation of rivers/ reservoirs in the Catchment if not controlled. Exhaust emissions are likely to be generated during the demolition period by the various machinery and equipment to be used as well as motor vehicles used for the exercise. *This impact is considered to be negative, long term of high significance.*

8.7.6 Occupational health and public safety hazards

Demolition works will inevitably expose workers and the public to occupational health and public safety risks: in particular, working with heavy equipment, handling and use of tools engender certain risks. The construction workers are also likely to be exposed to risk of accidents and injuries resulting from accidental falls, falling objects, injuries from hand tools and other equipment. *This impact is considered to be negative, long term of high significance.*

Table 8.18: Summary of Potential Impacts

Phase	Potential Impacts	Significance Value
Preparation/Mobilization	**Proposed dam and its components**	
	Loss of /disturbance of biodiversity (flora, fauna and ecosystem)	The impact is considered to be negative, long term and of high significance
	Deterioration/impairment of local air quality	The impact is predicted to be negative, cumulative, short-term duration and of moderate significance
	Nuisance and disturbance on/offsite receptors from noise pollution	The impact is predicted to be negative, short term and of moderate significance
	Air pollution due to dust	The impact is considered to be negative, long term and of low significance
	Depletion /degradation at points of source of construction materials	The impact is considered to be negative, cumulative, short to medium-term and of moderate significance
	Erosion of the top soil and reservoir sedimentation	The impact is considered to be negative, long term and of moderate significance
	Disruption of traffic flow during mobilization	The impact is considered to be negative, cumulative and of short-term and of moderate significance
	Conveyance system	
	Damage /disturbance to habitats and species	The potential impacts are considered to be negative, short term and of moderate significance
	Disruption of economic and subsistence (livelihoods) due to clearance of farmland/crops	The impacts are considered to be negative, short term and of moderate significance
	Deteriorated/impaired air quality	This impact is considered negative, short to transient medium term and of low significance

Phase	Potential Impacts	Significance Value
	Erosion of the top soil and reservoir sedimentation	The impact is considered to be negative, long term and of moderate significance.
	Increased cases of STDs, HIV/AIDS	This impact is considered negative, long term and of moderate significance.
	Access road	
	Deterioration aesthetics due to extractions of natural materials	The impact is considered to be negative, cumulative, short-term duration and of low significance
	Deterioration of ambient air quality	The impact is considered to be negative, short-term duration and of low significance
	Increased noise and vibrations	The impact is considered to be negative, cumulative, short-term duration and of low significance
	Generation of solid wastes	The impact is considered to be negative, cumulative, short-term duration and of low significance
	Road traffic accidents due to construction of the access road	The impact is considered to be negative, cumulative, short-term duration and of low significance
Construction	**Proposed dam and its components**	
	Disruption of the various users of the highway and road reserve	This impact is predicted to be negative, cumulative and of short-term duration and of high significance
	Deteriorated / impairment of local air quality	The impact is considered to be negative, cumulative, short-term duration and of moderate significance
	Noise pollution	The impact is predicted to be negative, short term but of moderate significance
	Air pollution due to dust	The impact is predicted to be negative of short-term duration and of moderate significance
	Increased soil and water pollution downstream	The impact is considered to be negative, short term and of moderate significance
	Contamination/impaired quality of receiving body – land, water from construction wastes	This impact is considered to be negative and high significance
	Contamination of soil and ground water quality from the batching plant	The impact is considered to be negative impacts, of short-term duration and of moderate significance
	Contamination of river waters from accidental spillages/discharges	The impact is considered to be negative, short-term duration and of high significance
	Soils damage/disturbance to surface and sub-surface organisms	The impact is considered to be negative, short-term duration and of moderate significance
	Injuries to the general public due to road accidents	The impact is considered to be negative, short term and of moderate significance
	Public health hazards/safety due to social interactions	The impacts are predicted to be negative, cumulative, long-term, and of moderate significance
	Health hazards associated with construction work	The impacts are predicted negative, short term and of high significance
	Conveyance system	
	Disruption/ disturbance/ damage of local ecology and resources	The impact is considered to be negative cumulative and of low significance.
	Disruption of the various users of the highway and road reserve	This impact is considered to be negative, cumulative and of short-term duration and of high significance.

Phase	Potential Impacts	Significance Value
	Pollution of land and water resources from waste	The impacts are considered to be negative, short term and of high significance
	Obstruction of local hydrological patterns and underground water resources	These impacts are considered to be negative, short term but of low significance
	Increase in erosion/susceptibility to erosion due to inadequacies in backfilling/compaction	These impacts are considered to be negative, short term but of low significance
	Impaired air quality	This impact is considered to be negative, short term of low significance
	Disturbance and nuisance to sensitive public facilities from increased traffic (noise and dust)	This impact is considered to be negative, short term of low significance
	Impact on the archaeological, historical and cultural sites	This impact is considered to be negative, short term of low significance
	Access road	
	Impairment of ambient air quality	The impact is considered to be negative, cumulative, short-term duration and of low significance
	Deterioration of scenic and visual quality	This impact is considered to be negative, cumulative, short-term duration and of low significance,
	Production of noise and vibrations by machinery, equipment and vehicles	The impact is considered to be negative, cumulative, short-term duration and of low significance
	Impact on surface water quality	This impact is considered to be negative, short term of low significance
	Impact on ground water quality	This impact is considered to be negative, short term of low significance
	Soil contamination	This impact is considered to be negative, short term of low significance
	Disruption of community access	This impact is considered to be negative, short term of low significance
Operation	Damage to the dam and conveyance system due to effects of natural factors and processes	This impact is considered negative, long-term and high significance
	Sediment loads transported into the dam and degradation of water quality	This impact is considered to be negative, long-term and high significance
	Impacts on the downstream ecosystem due to delayed and reduced flow	This impact is considered to be negative, long term and of high significance
	Reduced water quality due to pollution	This impact is considered to be negative, long term and of high significance
	Impacts related with climate change	This impact is considered to be negative, long term and of high significance
	Change in local ecosystem /stimulate of vegetation growth/change in species composition	This impact is considered to be negative, long-term and high significance

Phase	Potential Impacts	Significance Value
	Human wildlife conflicts	This impact is considered to be negative, long term and of high significance
	Flooding hazards	This impact is considered to be negative, long term and of high significance
	Contamination/impaired quality of soils and water from poorly controlled agricultural activities	This impact is considered to be negative, long-term and high significance
	Increased water and soil pollution	This impact is considered to be negative, long-term and high significance
	Exposure to chemicals, hazardous or flammable materials	This impact is considered to be negative, long term and of high significance
	Conveyance system	
	Damage to dam and conveyance system due to effects of natural factors and processes	This impact is considered to be negative, long-term and high significance.
	Damage to conveyance system due to inadequacies in monitoring and operations	The impacts are considered to be negative, long term and of high significance.
	Occupational health and safety hazards	The impacts are considered to be negative, long term and of high significance
	Access road	
	Road Safety Risk - Increase in road accident	The impacts are considered to be negative, short term and of moderate significance
	Increased noise, vibration and air pollution at operation phase	The impacts are considered to be negative, short term and of moderate significance
	Reduce water quality due to runoff	The impacts are considered to be negative, short term and of moderate significance
Potential Negative Impacts	Relocation/resettlement of people, farms, properties and disruption of economic activities	This impact is considered to be negative, long term and of moderate significance
	Increased conflicts over local water resources (communities downstream)	This impact is considered to be negative, long term and of high significance
	Increase conflict with people living in the upper catchment	This impact is considered to be negative, long term and of high significance
	Damage or loss of project structures due to anthropogenic activities	This impact is considered to be negative, long term and of high significance
	Public health hazards due to Water-borne and water-related diseases	This impact is considered to be negative, long term and of moderate significance
	Disruption of existing infrastructure and services (blocked road, water supply)	This impact is considered to be negative, long term and of moderate significance
	Increased population influx	This impact is considered to be negative, long term and of moderate significance
	Public health hazards/safety due to social Interactions	This impact is considered to be negative, long term and of high significance
	Conflicts among workers and the local population in the project area	This impact is considered to be negative, long term and of high significance

Phase	Potential Impacts	Significance Value
Potential Positive Impacts	Improved water quality and quantity	This impact is considered to be positive, long term and of high significance
	Improved health and sanitation status within the Region	This impact is considered to be positive, long term and of high significance
	Increased revenues and stimulation of industries	This impact is considered to be positive, long term and of high significance
	Increased income to locals from employment opportunities	This impact is predicted to be positive, cumulative, long-term and of high significance.
	Benefit to local producers and suppliers of construction materials	The potential impact associated with this impact is predicted to be positive, cumulative, short term and of moderate significance
	Increase of government revenue collections	The impact is predicted to be positive, cumulative, short term and of high significance
	Improved living standards	The impact is predicted to be positive, cumulative, short term and of high significance
	Skills transfer to locals	The impact is considered to be positive, long term and of high significance
	Increased fish production	This impact is considered to be positive, long term and of high significance.
	New market for agricultural produce from the villages	The impact is considered to be positive, long term and of high significance
	Increased market base for local products	The impact is predicted to be positive, cumulative, short term and of high significance
Decommissioning	Loss of vegetation cover and plant diversity	This impact is considered to be negative, long term of high significance
	Contamination and impaired water quality	This impact is considered to be negative, long term of high significance
	Loss of employments	Loss of job is considered negative, long-term duration and since survival of the people is very important here the impact are considered of high significance.
	Noise pollution	This impact is considered to be negative, long term of high significance
	Dust and exhaust emissions	This impact is considered to be negative, long term of high significance
	Occupational health and public safety hazards	This impact is considered to be negative, long term of high significance

8.8 CUMULATIVE IMPACT ASSESSMENT

8.8.1 Introduction

The assessment of cumulative impacts is required for any comprehensive ESIA to addresses impacts that may arise from the incremental impact of the proposed project when added to other closely related past, present and probable future projects. Cumulative impact is defined by the IFC Performance Standard 1 - Assessment and Management of Environmental and Social Risks and Impacts as *"…impacts that result from the incremental impact, on areas or resources used or directly impacted by the project,*

from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted". The impacts of the proposed Construction of Farkwa Dam, Water Treatment Plant and Water Conveyance System to Chemba District Council and Dodoma City thus need to be considered in conjunction with the potential impacts from other future developments or activities that are existing, planned or reasonably defined, and are located within a geographical scope where potential environmental and social interactions could act together with the proposed project to create a more or less significant overall impact.

8.8.2 Most important cumulative impacts

8.8.2.1 Existing, planned or reasonably defined developments

The proposed Construction of Farkwa Dam, Water Treatment Plant and Water Conveyance System project is mainly located in the Mombose and Bubutole Villages of Chemba District. The project is located in a remote area and a number of sources were reviewed to establish whether there are existing, planned or reasonably defined developments that are located within a geographical scope where potential environmental and social interactions could act together with the proposed project to create a more or less significant overall impact. It was established that currently there are no existing, planned or reasonably defined developments projects in the area. Thus potential impact of cumulative and cross border effects of the project is classified as negligible. Also there is no dams built in the same catchment, either in series (i.e. along the same river) or in parallel (i.e. on different tributaries). which inevitably may result in cumulative impacts. An individually insignificant impact may, when combined with others, produce a major change within a river ecosystem. However, such assessment is temporary as the area is expected to house several establishments as a result of construction of the Farkwa dam.

8.8.2.2 Positive social impacts

Positive impacts will derive from employment opportunities created by the project and ultimately the finished development will create additional employment and economic benefits for the people of Farkwa, Chemba District and Dodoma Region in general. The creation of a number of operations will result in the creation of a large, albeit dispersed market for goods and services, which will significantly stimulate the local economy and act as a catalyst for the government to improve service delivery in the region.

The successful implementation of the project will result in a reliable water supply that will have major positive benefits to the Dodoma region. It will provide the basis for increased economic activity due to the availability of reliable water supply. This will encourage investment into the region economy and may lead to an increase in industrial activity and employment. This will generate employment opportunities, increasing incomes and exports and the general well-being of the population. Modernization of agriculture would also be underpinned by reliable water supply particularly with respect to food production, processing and storage leading to export
opportunities.

8.8.2.3 Traffic disruption resulting from the construction works

The proposed project will result in significant numbers of additional high volume traffic particularly during construction, with associated impacts on public safety, transport and access. Also induced future projects will put additional strain on road networks and result in increased congestion from construction and operational traffic. Cumulative impacts on road networks and traffic congestion could have a negative

effect on community health and safety. Even though the individual traffic impacts during the dam construction works are significant, the impacts will be cumulative when taking into account the traffic impacts generated by other development projects in the area.

8.8.2.4 Impact on water flows and sedimentation processes

The proposed dam construction will have a permanent impact on water flows and sedimentation processes within and surrounding the project area. Construction activities will involve massive earth moving within the river plains and sections of the adjoining riverbanks and lands. This loosening of the soil creates a situation where any heavy rains will freely wash down the silt into the downstream areas. The silt so washed down may contain high levels of organic matter and deposition of this may lead to anoxic conditions in the lower water levels with potential risks to the associated aquatic life. Sediments loads, that are dependent on the catchment characteristics (geology, soil nature, topography and vegetation cover), is likely to be the major challenge to Farkwa dam considering the high potential of Bubu River to generate sand. Such impacts are largely unavoidable and will occur with any development across or within the catchment area. Nevertheless, these impacts will be cumulative.

8.8.2.5 Noise pollution

Maintenance of good air quality and acceptable ambient noise levels within the site, as well as at adjacent properties and infrastructure, will be of key importance to ensure that existing and future residential or other sensitive land uses are not adversely affected during the construction works, and that the overall quality of the environment is maintained. The noise impact assessment considers noise that is likely to be generated by the project in combination with ambient noise levels in the study area. Noise impacts during construction and operation were assessed to be of minor significance. The project will, however, contribute to cumulative noise impact in combination with other activities continuing in the area.

8.8.2.6 Dust pollution

Although the stockpile dust assessment indicates that dust levels produced by the stockpiling activities at the proposed development site will be within relevant air quality standards, the implementation of dust management measures during project implementation works by the contractor is nonetheless recommended to reduce the cumulative impact.

8.8.2.7 Impaired air quality

The numbers of individual items will vary, depending on the stage of the construction works. Each piece of diesel powered plant/equipment etc. has the potential to emit various air pollutants including carbon monoxide, hydrocarbons, nitrogen oxides and particulates. This effect would be largely reduced in rural areas where there is a low concentration of local traffic. Whilst the construction works will only cause this air pollution over a relatively short period of time, it will be important to control all air emissions from the works by all means in order to avoid any deterioration in the air quality conditions on or near the site, and minimize cumulative effects.

8.8.2.8 Social Infrastructure

There will be an increase in the number of workers in the area as a result of the continuing construction of the proposed project. The project area lies within rural setting, the villages are relatively small and the

provision of services and related infrastructure (e.g. health care, education, potable water) in the area is often inadequate.

8.8.2.9 Communicable diseases

For the purposes of this discussion communicable diseases most relevant to the project activities, as identified through the socio-economic and health study, are considered. These are malaria, HIV/AIDS, STDs and typhoid fever. Infectious disease is a potential cumulative impact associated with the presence of workers. Development in the area will attract jobseekers as well as those seeking an opportunity to provide services to the growing population. An increase in workers is often linked to an increase in the incidence (the rate at which infections occur) and prevalence (the number of people infected) of communicable diseases.

Cumulative impacts have been addressed in the mitigation measures identified by the ESIA team and these mitigation measures have been incorporated in the ESMP. Some of the mitigation measures will require the setting up of cooperative structures with other project development within the area.

9 MITIGATION/ENHANCEMENT MEASURES AND COMPLEMENTARY INITIATIVES

9.1 INTRODUCTION

The impacts which are most likely to affect the environment in the execution of the proposed farkwa dam project have been identified and analyzed in Chapter 8 above. Based on the analysis and hence classification of the most likely environmental impacts, this section provides a summary of mitigation measures of those impacts which are considered to be of moderate to high significance for all project components which are main dam and its components, conveyance system and access road. Most of the mitigation measures are combined as most of the impacts of one component e.g acess road are much related with another component (Conveyance system). Where the impacts are specific to one component specific mitigation measures are proposed to those specific impacts. The standards upon which the mitigation measures are targeted, the responsible entity and the associated mitigation costs are presented as part of the Environmental and Social Management Plan.

For each scenario, the study team has assessed what specific measures could be undertaken to avoid, minimize, or mitigate identified significant negative impacts and/or enhance positive effects. The measures include changes to policies as well as enhanced planning procedures, and the need for institutional changes as well as capacity development.

9.2 PREPARATION/MOBILIZATION PHASE

9.2.1 Loss of /disturbance of biodiversity (flora, fauna and ecosystem)

Clearing of vegetation for new access roads, conveyance system, workers camps; number of trucks and vehicles entering the project area; sites for quarrying activities; etc, will be as minimal as possible so as to avoid much destruction of this natural ecosystem. The Contractor shall clearly mark out the extent of clearing within the approved work-site and instruct all construction workers to restrict clearing to the marked areas and not to work outside defined work areas. When possible, MoW shall establish nurseries of indigenous plant species such as *Brachystegia spiciformis, Pterocarpus angolensis, Dalbergia melanoxylon, Tamarindus indica, Acacia lahai, Acacia sieberiana, Acacia brevispica* and *Acacia seyal* to be used during rehabilitation and restoration activities in all disturbed areas outside the project footprint. This will help to restore habitat for fauna, buffering climate, stabilizing soil, control water loss, maintain vitality of catchments etc. The natural environment down and upstream shall be maintained as much as possible so that mobile organisms that will have their habitats lost in the project site will take refuge either downstream or upstream areas. Furthermore, the plant species including the endemic ones which will be cut down in the project site and their stock shall be reserved in the upstream and downstream areas. The contractor will avoid planting non-native and exotic species on the site as well as those that constitute obstacles according to the airport regulations. The project will consult experts for advice and for potential flora stocks.

9.2.2 Deterioration/impairment of local air quality

During all mobilization related activities, air quality impacts from combustion sources (equipment emissions) shall be minimized through contracting new equipment or through routine inspection and

maintenance of combustion emission sources (such as generators, diesel engines, equipment's). No vehicles or equipment to be used that generates excessive black smoke. Maintenance will ensure that equipment is operating efficiently and is not producing excessive emissions. Where practical, contractors will inspect machines and vehicles on delivery. Moreover, contractors will enforce vehicle load restrictions to avoid excess emissions from engine overloading.

9.2.3 Nuisance and disturbance and on/offsite receptors from noise pollution and vibrations

Noise levels shall be controlled at all times but particularly when working at night or near noise sensitive receivers (NSRs). The contractor and project proponent shall ensure all plant, machinery and vehicles are fitted with appropriate mufflers, and that all mufflers and acoustic treatments are in good working order. Also shall ensure all plant, machinery and vehicles are regularly maintained and broken parts (such as mufflers) are replaced immediately. Further, the contract shall ensure all plant, machinery and vehicles are operated efficiently and according to the manufacturers specifications, by trained and qualified operators; and development and implementation of appropriate safety measures for site personnel, including the provision of suitable hearing protection.

9.2.4 Air pollution due to dust

Dust generating activities (excavation, handling and transport of soils) shall not be carried out during times of strong winds. The Contractor shall suspend earthworks operations wherever visible dust is affecting properties adjoining the project site. Water shall be applied whenever dust emissions (from vehicle movements or wind) are visible at the site in consultation with the Project Supervisor. Vehicles delivering soil materials will be covered to reduce spills and windblown dust and vehicle speeds will be limited to minimise the generation of dust on site and haul routes. Any complaints received by the Contractor regarding dusts will be recorded and communicated to Project Supervisor. Asphalt plants and concrete batching plants will be well sealed and equipped with a dust removal device.

9.2.5 Depletion /degradation at points of source of construction materials

The culture of reinstating borrows pits and quarry site immediately after exploiting construction materials lacks at many sites across the country including within the project area where materials for embankment construction and clay soils will be sources. In order to effectively mitigate the above impacts exploitation of construction materials will be from the authorized source only. These authorized dealers should have an ESIA certificate and the Mining license from the Ministry of Energy and Minerals. The licensed suppliers who hold the ESIA certificate and the Mining License comply with ILO labour conditions.

Also restoration of the borrow pits/quarries after use constituting leveling the area and seeding or planting of trees and/or grasses will done in association with local government (natural resources department) and local environmental NGOs. The Contractor shall be instructed and monitored to ensure the area is reinstated to its original condition. If appropriate the leveled area will be left for natural re-vegetation.

9.2.6 Erosion of the top soil and reservoir sedimentation

To mitigate the impact the MoW and contractor shall ensure that civil or earth work is done during dry season when there are no run off to reduce the impact severity. Deliberately re-cover exposed soils with grass and other appropriate species as soon as possible during dry season to enable vegetation growth before wet season. Also temporarily shall bind exposed soil and redirect flows from heavy runoff areas

that threaten to erode or result in substantial surface runoff to adjacent water courses. Further the contractor shall ensure that backfilling is done adequately, compacted, and the site restored. The earth used for backfilling shall be free from all roots, grass, shrubs, vegetation, trees, and rubbish. The backfilling operation will be performed in such a manner so as to prevent washing away of soil. Support structures shall be used in locations where soil can be washed away. Monitor areas of exposed soil during periods of heavy rainfall throughout the remaining construction phase.

9.2.7 Disruption of traffic flow during mobilization

The contractor shall employ drivers with authenticated class C license and with a minimum of 3 years of driving after obtaining the class C license. Transport routes to and from the project site will be agreed with government agencies (TANROAD, Chemba DC and Dodoma City) prior to commencement of the mobilization program. Traffic control measures (e.g. flagmen, appropriate lighting) will be deployed at the project site and strict speed controls will be implemented for all transport vehicles.

Traffic control measures (e.g. flagmen) will be deployed at all intersections of site access routes and main roads and strict speed controls will be implemented for all transport vehicles. The contactor shall install road bumps at regular intervals to limit speed of vehicles through the village and particularly at school crossings. All large or over-size transport vehicles will be accompanied by escort cars equipped with flashing yellow warning lights while in transit on public roads. Delivery of construction plant, equipment and goods will be planned so as to minimize the total number of required trips and will be scheduled outside of peak hour traffic times e.g. 09.00 pm – 05.00 am. Reporting mechanisms for the public to register concerns or complaints regarding perceived risks to their health and safety due to the mobilization activities will be established.

9.3 CONSTRUCTION PHASE

9.3.1 Disruption of the various users of the highway and road reserve

The pipeline route will be surveyed and clearly marked, and cleared of obstacles before starting trenching in a particular area. MoW/Contractor shall endeavour to obtain as much information as possible about underground services in the area (use maps) including: pipe lines, water mains, sewers, telephones, and power conduits, laid wires poles and guy wires, railways (Dodoma City), highways, bridges or other underground or above ground structures and/or properties crossing or adjacent to the pipeline trench being excavated. MoW shall liaise with utilities bodies like Railways, TANESCO, water, sewerage and sanitation departments/authorities, TANROAD and seek relevant permits from local authorities. In town/Municipality limits as well as in built up areas, manual labour only shall be used to ensure no damage is caused to any underground or surface installations belonging to other private/public utility services. Excavation work shall be carried out carefully, and follow recognized safe digging practice where trial holes by careful hand excavation are essential before any excavation is commenced.

The blocking of roads and walkways shall be prepared in close co-operation with the local police traffic unit, and the respective conditions in the digging permission shall be observed. The cutting of paved surface shall be avoided as much as possible. In case crossing of road cannot be avoided, the paved surfaces shall be cut properly in the width of the trench. No careless breaking of the surface shall be done. In areas of frequent traffic, part of the excavated soil and other construction related materials and equipment's shall be removed from the site immediately.

9.3.2 Deteriorated / impairment of local air quality

The proponent is committed to implementing measures that shall reduce air quality impacts associated with construction. All personnel working on the project will be trained prior to starting construction on methods for minimizing air quality impacts during construction. Specific training will be focused on minimizing exhaust gas emissions from heavy construction vehicles. Construction vehicles drivers will be under strict instructions to minimize unnecessary trips, refill petrol fuel tanks in the afternoon, and minimize idling of engines. Also reduction of air emissions from exhausts shall be achieved by contracting new equipment or well serviced and maintained equipment. No vehicles or equipment's to be used that generate excessive black smoke. Where practical, contract will inspect machines and vehicles on delivery. Also contractor will enforce vehicle load restrictions to avoid excess emissions from engine overloading.

9.3.3 Noise pollution

Working hours and rules will be established based on the needs to reduce the noise causing nuisance and disturbance, especially by avoiding the cumulative effect of increased noise due to simultaneous operation of different kinds of construction machinery and equipment. Best practice procedures will be implemented in order to reduce construction noise. Such measure will include hydraulic construction to be used in preference to percussive techniques where practical. Also all equipment will be properly maintained, silenced where appropriate and operated to prevent excessive noise and switched off when not in use. Loading and unloading of vehicles, dismantling of equipment such as scaffolding or moving equipment or materials around the site will be conducted as far as practicable during day time hours; and noise complaints will be immediately investigated.

9.3.4 Air pollution due to dust

To prevent any such adverse impacts, the batching plant/crushers shall be provided with appropriate dust control measures and be positioned such that the prevailing north-westerly wind does not carry dust fines downwind towards sensitive receptors. Dust emissions from the equipment shall also be controlled by closing all covers and screens and wetting down materials to be crushed. Likewise, dust emissions from this source whenever possible, will be mitigated by stabilizing pre-crushed material prior and after crushing.

9.3.5 Increased soil and water pollution downstream

Good house-keeping shall be practiced within material storage compounds or vehicle maintenance yards where the possibility of spillage is great. Vertiver grasses may be used to control areas prone to erosion. Silt fences may be used to reduce suspended solids from surface water runoff. Proper storage of fuels and other chemicals shall be ensured. Oils, hydrocarbons and other hazardous materials will be stored in designated locations with specific measures to prevent leakage and release of their contents, including the siting of the storage area away from storm water drains and on an impermeable base with impermeable containment that has no outflow and is of adequate capacity to contain 110% of the contents.

Machinery will be kept away from surface waters and will have drip trays installed beneath oil tanks / engines / gearboxes / hydraulics which will be checked and emptied regularly. Also the contractor will have a spill response plan, spill kits and trained personnel. The contractor will be required to maintain records. The contractor will be required to remediate any spills of hazardous substances caused by the construction project.

9.3.6 Contamination/impaired quality of receiving body – land, water from construction wastes

An efficient collection and disposal system based on the principles of reduction; re-use and recycling of materials, shall be instituted at the project site. Instructions to contractor to put on his/her methodologies for handling hazardous waste such as oils, lubricants and non-combustible waste during bidding process. Also to reduce the cost of the project, much of the excavated soil and rubble materials will be reused as initial filling materials where leveling of project site is required. Cleared vegetation, top soil and rubble will be used to fill up any other infrastructures (roads, pits etc) that needs filling.

Introduction of waste disposal bins, warning notices, "DOs & DoNTs" etc posted at strategic points, through the project area. No, on site burial or open burning of solid waste shall be permitted at the project area and MoW will make use of the existing solid waste disposal and collection system. Wastes not suitable for incinerations and general waste damping (e.g. Batteries, plastics, rubbers, tyres, etc) shall be removed from the project area for recycling, treatment, and/or disposal by licensed contractor as appropriate. Additionally, waste management training for all personnel, operators and services providers.

9.3.7 Contamination of soil and ground water quality from the batching plant

Waste water generated from any concrete batching and pre-cast concrete casting plant activities of washing down mixer trucks, drum mixers and similar equipment shall, wherever possible, be recycled – wastewater discharge shall be kept at a minimum. Following silt removal and pH adjustment where necessary (to within pH range of 6-10), the surplus wastewater may be discharged into sewers or being transported by the cesspit trucks.

9.3.8 Contamination of river waters from accidental spillages/discharges

Properly maintained and convenient toilet and shower facilities and waste disposal services shall be provided and clearly displayed in the project area; including wastewater collection. All toxic, hazardous and harmful materials (such as caustic and acidic substances, fuels, oils, drums, barrels and asphalt materials) will be stored away from any waterway, in banded areas with impervious bases and soak pits to contain accidental spills. The proponent shall minimize the stored quantities of diesel, oil, paint, thinners or other chemicals that pose environmental hazards and fit all drums and barrels with flow control taps and ensure proper labeling.

Engine repairs, truck/equipment's washing and maintenance activities shall be performed at designated areas with impervious surfaces and all potentially hazardous wash waters shall be carefully controlled with spill containment and collection facilities. Use of non-phosphate detergent shall be encouraged, as discharge of such phosphate free wash-waters would have less impact on nutrients levels within receiving waters. All equipment's shall be maintained in a condition such that spills of oil etc. are prevented. Spill kits shall be kept on the site and the contractor shall be trained such that any spills can be mopped up effectively. The contractor shall also implement fuel/chemical spill prevention procedures on the site and proper contingency planning, including availability of spill clean-up materials. Small plant such as pumps shall be equipped with drip trays. Emergency response procedures will be in place and contractor's site staff will be adequately trained in spill prevention and clean up procedures. Spill kits shall be located on site, especially near to watercourses.

9.3.9 Soils damage/disturbance to surface and sub-surface organisms

The proponent will ensure proper demarcation of the project area to be affected by the construction works. This will be aimed at ensuring that any disturbance to flora and fauna is restricted to the actual project area and avoid spill over effects on the neighbouring areas. In the same vein, there will be strict control of construction vehicles to ensure that they operate only within the area to be disturbed by access routes and other works. In addition, the proponent has committed itself to re-vegetation of some of the disturbed areas through implementation of a well designed landscaping programme.

9.3.10 Injuries to the general public due to road accidents

Traffic control measures (e.g. flagmen) will be deployed at all intersections of site access routes and main roads and strict speed controls will be implemented for all transport vehicles. The contactor shall install road bumps at regular intervals to limit speed of vehicles through the village and particularly at school crossings. The contractor shall employ drivers with authenticated class C licence and with a minimum of 3 years of driving after obtaining the class C licence. The contractor shall sensitize all drivers on the importance of observing traffic regulations. The contactor shall limit speed vehicles to 30km/h when passing through the village and enforce this limit by punishing offenders.

9.3.11 Public health hazards/safety due to social interactions

The MoW and Contactor will devote time in raising awareness of the dangers of the HIV/AIDS within the project premises. Although basic knowledge of HIV/AIDS is high among Tanzanians, knowledge of self-protection measures and behaviour change will be provided and a preference will be given to those who are vulnerable and to empower women for they compose one of the most vulnerable groups. When the need arises MoW and Contractor will seek for professional assistance from organizations working in the field of public health and control of HIV/AIDS for instituting a health education and disease control programme at the workplace.

9.3.12 Health hazards associated with construction work

Accidents will be minimized through proper arrangements of construction tools and equipment, protecting or guarding the cutting edges, and awareness of the people including workers on the dangers and make them understand how to protect themselves and others. Further, MoW and contractor shall comply with relevant Tanzania (OSHA, 2003) and International Finance Cooperation's Performance Standards and regulations on health and safety requirements including the provision of Personal Protective Equipment's (PPE), registering the work place, submission of designed drawings of the work place for approval, observing reasonable working hours and good working conditions and facilities. Also to develop and implement in-house manual/ guard lines on Health and Safety (H&S).

9.4 OPERATION PHASE

9.4.1 Damage to the dam and conveyance system due to effects of natural factors and processes

The engineering design and construction of the dam shall ensure that the dam and conveyance system can withstand normal natural processes. The engineering design and construction shall ensure minimal disturbance to the natural terrain of the area. The hills upstream shall be left to act as natural barriers to contain the water in the project site. This will ensure that some parts of the project area will remain

undisturbed to maintain natural scenery. The spillway shall be properly designed to ensure that the dam capacity is not exceeded.

Further according to section 11 (1) – (4) of the Water Resources Management (Dam Safety) Regulations, 2013, the owner of a dam shall carry out facility review at least once in every five years and submit the report of the review to the Director and a copy to the Basin Water Officer in accordance with the guidelines made under Regulation 24. Notwithstanding the provisions of sub-regulation (I), owner of a dam shall conduct inspection of a dam annually and submit the report to the Director. The Director may order periodic review at any time if it is necessary so to do. Copies of the records of the dam operation and maintenance manual shall be maintained and placed in a convenient manner at the dam sites at all times. The Director may in his own motion or upon advice by the Basin Water Officer give direction to owner of a dam regarding the reports submitted pursuant to this regulation.

9.4.2 Sediment loads transported into the dam and degradation of water quality

The natural vegetation in the sides/neighborhoods of the project area shall be conserved whenever possible to minimize soil erosion. Compaction of embankments shall be done to meet the recommended compaction in the design. Also the project proponent will plant tree around dam boundaries to compensate on tree losses as well as to minimize wind which is one of the factors for excessive evaporation.

9.4.3 Impacts on the downstream ecosystem due to delayed and reduced flow

The in-stream flow requirements to sustain the riverine ecosystem demands will fully be covered by the irrigation and livestock mitigation flows as the two are located downstream part of the river just before the Bahi swamp. However, a flow for the ecosystem to the Bahi swamp is considered independently of the later flows, as the irrigation and livestock mitigation flow are to be abstracted / consumed before reaching the Bahi swamp. Based on the study conducted to the Bahi drainage area (Appendix 10) and the discussions among the experts formed ESIA team, it was estimated that 10% of the natural flow of the Bubu River will contribute to the sustenance of the Bahi Swamp ecosystem and its associated ecological services (such as fishing). As it has been noted earlier the Bahi swamp is being contributed by a number of streams/rivers and precipitation, the latter being reported to account 60% of the total swamp water sources (M. McCartney, 2007).

Thus, the amount of water required to flow downstream of the Dam site in this case is the summation of the irrigation mitigation flow (27,812,505.6 m^3/year), livestock mitigation flow (381,901.5 m^3/year) and 10% of the natural flow of the Bubu River (14.79 MCM/year). The flow shall follow the natural regime of the river with exception of irrigation mitigation flow which will be confirmed within four months of irrigation period (i.e. from mid-December to mid-April). In this case the water from the Dam will only be released during wet season as per natural river flow condition.

9.4.4 Reduced water quality due to pollution

Identify and promote appropriate latrine technologies within the catchment area. The MoW also may support Local Government Authority within the catchment area to establish and operate basic solid waste management systems. Further a training program shall be developed for farmers on precautionary measures required for the handling, labelling and application of agro-chemicals under field conditions. The training shall be incorporated in a farmer's field school curriculum. Extension workers shall also be able to deliver awareness program on the amounts and conditions for applying fertilizers and pesticides to prevent water pollution. Application of fertilizer during rainy season for example will lead to leaching.

The same applies for pesticides and herbicides. Agrochemical application shall only be done when it's not rainy to allow the chemicals to soak and not leach.

9.4.5 Impacts related with climate change

Climate change was considered in the dam design and no specific mitigation measures are recommended for the Farkwa dam in relation to climate change and hydrology. However in times of low flows as a result of drought, the maintenance of the river ecological balance remains paramount and as such restrictions on water usage especially for irrigation downstream will be imposed i.e. irrigation will be halted an issue that may cause tension with the local communities who are beneficiaries and for that matter rigorous awareness creation will be required. The situation shall be monitored closely so that appropriate measures can be taken to manage water resources at both local (Bubu River) and sub-basin level.

9.4.6 Change in local ecosystem /stimulate of vegetation growth/change in species composition

Proper maintenance procedures especially within the dam shall be undertaken regularly to ensure that occurrence of water weeds is kept to a minimal. A detailed biological inventory of the plants and fauna species composition has to be conducted in area upstream and down-stream of the proposed project site. This will ascertain the species composition similarities and/or differences between the proposed project site and areas up/down stream. The natural environment down and upstream shall be maintained as much as possible so that mobile organisms that will have their habitats lost in the project site will take refuge either downstream or upstream areas. Furthermore, the plant species including the endemic ones which will be cut down in the project site shall have their stock reserved in the upstream and downstream areas. The project developers shall help to afforest ate the area when the work is complete. This will help to restore habitat for fauna, buffering climate, stabilizing soil, control water loss, maintain vitality of catchments etc.

9.4.7 Human wildlife conflicts

In order to reduce the impact of wildlife migration to the river and to the dam the project proponent shall collaborate with the Chemba District Wildlife Office, Swagaswaga Game Reserve management, forest division and other relevant government agencies in managing wildlife; create buffer zones, providing separate watering points for wildlife. Information, education and awareness programmes for local residents, especially children, with respect to wildlife and its protection.

9.4.8 Flooding hazards

The project management shall carry out facility review at least once in every five years and submit the report of the review to the Director and a copy to the Basin Water Officer in accordance with the guidelines made under Regulation 24. The spillway shall be properly designed to ensure that the dam capacity is not exceeded. The proponent shall provide sluice valve for regulating levels in the dam and install a prior warning system against an increase of water within the dam. Also the engineering design and construction of the dam shall ensure that the dam can withstand normal natural processes.

9.4.9 Contamination/impaired quality of soils and water from poorly controlled agricultural activities

This impact can be reversible if IPM approaches are undertaken or farmers are trained in techniques of agrochemical applications. A training program shall be developed for farmers on precautionary measures

required for the handling, labelling and application of agro-chemicals under field conditions. The training shall be incorporated in a farmer's field school curriculum. Extension workers shall also be able to deliver awareness program on the amounts and conditions for applying fertilizers and pesticides to prevent water pollution. Application of fertilizer during rainy season for example will lead to leaching. The same applies for pesticides and herbicides. Agrochemical application shall only be done when it's not rainy to allow the chemicals to soak and not leach. Alternatively the project should adopt a more environmental sustainable approach of promoting Integrated Pest Management in the project. The alternative pest management methods should include a best mix of biological or cultural controls.

9.4.10 Increased water and soil pollution

During the water treatment process, the flocculation method shall be used for the settling of the fine particles (sand, clay and organics). The incorporated chemical catalyst will be the aluminum sulphate. This chemical product joins the resulting solid sediments, i.e., the sludge that results from the process. This sludge will be disposed of at a storage and dehydration site, with base protected by a plastic membrane (geomembrane). Also the MoW shall consider measures to prevent pollution of ground water while designing the sludge storage site

9.4.11 Exposure to chemicals, hazardous or flammable materials

Chemicals, hazardous and flammables materials shall be secured, and stored accordingly (regulations and conditions of storage will depend on the type of materials used). Procedures for handling hazardous materials must be in place. They must be locked and only authorized personnel can have access to the materials. MSDS must be available and specific PPE shall be provided and users should be trained. If safely stored and procedures are in place, no risk or impacts on the communities shall arise for no contact or handling any of these products should happen. In case of leakage or spills that shall affect communities, this must be covered in the Contingency Plan.

Appropriate mitigation measures for the transport of chlorine shall include careful selection of transport routes for chlorine; use of well-maintained storage and transport facilities for chlorine; training and instruction of transport staff about appropriate safety measures when transporting chlorine. Further the MoW shall develop and implement a plan for transport of chlorine to the water treatment plant site and for handling the gas on site. Such a plan shall include:

- proper measures as a careful selection of transport routes for chlorine;
- training and instruction of transport staff on appropriate safety measures when transporting chlorine;
- a list of first measures to be done in case of an accident;
- contacts of the heads of villages along the transport route;
- numbers of police stations along the transport route;
- numbers of hospitals along the route etc. This list shall be carried by all trucks transporting chlorine gas.

9.5 POTENTIAL NEGATIVE SOCIAL IMPACTS

9.5.1 Relocation/resettlement of people, farms, properties and disruption of economic activities

Ministry of Water in collaboration with the local government authorities will work out/calculate the exact size and locations of the required land. Individuals with potential land acquisition issues shall then be

subject to a comprehensive sensitization and consultation process. MoW will then initiate a land and property valuation and compensation process guided by the Land Acquisition Act No 47 of 1967, National Land Act No. 4 of 1999 and the Village Land Act No. 5 of 1999. The Land Acts and the Land (assessment of the value of compensation) Regulations of 2001 [made under section 179 of Land Act no. 4 of 1999 see chapter 3] set clear procedures for full, fair and prompt compensation while acquiring land from citizens. These procedures shall be adhered to by MoW. The laws also advocate market value as basis for valuation. Market Value of affected property/asset may be arrived at by different methods. Regulation 3 of the Land (Assessment of the Value of Land for Compensation) Regulations, 2001 and Part III of the Village Land Regulations, 2002 provide for practical guidelines on assessment of compensation.

MoW shall effect compensation before the land is taken over. The affected people also shall be given ample time to find alternative land/plots for settlement and whenever appropriate the MoW will work with respective villages to assist the affected individual to acquire new land from the local government authorities and settle any dispute following existing laws and structures.

9.5.2 Increased conflicts over local water resources (communities downstream)

In order to minimise the impacts on impact that may arise from the reduced water flow, a proper plan for downstream water utilisation is recommended. This requires the design to ensure that total closure of water is avoided by ensuring that irrigation mitigation flow (27,812,505.6 m3/year), livestock mitigation flow (381,901.5 m^3/year) and 10% of the natural flow of the Bubu River (14.79 MCM/year) is maintained in the river downstream. Further to prevent conflict between irrigation farming and livestock keeping downstream, extension services on improved livestock keeping that is more intensive than extensive shall be promoted. Practices such as keeping fewer but better breeds that are of more economic benefit shall be promoted. In addition, practices such as zero grazing shall be introduced to reduce land requirement for livestock keeping.

Proper farm management shall be instilled among the project's farmers so as to reduce incidences of poor soil management and contamination of water sources for domestic use. Extension services to train farmers on appropriate soil, water and farm chemical management shall be engendered into the project to facilitate for proper soil and water management. This will in extension safeguard fish breeding zones and therefore reduce conflicts with the fishing communities. The project design should incorporate fallow areas where grazing should be undertaken within the project area.

9.5.3 Increase conflict with people living in the upper catchment

MoW shall involve communities in managing the upper catchment zone of the water sources. Discussions with relevant village leaders in the catchment zone shall be enhanced and deliberations implemented. Identification of NGOs, CBOs or other cultural groups, which would help in better managing of the catchment, shall be done. Provision of incentives and participation of development programmes in the villages can help to bring more understanding of the problem and can open up ways for getting better solutions.

Whenever appropriate MoW shall advocate afforestation in the catchment and will supply seedlings for the project. Monitoring programme in the catchment shall be established as means of providing information on its environmental performance. Legislation on protection of water sources shall be enforced for instance adherence to the 60m way leave of the river banks. Also education on good farming methods and good sanitation practices shall be provided.

9.5.4 Damage or loss of project structures due to anthropogenic activities

Marker (warning) tape shall be placed over the pipe but below the soil to warn future workers in the area that a water pipeline lies below to prevent being damaged. Proper documentation of the route detailing coordinates shall be done to ensure that it is possible to locate the route in future. The pipeline directly trenched in the ground shall be placed deep enough to provide adequate protection.

If excavation is not possible to the minimum depth of 100cms, full facts shall be brought to the notice of the engineer-in-charge giving details of location and reason for not being able to excavate that particular portion to the minimum depth. Approval shall be granted by competent personnel. However, measure shall be taken to protect the pipe where the depth is below the recommended minimum. Prior to commencements of construction works, MoW shall serve notices to other road reserve users - local authorities and utilities bodies (CDA, TANESCO, TANROAD, water, sewerage and sanitation departments/authorities) on the plans to lay the pipeline.

9.5.5 Public health hazards due to Water-borne and water-related diseases

To mitigate these impacts the proponent shall employ disease vectors disruption techniques such as regulated reservoir operation to curb vectors for malaria and water borne diseases. Also shall encourage natural aquatic life that takes care of mosquito larva as part of the food chain. Whenever possible MoW will support on – going and new community health and safety programmes undertaken by Chemba District Council and Village leaders for community mobilization to control preventable communicable diseases and vectors through awareness and sensitization campaigns: e.g. use of mosquito bed nets, good hygiene practices, (construct and use toilets, boiling drinking water); chemical treatment of surface waters (dams).

9.5.6 Increased population influx

The key to the reduction in immigration of people from other parts of the country that could negatively compete for employment opportunities with the local peoples is to implement a stringent recruitment policy. This will ensure that preference is to be given to existing members of communities, especially those from the local villages such as Farkwa, Gonga, Mombose and Bubutole. A skills audit could be undertaken and a register compiled of persons who have skills that could be used by the project. The contractor recruitment policy shall be communicated to the general public in advance.

9.5.7 Conflicts among workers and the local population in the project area

In the dialogues of health and safety the contractor shall explain to workers about the importance of keeping a good relationship with local communities. Amongst the local workers shall be a group of community liaison, responsible for establishing communication between project staff and community, which will be particularly important in cases of complaint. Such elements shall be familiar with the project in general and being able to properly troubleshoot or forward any complaints/claims. Also set of rules (or a Code of Conduct) for the workplace shall be established and implemented. The standards shall include, inter alia, the entry of persons outside the service and the prohibition of prostitution in the storage yards.

9.6 DECOMMISSIONING PHASE

9.6.1 Loss of vegetation cover and plant diversity

Use existing maintenance access roads and the pipeline maintenance access route to dismantle and transport the decommissioned material. If necessary only clear the minimum width of the route for dismantling operation. Experienced ecological advisors must be appointed and be present on each spread during construction activities to chase animals away and collecting and relocating sensitive species from the area, preventing them to be harmed. All personnel must be briefed on environmental sensitivities in the surrounding area. Reinstatement to maintain habitat continuity as far as is practicable. At the commencement of works, the working width will be clearly delineated where it passes through environmental sensitive areas.

9.6.2 Contamination and impaired water quality

The contractor shall prevent any uncontrolled run-off to waters, especially during rainfall events or when spillages occur. Measures shall be taken to minimize the flow of leakages into trenches that may act as short cuts to the river waters. Channels and sand bags shall be provided on site so as to direct storm water to the proper containment/removal facilities. Demolished materials shall be kept within planned boundaries and with a clear separation distance from waters. If it is essential to stockpile materials close to the water, runoff control measures shall be implemented, such as excavation of a shallow water/sediment collection ditch around the boundaries of stockpiles to contain run-off water for a sufficient length of time to allow for settlement of solids.

Stockpiles or other storage compounds (e.g. demolished material) boundaries shall be clearly marked out with physical boundary markers such as posts. Windbreaks or fencing shall be erected between the stockpiles and the predominant wind direction. Monitoring and auditing of the works and site practices shall be undertaken, including monitoring the water quality during the works. This will be necessary to enforce good site practice and principles as well as good and compliant behavior.

9.6.3 Loss of employments

The only major impact that will result when the project is decommissioned is loss of jobs. In order to minimize the impacts that may result from this eventuality MoW will ensure that all employees are members of the pension fund and will ensure that the contributions are made. Also will prepare workers for forced retirement by providing skills for self-employment, wise investment and will provide relevant skills to workers through on job training to make them marketable after decommission.

9.6.4 Noise pollution

During decommissioning the contractor will coordinate activities that produce the most noise levels and portable barriers will be installed to shield compressors. Use of equipment designed with noise control elements will be adopted where necessary. Use of very noisy equipment will be limited to daytime only. All workers operating in noisy areas or operating noisy equipment will be provided with earpieces to protect against extreme noise.The demolition exercise will be limited at day time only. The contractor will further improve on the existing management of noise generation from equipment and staff to ensure that they comply with Tanzanian legislation at the time of decommissioning.

9.6.5 Dust and exhaust emissions

A site waste management plan will be prepared by the contractor prior to commencement of demolition works. All personnel working on the project will be trained prior to commencing the demolition exercise on methods for minimizing negative impacts on air quality. The contractor will douse the surface with water to suppress excessive dust and whenever possible, water sprinklers shall be used. Exposed demolition debris of e.g. dust and sand, will be enclosed, covered, and watered daily before transported to disposal site. Also the contractor will provide protective gear (i.e. breathing masks) to workers working in dusty environment.

9.6.6 Occupational health and public safety hazards

All workers will be sensitized before the exercise begins, on how to control accidents related to the demolition exercise. A comprehensive contingency plan will be prepared before demolition begins, on accident response. Adherence to safety procedures will be enforced at all stages of the exercise. All workers, pursuant to labour laws, shall be accordingly insured against accidents. All workers will be provided and instructed to wear protective clothing during demolition, including helmets. Demolition work will be limited to daytime only avoid workers accidents due to poor visibility.

9.7 ENHANCEMENT OF POSITIVE SOCIO-ECONOMIC IMPACTS

9.7.1 Employment/Income generation

It is expected that during construction and operation phases, a good number of people will be employed. Offering local people the opportunity for employment during the construction or of providing services such as supplying construction materials (e.g., soil, gravel) etc., will provide an additional income-generating opportunity to a significant number of persons who may be affected in these targeted areas. For each position, must be disclosed the exact number of jobs available, the applicable period and the remuneration to be allocated for each type of work. The hiring requirements must be clear, properly publicized before the start of the recruitment process and respected by the designated contractor. For a better impact on the communities this process shall be conducted with the involvement of local leaders.

The necessary skills for the positions must be provided or, in cases where it is not applicable, must be clearly indicated that no special qualifications are required. In the event there are local expectations for employment that cannot be met by the project, the limited availability of places shall be made known to the interested parties through local authorities. The principles and procedures for hiring should, as far as possible, give priority to the hiring of skilled local workers. It will be made clear during the tendering process for project that about 85% of the people employed will be the local people. One way of promoting this would be for the contractor to train local people to acquire the skills needed by these contractors to carry out the work.

9.7.2 Benefit to local producers and suppliers of goods and services

Where ever possible the project will procure materials from local sources. This will benefit local producers and suppliers. The use of locally available materials and labour for the proposed project development will contribute towards growth of the economy by contributing to the gross domestic product. The consumption of these materials, fuel oil and others will attract taxes including VAT, which will be payable to the government hence increasing government revenue while the cost of these raw materials will be payable

directly to the producers. Some of the project services, such as carrying out Environmental Impact Assessment, have been already contracted to Tanzanian suppliers and contractors.

9.7.3 Improvement of health conditions of the population as a result of the consumption of drinking water

The project to upgrade and expand the water supply system will create conditions for improving the lives of the recipient population by providing more efficient access to water supply services. The availability of quality water will help in reducing the incidence of waterborne diseases, increasing the welfare of local people. This will be a positive impact of the project and great motivation for its implementation.

To enhance this impact the MoW shall carry out campaigns to sensitize the population about the importance of using piped water. Also shall sensitize the population about the risks of using water from wells and streams that might be a source of waterborne diseases. Further shall consider applying subsidized rates for disadvantaged populations and shall ensure coordination to identify mechanisms to finance household connections.

9.7.4 Planned water supply and reliability of water supply system

The improvement and expansion of water supply system will enable greater responsiveness to the demand, increasing also the reliability of the operating system. The reliability of the system will allow adequate planning for water supplies.

9.7.5 Rural income improvement

Implementation of the proposed project will induce a commercially sustainable agriculture for improved income level for the household, and thus help in poverty reduction, which is the core socioeconomic problem in the area. Poverty is to be reduced through provision of reliable water, which apart from creating the condition for more production and intensification will also reduce the high risk in agricultural production.

9.7.6 Opportunities for skills acquisition

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

10 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

10.1 INTRODUCTION

The Environmental and Social Management Plan (ESMP) is presented below in table 10.1. This ESMP for the proposed Farkwa dam project aims to address the impacts associated with the proposed project. So, the following proposed environmental management measures are intended to strengthen the current plan. Based on the assessment undertaken as part of the ESIA, a series of mitigation measures have been identified which aim to reduce and / or eliminate the predicted impacts of the project. It is important that these mitigation measures are appropriately applied to the project mobilization, construction and operation, and this management plan provides a strategic framework for their implementation.

The Contractor shall implement components relevant to design, mobilization of materials and machines and actual construction. The estimated costs for implementing the mitigation measures are just indicative. Additionally, the ESMP include an estimate of the costs of the measures so that the project proponent can budget the necessary funds. Appropriate bills of quantities should clearly give the actual figures. In any case the consultant used informed judgment to come up with these figures.

10.1.1 Purpose of the ESMP

The purpose of the ESMP is to describe the measures that should be implemented by the Contractors and Ministry of Water during the implementation of the project to eliminate or reduce to acceptable levels key potential impacts and social and health impacts related to project activities. The specific measures set out in the ESMP must be fully adhered to by all the project parties. In particular the project must strive to avoid significant impacts on the bio-physical, socioeconomic, or health aspects during implementation. Avoidance through good detailed design of site specific works and through preparation of the detailed site specific contractor ESMPs will be key to success in this area. Where impacts cannot be avoided they must be mitigated against using appropriate measures. The ESMP has been developed:

- To bring the project to comply with Government of Tanzania applicable national environmental and social legal requirements social policies and procedures;
- To provide guidance on EHS issues as required by the AfDB EHS Guidelines
- To outline the mitigating/enhancing, monitoring, consultative and institutional measures required to prevent, minimise, mitigate or compensate for adverse environmental and social impacts, or to enhance the project beneficial impacts.
- To provide an operational reference and tool for environmental management during project rehabilitation and operation activities.

All contractual and legal obligations relating to the ESMP apply to the main Contractors and any Sub-Contractors appointed by them. It is the responsibility of the Construction Contractors to provide adequate resources to ensure effective implementation and control of the ESMP. The Sub-Contractor is responsible to its respective Contractor for compliance with the measures presented in the ESMP. It is also the responsibility of the Construction Contractors and their Sub-Contractors to ensure that all project staff is trained and procedures are understood and followed.

10.1.2 Key Players in Implementing the ESMP

In order to ensure the sound development and effective implementation of the ESMP, it will be necessary to identify and define the responsibilities and authority of the various persons and organisations that will be involved in the project. The following entities will be involved on the implementation of this ESMP:

- Funding Institutions
- Ministry of Water;
- Consultants;
- Contractor;
- The National Environmental Management Council (NEMC).

(f) Funding Institutions

The Government of the United Republic of Tanzania through the Ministry of Water will received financing from the International Bank for Reconstruction and International Development Association (IDA) toward the cost of Water Sector Development Program. The MoW intends to apply a portion of the funds to finance construction of the proposed project. The funding organization will have overarching responsibility to ensure that the Project is carried out to the highest environmental standards strictly in accordance with the ESIA and the mitigation measures set out therein. Additionally it is a requirement of the funding Institution that environmental and social impacts are managed in accordance with the AfDB Operational Guidelines.

(g) Project implementation unit at the Ministry of Water

The responsibility for ensuring that mitigation measures specified in this ESMP and the contract documents are implemented will lie with the MoW. The environmental monitoring staff / Environmental Field Officer (EFO) and a Health and Safety Officer (HSO) from MoW and if necessary, representatives from NEMC will undertake monitoring during construction and operation phases of the project. Aalso will be responsible to

- Monitor ESMP and EMP implementation and ensure adequate environmental and social mitigation measures are implemented based on requirement standards, including Contractors and sub-contractors
- Ensure adequate stakeholder engagement plan is being implemented throughout the project implementation and operation including effective grievance redress mechanisms
- Liaise with all key stakeholders at government and community level throughout the project

(h) Environmental Consultant

The appointed Environmental Consultant will be required to oversee the construction programme and construction activities performed by the Contractor, in compliance with the present ESMP. It is recommended that prior to commencement of actual construction; the Environmental Consultant should submit a work site plan that complies with the national environmental guidelines and an updated ESMP for the different phases of the work. The environmental plan should specify in particular the location of sources of materials, disposal area of construction debris and arrangements for traffic management. The plan should take into consideration the mitigation measures proposed in this ESIA Project Report. MoW

or Contractor should also appoint an Environmental Field Officer (EFO) and a Health and Safety Officer (HSO) or Consultant who will be responsible for the following tasks:

- Drafting environmental aspects during project implementation;
- Managing environmental and safety aspects at the work sites;
- S/He shall participate in the definition of the no working-areas;
- Recommending solutions for specific environmental problems;
- S/He shall facilitate the creation of liaison group with the stakeholders at the project site and shall monitor the compliance ESMP;
- Organising consultations at key stages of the project with the stakeholders and interested parties;
- S/He will be required to liaise with the MoW Environmental Management Unit or NEMC on the level of compliance with the ESMP achieved by the Contractor on a regular basis for the duration of the contract;
- Controlling and supervising the implementation of the ESMP;
- Preparing environmental progress or "audits" reports on the status of implementation of measures and management of work sites.

(i) The Contractor

The project will be implemented by Contractor and will be responsible for constructing the project in accordance with the Technical Specifications required. The Contractors will implement the project fully in accordance with the ESIA Mitigation measures. The Contractor will nominate an Environmental Site Officer (ESO) who will be the Contractor's focal point for all environmental matters. The ESO will be routinely on-site for the duration of the construction works.

(j) The National Environment Management Council

The National Environmental Management Council of Tanzania will play a key role in monitoring the project during the construction and operational phases to ensure that the mitigation measures set out in chapter 9 above are fully implemented.

(k) Local Government District Authorities

Chemba district has been showing commitment on implementation of different activities with respect to Farkwa dam project whereby Chemba District Council staffs were involved in awareness to local community within proposed project area on social economic importance of the project; during pre-feasibility and feasibility studies, during environmental and social impact assessment, during compensation to People Affected Project (PAPs) in Mombose and Bubutole villages and also during shifting of graves to Sankwaleto settlement planned area. The district will oversee and advice on implementation of the project, Monitor ESMP and EMP implementation and ensure adequate environmental and social mitigation measures are implemented based on requirement standards, including Contractors and sub-contractors

10.2 ENVIRONMENTAL AUDIT PROCEDURES

In complying with the requirements of the Environmental Management Act Cap 191 the project will conduct independent audits biannually and submit on annual basis, an environmental monitoring report. The annual report will review the performance of various environmental parameters. The MoW will also

ensure compliance with the audit requirements. Environmental auditing will seek to undertake the following, as its minimum requirements:

- Review all monitoring data and, if deemed warranted by the independent third-party auditor, undertaking an independent round of monitoring.
- Review various environmental reports compiled throughout the year.
- Review operations, inspect facilities and observe monitoring activities for purpose of assessing effectiveness of the Company's environmental management procedures, implementation and identifying potential improvements if deemed appropriate.
- Prepare an audit report complete with photographic record and recommendations.

The final audit report, together with monitoring data for the previous year, will be distributed to the Ministry of Water, the NEMC, and the Chemba District Council through the District Environmental Management Officer for review, guidance and comments. The summary of the key issues of the proposed project and their management are shown in Table 10.1 below.

Table 10.1: Environmental and Social Management Plan

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution	Estimated Costs (TZS)
Preparation/Mobilization phase	Loss of /disturbance of biodiversity (flora, fauna and ecosystem)	Clearing of vegetation shall be as minimal as possible so as to avoid much destruction of this natural, unique and small ecosystem. The Contractor shall clearly mark out the extent of clearing within the approved work-site and instruct all construction workers to restrict clearing to the marked areas and not to work outside defined work areas. The MoW shall help to afforest ate the area when the construction work is complete. The plant species including the endemic ones which will be cut down in the project site and their stock shall be reserved in the upstream and downstream areas.	Type, number, distribution etc. of species	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	5,000,000
	Deterioration/impairment of local air quality	During all mobilization related activities, air quality impacts from combustion sources (equipment emissions) shall be minimized through contracting new equipment or through routine inspection and maintenance of combustion emission sources (such as generators, diesel engines, equipment's). No vehicles or equipment to be used that generates excessive black smoke. Maintenance will ensure that equipment is operating efficiently and is not producing excessive emissions. Where practical, contractors will inspect machines and vehicles on delivery. Moreover, contractors will enforce vehicle load restrictions to avoid excess emissions from engine overloading.	$SO_{2:}$ -average 100 µg/Nm^3 (0.129mg/kg) for 24hour NO_2 : 150 µg/Nm^3 for 24-hours average value CO: 10mg/Nm^3 for 8 hours Black smoke PM_{10} : 40 to 60 µg/Nm^3 refer also table 6.4 above for TBS/WHO standards	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	6,000,000
	Nuisance and disturbance on/offsite	The contractor and project proponent shall ensure all plant, machinery and vehicles are fitted with appropriate mufflers, and that all mufflers and acoustic treatments are in good working order. Also shall ensure all plant, machinery	shall not exceed 75 dB(A)(peak readings), daytime	Contractor/ Environmental Consultants /	4,000,000

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution	Estimated Costs (TZS)
	receptors from noise pollution	and vehicles are regularly maintained and broken parts are replaced immediately. The contract shall ensure all plant, machinery and vehicles are operated efficiently and according to the manufacturers specifications, by trained and qualified operators; and development and implementation of appropriate safety measures.	or 55 dB(A) (peak readings) at night, No complaints from the local people	MoW/ CDC / NEMC	
	Dust pollution	Dust generating activities shall not be carried out during times of strong winds. Water shall be applied whenever dust emissions are visible at the site in consultation with the Project Supervisor. Vehicles delivering soil materials will be covered to reduce spills and windblown dust and vehicle speeds will be limited to minimize the generation of dust on site and haul routes. Any complaints received by the Contractor regarding dusts will be recorded and communicated to Project Supervisor.	$PM_{2.5}$ not to exceed 250 mg/Nm3 (peak readings),	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	5,000,000
	Depletion /degradation at points of source of construction materials	Construction materials will be from the authorized source only. These authorized dealers should have an EIA certificate and the Mining license from the Ministry of Energy and Minerals. The licensed suppliers who hold the EIA certificate and the Mining License comply with ILO labour conditions. Also restoration of the borrow pits/quarries after use constituting leveling the area and seeding or planting of trees and/or grasses will done in association with local government and local environmental NGOs.	Materials to be sourced in licensed area, No complaints from the local people.	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	5,000,000
	Erosion of the top soil and reservoir sedimentation	The MoW and contractor shall ensure that civil or earth work is done during dry season when there are no run off to reduce the impact severity. Temporarily shall bind exposed soil and redirect flows from heavy runoff areas that threaten to erode or result in substantial surface runoff to adjacent water courses. The contractor shall ensure that backfilling is done adequately, compacted, and the site restored. The earth used for backfilling shall be free from all roots, grass, shrubs, vegetation, trees, and rubbish.	No erosion tendencies	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	5,000,000
	Disruption of traffic flow during mobilization	The contractor shall employ drivers with authenticated class C licence and with a minimum of 3 years of driving after obtaining the class C licence. Transport routes to and from the project site will be agreed with government	As minimum disruption as possible	Contractor/ Environmental Consultants /	10,000,000

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution	Estimated Costs (TZS)
		agencies prior to commencement of the mobilization program. Traffic control measures (e.g. flagmen, appropriate lighting) will be deployed at the project site and strict speed controls will be implemented for all transport vehicles. Reporting mechanisms for the public to register concerns or complaints regarding perceived risks to their health and safety due to the mobilization activities will be established.		MoW/ CDC / NEMC	
Construction Phase	Disruption of the various users of the highway and road reserve	The pipeline route will be surveyed and clearly marked, and cleared of obstacles before starting trenching in a particular area. MoW/Contractor shall endeavour to obtain as much information as possible about underground services in the area (use maps) including: pipe lines, water mains, sewers, telephones, and power conduits, laid wires poles and guy wires, railways (Dodoma City), highways, bridges or other underground or above ground structures and/or properties crossing or adjacent to the pipeline trench being excavated. The blocking of roads and walkways shall be prepared in close co-operation with the local police traffic unit, and the respective conditions in the digging permission shall be observed.	As minimum disruption as possible	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	5,000,000
	Deteriorated / impairment of local air quality	The proponent is committed to implementing measures that shall reduce air quality impacts associated with construction. All personnel working on the project will be trained prior to starting construction on methods for minimizing air quality impacts during construction. Specific training will be focused on minimizing exhaust gas emissions from heavy construction vehicles. Construction vehicles drivers will be under strict instructions to minimize unnecessary trips, refill petrol fuel tanks in the afternoon, and minimize idling of engines. Also reduction of air emissions from exhausts shall be achieved by contracting new equipment or well serviced and maintained equipment.	SO_2: -average 100 µg/Nm^3 (0.129mg/kg) for 24hour NO_2 : 150 µg/Nm^3 for 24-hours average value CO: 10mg/Nm^3 for 8 hours Black smoke PM_{10} : 40 to 60 µg/Nm^3 refer also table 6.4 above for	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	5,000,000

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution	Estimated Costs (TZS)
			TBS/WHO standards		
	Noise pollution	Working hours and rules will be established based on the needs to reduce the noise causing nuisance and disturbance, especially by avoiding the cumulative effect of increased noise due to simultaneous operation of different kinds of construction machinery and equipment. Best practice procedures will be implemented in order to reduce construction noise. Also all equipment will be properly maintained, silenced where appropriate and operated to prevent excessive noise and switched off when not in use.	shall not exceed 75 dB(A)(peak readings), daytime or 55 dB(A) (peak readings) at night, No complaints from the local people	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	6,000,000
	Dust pollution	The batching plant/crushers shall be provided with appropriate dust control measures and be positioned such that the prevailing north-westerly wind does not carry dust fines downwind towards sensitive receptors. Dust emissions from the equipment shall also be controlled by closing all covers and screens and wetting down materials to be crushed. Likewise, dust emissions from this source whenever possible, will be mitigated by stabilizing pre-crushed material prior and after crushing.	$PM_{2.5}$ not to exceed 250 mg/Nm3 (peak readings),	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	5,000,000
	Increased soil and water pollution downstream	Good house-keeping shall be practiced within material storage compounds or vehicle maintenance yards where the possibility of spillage is great. Vertiver grasses may be used to control areas prone to erosion. Silt fences may be used to reduce suspended solids from surface water runoff. Proper storage of fuels and other chemicals shall be ensured. Machinery will be kept away from surface waters and will have drip trays installed beneath oil tanks / engines / gearboxes / hydraulics which will be checked and emptied regularly. Also the contractor will have a spill response plan, spill kits and trained personnel. The contractor will be required to maintain records and to remediate any spills of hazardous substances caused by the construction project.	Maximum 15 ppm for hydro-carbons No leakage /spillage of hydrocarbons	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	6,000,000
	Contamination/impaired quality of receiving body – land, water	An efficient collection and disposal system based on the principles of reduction; re-use and recycling of materials, shall be instituted at the project site. Instructions to contractor to put on his/her methodologies for handling	Adequate solid waste collection	Contractor/ Environmental Consultants /	5,000,000

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution	Estimated Costs (TZS)
	from construction wastes	hazardous waste such as oils, lubricants and non-combustible waste during bidding process. Also to reduce the cost of the project, much of the excavated soil and rubble materials will be reused as initial filling materials where leveling of project site is required. Cleared vegetation, top soil and rubble will be used to fill up any other infrastructures (roads, pits etc) that needs filling.	bins and sanitation facilities	MoW/ CDC / NEMC	
	Contamination of soil and ground water quality from the batching plant	Waste water generated from any concrete batching and pre-cast concrete casting plant activities of washing down mixer trucks, drum mixers and similar equipment shall, wherever possible, be recycled – wastewater discharge shall be kept at a minimum. Following silt removal and pH adjustment where necessary (to within pH range of 6-10), the surplus wastewater may be discharged into sewers or being transported by the cesspit trucks.	As minimum as possible	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	5,000,000
	Contamination of river waters from accidental spillages/discharges	Properly maintained and convenient toilet and shower facilities and waste disposal services shall be provided and clearly displayed in the project area; including wastewater collection. All toxic, hazardous and harmful materials (such as caustic and acidic substances, fuels, oils, drums, barrels and asphalt materials) will be stored away from any waterway, in banded areas with impervious bases and soak pits to contain accidental spills. The proponent shall minimize the stored quantities of diesel, oil, paint, thinners or other chemicals that pose environmental hazards and fit all drums and barrels with flow control taps and ensure proper labeling.	Maximum 15 ppm for hydro-carbons No leakage /spillage of hydrocarbons	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	4,000,000
	Soils damage/disturbance to surface and sub-surface organisms	The proponent will ensure proper demarcation of the project area to be affected by the construction works. This will be aimed at ensuring that any disturbance to flora and fauna is restricted to the actual project area and avoid spill over effects on the neighbouring areas. In the same vein, there will be strict control of construction vehicles to ensure that they operate only within the area to be disturbed by access routes and other works.	As minimum as possible	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	6,000,000
	Injuries to the general public due to road accidents	Traffic control measures (e.g. flagmen) will be deployed at all intersections of site access routes and main roads and strict speed controls will be implemented for all transport vehicles. The contactor shall install road bumps	No injury and sufficient no of road signs	Contractor/ Environmental Consultants /	5,000,000

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution	Estimated Costs (TZS)
		at regular intervals to limit speed of vehicles through the village and particularly at school crossings. The contractor shall employ drivers with authenticated class C licence and with a minimum of 3 years of driving after obtaining the class C licence.		MoW/ CDC / NEMC	
	Public health hazards / safety due to social interactions	The MoW and Contactor will devote time in raising awareness of the dangers of the HIV/AIDS within the project premises. Although basic knowledge of HIV/AIDS is high among Tanzanians, knowledge of self-protection measures and behaviour change will be provided and a preference will be given to those who are vulnerable and to empower women for they compose one of the most vulnerable groups. When the need arises MoW and Contractor will seek for professional assistance from organizations working in the field of public health and control of HIV/AIDS for instituting a health education and disease control programme at the workplace.	Tanzania AIDS/HIV Policy, No HIV/AIDS victims	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	8,000,000
	Health hazards associated with construction work	Accidents will be minimized through proper arrangements of construction tools and equipment, protecting or guarding the cutting edges, and awareness of the people including workers on the dangers and make them understand how to protect themselves and others. Further, MoW and contractor shall comply with relevant Tanzania (OSHA, 2003) and IFC's Performance Standards and regulations on health and safety requirements including the provision of PPE, registering the work place, submission of designed drawings of the work place for approval, observing reasonable working hours and good working conditions and facilities.	Tanzania OSHA 2003, Low risk to workers and no exposure	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	6,000,000
Operation Phase	Damage to the dam and conveyance system due to effects of natural factors and processes	The engineering design and construction of the dam shall ensure that the dam and conveyance system can withstand normal natural processes. The engineering design and construction shall ensure minimal disturbance to the natural terrain of the area. The hills upstream shall be left to act as natural barriers to contain the water in the project site. This will ensure that some parts of the project area will remain undisturbed to maintain natural scenery. The	Construction as per design specification	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	10,000,000

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution	Estimated Costs (TZS)
		spillway shall be properly designed to ensure that the dam capacity is not exceeded.			
	Sediment loads transported into the dam and degradation of water quality	The natural vegetation in the sides/neighborhoods of the project area shall be conserved whenever possible to minimize soil erosion. Compaction of embarkments shall be done to meet the recommended compaction in the design. Also the project proponent will plant tree around dam boundaries to compensate on tree losses as well as to minimize wind which is one of the factors for excessive evaporation	Turbidity 30 NTU, DO Less than 75% of saturation concentration	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	5,000,000
	Impacts on the downstream ecosystem due to delayed and reduced flow	The in-stream flow requirements to sustain the riverine ecosystem demands will fully be covered by the irrigation and livestock mitigation flows as the two are located downstream part of the river just before the Bahi swamp. However, a flow for the ecosystem to the Bahi swamp is considered independently of the later flows, as the irrigation and livestock mitigation flow are to be abstracted / consumed before reaching the Bahi swamp. Based on the study conducted to the Bahi drainage area (Appendix 10) and the discussions among the experts formed ESIA team, it was estimated that 10% of the natural flow of the Bubu River will contribute to the sustenance of the Bahi Swamp ecosystem and its associated ecological services (such as fishing). As it has been noted earlier the Bahi swamp is being contributed by a number of streams/rivers and precipitation, the latter being reported to account 60% of the total swamp water sources. The amount of water required to flow downstream of the Dam site in this case is the summation of the irrigation mitigation flow (27,812,505.6 m^3/year), livestock mitigation flow (381,901.5 m^3/year) and 10% of the natural flow of the Bubu River (14.79 MCM/year). The flow shall follow the natural regime of the river with exception of irrigation mitigation flow which will be confirmed within four months of irrigation period (i.e. from mid-December to mid-April). In this case the water from the Dam will only be released during wet season as per natural river flow condition.	Standard dam operational rules, water right user permit, No complains	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	5,000,000

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution	Estimated Costs (TZS)
	Reduced water quality due to pollution	Identify and promote appropriate latrine technologies within the catchment area. The MoW also may support Local Government Authority within the catchment area to establish and operate basic solid waste management systems. Further a training program shall be developed for farmers on precautionary measures required for the handling, labelling and application of agro-chemicals under field conditions. The training shall be incorporated in a farmer's field school curriculum. Extension workers shall also be able to deliver awareness program on the amounts and conditions for applying fertilizers and pesticides to prevent water pollution. Application of fertilizer during rainy season for example will lead to leaching.	Nitrate 30 mg/l, Lead 0.05 mg/l, Sulphate 600 mg/l, Turbidity 30 NTU, DO Less than 75% of saturation concentration; Maximum 15 ppm for hydro-carbons; +/- 0.5 from the pH baseline	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	6,000,000
	Impacts related with climate change	Climate change was considered in the dam design and no specific mitigation measures are recommended for the Farkwa dam in relation to climate change and hydrology. In times of low flows as a result of drought, the maintenance of the river ecological balance remains paramount and as such restrictions on water usage especially for irrigation downstream will be imposed. The situation shall be monitored closely so that appropriate measures can be taken to manage water resources at both local and sub-basin level.	As minimum as possible	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	4,000,000
	Change in local ecosystem /stimulate of vegetation growth/ change in species composition	Proper maintenance procedures especially within the dam shall be undertaken regularly to ensure that occurrence of water weeds is kept to a minimal. A detailed biological inventory of the plants and fauna species composition has to be conducted in area upstream and down-stream of the proposed project site. This will ascertain the species composition similarities and/or differences between the proposed project site and areas up/down stream.	Standard dam operational rules, water right user permit	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	5,000,000
	Human wildlife conflicts	In order to reduce the impact of wildlife migration to the river and to the dam the project proponent shall collaborate with the Chemba District Wildlife Office, Swagaswaga Game Reserve management, forest division and other relevant government agencies in managing wildlife; create buffer zones, providing	Standard dam operational rules, water right user permit, No conflict	Contractor/ Environmental Consultants /	3,000,000

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution	Estimated Costs (TZS)
		separate watering points for wildlife. Information, education and awareness programmes for local residents, especially children, with respect to wildlife and its protection.		MoW/ CDC / NEMC	
	Flooding hazards	The spillway shall be properly designed to ensure that the dam capacity is not exceeded. The proponent shall provide sluice valve for regulating levels in the dam and install a prior warning system against an increase of water within the dam. Also the engineering design and construction of the dam shall ensure that the dam can withstand normal natural processes.	As minimum as possible	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	4,000,000
	Contamination/impaired quality of soils and water from poorly controlled agricultural activities	This impact can be reversible if IPM approaches are undertaken or farmers are trained in techniques of agrochemical applications. A training program shall be developed for farmers on precautionary measures required for the handling, labelling and application of agro-chemicals under field conditions. The training shall be incorporated in a farmer's field school curriculum. Extension workers shall also be able to deliver awareness program on the amounts and conditions for applying fertilizers and pesticides to prevent water pollution. Application of fertilizer during rainy season for example will lead to leaching. The same applies for pesticides and herbicides. Agrochemical application shall only be done when it's not rainy to allow the chemicals to soak and not leach.	Dissolved phosphate (as P), *5* mg/l*, max*	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	
	Increased water and soil pollution	During the water treatment process, the flocculation method shall be used for the settling of the fine particles. The incorporated chemical catalyst will be the aluminium sulphate. This chemical product joins the resulting solid sediments, i.e., the sludge that results from the process. This sludge will be disposed of at a storage and dehydration site, with base protected by a plastic membrane. Also the MoW shall consider measures to prevent pollution of ground water while designing the sludge storage site.	Nitrate 30 mg/l, Lead 0.05 mg/l, Sulphate 600 mg/l, Turbidity 30 NTU, DO Less than 75% of saturation concentration; +/- 0.5 from the pH baseline	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	6,000,000
	Potential Negative Impacts				

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution	Estimated Costs (TZS)
	Relocation/resettlement of people, farms, properties and disruption of economic activities	MoW in collaboration with the local government authorities will work out/calculate the exact size and locations of the required land. Individuals with potential land acquisition issues shall then be subject to a comprehensive sensitization and consultation process. MoW will then initiate a land and property valuation and compensation process guided by relevant Tanzania laws. MoW shall effect compensation before the land is taken over. The affected people also shall be given ample time to find alternative land/plots for settlement and whenever appropriate the MoW will work with respective villages to assist the affected individual to acquire new land from the local government authorities and settle any dispute following existing laws and structures.	As per the provision of Land Act 1999 and O Involuntary Resettlement (OP 4.12)	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	5,000,000
	Increased conflicts over local water resources (communities downstream)	This requires the design to ensure that total closure of water is avoided by ensuring that irrigation mitigation flow (27,812,505.6 m3/year), livestock mitigation flow (381,901.5 m^3/year) and 10% of the natural flow of the Bubu River (14.79 MCM/year) is maintained in the river downstream. Further to prevent conflict between irrigation farming and livestock keeping downstream, extension services on improved livestock keeping that is more intensive than extensive shall be promoted. Practices such as keeping fewer but better breeds that are of more economic benefit shall be promoted. In addition, practices such as zero grazing shall be introduced to reduce land requirement for livestock keeping.	As minimum conflict as possible, no complaints from the local people	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	5,000,000
	Increase conflict with people living in the upper catchment	MoW shall involve communities in managing the upper catchment zone of the water sources. Discussions with relevant village leaders in the catchment zone shall be enhanced and deliberations implemented. Identification of NGOs, CBOs or other cultural groups, which would help in better managing of the catchment, shall be done. Provision of incentives and participation of development programmes in the villages can help to bring more understanding of the problem and can open up ways for getting better solutions. Monitoring programme in the catchment shall be established as	As minimum conflict as possible, no complaints from the local people	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	4,000,000

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution	Estimated Costs (TZS)
		means of providing information on its environmental performance. Also education on good farming methods and good sanitation practices shall be provided			
	Damage or loss of project structures due to anthropogenic activities	Marker (warning) tape shall be placed over the pipe but below the soil to warn future workers in the area that a water pipeline lies below to prevent being damaged. Proper documentation of the route detailing coordinates shall be done to ensure that it is possible to locate the route in future. The pipeline directly trenched in the ground shall be placed deep enough to provide adequate protection.	As minimum as possible	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	4,000,000
	Public health hazards due to Water-borne and water-related diseases	To mitigate these impacts the proponent shall employ disease vectors disruption techniques such as regulated reservoir operation to curb vectors for malaria and water borne diseases. Also shall encourage natural aquatic life that takes care of mosquito larva as part of the food chain. Whenever possible MoW will support on – going and new community health and safety programmes undertaken by Chemba District Council and Village leaders for community mobilization to control preventable communicable diseases and vectors through awareness and sensitization campaigns: e.g. use of mosquito bed nets, good hygiene practices, (construct and use toilets, boiling drinking water); chemical treatment of surface waters (dams).	As minimum as possible	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	5,000,000
	Increased population influx	The key to the reduction in immigration of people from other parts of the country that could negatively compete for employment opportunities with the local peoples is to implement a stringent recruitment policy. This will ensure that preference is to be given to existing members of communities, especially those from the local villages such as Farkwa, Gonga, Mombose and Bubutole. A skills audit could be undertaken and a register compiled of persons who have skills that could be used by the project. The contractor recruitment policy shall be communicated to the general public in advance.	As minimum as possible	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	4,000,000
	Danger of people drowning either	Awareness raising and education to the communities including posting banners and warning signs at appropriate places shall be provided to advise	As minimum as possible	Contractor/ Environmental	5,000,000

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution	Estimated Costs (TZS)
	intentionally or accidentally looms within the dam	farmers/villagers on proper use of the dam and by laws shall be enacted to protect the dam from those who would have wanted to use it carelessly.		Consultants / MoW/ CDC / NEMC	
	Conflicts among workers and the local population in the project area	In the dialogues of health and safety the contractor shall explain to workers about the importance of keeping a good relationship with local communities. Amongst the local workers shall be a group of community liaison, responsible for establishing communication between project staff and community, which will be particularly important in cases of complaint. Such elements shall be familiar with the project in general and being able to properly troubleshoot or forward any complaints/claims. Also set of rules for the workplace shall be established and implemented. The standards shall include, inter alia, the entry of persons outside the service and the prohibition of prostitution in the storage yards.	As minimum conflict as possible, no complaints from the local people	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	4,000,000
	Exposure to chemicals, hazardous or flammable materials	Chemicals, hazardous and flammables materials shall be secured, and stored accordingly. Procedures for handling hazardous materials must be in place. They must be locked and only authorized personnel can have access to the materials. MSDS must be available and specific PPE shall be provided and users should be trained. Appropriate mitigation measures for the transport of chlorine shall include careful selection of transport routes for chlorine; use of well-maintained storage and transport facilities for chlorine; training and instruction of transport staff about appropriate safety measures when transporting chlorine.	Tanzania OSHA 2003, Low risk to workers and no exposure	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	6,000,000
Decommissioning phase	Loss of vegetation cover and plant diversity	Use existing maintenance access roads and the pipeline maintenance access route to dismantle and transport the decommissioned material. If necessary only clear the minimum width of the route for dismantling operation. Experienced ecological advisors must be appointed and be present on each spread during construction activities to chase animals away and collecting and relocating sensitive species from the area, preventing them to be harmed. All personnel must be briefed on environmental sensitivities in the surrounding	Specific to project core area to be cleared	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	5,000,000

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution	Estimated Costs (TZS)
		area. Reinstatement to maintain habitat continuity as far as is practicable. At the commencement of works, the working width will be clearly delineated where it passes through environmental sensitive areas.			
	Contamination and impaired water quality	The contractor shall prevent any uncontrolled run-off to waters, especially during rainfall events or when spillages occur. Measures shall be taken to minimize the flow of leakages into trenches that may act as short cuts to the river waters. Channels and sand bags shall be provided on site so as to direct storm water to the proper containment/removal facilities. Demolished materials shall be kept within planned boundaries and with a clear separation distance from waters. If it is essential to stockpile materials close to the water, runoff control measures shall be implemented, such as excavation of a shallow water/sediment collection ditch around the boundaries of stockpiles to contain run-off water for a sufficient length of time to allow for settlement of solids.	Nitrate 30 mg/l, Lead 0.05 mg/l, Sulphate 600 mg/l, Turbidity 30 NTU, DO Less than 75% of saturation concentration; Maximum 15 ppm for hydro-carbons; +/- 0.5 from the pH baseline	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	10,000,000
	Loss of employments	The only major impact that will result when the project is decommissioned is loss of jobs. In order to minimize the impacts that may result from this eventuality MoW will ensure that all employees are members of the pension fund and will ensure that the contributions are made. Also will prepare workers for forced retirement by providing skills for self-employment, wise investment and will provide relevant skills to workers through on job training to make them marketable after decommission.	All employees covered	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	5,000,000
	Noise pollution	During decommissioning the contractor will coordinate activities that produce the most noise levels and portable barriers will be installed to shield compressors. Use of equipment designed with noise control elements will be adopted where necessary. Use of very noisy equipment will be limited to daytime only. All workers operating in noisy areas or operating noisy equipment will be provided with earpieces to protect against extreme noise. The demolition exercise will be limited at day time only. The contractor will further improve on the existing management of noise generation from	TBS and WHO standards noise emissions shall not exceed 75 dB(A)(peak readings), daytime or 55 dB(A) (peak readings) at night,	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	5,000,000

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution	Estimated Costs (TZS)
		equipment and staff to ensure that they comply with Tanzanian legislation at the time of decommissioning.			
	Dust and exhaust emissions	A site waste management plan will be prepared by the contractor prior to commencement of demolition works. All personnel working on the project will be trained prior to commencing the demolition exercise on methods for minimizing negative impacts on air quality. The contractor will douse the surface with water to suppress excessive dust and whenever possible, water sprinklers shall be used. Exposed demolition debris of e.g. dust and sand, will be enclosed, covered, and watered daily before transported to disposal site. Also the contractor will provide protective gear (i.e. breathing masks) to workers working in dusty environment.	To minimize dust emission. PM 2.5 not to exceed 250 mg/Nm3 (peak readings), No complaints from the local community	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	5,000,000
	Occupational health and public safety hazards	All workers will be sensitized before the exercise begins, on how to control accidents related to the demolition exercise. A comprehensive contingency plan will be prepared before demolition begins, on accident response. Adherence to safety procedures will be enforced at all stages of the exercise. All workers, pursuant to labour laws, shall be accordingly insured against accidents. All workers will be provided and instructed to wear protective clothing during demolition, including helmets. Demolition work will be limited to daytime only avoid workers accidents due to poor visibility.	OSHA 2003, Low risk to workers No exposure	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	4,000,000
	Enhancement measures for potential positive impacts				
	Employment/Income generation	From the start of the project the contractor during construction and the proponent shall strive to employ local community in most position. Training shall be provided where necessary to give basic understanding on some of the aspects of dam construction in order to increase the number of locals to be involved with the project. Salaries for the workers shall be over and above the government minimum wage.	As maximum as possible	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	4,000,000
	Benefit to local producers and	Where ever possible the project will procure materials from local sources. The use of locally available materials and labour for the proposed construction of	As maximum as possible	Contractor/ Environmental Consultants /	5,000,000

Phase	Potential Impacts	Management/Mitigation Measures	Target Level / Standard	Responsible Institution	Estimated Costs (TZS)
	suppliers of goods and services	Farkwa Dam will contribute towards growth of the economy by contributing to the gross domestic product.		MoW/ CDC / NEMC	
	Improvement of health conditions of the population as a result of the consumption of drinking water	The project to upgrade and expand the water supply system will create conditions for improving the lives of the recipient population by providing more efficient access to water supply services. The availability of quality water will help in reducing the incidence of waterborne diseases, increasing the welfare of local people. This will be a positive impact of the project and great motivation for its implementation.	As maximum as possible	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	5,000,000
	Planned water supply and reliability of water supply system	The improvement and expansion of water supply system will enable greater responsiveness to the demand, increasing also the reliability of the operating system. The reliability of the system will allow adequate planning for water supplies.	As maximum as possible	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	5,000,000
	Rural income improvement	Implementation of the proposed project will induce a commercially sustainable agriculture for improved income level for the household, and thus help in poverty reduction, which is the core socioeconomic problem in the area. Poverty is to be reduced through provision of reliable water, which apart from creating the condition for more production and intensification will also reduce the high risk in agricultural production.	As maximum as possible	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	5,000,000
	Opportunities for skills acquisition	This impact is high and of great importance and therefore it will be enhanced by ensuring there is skill transfer through an elaborate programme. Staff will be categorized and each group will be supervised by dedicated skilled personnel to ensure on job training. The proponent will encourage job on training through observation and trial under supervision	As maximum as possible	Contractor/ Environmental Consultants / MoW/ CDC / NEMC	4,000,000
				Total	**258,000,000**

11 ENVIRONMENTAL MONITORING PLAN

11.1 INTRODUCTION

The correct and successful implementation of impact mitigation measures in order to reduce adverse impacts on environmental conditions needs to be ensured by a proper monitoring programme. This chapter presents the Environmental and social monitoring plan (EMP) that will be carried out throughout the project implementation to mitigate the impacts and enhance the benefits of the project. The EMP outlines the specific actions that shall be undertaken to ensure that the Project complies with all applicable laws and regulations related to environmental impacts and impact mitigation. The EMP deals with all mitigation required for the physical, biological and socio-economic impacts and focuses on the impacts of higher significance as provided in table 10.1 above.

11.2 OBJECTIVES OF EMP

The EMP applies to, and will be implemented throughout, all phases of the project: mobilization, operation, and decommissioning. The objective of the EMP is to set out clearly the key components of environmental and socio-economic management for the proposed project and thereby ensure that the following concepts are realized throughout the mobilization, construction, operation, and decommissioning.

- negative impacts on the physical, biological and socio-economic environments are mitigated;
- benefits that will arise from the development of the proposed project are enhanced;
- support smooth implementation of project with minimum losses to environmental and social infrastructure;
- compliance and guided by National, International laws, standards and guidelines e.g. effluents standards, noise level standards, occupational and safety standards etc and best practice is achieved; and
- good will and good relations with communities, and governments at local and national levels are maintained.

11.3 MONITORING RESPONSIBILITY

Implementation of the EMP is the solely the responsibility of the project proponent. MoW shall supervise and monitor components of the monitoring plan and keep record of monitoring outcome. MoW has ability to provide the necessary supervisory oversight to ensure the mitigation measures are working and where they are not remedial measures are established. MoW is committed to protect, and will enhance the environment.

Detailed parameters to be monitored have been considered along with responsible institution (s). The MoW will endeavor to ensure that resources are available to implement the EMP throughout all phases of project development and decommissioning. The EMP will be subject to the principle of continuous improvement. The details of environmental issues, environmental impacts, proposed parameter to be monitored and timing agencies responsible for execution of proposed actions during mobilisation, construction, operation and decommissioning stages are presented in Tables 11.1 below.

Table 11.1: Environmental and Social Monitoring Plan

Phase	Potential Impacts	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring Method	Target Level / Standard	Responsible Institution	Estimated Costs -TZS
Preparation/Mobilization phase	Loss of /disturbance of biodiversity (flora, fauna and ecosystem)	Size of land cleared, number of trees planted, type of planted trees	Weekly inspection	Project area	M_2, Number of affected species	Site inspection, Visual observation	Type, number, distribution etc. of species	Contractor/ MoW	6,000,000
	Deterioration/impairment of local air quality	SO_2	Once a Month	Project site	Mg/l	Detector tubes	average 100 µg/Nm^3 (0.129mg/kg) for 24hour	Contractor/ MoW	5,000,000
		NO_2	Once a Month	Project site	Mg/l	Detector tubes	150 µg/Nm^3 for 24-hours average value		
		CO	Once a Month	Project site	ppm	Mini-Vol Sampler	10mg/Nm^3 for 8 hours		
		Black smoke PM_{10}	Once a Month	Project site	ppm	Mini-Vol Sampler	40 to 60 µg/Nm^3		
	Nuisance and disturbance on/offsite receptors from noise pollution	Noise level	Weekly checks	Transportation route, Project site	dBA	Noise level meter	shall not exceed 75 dB(A)(peak readings), daytime	Contractor/ MoW	4,000,000
	Air pollution due to dust	Dust level	Twice daily	Transportation route, Project site	µg/m^3	Dust level meter/ Mini-Vol Sampler	PM 2.5 not to exceed 250 mg/Nm3 (peak readings)	Contractor/ MoW	5,000,000
	Depletion /degradation at points of source of construction materials	Documentation on resource procurement practices	Weekly checks	Materials sourcing area	Affected resource	Visual observation	No degradation of local resources, no complaints from local people	Contractor/ MoW	5,000,000

Phase	Potential Impacts	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring Method	Target Level / Standard	Responsible Institution	Estimated Costs -TZS
	Erosion of the top soil and reservoir sedimentation	Visible erosion	Daily for quarries and borrow pits & at least weekly else where	project site – borrow pits and quarries	Level of erosions – visible erosion	Site inspection, visual observation	No erosion tendencies	Contractor/ MoW	5,000,000
	Disruption of traffic flow during mobilization	Traffic control measures in place	Weekly checks	Transportation routes and project area	Number and duration of disruption	Visual inspection	As minimum disruption as possible	Contractor/ MoW	10,000,000
Construction Phase	Disruption of the various users of the highway and road reserve	Traffic control measures in place	Weekly checks	Conveyance routes and project area	Number and duration of disruption	Visual inspection	As minimum disruption as possible	Contractor/ MoW	5,000,000
	Deteriorated / impairment of local air quality	SO_2	Once a Month	Project site	Mg/l	Detector tubes	average 100 µg/Nm^3 (0.129mg/kg) for 24hour	Contractor/ MoW	5,000,000
		NO_2	Once a Month	Project site	Mg/l	Detector tubes	150 µg/Nm^3 for 24-hours average value		
		CO	Once a Month	Project site	ppm	Mini-Vol Sampler	10mg/Nm^3 for 8 hours		
		Black smoke PM_{10}	Once a Month	Project site	ppm	Mini-Vol Sampler	40 to 60 µg/Nm^3		
	Noise pollution	Noise levels, sound abatement measures in place	Weekly inspections	Concrete batching plant area	dBA	Noise level meter	shall not exceed 75 dB(A) daytime or 55 dB(A) at night,	Contractor/ MoW	6,000,000
	Air pollution due to dust	Dust level	Weekly checks	Transportation route, project site	µg/m^3	Dust level meter/ Mini-Vol Sampler	PM 2.5 not to exceed 250 mg/Nm3 (peak readings)	Contractor/ MoW	5,000,000

Phase	Potential Impacts	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring Method	Target Level / Standard	Responsible Institution	Estimated Costs -TZS
	Increased soil and water pollution downstream	Fuel and hazardous material storage areas, plant, machinery, re-fuelling & delivery areas	Weekly inspections	Project area	mg/l	Sampling and analysis(Spectrophotometer)	Maximum 15 ppm for hydro-carbons No leakage /spillage of hydrocarbons	Contractor/ MoW	6,000,000
	Contamination/impaired quality of receiving body – land, water from construction wastes	BOD, TSS; signs of floating wastes at river; management records	Weekly inspections	Project area	types of waste	Visual inspection	Less complaints from neighboring communities	Contractor/ MoW	5,000,000
	Contamination of soil and ground water quality from the batching plant	Water turbidity	Once per week	project area	NTU	Sampling and analysis (Spectrophotometer)	< 25 NTU	Contractor/ MoW	5,000,000
		Total Solids	Once per week		mg/L	Drying and Weighing	As minimum disturbance as possible		
		pH	Once per week	project area		pH meter	6.5-9.2		
	Contamination of river waters from accidental spillages/discharges	Fuel and hazardous material storage areas, plant, machinery, re-fuelling & delivery areas	Weekly inspections	Project area	mg/l	Sampling and analysis(Spectrophotometer)	Maximum 15 ppm for hydro-carbons No leakage /spillage of hydrocarbons	Contractor/ MoW	4,000,000
	Soils damage/disturbance	Impacted habitats / Species	Continuously	project area	Type/quantity/area of fauna/ flora	Visual inspection	As minimum disturbance as possible	Contractor/ MoW	6,000,000

Phase	Potential Impacts	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring Method	Target Level / Standard	Responsible Institution	Estimated Costs -TZS
	to surface and sub-surface organisms								
	Injuries to the general public due to road accidents	Traffic control measures in place	Weekly checks	Transportation route, project site	Number and duration of disruption	Visual inspection	As minimum disruption as possible	Contractor/ MoW	5,000,000
	Public health hazards / safety due to social interactions	Incidence of medical reports of HIV/AIDS or other disease,	Every 3months	Project records	Number of people infected	HIV blood tests and surveys	Tanzania AIDS/HIV Policy, No HIV/AIDS victims	Contractor/ MoW	10,000,000
	Health hazards associated with construction work	Registered worker Injury /illness, Proper use PPE	Continuously	Project area	Number of cases, PPE users	Medical records, and site inspection	OSHA 2003, Low risk to workers, No exposure	Contractor/ MoW	6,000,000
Operation Phase	Damage to the dam and conveyance system due to effects of natural factors and processes	Construction workmanship Certificate of works	Every month	Project area	Presence of cracks	site inspection	Construction as per design specification	MoW	10,000,000
	Sediment loads transported into the dam and degradation of water quality	Water turbidity	Once per week	Dam site	NTU	Sampling and analysis (Spectrophotometer)	< 25 NTU	MoW	5,000,000
		Total Solids	Once per week	Dam site	mg/L	Drying and Weighing	As minimum disturbance as possible		
		pH	Once per week	Dam site		pH meter	6.5-9.2		
	Impacts on the downstream ecosystem due to delayed and reduced flow	Flow rate downstream	Every month	Dam site	m^3/day	V- Notch Weirs, Frequencies of conflicts	Standard dam operational rules, water right user permit, No complains	MoW	5,000,000

Phase	Potential Impacts	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring Method	Target Level / Standard	Responsible Institution	Estimated Costs -TZS
	Reduced water quality due to pollution	Nitrate	Once per day	Dam site, all water sources at the quarry and access road	mg/l	Sampling and analysis	30	MoW	6,000,000
		Lead	Once per day		mg/l	Sampling and analysis (AAS)	0.05		
		Sulphate	Once per day		mg/l	Sampling and analysis	600		
		Turbidity	Once per day		NTU	Sampling and analysis	< 25 NTU		
		pH	Once per-day		mg/l	pH Meter	+/- 0.5 from the baseline		
		DO	Twice per day		mg/l	DO meter	Less than 75% of saturation concentration		
	Impacts related with climate change	Performance of the dam, Water levels	Every month	Project area	None	Visual and site inspection,	As minimum as possible	MoW	4,000,000
	Change in local ecosystem /stimulate of vegetation growth/ change in species composition	Species diversity	Once after one year of commissioning	Project area	m2, number of affected species	Visual observation and area computation	Standard dam operational rules, water right user permit	MoW	5,000,000
	Human wildlife conflicts	Reported conflicts	Every month	Project area	frequencies of conflicts	Reported complains, Visual observation	Conflict kept as minimum as possible	MoW	3,000,000
	Flooding hazards	Performance of the dam, Water levels	Every month	Project area	None	Visual and site inspection,	No crack in the foundation	MoW	4,000,000

Phase	Potential Impacts	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring Method	Target Level / Standard	Responsible Institution	Estimated Costs -TZS
	Contamination/impaired quality of soils and water from poorly controlled agricultural activities	Water quality – chemical content (of known chemicals and fertilisers), Soil contamination	Once every six months	Dam site	Mg/l ppm	Sampling and analysis (Spectrophotometer)	TBS standard, Dissolved phosphate (as P), *5* mg/l*, max*	MoW	5,000,000
	Increased water and soil pollution	Water quality – sediments, silt, turbidity	Once every six months	Dam site	NTU	Sampling and analysis	< 25 NTU	MoW	6,000,000
	Potential negative impacts								
	Relocation/resettlement of people, farms, properties and disruption of economic activities	Number of affected people	Once before construction	Project site	Numbers	RAP, Reported complains, Visual observation	As per the provision of Land Act 1999	MoW	5,000,000
	Increased conflicts over local water resources (communities downstream)	Reported conflicts	Every month	Project area	Frequencies of conflicts	Visual inspection and interview with local communities	Conflict kept as minimum as possible / No complaints from the local people	MoW	5,000,000
	Increase conflict with people living in the upper catchment	Reported conflicts	Every month	Project area	Frequencies of conflicts	inspection and interview with local communities	Conflict kept as minimum as possible / No complaints from the local people	MoW	4,000,000
	Damage or loss of project structures due to anthropogenic activities	Affected structures	Once after construction	Dam site	None	Visual inspection	As minimum as possible	MoW	4,000,000
	Public health hazards due to Water-borne and	Prevalence of water-borne diseases	Once every year	Health Centre	Number of Patients	Medical reports	No or minimum incidences of water	MoW	5,000,000

Phase	Potential Impacts	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring Method	Target Level / Standard	Responsible Institution	Estimated Costs -TZS
	water-related diseases				and types of ailments		borne and water related diseases		
	Increased population influx	Number of people	Once every six months	Report files	Numbers	Visual observation	As minimum as possible	MoW	4,000,000
	Danger of people drowning either intentionally or accidentally looms within the dam	Number of people drowning, awareness program in place	Continuously	Project area	Number of cases / injuries	Medical records, and site inspection	Low risk to people No exposure	MoW	5,000,000
	Conflicts among workers and the local population in the project area	Reported conflicts	once every six months	Project site	Numbers	Numbers	Conflict to be kept as minimum as possible	MoW	4,000,000
	Exposure to chemicals, hazardous or flammable materials	Water quality – chemical content, Reported exposure	Once every six months	Down stream	Mg/l ppm	TBS standard	Tanzania OSHA 2003, Low risk to workers and no exposure	MoW	6,000,000
Decommissioning phase	Loss of vegetation cover and plant diversity	Flora diversity	Once before construction	Dam site upstream and down stream	Numbers and names	Site inspection, survey,	IUCN list CITES list	Contractor/ MoW	5,000,000
	Contamination and impaired water quality	Nitrate	Once per day	Dam site	mg/l	Sampling and analysis	30	Contractor/ MoW Designated Environment Officer	10,000,000
		Lead	Once per day		mg/l	Sampling and analysis (AAS)	0.05		
		Sulphate	Once per day		mg/l	Sampling and analysis	600		
		Turbidity	Once per day		NTU	Sampling and analysis	< 25 NTU		
		pH	Once per day		mg/l	pH Meter	+/- 0.5 from the baseline		

Phase	Potential Impacts	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring Method	Target Level / Standard	Responsible Institution	Estimated Costs -TZS
		DO	Twice per day		mg/l	DO meter	Less than 75% of saturation concentration		
	Loss of employments	Pension fund remittance	Once every year	Project site	Employees registered for pension fund	Workers register book	All workers	Contractor/ MoW	5,000,000
	Noise pollution	Noise level	During decommissioning	Project Site	dBA	Noise level meter	noise emissions shall not exceed 75 dB(A)(peak readings), daytime or 55 dB(A) (peak readings) at night,	Contractor/ MoW Designated Environment Officer	5,000,000
	Dust and exhaust emissions	Suspended solids in air	During decommissioning	Project Site	$\mu g/m^3$	Dust level meter	PM 2.5 not to exceed 250 mg/Nm3 (peak readings), No complaints from the local community	Contractor/ MoW Designated Environment Officer	5,000,000
	Occupational health and public safety hazards	Registered worker Injury / illness, Proper use PPE	Monthly	Work sites	Number of cases/injuries, workers using PPE	Medical records, and site inspection	OSHA 2003, Low risk to workers, No exposure	Contractor / MoW Designated Environment Officer	4,000,000
	Enhancement measures for potential positive impacts								
	Employment/Income generation	Local people employed and training conducted	Continuously during operation	Project records	Numbers of local people employed	Numbers of local people employed	As maximum as possible	Contractor/ MoW	4,000,000
	Benefit to local producers and	Procurement records	Continuously during operation	Project records	Amount	Amount	As maximum as possible	Contractor/ MoW	5,000,000

Phase	Potential Impacts	Parameter to be monitored	Monitoring Frequency	Monitoring Area	Measurement Units	Measuring Method	Target Level / Standard	Responsible Institution	Estimated Costs -TZS
	suppliers of goods and services								
	Improvement of health conditions of the population as a result of the consumption of drinking water	Health conditions within project area	Monthly	Work sites	Number of cases	Medical records, and site inspection	More improvement of health conditions of the population	MoW	5,000,000
	Planned water supply and reliability of water supply system	Water supply	First year of operation	Project records	Water provided	M^3	As maximum as possible	MoW	5,000,000
	Rural income improvement	Income of local people	Continuously during operation	Project records	Amount	Amount	As maximum as possible	MoW	5,000,000
	Opportunities for skills acquisition	Local people trained	Continuously during operation	Project records	Numbers of local people employed	Numbers of local people trained	As maximum as possible	MoW	4,000,000
								Total	**265,000,000**

12 COST BENEFIT ANALYSIS

12.1 FINANCIAL EVALUATION

The economic analysis for the establishing Farkwa Dam and the conveyance system was conducted during feasibility study to evaluate whether establishing the Dam will yield economic and social benefit to the project proponent and communities in Dodoma Region.

12.2 METHODOLOGY

12.2.1 Analysis Indicator

The aim of the analysis is to calculate the Net Present Value (NPV) and the Internal Rate of Return (IRR) in order to evaluate the profitability of the project.

- The Net Present Value is estimated as the difference between total benefit and project's total cost discounted at the same date. It is derived as summed discounted benefits less sum discounted costs.
- The Internal Rate of Return can be defined as the rate at which the Net Present Value of the net benefit stream in financial terms becomes zero. Thus, it is the rate that equates project's discount financial benefits to discounted financial costs.

The normal cost of capital in the water sector in Tanzania is known to range from 8 to 15%. This parameter was used as reference for the analysis, which was carried out as follows:

- Firstly the Net Present Value was calculated for both discount rates 8% and 15%;
- Secondly the price of water was computed on the basis of a fixed IRR. The computation was made for two IRR values: 8 and 15%, to cover the normal range.

12.2.2 Parameters and Assumptions

The framework of the analysis is set by the selection of the following parameters and assumptions

a. Project revenues and costs are estimated and projected over the period 2014 -2034.
b. Costs and revenues used in the analysis were based on price level in year 2014 at the corresponding exchange rate of Tshs 1,600 to USD 1.
c. The base year for discounting is 2014 and a discount rate of 8% was used in line with similar water supply projects in the country financed by the government.
d. Useful life of assets for the purpose of calculating residual value has been taken to be 40 years for civil works and for pipes and fittings is 20 years.
e. The incremental projection of the operation and maintenance costs was based on a fixed proportion of the investment costs. Civil works, pipes and buildings were estimated to represent 0.5% of the investments costs per year and hydro-electrical and mechanical components to represent 0.5% of the investment costs per year. It represents 10% of the construction cost for 20 years.
f. Taxes on investment and maintenance materials were not considered in the present analysis.

12.3 COST ESTIMATE

A cost estimate was prepared during the feasibility study for the project infrastructures (dam, conveyance system and others). Cost estimates for the social and environmental impacts mitigation, land valuation and others are also presented here below.

12.3.1 Infrastructure Cost

The dam cost is estimated at **38.6 MUSD** for the recommended option (composite RCC and earthfill Main Dam, FLS 1,110m), including the cost for operations and maintenance estimated at **2.6 MUSD**. The dam cost without the operations and maintenance cost is therefore estimated at **31.6 MUSD**.

The conveyance system cost is estimated at **175 MUSD**, including the cost for operations and maintenance estimated at **15 MUSD**. The conveyance system cost without the operations and maintenance cost is therefore estimated at **160 MUSD**. A provision of **16 MUSD** is providing in order to anticipate the increase of the conveyance system cost due to the addition of 3 districts (increase in water demand).

The treatment plant cost is estimated at **33 MUSD**, including the cost for operations and maintenance estimated at **3 MUSD**.

These later costs include costs related to access roads but not the cost related to the power supply to the dam site. The total infrastructures cost is therefore estimated at **222 MUSD** without the operation and maintenance costs, which are estimated at **20.5 MUS**.

12.3.2 Social and Environmental Cost Estimates

12.3.2.1 Environmental and Social Mitigation Costs

The cost benefit analysis of the project has been performed under the feasibility study by Tractebel Engineering S.A. The environmental and social mitigation costs were estimated to **12.7 MUSD**. The costs of all the pollution control equipment, operation and maintenance of that equipment's and the procurement of the monitoring equipment are included in the project cost. Other cost to be incurred by the project proponent are as detailed under the environmental management and monitoring plans.

12.3.2.2. Land Valuation Cost

As part of the feasibility study, a land valuation study was carried out and is documented in a separate report. The Market Value of identified property within the project area was estimated to Tshs15,935,538,781, which corresponds to **10.0 MUSD**.

12.3.3 Cost of Studies and Construction Supervision

A provision of **20 MUSD** was used to take into account the cost related to the engineering studies and construction supervision. This estimate corresponds to approximately 10% of the infrastructures costs, which is assessed as relevant at this stage of the study.

12.3.4. Capital Cost

The capital cost is computed after compilation of the costs documented in the previous paragraphs. All those costs will occur during the design and construction phase of the project. The cost for operation and maintenance is analysed separately as it corresponds to the post-construction phase. The capital cost is estimated to **284.7 MUSD** as per the breakdown given here below.

Table 12.1: Capital Cost Breakdown

Item	Cost (MUSD)
Infrastructure	112
Dam	(36)
Conveyance system and associated civil works	(160.0)
Provision due to water demand revision	(16)
Treatment Plant	30
Environmental and social mitigation	12.7
Land Valuation cost	10.0
Construction Studies and Supervision	20.0
Total	**284.7**

12.4 INCOMES

12.4.1 Incomes from Water

12.4.1.1 Water Demand

A water demand assessment was carried out to estimate the water demand in 2034. The net water demand is estimated to 105,022 m^3 per day in 2034. The domestic and industrial demands represent over 90% of the total demand. These two demands were estimated on the basis of an estimate of the present demand and an annual increase rate of 2.4%. The water demand was therefore modelled over the 2014-2034 period covered by the present analysis with for parameters:

- A total water demand in 2034 of 105,022 m3 per day
- A annual increase rate of 2.4% over the period of 2014-2034
- A total water demand in 2014 of 64,600 m3 per day

12.4.1.2 Water Price

In the present analysis the water unit cost is the output as explained in the methodology paragraph. It is calculated for IRR of 8 and 15%, the two end values of the normal range.

12.4.1.3 Water Sales (Income)

The water sales are calculated as the water demand multiplied by the unit cost of water. The water sales were foreseen to start during the fourth year of construction after commissioning of the conveyance system.

12.4.2 Other Incomes

A provision of 0.5% of the water sale was made to account for other incomes.

12.4.3 Residual Value of Asset (RVA)

As indicated in the paragraph on the analysis main assumptions, useful life of assets for the purpose of calculating residual value was taken to be 40 years for civil works and 20 years for the conveyance system. It was assumed for the purpose of the present analysis the conveyance system was foreseen to be operated during 17 years. The Residual Value of the Asset (RVA) was calculated as follows:

- For the dam : RVA = (40-17)/40 * Investment cost
- For the pipe : RVA = (20-17)/20 * Investment cost

The total RVA is estimated to 51.6 MUS as detailed below.

Table 12.2: Residual Value of Asset (RVA)

	Residual Value of Asset
Dam RVA	20.7 MUSD
Pipe RVA	30.9 MUSD
Total	**51.6 MUSD**

12.5 FINANCIAL ANALYSIS

12.5.1 Net Present Value (NPV)

The normal cost of capital in the water sector in Tanzania is known to range from 8 to 15%. The Net Present Value was therefore calculated for the two ends of the range i.e. 8 and 15%. In order to calculate the inflows water cost was fixed at USD 0.4 according to the "Ministry of Water and Irrigation Water Sector Status Report 2009", dated of February 2010.

- At a discount rate of 8%, NPV is negative USD – 145,659,460;
- At a discount rate of 15%, NPV is negative USD – 155,416,967.

The net present value is negative, it indicates that when the cost of capital is between 8 and 15% (normal cost of capital in the water sector in Tanzania) and for a water cost of USD 0.4 (actual water cost in Dodoma), the project would make losses because the cut off rate at which total PV of inflows equals total PV of outflows is less than 8%.

12.5.2 Internal Rate of Return (IRR)

The Internal Rate of Return (IRR) is a tool to measure the profitability of a project. The IRR of an investment is the discount rate at which the net present value of costs (negative cash flows) of the investment equals the net present value of the benefits (positive cash flows) of the investment. The aim of this paragraph is to calculate the unit water price in order to have an IRR between 8% and 15%. The results of the analysis are as follows:

- The Unit cost of water is estimated to 1.09 USD/m3 for an IRR of 8%
- The Unit cost of water is estimated to 1.81 USD/m3 for an IRR of 15%

The computed price of water is therefore ranging from 1.09 to 1.81 USD per m3 for an IRR of 8 to 15% respectively. These results appear to be higher than the water prices used in the country, which averaged 0.34 USD/m3 in 2010 as documented hereafter. The willingness to pay is far lower than these prices and thus the government will need to continue to subsidize for the long term operation of the project (Feasibility Study, Interim Report N°2, 2014).

12.6 ENVIRONMENTAL COST BENEFIT ANALYSIS

Environmental cost benefit analysis is assessed in terms of the negative versus positive impacts. Furthermore, the analysis is considering whether the impacts can be mitigated and if the costs of this are reasonable. As it has been mentioned in Chapters 6 – 9, the potential benefits of the project, in terms of financial and social benefit are substantial. The environmental impacts can be mitigated and the financial resources needed to mitigate negative impacts, when compared to the required investment, are relatively small.

12.7 SOCIAL ECONOMIC COST BENEFIT ANALYSIS

Availability of reliable water supply to Chemba District and Dodoma City as a Capital City in Tanzania is expected to accelerate social economic development. There are several governmental initiatives such as the attraction of foreign and local investors to Tanzania which cannot be realized without reliable water supply. If reliable water is established, one should expect more investments to be established and thus create employment for the local communities. Generally a major positive impact of this project is that will meet the requirements of the “right to potable water to people” as provided in the Water Supply and Sanitation Act, 2009 (Act No. 12/2009) and the National Water Policy 2002. These rights are also protected by the Millennium Development Goals (Goal 7), of which Tanzania is a signatory.

13 DECOMMISSIONING PLAN

13.1 INTRODUCTION

This is a preliminary decommissioning plan. This plan establishes feasible decommissioning schemes that can be accomplished without undue risk to the health and safety of the public and decommissioning personnel, without adverse effects on the environment, and within established guides and limits of the appropriate regulatory agencies. This preliminary plan will serve to ensure that the decommissioning and ultimate dispositions of proposed dam and its components are considered during the initial design of the project implementation. The preliminary plan will remain a "living document," and revisions will be made throughout the operating life of the dam and its components. It must be reviewed periodically and revised to reflect any changes in the project or operation that might affect decommissioning. Prior to the initiation of actual decommissioning activities for a dam and its components, a detailed final disposition plan will be prepared.

The final plan should be based on the preliminary plan and revisions, and will define specific work activities and include safety evaluations of planned decommissioning methods, new technology, and the dam and its components status that will result from the decommissioning program. In addition, this plan must contain sufficient information to obtain any approvals needed from the appropriate regulatory agencies to proceed with decommissioning activities.

13.2 AIM OF THE PRELIMINARY PLAN

The preliminary plan serves to establish decommissioning as an important consideration from the inception of the project, during design and throughout the operation of the project. The plan has the following purposes:

a) The primary purpose of the preliminary plan is to ensure that proposed Farkwa dam project designers are cognizant of decommissioning during the design of the project. Thus, where design choices that would enhance decommissioning are available for types of materials and system components, and location of components, these choices shall be made.
b) Another purpose of the preliminary plan is to identity the ultimate decommissioning options and final project status. These options would be evaluated and narrowed to the decommissioning method of choice as the end of Farkwa dam project life is approached.
c) The final purpose of the preliminary plan is to demonstrate to regulatory agencies that important aspects of decommissioning are considered as early as possible during the design of the project. The plan serves as the starting point to demonstrate that areas such as decommissioning methods, costs, schedules, and operating impact on decommissioning will be reviewed and refined throughout the operating life of the Farkwa dam.

13.3 CONTENT OF THE PRELIMINARY

The preliminary plan provides a general description of decommissioning methods considered feasible for the Farkwa dam project. The description is intended to demonstrate that the methods considered are practical and that they protect the health and safety of the public and decommissioning personnel. Design personnel should study the proposed decommissioning methods and take steps to ensure that the design incorporates features that will facilitate decommissioning. Considerations include:

a) An estimate of manpower, materials, and costs anticipated to support decommissioning.
b) A description of the anticipated final disposition and status of the project equipment and site.
c) A discussion demonstrating that adequate financing will be programmed for decommissioning.
d) Identification of records that should be maintained during construction and operation which might facilitate decommissioning, including a set of “as built” drawings.

13.4 DEMOBILIZATION OF THE PROJECT

Upon completion of the Contract Work, the contractor shall remove all of its tools, materials and other articles from the construction area. Shall the contractor fail to take prompt action to this end, the MoW, at their option and without waiver of such other rights as it may have, upon sixty (60) calendar days-notice, may treat such items as abandoned property. The contractor shall also clean areas where he worked, remove foreign materials and debris resulting from the contracted work and shall maintain the site in a clean, orderly and safe condition.

Materials and equipment shall be removed from the site as soon as they are no longer necessary to minimize the demobilization work after completion of the project. Before the final inspection, the site shall be cleared of equipment, unused materials and rubbish so as to present a satisfactory clean and neat appearance.

All the camp sites will be built as temporary structures and these will also include the use of movable structures such as movable containers. All the temporary structures built outside the project affected area that can be beneficial to the community shall be left to the local government for other uses in the area.

13.5 PROJECT DECOMMISSIONING METHODOLOGY AND SCHEDULE

MoW shall fund and implement all aspects of project decommissioning, including but not limited to, all engineering, environmental assessment, permitting, construction, and mitigation activities associated with the removal of the structures, in accordance with this plan and mitigation of project removal impacts on site. MoW shall monitor environmental impacts during and after project removal to respond to defined events during the monitoring phase.

1. Decommissioning will involve, but not limited to the specified list, because some issues or problems may surface during subsequent monitoring and audits:

    a) The dam and its associated infrastructure will continuously be rehabilitated and renovated. While doing that there will be solid wastes which will be disposed of according to the EMP.

    b) Moreover during decommissioning the dam and conveyance system will be demolished accordingly to suit the new activity while doing that the rubble will be disposed of according to the directions of the District Council’s directives.

2. Employees will be terminated from their employments and to them the future will look blunt. Three things will be observed: their contributions to the pension fund will be made monthly as required by law; a training programme will be made to continuously advance them into apt skills and professions; and the termination benefits including transport and disturbance allowances will be made.

3. On decommissioning the MoW will search for experts' opinions in order to convert the entire area into another or other uses.

4. The restoration plan for the entire area will be made by MoW (with expertise from environmentalists and economists) and then forwarded to NEMC for approval.

5. Also MoW shall obtain all permits required to undertake decommissioning of the Project. This basically will include Pension Fund, Bahi District Council, Chemba District Council and Dodoma Municipal Council etc.

Project removal will begin six months after closure and continue for twelve months. Within the six months from closure, MoW will inventories all components that need to be removed and or disposed of. This inventory will include dam and conveyance structures, equipment etc. to be demolished/dismantled. Also mode of disposal will have to be finalized. This information will assist in the preparation of the final decommissioning plan, for approval by NEMC.

After the approval of the decommissioning plan the metal parts will be removed first within the first three months (this is important to ensure that they are not vandalized). The second three months of the decommissioning will be used to remove concrete structures and foundations. Debris will be used as road fills for rural roads. All disturbed areas will be landscaped and re-vegetated using indigenous trees.

Project decommissioning has five phases: (1) pre-removal monitoring; (2) permitting; (3) interim protective measures; (4) Project removal and associated protective actions; and (5) post-removal activities, including monitoring of environment and socio economic activities.

The first three phases will occur prior to removal of the project (i.e. within the first six months). The fourth phase — project removal and associated protective actions — will take place twelve months after closing business. The fifth phase will begin after total removal and continue for at least one year. The description that follows outlines the activities that will occur in each phase:

(1) Pre-removal monitoring: Pre-removal monitoring includes environmental and socio economic status of the project site and the surrounding. This monitoring is essential to identify if there is any environmental or social liability which need to be settled before the permit for closure is given. This period will also be used to inventories all assets and facilities that need to be disposed of and to prepare a final decommissioning plan for approval by NEMC.

(2) Permitting: MoW shall obtain all permits required to undertake removal of the Project. This basically will include NEMC, Pension Fund, and District Councils etc.

(3) Interim Protective Actions: This will take care of any interim protective measure that needs to be implemented to protect human health and environment, if any.

(4) Project Removal: As noted above, the removal of the project will be completed within twelve months.

(5) Post-Removal Activities: Post-Project removal monitoring will continue for one year

14 INSTITUTIONAL CAPACITIES AND STRENGTHENING PLAN

14.1 INSTITUTIONAL ARRANGEMENTS FOR THE PROJECT

The construction of the proposed Farkwa Dam and Water Conveyance to Chemba and Dodoma City will require an effective institutional and management arrangement in order to ensure achievement of the intended benefits. Also the successful implementation of this ESIA recommendations depends on the commitment and capacity of various institutions and stakeholders to implement the recommendations effectively. Thus, the arrangement as well as the roles and responsibilities of the institutions and persons that will be involved in the implementation monitoring and review of the ESIA recommendations are discussed below.

14.1.1 Ministry of Water

The Ministry of Water is the overall overseer of all water projects in the country and is responsible for enacting various policies, laws, strategies, regulations and guidelines on the implementation of water projects and the provision of water and sanitation services in the country. Moreover, this particular project will be of great interest as it combines the resources under all four core divisions in the Ministry i.e. Water Resources; Urban Water Supply and Sanitation; Rural water supply and sanitation and Water quality Management. During the construction and post construction phases, the Ministry is expected to play an important role in ensuring that the design criteria are met and that proper operating and monitoring are carried out. The Ministry is also a key actor in the implementation and coordination of training and capacity building initiatives, which will have for aim to ensure efficient management of the project assets.

The Ministry has an overarching responsibility to ensure that the proposed project is carried out to the highest environmental standards strictly in accordance with the ESIA and the mitigation measures set out therein. The Ministry of Water will be supporting the ESIA and ESMP process. Will take over use, management and maintenance after the contract has been completed. Their responsibilities include:

- Monitor ESMP and EMP implementation and ensure adequate environmental and social mitigation measures are implemented based on requirement standards, including Contractors and sub-contractors
- Ensure adequate stakeholder engagement plan is being implemented throughout the project implementation and operation including effective grievance redress mechanisms
- Liaise with all key stakeholders at government and community level throughout the project

14.1.2 Dodoma Urban Water Supply and Sanitation Authority

Dodoma Urban Water Supply and Sanitation Authority (DUWASA) is an autonomous water utility in charge of the water supply and sewerage disposal services to urban residents of Dodoma City. DUWASA was established under the Act, section 3 (i) of the Laws of Tanzania Cap 272 of 1997 as repealed by Water Supply and Sanitation Act No.5 of 2019. Being classified as a category “A” urban water Authority in Tanzania, DUWASA is required to cover at full cost its operations and maintenance including part of its investment costs.

Following the Water Supply and Sanitation Act No.5 of 2019 which repealed the Water Works Ordinance, 1972 (Cap 272), DUWASA is required to deal with all sanitation services including wastes from pit latrines,

septic tanks and solid wastes which were previously taken care by the Municipal authority. DUWASA operates under the Board of Directors and the day-to-day activities of the Authority are managed by a Managing Director, assisted by three Heads of departments and five Heads of Units. The construction of the proposed project is expected to improve the water supply services situation in the City. DUWASA is thus having experience of managing production of water from distant source. For that reason, it is recommended that DUWASA should own, operate and maintain the Dam and Water Conveyance.As the foreseen asset owner and operator, DUWASA will have to perform the following functions:

- Operate and maintain the dam;
- Carry out safety inspection of the dam;
- Run the treatment plant and undertake or supervise all maintenance worksthereafter.
- Maintain the monitoring and quality assurance for the service delivery.
- Implement all recommendation or conditions attached to the environmentalcertificate of the project
- Carry out statutory environmental monitoring pertaining to the performance of the specific mitigations measures contained in the project
- Report the environmental monitoring results to NEMC

14.1.3 Consulting Engineer (CE)

The MOW will engage a Consulting Engineer (CE) to supervise the project construction and ensure that all environmental requirements are met on behalf of the proponents. The Consulting Engineer will ensure that all environmental mitigation is properly implemented and will carry out routine inspections and audits of the Contractors activities. The CE will act as the interface between the Contractors and MOW in relation to contract implementation and implementation of the mitigation under the ESMP. The CE will also review the detailed site specific contractor ESMPs together with MOW.

14.1.4 The National Environmental Management Council (NEMC)

The National Environmental Management Council of Tanzania will play a key role in monitoring the project during the construction and operational phases to ensure that the mitigation measures set out in this report are fully implemented. Specifically, NEMC is responsible for enforcement, compliance, review and monitoring of the EIA during the construction and operational phases. It prepares and submits bi-annual reports on the implementation of the provisions set out in the Environment Management Act.

In respect to this project it has a specific role of monitoring and ensuring that the mitigation measures are fully implemented. It will ensure that its District staff are fully trained and equipped to carry out its monitoring role. It will review the results of any monitoring and reports generated as part of the project implementation phase and will issue directives based on the monitoring activities to ensure full compliance with the mitigation measures required and to address any issues that may arise. NEMC may engage the services of independent experts to assist them in evaluating the monitoring information and any associated reports.

14.1.5 Contractors

The project will be implemented by Contractors (CC) under and Engineer, Procure Supply and Construct Contract. The Contractors will be responsible for constructing the Project in accordance with the Technical Specifications required. Based on their proposed construction method they will draw up detailed site-specific contractor ESMPs as required. These will be issued to the CE for approval and must be approved

before any construction commences. The Contractors will implement the project fully in accordance with the ESIA Mitigation measures, "this ESMP" and the detailed site-specific contractor ESMP approved by the Consulting Engineer (CE). Each Contractor will nominate a Site Environmental Management Officer (SEMO) who will be the Contractor's focal point for all environmental matters. The SEMO will be routinely on-site for the duration of the construction works.

SEMOs may be appropriately briefed technical officers (e.g. the CC site engineer). The SEMO carries out regular inspections of the CC activities in relation to environmental issues, and provides day-to-day advice to Contractor personnel about environmental issues. They will also liaise with technical experts assigned as part of the project implementation required to be present during cable laying operations.

14.1.6 CE Roles and Responsibilities

The Consulting Engineer (CE) will be responsible for monitoring, reviewing and verifying compliance with the ESMP by the Construction Contractors. In addition, the CE will be responsible for ensuring that mitigation and compensation measures developed in the ESIA are implemented by the Contractor where applicable. The CE will evaluate any detailed site-specific contractor ESMP prepared by the Contractors and shall recommend their implementation, either as prepared or with recommended changes, to MOW. The CE will monitor the implementation of the ESMP and any detailed site specific contractor ESMP, supplemented by additional staff if required. The CE will also ensure compliance (as per the construction contract). The CE duties in this regard, include the following:

- checking CC equipment complies with the contract specifications regarding environmental standards;
- issuing or refusing the final Environmental Compliance Certificate (post construction audit) to the Construction Contractor;
- taking decisions in case of severe non-compliances to the ESMP or detailed site specific contractor ESMP are detected
- providing input for ongoing internal review of the ESMP or detailed site-specific contractor ESMP;
- stopping works in case of emergency or if significant environmental impact is apparent or imminent.
- maintaining records of issues and corrective actions

The CE ensures the CC has all plans, procedures, approvals, and documentation in place to ensure ESMP and detailed site-specific contractor ESMP compliance prior to commencement of any work. The CE duties here include the following:

- supervising preparation and maintenance of the ESMP and detailed site-specific contractor ESMP;
- monitoring and verifying that the ESMP and detailed site-specific contractor ESMP guidelines are adhered to at all times and taking action if the specifications are not followed;
- monitoring and verifying that environmental impacts are kept to a minimum;
- reporting on the environmental issues;
- reporting on social issues
- recommending the issuing of penalties for contraventions of the ESMP and detailed site-specific contractor ESMP;
- recommending to stop work in emergencies or if significant environmental impacts are apparent or imminent;
- completing post-construction audit;
- preparing the background information for the Quarterly ESMP Report;

- participating, upon request in meetings with interested or affected parties as requested by the proponent;
- Liaison with NEMC as applicable.

14.1.7 Contractor roles and responsibilities

The Contractors have responsibility to undertake the construction of the project strictly in accordance with the Contract Specifications and Conditions and in accordance with the requirements of this report and any subsequent detailed site-specific contractor ESMPs developed. The Contractors must ensure that all mitigation measures described in the ESIA will be fully implemented and also any additional mitigation proposed by the Contractors resulting from the detailed site-specific contractors ESMPs. The Contractor must ensure that any monitoring identified as being the Contractors responsibility must be fully implemented and the results of such monitoring or any Reports generated are submitted to the relevant authorities (CE, NEMC). Should environmental or social issues arise during the construction period the Contractor shall propose measures to overcome these and shall comply with any additional requirements imposed by the NEMC.

The Contractor will ensure that the Site Environmental Management Officer (SEMO) staff is fully trained in environmental issues and fully aware of the possible impacts the construction could have and the mitigation measures proposed.

Specifically, each Contractor shall appoint two SEMOs, one for Environmental Management and one for Social Management. Each SEMO has the responsibility of observing construction activities and ensuring that those activities are in compliance with the ESMP requirements from the CCs side and that mitigation measures are strictly adhered to. To accomplish this, each SEMO should be familiar with the ESMP this ESMP, any detailed site-specific contractor ESMPs developed by the Contractors and the contract specifications. The SEMO will also be responsible for ensuring that the Contractors' activities are fully in compliance with "the ESMP" and the detailed site-specific contractor ESMP.

The specific responsibilities of the SEMO are to monitor implementation of environmental mitigation measures by CC construction staff against contractual obligations by

- detecting non-conformance and approving corrective action (with advice from CE if necessary); and identifying circumstances requiring management decisions to evaluate variance or compliance issues. Also will interface with CE to assist in field interpretation of environmental requirements,
- provide advice regarding corrective actions and resolving non-compliance situations, and issue specific formal instructions to the CC workforce;
- Interface with CC manager to help communicate requirements, obtain a hands-on view of special problems so that implementation difficulties can be communicated to the CE to aid in problem resolution especially in situations where adjustment of compliance requirements may be necessary;
- Maintain records of issues and corrective actions taken Regular communicate to CE by monthly reports.
- Ensure that all training programmes are attended by Employees and maintain a Register of such training.

14.2 OTHER KEY INSTITUTIONS

14.2.1 CHEMBA - Rural Water Supply and Sanitation Agency (RUWASA)

The Water Supply and Sanitation Act No.5 of 2019, among other things, established the Rural Water Supply and Sanitation Agency (RUWASA) which took over mandates that were previously vested to PO-RALG, Regional Secretariats (RSs) and Local Government Authorities (LGAs). The transferred mandates involve ensuring the provision of water services to rural communities, small towns and district headquarters. The Water Supply and Sanitation Act No.5 of 2019 has also transferred accountability of officers responsible for water service provisions from PO-RALG, RSs and LGAs to the Ministry of Water. The newly established Agency (RUWASA) has offices at Headquarters, Regional and District levels as opposed to previous structure which compose of office at LGAâ ™s level and RSs.

The RUWASA Chemba District Offices under the District Manager will be the key implementer of the proposed project in Chemba District. In addition, this office will play a principle role in building the capacity of CBWSOs to enable sustainable service delivery.

14.2.2 Local Government District Authorities

The layout of the proposed project cuts across the area of jurisdiction of three LGA namely Chemba district Council and Bahi district Council and the Dodoma City Council. These entities have mandates and interest on the welfare of the people of their respective areas and provide the overall oversight for implementation and monitoring of development programmes in their respective areas. The Water Supply and Sanitation Act, 2019 empowers the District Councils to regulate the activities of COWSOs.

14.2.3 The Energy and Water Utilities Regulatory Authority

The Energy and Water Utilities Regulatory Authority (EWURA) is an autonomous multi-sectoral regulatory authority established by the Energy and Water Utilities Regulatory Authority Act, Cap 414 of the laws of Tanzania. It is responsible for technical and economic regulation of the electricity, petroleum, natural gas and water sectors in Tanzania pursuant to Cap 414 of the laws of Tanzania and sector legislation. The functions of EWURA include among others, licensing, tariff review, monitoring performance and standards of Water Authorities with regards to quality, safety, health and environment. EWURA is also responsible for promoting effective competition and economic efficiency, protecting the interests of consumers and promoting the availability of regulated services to all consumers including low income, rural and disadvantaged consumers in the regulated sectors.

14.2.4 Villages likely to be affected by the proposed project

Various rural villages will be affected by the project. these include villages located within the dam reservoir, which will have to resettle in another area; villages within the vicinity of the Bahi Swamp, which are relying on the river flow for economic activities; villages located along the conveyance pipelines, which establishment will be impacted on during the construction phase and potentially the post-construction phase. The villages downstream, in the Bahi watershed, which depend on water from the Bubu River, are facing uncertainty about the availability of enough water after the construction of the proposed Farkwa dam. Villagers in these areas need to share and participate in implementing the proposed environmental mitigation measures to address the downstream effects. Existing Bahi Irrigation Schemes, which depend

for their water of the Bubu River and future entities to be established in the area, will have to participate fully in the environmental monitoring programmes to address the impacts.

14.3 CAPACITY BUILDING AND INSTITUTIONAL STRENGTHENING

Capacity building is the long-term, voluntary process of increasing the ability of an institution to identify and solve its own problems and risks, and to maximize its opportunities. DUWASA is experienced in operating and managing distant ground water source including long water conveyance. Farkwa Dam, Water Treatment Plant, and Water Conveyance System to Chemba and Dodoma City will constitute the second distant site for water production. Unlike the current water source, the new source will involve operation and management of a dam for which the authority does not have experience. Therefore, DUWASA requires capacity building in the operation and management of the dam and the treatment plant to be constructed close to the dam. DUWASA will use its experience of operating and managing the current long water conveyance to operate and manage the new one.

Also DUWASA will need to recruit additional staff to operate and maintain the dam, treatment plant and the water conveyance. In addition, the new employed staff and the current staff to be assigned duties in operating the new facilities will require capacity building and training. Operation and maintenance staff are expected to require tailored training. The following basic training modules are suggested as a first advice.

Table 14.1: Suggested Training Modules for DUWASA Staff

Training Module	Training Institution
Operations and maintenance of dam and pumping station	On the job-training with contractor of the facilities
Distant learning on Operation, Maintenance, Surveillance and dam safety Programmes	ASDSO info@damsafety.org.
Operation and maintenance of the conveyance system	On the job-training with DUWASA

The ASDOSO is a web-based seminar as Distance Learning Program conducted by Association of State Dam Safety Officials at a fee of USD 100 per person.

Relevant staff within the concerned Ministries and regulatory bodies are also expected to benefit from tailored training, such as training on Safety surveillance of the dam and Environmental mitigation measures. Further, rural villages will be affected by the implementation of the project. The communities of those villages should be informed on the project through social programs. These programs will have to be tailored to the communities needs raised from the implementation of the project.

15 GRIEVANCE REDRESS MECHANISM

15.1 INTRODUCTION

The proposed the construction of Farkwa Dam and Water Conveyance System to Chemba and Dodoma City project is anticipated to impact both directly and indirectly, positively and negatively on communities in the project area. These impacts can potentially affect the lives of people living and working in these communities, thus giving rise to grievances. These potential grievances may relate to any aspect of the project. They might be felt and expressed by a variety of parties including individuals, groups, communities, entities, or other parties affected or likely to be affected by the social or environmental impacts of the project. To address the environmental and social impacts related to the project, the MOW commissioned TRES Consult (T) Limited (Registered Environmental Consultancy Firm) to carry on the ESIA for the project. The Environmental Management Act, Cap 191 and the Environmental Impact Assessment and Environmental Audit Regulation, G.N. No 349 of 2005 were observed in the ESIA study. The Environmental Impact Assessment certificate with application number 2225 and registration number EC/EIS/2333 was issued to MOW on 09th March 2016.

Despite that the ESIA document was developed for the project, large-scale development projects such as the construction of Farkwa Dam and Water Conveyance System to Chemba and Dodoma City represent dramatic change for communities. While change may lead to opportunity for some, it may put others at risk, despite project efforts to be socially and environmentally responsible, and despite genuine attempts to engage communities and create project safeguards. Risk and change work hand in hand to create conditions where community conflicts arise. To manage the potential grievances related to any aspect of the project, to enable community members to raise concerns about possible negative impacts and to give MOW the opportunity to address those concerns, MOW develop this Grievance Mechanism. This grievance mechanism also ensures MOW alignment with international best practices in stakeholder engagement.

15.2 PURPOSE

This document is to outline the requirements for designing and implementing an appropriately tailored site Grievance Management and Resolution Procedure, or “Grievance Mechanism” for short. It also outlines the Ministry of Water approach to accepting, assessing, resolving and monitoring grievances from those affected by proposed project. The purpose of a Grievance Mechanism document is to manage complaints and grievances from communities and other local stakeholders in a systematic, fair, timely and transparent manner in order to promote mutual confidence and trust. A Grievance Mechanism also provide the site with information about stakeholder issues and concerns and serves as an early warning mechanism that addresses issues before they become more difficult and more costly- to resolve. Timely redress or resolution of such grievances is vital to ensure successful implementation of the project

Grievances can encompass minor concerns as well as serious or long-term issues. They might be felt and expressed by a variety of parties including individuals, groups, communities, entities, or other parties affected or likely to be affected by the social or environmental impacts of the project. It is essential to have a robust and credible mechanism to systematically handle and resolve any complaints that might arise in order that they do not escalate and present a risk to operations or the reputation of the MOW (nationally or internationally). If well-handled, an effective grievance mechanism can help foster positive relationships and build trust with stakeholders.

This Grievance Mechanism has been considered in parallel to the Stakeholder Engagement Plan (SEP) due to the inter-relationship between these two planning mechanisms. It has been designed to meet the legal requirements of Tanzania laws and regulations and the requirements of the International Finance Corporation (IFC) in relation to grievance management. The mechanism for addressing employee grievances is not addressed through this mechanism which is solely to manage the interface with external stakeholders.

15.3 SCOPE

This grievance mechanism will be applied to stakeholder complaints and grievances, perceived or actual which relate to the activities of the MOW and its contractors' undertaken in relation to the proposed construction of Farkwa Dam and Water Conveyance System to Chemba and Dodoma City project. A complaint or grievance is an issue, concern, problem, or claim (perceived or actual) that an individual stakeholder or community group has related to MOW and its contractors' operations and activities.

This grievance mechanism focuses on communities and other stakeholders and does not incorporate employee-related grievances, which should be addressed through the relevant department at the MOW and other channels. However, the procedure should cover other related grievances from employees or contractors who live in the community. It is intended that both collective and individual community grievances could be resolved through this process. Grievances of a more collective nature and shared by large numbers of the community may be better addressed through a different process such as open public meetings to discuss and collectively resolve the specific issue. However, where a grievance is formally lodged by collective community members, the site must follow the process it established in the site-level grievance procedure.

15.4 ROLES AND RESPONSIBILITIES

15.4.1 Knowledge of the Standard

This Grievance Mechanism provides guidance to all MOW employees and contractors on receiving, registering, assessing and resolving community complaints or grievances emanating from the project's operations and activities. The fundamental objective of this mechanism is to:

- Provide a predictable, transparent, and credible process to all parties for resolving grievances, resulting in outcomes that are seen as fair, effective, and lasting;
- Build trust as an integral component of broader community relations activities; and
- Enable more systematic identification of emerging issues and trends, facilitating corrective action and pre-emptive engagement.

15.4.2 Values during implementation and operation of the system

To maximise the effectiveness of the Grievance Mechanism, MOW shall uphold the following values during implementation and operation of the system:

- Commitment to fairness in both process and outcomes;
- Freedom from reprisal for all involved parties – within MOW and in the external stakeholder group;
- Clear operating rules, and accountability;

- Validity of all complaints submitted;
- Culturally accessible and applicable;
- Accessible to vulnerable groups of stakeholders;
- Confidentiality if requested.

15.4.3 Review

The Designated Grievance Officer; Community Relations Officer; and Environmental Officer will periodically review this Grievance Mechanism at a minimum of one year in close consultation with the Project Coordinator at the Ministry of Water.

15.4.4 Key Responsibilities

It is important that responsibility to resolve grievances is clearly defined through an appropriate organisational structure and accountability framework. In addition, those responsible for the implementation and management of the mechanism must ensure that departments and/or individuals implicated in a complaint or grievance are informed and involved in the review and subsequent resolution of the grievance.

Table 15.1: Key Responsibilities

SN	Title or Position	Key Responsibility
1.	Project Coordinator	• The Project Coordinator is responsible for site compliance with this Grievance Mechanism. • Approves the site's Grievance Mechanism and associated financial administrative processes, • Assigns responsibility to other staffs to ensure grievances within their area are resolved as per the grievance mechanism document. • Ensures that environmental department implicated in the complaint/grievance provide a timely grievance review outcome to the Grievance Officer.
2.	Community Relations Officer	• Implementation of this grievance mechanism • Establishing a site grievance mechanism, and document a site-level grievance management procedure. • In coordination with the Project Coordinator, determine the scope or mandate for the designated Grievance Officer to resolve grievances based on a first assessment. • Ensuring external stakeholders are involved in the design and development of the site grievance mechanism. • Assigning resources to ensure the process defined in this Procedure is effectively managed. • Together with the SHE officer reviewing the effectiveness of the site's grievance mechanism annually.
3.	Grievance Officer	• Implement the Grievance Mechanism procedure and management system providing guidance on solutions to complaints and grievances in consultation with the relevant departments and ensure consistency of redress for all grievances received in relation to the MOW project.

		• Promote the Grievance Mechanism to maintain momentum and ensure project wide and community commitment to, and understanding of, its implementation and operation. • Involvement in the investigation of grievances and the agreement of redress as well as overseeing interaction between various MOW Departments and contractors as well as the senior official as required. • Supporting the site Community Relation Office in the development of a site grievance mechanism based on this grievance mechanism. • Overall management of the Grievance Mechanism including: - Informing communities how to access the mechanism - Conducting first level review - Keeping complainants informed of the status of any lodged complaints. - Tracking and reporting on grievances - Running the Complaint/Grievance System.
4.	Heads of Department	• Receive and acknowledge any issue, concern, complaint or grievance from the community, verbally or in writing. Recording the issue and report it to the Grievance Officer in compliance with the Grievance Mechanism procedure. • Involvement in the investigation of grievances as required depending on the nature and severity of the grievance and as directed by the Grievance Committee. • Assigning responsibility for grievance review/investigation to the Nominated Person within the department. • Ensuring grievances related to the department are resolved.
5.	Nominated Person	• Conducting the grievance review upon request of the Project Coordinator, Head of Department and the Grievance Officer and proposing a resolution to the Grievance Officer in a timely manner. • Assisting with keeping complainants informed of the status of any lodged complaints.
6.	Grievance Committee	• Facilitating an independent review and resolution. This could include a standing committee which meets regularly or an ad hoc committee which meets only when necessary.
7.	Ministry Legal Officer	• Providing required timely legal advice and assistance on matters having legal implications forwarded by the Grievance Officer. • Overseeing application of the third order grievance resolution mechanism. • With site management, closing out cases presented by the Grievance Officer as unresolvable. • Monitoring, managing and escalating Human Rights related Grievances.

15.5 PUBLICIZING THE GRIEVANCE MECHANISM

MOW will proactively communicate the details of the Grievance Mechanism to stakeholders to raise awareness and offer transparency of how stakeholders can voice their grievances. This will include information about where people can go and who they can talk to if they have a grievance. This information shall be widely and regularly publicized, throughout the duration of the public consultation exercise, through meetings and the distribution of fliers.

MOW will provide the information in a format and languages that are readily understandable by the local population and/or orally in areas where literacy levels are low during routine stakeholder engagement. Notification will include:

- A summary of the Grievance Mechanism and how it can/should be used;
- Details of the process, such as who is responsible for receiving and responding to grievances, and any external parties that can receive grievances from communities;
- When stakeholders can expect a response, and
- Safeguards in place to ensure confidentiality.

MOW will communicate this grievance mechanism via brochure and during stakeholder meetings or engagements with Village Administrators, local government and community members. A handout / brochure will be provided in Swahili language with information about the grievance mechanism and contact details. During the notification process, MOW will solicit feedback on how the grievance mechanism could be improved. This information will be taken into consideration when revising this procedure.

15.6 EFFECTIVENESS CRITERIA

The Guiding Principles have suggested a set of eight effectiveness criteria applicable to project operational-level grievance mechanism. The criteria ensure that a grievance mechanism is effective if it is: (i) Legitimate, (ii) Accessible, (iii) Predictable, (iv) Equitable, (v) Transparent, (vi) Rights-compatible, (vii) A source of continuous learning and (viii) Based on engagement and dialogue.

15.6.1 Legitimate

Legitimacy stems from the recognition of a grievance mechanism as valid by its users and its acceptance and use as the regular channel to raise grievances or concerns. This implies that users trust the mechanism and its outcomes. Stakeholders must view the mechanism as legitimate and trust that it is accountable. The mechanism should also be empowering and responsive by ensuring that all complainants are understood and treated respectfully and with sensitivity irrespective of their perceived authenticity. It is important that relevant eligibility criteria are defined early on for acceptance of complaints and grievances and for escalating complaints from one order to another.

15.6.2 Accessible

The mechanism should be easily approachable, used and understood by any stakeholder who wishes to raise a concern, regardless of language, gender, disability, literacy level or any other issue that may impede affected stakeholders to access remedy. It is important that the mechanism is straight forward and easy for community members (who may be adversely impacted) to access with no cost meaning that communities should face no obstacle using the mechanism. It should be easily understood, written in non-jargon, local language, and easy for aggrieved people to lodge a complaint with us.

The mechanism should be appropriately publicized through culturally appropriate channels, external processes (community meetings, radio, newspapers, leaflets, etc.) and routine stakeholder engagement processes. Consideration should be given to allow different ways of making complaints and adapt these to the local culture, helping to overcome barriers people may face in accessing the mechanism, including language, literacy, awareness, distance or fear of retribution or reprisal.

15.6.3 Predictable

The mechanism must be predictable providing a clear and known timeframe for each stage and clarity on the types of process and outcome available and means of monitoring implementation. Users should be able to understand what to expect from the process (the steps, the timeline, which types of grievances are within the scope of the mechanism, the contact points in the MOW) and that the mechanism is not founded on, or subject to, individual preferences or interests within the project. Having a formal process also enables monitoring by any stakeholder at any stage.

15.6.4 Equitable

The mechanism should ensure that aggrieved parties have reasonable access to sources and information, advice and expertise needed to engage in a grievance process on fair, informed and respectful terms. The equitability principle seeks to redress real or perceived imbalances by placing responsibility on the MOW to help level the playing field. This particularly applies to vulnerable groups and women.

15.6.5 Transparency

Grievance mechanisms should find a balance between issues that are strictly confidential and those that can be shared openly. All parties to a grievance should be informed about its progress, and providing sufficient information about the mechanism's performance to build confidence in its effectiveness and meet any public interest at stake. The key elements of outcomes must have sufficient transparency to meet stakeholder concerns and expectations.

15.6.6 Rights-Compatible

A grievance mechanism is rights-compatible when its process and outcomes are respectful of internationally recognized human rights and when it enables the exercise of rights of individuals or groups without affecting the rights of others. The mechanism should ensure that the outcomes and remedies accord with internationally recognized human rights.

15.6.7 Continuous Improvement

The mechanism should draw on relevant measures to identify lessons for improving the mechanism and preventing future grievances and harms. Implementing a grievance mechanism is not a static process. Based on the records of the complaints received and resolved, the mechanism is evaluated and monitored, and lessons are drawn on a regular basis. These lessons become valuable inputs not only for improving the functioning of the mechanism but also for adjusting MOW policies and practice more broadly.

15.6.8 Based on Engagement and Dialogue

Engagement and dialogue are at the core of an effective operational-level grievance mechanism. Engaging and effectively using dialogue implies much more than meeting with the complainant to collect information. Wherever possible communities and other stakeholders should be involved in the design of the mechanism to ensure it is acceptable, respectful of local cultural norms and inclusive of local/customary decision making processes. This may be particularly important in societies where we operate that have a distinct segregation of roles and responsibilities, gender imbalances, hierarchical

leadership, and also where indigenous peoples reside. Engagement also takes place throughout the process of reviewing and resolving complaints and grievances as the site undertakes dialogue with the complainant and affected stakeholders.

15.7 GRIEVANCE MECHANISM PROCESS

15.7.1 Administration

The Project Coordinator will administer the grievance mechanism at MOW by providing resources to Grievance Officer to handle correspondence, coordinate internal resolutions, manage a log, and report (both internally and externally). Grievance Officer will need to liaise with, support, and work with other work groups in order to be able to formulate a solution and response. The approval process for external correspondence and reporting will be important to ensure that communication is consistent with the MOW 's policies and approved key messages.

15.7.2 Receive and Register Grievance

All grievances shall be logged using the Stakeholder Grievance Notification Form (Appendix 24). MOW will log, document and track all grievances received within the Grievance Database system. If the complainant cannot complete the Stakeholder Grievance Notification Form, the Grievance Officer or a representative of the Grievance Officer must complete the form on their behalf. The Grievance Officer must read and explain what has been recorded to the complainant to confirm the complaint or grievance has been recorded properly. Where the grievance has been received by someone other than the Grievance Officer, all forms must be handed over to the Grievance Officer within 24 hours of being presented or as soon as is practicable.

The Grievance Officer must provide a response and act in accordance with this Grievance Mechanism, explaining to the complainant the expected process and timeline for further review. The Grievance Officer must enter the details of the complaint/grievance into the Grievance Register or System within 24 hours of the complaint/grievance being lodged with the Grievance Officer. It is important that all details are sought from the complainant for the grievance to be effectively resolved.

If the grievance is urgent and requires immediate attention, the complainant must be directed to the Grievance Officer and the Project Coordinator must be notified. These include environmental, safety issues or security related human rights complaints. Grievances shall be assigned a case number and records of communication/consultation shall all be attached with the relevant entry and filed. The database shall be monitored regularly for recurring grievances so that appropriate mitigation can be developed.

15.7.3 Acknowledging Receipt of a Grievance

The Grievance Officer will formally acknowledge receipt of any grievance as soon as possible, but up to seven days from the date it was submitted and shall inform the complainant about the timeframe in which a response can be expected. The Grievance Acknowledgement Receipt Form (Appendix 25) must have a reference number, and a phone number or alternative mechanism to contact the MOW and include a commitment from the project to provide a response within a pre-specified time period (e.g. fourteen (14) days) of logging the grievance. Acknowledgement should include a summary of the grievance, MOW's approach to responding to the grievance, and an estimated timeframe in which the final response will be

issued. If needed, use the acknowledgement opportunity to clarify issues from the grievance or request further information if required.

A Grievance Acknowledgement Receipt shall be signed and a copy provided to the complainant. A copy of the Grievance Acknowledgement Receipt must be kept on record. At defined entry points for grievances the Grievance Officer must ensure that appropriate training on this Grievance Mechanism has been completed; relevant grievance forms are available; and requirements for forwarding grievances to the Grievance Officer (e.g. within 24hrs, in writing or verbally) are clearly understood and agreed to.

15.7.4 Screen

After receipt of the grievance, each grievance will be screened from Level 1 to 3, per definitions provided in Table 2 below, in order to determine the appropriate response. The Grievance Officer is responsible for assigning a grievance owner to liaise with the external stakeholder/s and work on a resolution. Grievances will be screened depending the level of severity in order to determine who the grievance owner will be and how the grievance is approached.

Table 15.2: Grievance Screening Categories

Category	Issue description	Management Approach
Level 1	A grievance for which an answer can be provided immediately and/or there is already a MOW management-approved response and an answer can be provided immediately. This level also includes grievances that are out of scope.	Grievance Officer will inform MOW management and then utilize approved answers to handle response.
Level 2	Grievances characterized by being a one-time situation, local in nature, and that will not impact MOW 's reputation.	Define grievance response plan and draft a response for MOW and other management approval.
Level 3	Repeated, widespread or high-profile grievances that may result in a negative impact on MOW 's business activities and/or reputation. Level 3 grievances indicate a gap in a management plan or procedure, or that a serious breach in MOW policies or Myanmar law has occurred.	Prioritize through Issues Management /Legislative and Regulatory Advocacy Process and define appropriate management strategy

Following the initial screening, the Grievance Officer must update the Grievance Notification Form and include signatures from the complainant, witnesses or any other individuals who choose to make comment with regard to the particular grievance. If a grievance can be managed at the first (rapid) assessment, the following requirements must be met:

- The resolution must be in accordance with the Grievance Officer's delegated authority;
- The resolution must be in accordance with site procedure and the MOW agreed position on the subject matter of the grievance;
- The Grievance Officer must be satisfied that the resolution will likely bring finality to the grievance;
- The complainant is satisfied with the resolution and will provide the required written confirmation at the time.

The involvement of third parties (such as a community leader) by the complainant at this stage is at their discretion.

15.7.5 Investigating a Grievance

The Grievance Officer will investigate fully all grievances submitted, and will involve other departments, contractors and senior management as required in the process in order to fully understand the circumstances that led to the grievance being raised. This should be performed in a timely manner to avoid delaying the resolution of a grievance. MOW will aim to resolve any grievances within fourteen days from the date that it was received. This timeframe can be extended to 30 days for more complex grievances (e.g. level 4 grievances), if required. (Please see point 6 below on assessing grievance significance). The Grievance Officer is responsible for ensuring the complainant is kept informed of the status of the review. If additional time is needed to examine the grievance, the complainant should be notified of this in writing and advised of when a resolution will be presented.

The following steps shall be performed in a timely manner to avoid delaying resolution of a grievance:

1) Obtain as much information as possible from the person who received the complaint, as well as from the complainant to gain a first-hand understanding of the grievance.
2) Undertake a site visit, if required, to clarify the parties and issues involved. Gather the views of other stakeholders, if necessary and identify initial options for settlement that parties have considered.
3) Determine whether the grievance is eligible.

    - Eligible grievances include all those that are directly or indirectly related to the proposed project and that fall within the scope of the Grievance Mechanism as outlined above.
    - Ineligible Complaints may include those that are clearly not related to proposed project or its contractors' activities, whose issues fall outside the scope of this Grievance Mechanism procedure.

4) If the grievance is deemed ineligible, it can be rejected however a full explanation as to the reasons for this must be given to the complainant and recorded in the Grievance Database.
5) If the grievance is eligible, determine its severity level. This will help to determine whether the grievance can be resolved immediately or requires further investigation and whether senior management will need to be informed of the grievance.
6) If the grievance concerns physical damage, (e.g. crop, house, community asset) take a photograph of the damage and record the exact location as accurately as possible.
7) Inform the complainant of the expected timeframe for resolution of the grievance.
8) Enter the findings of the investigation in the Grievance Database.

15.7.5 Settlement and resolution approach

All grievances shall be dealt with on a case by case basis. However, all will require further discussions with complainants and community members that seek to jointly identify and select measures for grievance settlement. This will help to increase ownership of solutions and to mitigate perceptions that resolutions unfairly benefit MOW.

Where possible, grievances will be addressed directly by Grievance Officer and this level can be referred as level 1. The resolution proposal shall be respectful and considered, including rationale for the decision and any data used in reaching it. The resolution at the level 1 will be normally be done within fourteen working days and notified to the concerned party. Should the Grievance be not solved within this period, this would be referred to the next level of Grievance Mechanism. However, if the Grievance Officer feels

that adequate solutions are worked out the problem and it would require a few more days for actions to be taken, he can decide on retaining the issue at the first level by informing the complainant accordingly. However, if the complainant requests for an immediate transfer of the issue to the next level, it would be accepted and the issue would be taken to level 2. But in any case if the issue is not addressed within fourteen days, it needs to be taken to level 2. Also if wider consultation is necessary, grievances will be forwarded to level 2. This refers to the process that needs to be followed when the grievance cannot be resolved directly between the Grievance Officer and the complainant, requiring a review by a Grievance Committee. The Grievance Committee formed at the MOW would be the one which would address the grievance in the level 2 in case the problem is not solved at the first level.

The Grievance Officer (GO) coordinate the convening of the meetings of the GC. GO is responsible for briefing the GC on the deliberations of the first level mechanism and on the views of both the parties. (Complainant and the Grievance Officer). The GC hold the necessary meetings with the affected party / complainant and the concerned officers and attempt to find a solution acceptable at all levels. GC would record the minutes of the meeting. The decisions of the GC are communicated to the complainant formally and if he accepts the resolutions, the complainant's acceptance is obtained.

15.7.6 Third party appeal

If the complainant does not accept the solution offered by the GC and need wider consultation, grievances will be forwarded to a third party for review and final decision. The Chairman of the GC would require to forward the issue to the next level (third party) after consultation with the project Legal Officer. This third party should be neutral, well-respected, and agreed upon by both MOW and the affected parties. These may include public defenders, District Commissioner, Regional Commissioner, Legal Advisors, Local or International NGOs, or technical experts.

The third party reviews the case and determines if further reasonable action is possible. If options for reasonable, justified corrective actions are exhausted, a written notice should be provided to the Claimant notifying him or her that their grievance is being closed. Supporting documentation of resolution actions and the Grievance Mechanism Procedure may be sent with the notice. Examples include paid invoices, written agreements, photographs, emails, etc. If an address is not available, the Complainant may be notified by telephone or in person.

15.7.7 Follow-up and Close Out

Where resolutions have been approved and agreed upon by the complainant, the Grievance Officer must ensure that the administrative process for redressing the grievance is immediately initiated. The resolution details (action plan) and target timeframe for closure must be updated in the Complaint/Grievance Register. Only when the agreed resolution is implemented, the case moves from a "resolved" status to a "closed" status. The Grievance Officer must ask the complainant to sign the form in three places to acknowledge receipt; acknowledge satisfaction with the outcome and if not, that they have been notified of a second and third order mechanism with a limit of 30 days for activation; and acknowledge that the complainant has been respectfully informed about the outcome of the reviews and has no objections.

In case complainants are reluctant to sign any forms, or in case no forms are used, the Grievance Officer verbally inquires about satisfaction on process and outcome ("e.g. if we were to improve the process, could we do anything else or are you ok with how we handled the process?"). This can be recorded on a voice recorder with the consent of all those present.

15.7.8 Legal action

As a last resort, aggrieved parties have a right to take legal action. This is a more formal rights based approach that shall only be taken if all other approaches have failed or when there are serious conflicts about facts and data. The final decision will be taken by the arbitrator or courts based on compliance with laws, policies, standards, rules, regulations, procedures, past agreements or common practice.

15.8 MONITORING AND REPORTING

It is necessary to monitor and evaluate the overall performance of the grievance mechanism throughout the project life cycle. The goal of this level of monitoring is not only to improve the system, but also to improve the project. All reported grievances must be logged into the designated System as they are received, along with the relevant target resolution dates. MOW management will monitor grievances routinely as part of the broader management of the project. This entails good record keeping of complaints raised throughout the life of the project. On receipt of grievances, electronic notification to management must be distributed. Grievance records must be made available to management at all times. Monthly internal reports will be compiled by the Grievance Officer and distributed to the management team. These grievance reports will include:

- The number of grievances logged in the proceeding period by level and type.
- The number of stakeholders that have come back after 30 days stating they are not satisfied with the resolution.
- The number of grievances unresolved after 60 days by level and type.
- The number of grievances resolved between Grievance Officer and complainant, without accessing legal or third party mediators, by level and type
- The number of grievances of the same or similar issue
- Grievance Officers' responses to the concerns raised by the various stakeholders.
- The measures taken to incorporate these responses into project design and implementation.

These reports and other records will be made available for external review if required. An appropriate grievance report should be part of MOW 's annual reporting. Annual reports will be made available to the public. A hard copy will be located at the MOW offices, and an electronic copy will be made available online.

15.9 STORING OF GRIEVANCES

All records, including grievance forms, investigation notes, interviews and minutes of meetings will be securely filed by MOW to ensure privacy and confidentiality is maintained for all parties involved.

16 SUMMARY AND CONCLUSIONS

The ESIA establishes the baseline condition of the site and assesses the impact of the proposed project. The likely positive and negative impacts of the proposed project are identified and quantified to the extent possible. The issues/ impacts have been assessed and described in some detail to gain an adequate understanding of possible environmental effects of the proposed project – from mobilization phase to decommissioning phase in order to formulate mitigation measures in response to negative aspects which have emerged.

In summary, the Farkwa dam is acceptable to a majority of the local residents, most of whom appreciates the value it will have on the social and economic wellbeing of the area. To enhance social Integration, the local communities and all the stakeholders involved shall be sensitized on the benefits and risks of the project so that they are all on board in advance for effective participation and sustainability. A social component, therefore, needs to be built into the overall project implementation. Entrench ownership of the project upon the residents through participation during construction and thereafter when they can report negative activities within the project area. In this endeavor, local sensitization committees shall be developed from the communities to act as liaison between the project implementation group and the stakeholders.

Also from the findings gained during the investigations to the impact assessment to the proposed project it can be stated that the proposed project can be constructed and operated without having major significant negative impact on the bio-physical and socio-economic environment and does not show any non-acceptable risk regarding health and safety aspects if the proposed mitigation measures are implemented. The environmental and social management plan (ESMP) provides the way forward for implementation of the identified mitigation measures.

The ESIA report also outlines the environmental monitoring plan (EMP). The EMP consists of the set of mitigation, monitoring, and institutional measures to be taken during mobilization to decommissioning of the proposed project to eliminate, offset, or reduce adverse environmental and social impacts. It supports the ESMP by maintaining a record of environmental performance and enabling adjustments to be made to mitigate environmental and socio-economic impacts during the lifetime of the project.

In all phases occupational health and safety will be carefully considered and controlled through continuous inspection to prevent disease and accidents, and workers will undergo an environmental and safety briefing on safety, sanitation measures, and emergency rescue procedures before development begins. The MoW shall also set up a corresponding Health, Safety and Environment Management (HSE) Plan and employ an Environmental Field Officer (EFO) and a Health and Safety Officer (HSO) both full time during the whole construction period. The overall objective of them will be the implementation of the ESMP by the MoW.

Given the nature and location of the development, the conclusion is that the potential impacts associated with the proposed project are of a nature and extent that can be reduced, limited and eliminated by the application of appropriate mitigation measures. The proposed environmental management plan and environmental monitoring plan if implemented will safeguard the tranquility of the environment.

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APPENDICES

APPENDIX 1: TERMS OF REFERENCE

TERMS OF REFERENCE FOR ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED CONSTRUCTION OF FARKWA DAM AT MOMBOSE AND BUBUTOLE VILLAGES, FARKWA WARD, CHEMBA DISTRICT AND WATER CONVEYANCE SYSTEM TO CHEMBA AND DODOMA CITY, DODOMA REGION, TANZANIA

1. INTRODUCTION

1.1 Project Background

The Ministry of Water through the Water Sector Development Programme is looking at developing a complementary water supply for the Dodoma City. The present main source of water is the Makutupora well field with an upgraded supply capacity of 61,000 gross m^3/day. This present source is considered not to be reliable enough for the supply of a growing population. The Ministry of Water carried out pre-feasibility studies, which identified Farkwa area as potential site for development of a Dam "Farkwa Dam" that would provide a reliable source of water supply to the Dodoma City. The Farkwa Dam is proposed to be constructed immediate downstream the confluence of Bubu and Mkinki rivers located in Mombose and Bubutole Villages of Farkwa Ward in a newly established District of Chemba in Dodoma Region, Tanzania. The site is approximately 130 kilometres North of Dodoma on the road to Kondoa District.

The Dam consists of 25m high composite RCC and earthfill Main Dam with intake, outlet works and spillway – FSL 1,110m, 10 m high earthfill Saddle Dam and the site access roads. Other component is the Conveyance System consisting of 115 km long conveyance pipeline with an end connection to the Kilimani Tank N°2 in Dodoma; pump station, pumps and associated HEM equipment located downstream of the dam on the left river bank; associated civil works and HEM equipment and the Interim tank to be located approximately 14 km from the dam site.

During scoping several key environmental issues were identified after site reconnaissance, holding consultations with stakeholders of the project and reviewing various literatures related to the project. Similarly, expert opinion was sought on various key issues identified as requiring specialized knowledge. The purpose of developing the Terms of Reference (TOR) is to provide formal guidance to the project proponent and contracted Consultant for carrying out the ESIA of the proposed project on the range of issues that must be addressed in the ESIA process. Furthermore, they form the basis for subsequent review process. In these ToR, strategies for addressing the issues identified during scoping have been incorporated to make the ESIA focused. The scoping exercise was used to develop ToR.

1.2 Objectives of ESIA

The objectives of the ESIA are:

- To establish baseline information on both natural and built environment including socio-economic conditions of the proposed construction of Farkwa Dam, Water Treatment Plant and Water Conveyance System to Chemba and Dodoma City, Dodoma Region, Tanzania.
- To identify, predict and evaluate foreseeable impacts, both beneficial and adverse, of the proposed project; and
- To develop mitigation measures that aim at eliminating or minimizing the potential negative impacts and promote positive ones.

- To develop management clauses and monitoring aspects to be observed during project implementation.

This requirement clearly presents a broad challenge on what type of activity that is environmentally friendly need to be dealt with the proposed project.

1.3 Environmental Assessment Requirements

The Environmental Management Act, cap 191 requires that ESIA be undertaken for all new projects that may cause adverse environmental and social impacts. Under the Environment Impact Assessment and Audit Regulations, 2005 the proposed project is categorized as an ESIA obligatory project for which a full ESIA is required.

1.4 Study Area

The proposed dam site is located about 130 km north of the Dodoma city along the way to Kondoa. Administratively the Dam will be located in Mombose and Bubutole villages, Farkwa Ward, Chemba District, Dodoma Region. Water from the dam area will be conveyed to Dodoma City through a pipeline within 10 meters way-leave that will run almost parallel to the main road. Villages along the conveyance system namely Gonga, Farkwa, Donse, Khubunko (Erenzese sub village), Makorongo (Makorongo B Sub village), Babayu (Uswahilini and Masimba Sub villages), Mayamaya (Zamachelo sub village) and Zanka (Azimio sub village) will also be supplied with the water. The Consultant shall: further determine and set the project boundaries particularly spatial boundaries (i.e. impact area coverage and area of influence).

1.5 Environmental Impact Assessment Scope of Work

The the scope of environmental assessment covers the dam and all ancillary infrastructure required for full performance of the dam such as the rehabilitation of the dam access road and the construction of a transmission line to Dodoma City.

Task 1: Description of the Proposed Project

The Consultant shall give details of:

- Location of all project-related development and operation sites
- General layout of facilities - diagrams of facilities, design basis, size, sources of utilities;
- pre-construction activities and construction activities;
- Organizational relationships, mandates and interactions among the different parties to be involved in the project

Task 2: Description of the affected environment

The consultant shall assemble, evaluate and present baseline data on the relevant environmental characteristics of the study area and adjacent areas. The Consultant will present the current status of the environment and include information on any changes anticipated before the project commences. The consultants will in particular describe the following:

i. Physical environment: Geological features, soils, climate and meteorology, ambient air quality surface and groundwater hydrology; existing sources of air emission, existing water pollution discharges and receiving water quality archaeological / historical features (if any).

ii. Biological environment: flora / fauna, rare or endangered species, scientific importance taking into consideration the sensitivity of the main habitats.
iii. Socio-economic and cultural conditions within the general project area that can impact or be impacted by the project – administration, demography and community structure; land use and use of other natural resources in the project area; employment and economic and social infrastructure; current and planned development activities in the project area. Baseline information will include both present and projected where appropriate.
iv. Identification of different categories of people likely to be impacted by the project (PAP) etc.

Task 3: Legislative, Regulatory and policy Considerations

The Consultant shall:
Describe the pertinent policy, regulations and standards governing environmental quality, health and safety, sitting, land use control etc., at international and national (Tanzania) levels. The Consultant shall assess to what level the project design addresses the requirement of these acts, regulations, and policies. The source of information will be secondary data.

Task 4: Determination of Potential Impacts of the new Proposed Project Component

Under this activity the consultant shall:
i. identify issues and concerns in order to find suitable remedies;
ii. identify linkages among project components and the issues;
iii. identify where project activities or elements interact with social and biophysical environment (direct impacts):
iv. identify indirect impacts of the project on the environment;
v. identify cumulative impacts that may be anticipated;
vi. identify residual impacts if any;
vii. predict probability, magnitude, distribution and timing of expected impacts:
viii. for certain project components it might be necessary to carry out assessment at two or more sites (alternatives) in order to come out with the best option; and
ix. Forecast what will happen to the affected environmental components if the project is implemented as is or if the alternatives (e.g. sites and routes) are chosen.

Task 5: Analysis of Alternatives

The environmental assessment shall include an analysis of alternative (in terms of sitting, design, technology, phasing etc) that were considered or examined in the course of developing the proposed construction activities and identify other reasonable alternatives that meet the ultimate project objective. However, a "no action" alternative, in order to demonstrate environmental conditions without project shall be done.

The consultant shall describe how the alternatives compare in terms of potential impacts, costs, suitability under local conditions, and institutional, and monitoring requirements. When describing the impacts of alternatives, the consultant shall indicate which impacts would be irreversible or unavoidable and which could be mitigated. To the extent possible, the consultant shall quantify the costs and benefits of each alternative, incorporating the estimated costs of any associated mitigating measures. The consultant shall describe the reasons for selecting the proposed project over the other alternatives.

Task 6: Cost Benefit Analysis

The analyses of the cost benefits for the project will be done by the consultants basing on important parameters such as the estimations for project benefit costs; social costs plus a number of associated elements; including running costs such as wages and salaries, staff benefits, services and rehabilitations, utility costs and others; environmental costs; and the cash outlay.

Task 7: Estimation of the significance of the impacts

The consultant shall:

i. determine which environmental components are mostly affected by the project or its alternatives;
ii. list issues raised by the public and classify them according the level and frequency of concern whenever possible;
iii. list regulatory standards, guidelines etc. that need to be met; and
iv. Rank predicted impacts in order of priority for avoidance, mitigation, compensation and monitoring.

Task 8: Development of Management Plan to Mitigate Negative Impacts and develop a monitoring plan

The consultant shall:

i. determine appropriate measures to avoid or mitigate undesirable impacts;
ii. assess and describe the anticipated effectiveness of proposed measures;
iii. ascertain regulatory requirements and expected performance standards;
iv. determine and assess methods to monitor impacts for prediction accuracy remedial measures for effectiveness;
v. determine and assess methods to monitor for early warning of unexpected effects;
vi. re-assess project plans, design and project management structure;
vii. describe follow-up scheme and post-project action plan for achieving EIA objectives; and
viii. Assess the level of financial commitment by the project proponent for the management and monitoring plan, and follow up activities.

The consultant shall be guided by the cost-effectiveness principles in proposing amelioration measures. Estimation of costs of those measures shall be made. The assessment will provide a detailed plan to monitor the implementation of the mitigation measures and impacts of the project during construction and operation.

Task 9: Institutional set-up for

The Consultant shall review the institutional set-up - community, ward, District/ Regional and national levels - for implementation of the Management and Monitoring Plans recommended in the environmental assessment. The assessment shall identify who should be responsible for what and when.

Task 10: Drawing Recommendations

The consultant shall:

i. highlight key concerns and considerations associated with the acceptance and implementation of recommended actions;
ii. determine resources requirements for implementing recommendations;
iii. determine capacity and resourcefulness of the client to meeting such commitment;

iv. explain rationale for proposed development and benefits and costs vis-à-vis the no-project option;
v. Ascertain degree of public acceptance of or reaction to recommendations.

Task 11: Environmental and Social Impact Assessment (ESIA)

The assessment shall result into an ESIA focusing on findings of the assessment, conclusions and recommended actions, supported by summaries of data collected etc. This shall be a concise document limited to significant environmental issues. The report format will be as per ESIA and Audit Regulations, 2005.

Task 12: Review

The review report from NEMC may require further input (data collection, consultation inputs etc.). The consultant shall undertake to provide extra information and inputs until the project review is satisfactorily concluded.

Task 13: Stakeholder consultations and community involvement

The assessment shall establish the level of consultation of the affected stakeholders before designing the project, level of involvement in the running and maintenance of the project facilities as this is an important aspect for both environmental and project sustainability.

The assessment will provide a framework:

- For co-ordinating the environmental impact assessment with other government agencies, and
- For obtaining the views of affected groups, and in keeping records of meeting and other activities, communications, and comments and their disposition.
- Description of the consultation and participatory processes used to plan the resettlement, including the results of these processes;

A people's participation report will be prepared as part of the ESIA i.e. apart from the socio- economic and cultural impact report (which basically are dealing with consultants' perception and interpretation of issues). Consultations with various stakeholders have been conducted during the scoping and further consultation will be conducted during the EIA study.

Task 14: The Social and Economic Assessment

The consultant shall identify and evaluate social and economic impacts resulting from project implementation including but not limited to the

i. types of social impacts,
ii. extent and severity of these impacts (Constructions areas; quarry areas, spoil disposal areas, construction camps, communities resettlement areas, access roads, power transmission, distribution line/corridors and water conveyance route (water pipe line)).

Task 15: Drawing recommendations

The Consultant shall:

- Highlight key concerns and considerations associated with the acceptance and implementation of recommended actions;

- Determine resources requirements for implementing recommendations;
- determine capacity and resourcefulness of the client to meeting such commitment;
- Explain rationale for proposed development and benefits and costs vis-à-vis the no-project option;
- Ascertain degree of public acceptance of or reaction to recommendations.

Task 16: Resettlement Action Plan (RAP) as per WB-OP.4.12

The consultant shall prepare a Resettlement Action Plan to ensure that relevant social issues arising from the Proposed Farkwa Dam, Water Treatment Plant and Water Conveyance System to Chemba and Dodoma City project are taken into account to minimize negative impacts on people and communities in the project area. The plan will provide a road map for resolving displacement, resettlement and compensation issues related with the project implementation by ensuring that livelihoods of the Project Affected Persons (PAPs) are improved or restored to pre-displacement levels prevailing prior to the beginning of project implementation.

1.6 Time Scale

It is expected that the study would be completed within a period of six months.

1.7 Personnel Requirement

The consultants shall deploy consultants/experts with the demonstrable practical experience in conducing EIA studies. Specifically an integrated team that will include: Environmental and Social Impact Assessor, Environmental Management and Planning expert, Biodiversity Specialist, and Water Resources Engineer/Hydrologist.

1.8 Reporting and Report Presentation

The draft of the EIA document submitted to Council should be concise, following the report writing guidelines in the Environment Impact Assessment and Audit Regulations, Gn No.349/2005 for simplifying the review process.

1.9 Record of Meetings

The consultants shall provide record of the names of organizations, government and departments and individuals whose views will be obtained. The record will also provide description of views and information that will be obtained.

1.10 Outputs

The consultant shall submit to the Client, 3 original bound hard copies and electronic copies of the Scoping Report and the Environmental and Social Impact Assessment (ESIA). The Consultant shall also make 15 copies for the review process as stipulated in the EMA 2004.

1.11 Reference

The consultant shall provide a list of all information sources used, including unpublished documents and sources.

APPENDIX 2: NEWSPAPER ADVERTS

spital where ealth service from expert

an effective way of getting HIV infected babies and children on medication.

UNITED REPUBLIC OF TANZANIA
MINISTRY OF WATER

PUBLIC NOTICE

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) FOR PROPOSED CONSTRUCTION OF FARKWA DAM AND WATER CONVEYANCE SYSTEM TO DODOMA MUNICIPALITY, DODOMA REGION, TANZANIA

In compliance with the Environmental Management Act, Cap 191 and the subsequent Environment Impact Assessment and Audit Regulations, 2005 - G.N. No. 349, this notice is hereby posted to inform the public that TRES Consult (T) Limited of Dar es Salaam has been commissioned on behalf of Ministry of Water to undertake a full Environmental Impact Assessment for their proposed construction of Farkwa Dam and Water Conveyance System to Dodoma Municipality.

The Ministry of Water carried out pre-feasibility studies, which identified Farkwa area as potential site for development of a Dam "Farkwa Dam" that would provide a reliable source of water supply to the Dodoma Municipality. The Farkwa Dam is proposed to be constructed immediate downstream the confluence of Bubu and Mkinki rivers located in Mombose and Bubutole Villages of Farkwa Ward in a newly established District of Chemba in Dodoma Region, Tanzania. The site is approximately 130 kilometres North of Dodoma Municipality. The project will also involve the water conveyance system from the Dam site to Dodoma Municipality running nearly parallel to the existing road(s).

The Environmental Impact Assessment seeks to address all significant impacts (both positive and negative) associated with the project, so as to provide objective information to the decision makers.

This notice is published to solicit the concerns of, and seek the views of all interested and affected parties. For all requests, or any additional information, suggestions, opinions or concerns, please contact:

Project Proponent	**Ministry of Water**, Maji Ubungo, P.O. Box 9153 Dar es Salaam, Tanzania. Telephone: 022 2450838/40-41; Fax No: 022 2450533; Email: psmw@maji.go.tz; Contact Person: Permanent Secretary
EIA Consultants	**TRES Consult (T) Limited,** Josam House, Plot No. 16 Mikocheni Industrial Area. P.O Box 31155 Dar es Salaam, Tanzania, Phone (+255) 0713 425442, (+255) 0782 425442, Fax: +255 22 2461054, E-mail: tresconsultants@gmail.com
Environmental Regulatory Authority (NEMC)	Director General, **the National Environment Management Council** Regent Estate, Plot No. 29/30, P.O. Box 63154, Dar es Salaam, Tanzania, Tel: +255 (0)22 2774852/4889; Fax: +255 (0)22 2774901; E-mail: dg@nemc.or.tz

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imbani kwao kwa
ema Kenyatta.
a akizungumza na wa-

cha masuala ya diaspora katika Wizara ya Mambo ya Nje kwa ajili ya kuwashughulikia wakenya wanaoishi nje ya nchi yao.

JAMHURI YA MUUNGANO WA TANZANIA
WIZARA YA MAJI

TANGAZO KWA UMMA

TATHMINI YA ATHARI YA MAZINGIRA NA JAMII YA UJENZI WA BWAWA LA MAJI LA FARKWA NA MFUMO WAKE WA KUPELEKA MAJI KATIKA MANISPAA YA DODOMA, MKOA WA DODOMA, TANZANIA

Ili kutimiza matakwa ya, Sheria ya Usimamizi wa Mazingira ya Mwaka 2004 (cap 191 ya 2004) na kanuni zake za utekelezaji za mwaka 2005 (Kanuni za Tathmini ya Athari kwa Mazingira na Ukaguzi za Mwaka 2005- G.N. Na. 349), hili tangazo linatolewa kuujulisha umma kuwa Kampuni ya TRES Consult (T) Limited ya Dar es Salaam kwa niaba ya Wizara ya MAji inaandaa Tathmini ya Athari kwa Mazingira na Jamii ya bwawa la maji la Farkwa na mfumo wake wa kupeleka maji katika Manispaa ya Dodoma, Mkoa wa Dodoma, Tanzania.

Wizara ya Maji ilifanya upembuzi yakinifu ambao ulipendekeza eneo la Farkwa kuwa sehemu muhimu ya kujenga bwawa ambalo litaweza kutoa maji ya uhakika kwa ajili ya matumizi ya Manispaa ya Dodoma. Bwawa la Farkwa linakusudiwa kujengwa kwenye chini kidogo ya maungano ya mito ya Bubu na Mkinki kwenye vijiji vya Mombose na Bubutole ambavyo viko katika Kata ya Farkwa kwenye Wilaya mpya ya Chemba, Mkoa wa Dodoma, Tanzania. Eneo la bwawa liko kilomita 130 kaskazini mwa Manispaa ya Dodoma. Mradi huu utahusisha pia ujengaji wa mfumo wa mabomba sambamba na bararabara zilizopo kutoka eneo la bwawa mpaka Manispaa ya Dodoma.

Tathmini ya Athari kwa Mazingira na Jamii inakusudia kubainisha athari zote muhimu (mbaya na nzuri) ambazo zinahusiana na mradi huu, ili kuweza kutoa taarifa muhimu zitakazosaidia watoa maamuzi kutoa uamuzi sahihi katika kuendeleza mradi huu.

Tangazo hili limetolewa kukusanya maoni, dukuduku na kupata ushauri wa wadau mbalimbali na watu ambao kwa njia moja au nyingine wanaweza kuathiriwa na mradi huu. Kwa taarifa zaidi, ushauri, maoni, maswali au dukuduku tafadhali wasiliana na ofisi zifuatazo:

Mwendelezaji wa Mradi	Wizara ya Maji, Maji Ubungo, S.L.P 9153 Dar es Salaam, Tanzania. Simu: 022 2450838/40-41; Nukushi Na: 022 2450533; Baruapepe: psmw@maji.go.tz; Kwa mawasiliano: Katibu Mkuu
Washauri wa Tathmini ya Mazingira:	TRES CONSULT (T) LIMITED; Josam House, Kitalu No. 16 Eneo la Viwanda la Mikocheni. S.L.P 31155 Dar es Salaam; Simu (+255) 0713 425442, (+255) 0782 425442, nukushi: +255 22 2461054, Baruapepe: tresconsultants@gmail.com
Baraza la Taifa la Hifadhi na Usimamizi wa Mazingira (NEMC)	Mkurugenzi Mkuu, Baraza la Taifa la Hifadhi na Usimamizi wa Mazingira, Regent Estate, Kitalu Na. 29/30, S.L.P 63154, Dar es Salaam, Tanzania; Simu: +255 (0)22 2774852/4889; Nukushi: +255 (0)22 2774901; Baruapepe: dg@nemc.or.tz

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APPENDIX 3: STAKEHOLDERS CONSULTED AND THEIR SIGNATURE

UPDATING ESIA CONSULTATION ACTIVITIES

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) REPORT FOR THE PROPOSED FARKWA DAM, WATER TREATMENT PLANT AND WATER CONVEYANCE SYSTEM TO DODOMA CITY AND CHEMBA DISTRICT COUNCIL, DODOMA REGION, TANZANIA

Name and Signature of Consulted Stakeholders

DATE/TAREHE	NAME/JINA	POSITION & INSTITUTION /TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
02/08/2021	DR. FATUMA MGANGA	RS - DODOMA	0766648266 DODOMA.	[signature]
03/08/2021	RHOBI STEPHANO	KNT DC	0683757983 CHEMBA	[signature]
03/08/2021	JOFREY E. PIMA	Ag. DED - CHEMBA DC	0754485080	[signature]
03/8/2021	MOHAMED SEMDOE	DEMO	0767830269	[signature]
3/08/2021	ALEN W. MTUNGUJA	W.T	0716182188 0765093263	[signature]

DATE/TAREHE	NAME/JINA	POSITION & INSTITUTION /TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
03/08/2021	MATHIAS KASUGA	M/TARAFA	0653 011 561	[signature]
03/08/2021	STEPHANO PATRICE	MH' DIWANI	0758484951	[signature]
03/08/2021	ZUHURA ALLY	MJUMBE	- -	[signature]
03/8/2021	RASHIDI SALIMU	M/KARIBISHAJI	0622007370	[signature]
03/8/2021	JUMAA ISSA SAIDI	K/MWENYEKITI KITONGOJI	0788599065	[signature]
~~03/8/2021~~	~~SALMA IDD ATHUMANI~~	~~AT~~		-
03/8/2021	SAMSAMBIA R. NKYA	WEO	0769869464	[signature]

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) REPORT FOR THE PROPOSED FARKWA DAM, WATER TREATMENT PLANT AND WATER CONVEYANCE SYSTEM TO DODOMA CITY AND CHEMBA DISTRICT COUNCIL, DODOMA REGION, TANZANIA

Name and Signature of Consulted Stakeholders

DATE/TAREHE	NAME/JINA	POSITION & INSTITUTION /TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
03/08/2021	HOSEA NDALAMI	MKITI WAKIJIJI	0629710322	[signature]
03/08/2021	GODBLESS. C. MCHAKY	VEO/BUBUTOLE	0787175111	[signature]
03/08/2021	SALIM I. ATHUMANI	MJUMBE	0624012800	[signature]
03/08/2021	HASSANI A. SANTIE	MJUMBE		M. A. Santie
03/08/2021	JULIUS N. MASUNGA	—	0625879434	J. Ne
03/08/2021	MAGUA NDAMO	— —	0783969741	[signature]

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) REPORT FOR THE PROPOSED FARKWA DAM, WATER TREATMENT PLANT AND WATER CONVEYANCE SYSTEM TO DODOMA CITY AND CHEMBA DISTRICT COUNCIL, DODOMA REGION, TANZANIA

Name and Signature of Consulted Stakeholders

DATE/TAREHE	NAME/JINA	POSITION & INSTITUTION /TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
04/08/2021	PAULO. F. LUBUVA	VEO – ROFATI	0737286145	[signature]
	YASINI. M. MUHOGO	MJUMBE	073729266	[signature]
	KASIMU M. MUHOGO	MJUMBE	0737292626	[signature]
OFISA MTENDAJI KIJIJI CHA ROFATI CHEMBA	ASIA A' HASANI	MJUMBE	0734046212	OFISA MTENDAJI KIJIJI CHA ROFATI CHEMBA [signature]
	HASANI-L. KERE	M/KITI-ROFATI	0735630051	[signature]
	MAGANGA. K. FLANGA	MJUMBE	0688880602	[signature]
	AHMA MLANGI	MJUMBE	0744222215	Mlangi
	OMARY A. OMARY	MJUMBE	0737292070	Abdalah

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) REPORT FOR THE PROPOSED FARKWA DAM, WATER TREATMENT PLANT AND WATER CONVEYANCE SYSTEM TO DODOMA CITY AND CHEMBA DISTRICT COUNCIL, DODOMA REGION, TANZANIA

Name and Signature of Consulted Stakeholders

DATE/TAREHE	NAME/JINA	POSITION & INSTITUTION /TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
4/8/2021	REHEMIA HAMIS ALMASI	WEO	0762282605	
4-8-2021	PETRO SILLA	MW/KITI	0745167367	
4/8/2021	AMOS S. MLEWA	K/VEO	0692-417887	
4/8/2021	JOSEPH NING	Mjumbe		
4/8/2021	SHAURI YOVENS	MJUMBE	0715387423	
4/8/2021	ELIAS PETRO	MJUMBA	0683864562	
4/8/2021	JULIETA PETRO	MJUMBE	-	J. PETRO
4/8/2021	PHILIPO S. DOO	MW/KITONGOJI	0782931046	
4/8/2021	DELERA A. AIMA	MJUMBE	0621621148	
4/8/2021	MUSA B. MAZEMBA	MJUMBE	0717127096	MMAZEMBA

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) REPORT FOR THE PROPOSED FARKWA DAM, WATER TREATMENT PLANT AND WATER CONVEYANCE SYSTEM TO DODOMA CITY AND CHEMBA DISTRICT COUNCIL, DODOMA REGION, TANZANIA

Name and Signature of Consulted Stakeholders

DATE/TAREHE	NAME/JINA	POSITION & INSTITUTION /TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
4/08/2021	MATHEI DOO SUKI	M/KITI/KIJIJI GWANDI	0734798800	
	OMARY G. MWEMBA	K/VEO GWANDI	0737286174	
4/08/2021	FATUMA M. FEDA	MJUMBE M/KITI	0763209016	
4/8/2021	ALLY MANDI INGA	M/KITI/KITONGOJI	0737289744	
4/8/2021	JUMANNE DOO	MJUMBE	0658430475	
4/8/2021	OMARI MANDELA	MJUMBE	0734577716	
4/8/2021	MWAJUMA B. MAFAKILA	MJUMBE		

AFISA MTENDAJI KIJIJI GWANDI

DATE/TAREHE	NAME/JINA	POSITION & INSTITUTION /TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
4/8/2021	MGENI KOLE	MJUMBE	0764741941	[illegible]
	BURHAN HASSAN	MJUMBE	0719167835	[illegible]
	KHALID J. SALIM	MJUMBE	0717153765	[illegible]
	ABDALLAH KHAMISI	MJUMBE	0767374015	[illegible]
	SALIMU J. SAIDOMA	〃	0737287174	[illegible]
04/08/2021	PASCHAL B. ITENO	WEO	0621070891	[illegible]
	WILSON A. MKAMATE	KATIBU /MAFI	078-306868	[illegible]
	LEGANGA LUGANO	MWIKIT KITONGOJI	0737291772	L. Lugano

AFISA MTENDAJI KIJIJI
GWANDI
S.L.P 830 CHEMBA

HALMASHAURI YA KIJIJI CHA MOMBOSE.
MAHUDHURIO YA MKUTANO WA HADHARA WA TATHMINI YA ATHARI YA MAZINGIRA NA JAMII - UJENZI WA BWAWA LA FARKWA - 03/08/2021.

AFISA MTENDAJI KIJIJI
MOMBOSE-CHEMBA

S/N.	JINA KAMILI	WADHIFA	KITONGOJI	SIMU	SAINI
1.	Lazaro J. Mussa	Mkuu	M/Barabarani	—	
2.	JOHN L. WENGA	VEO	B/RANI	0786731150	
3	FABIAN ANDREA	MJUMBE	B/RANI	0717129353	
4.	HALFA S SONGO	M/KITI	B/RANI	0686,231381	
5.	MOHAMEDI P. DANIELI	—11—	B/RANI	- - -	M.P.D.
6.	HAMISI MSHAYO MLEWA	—11—	B/RANI	- - -	H.M.M
7.	JOHN AMBALA	—11—	B/RANI	— - -	
8.	BONIFASI MATEI	M/KITI	SITU.	—	
9.	PETER A. GIKAGE	MJUMBE	Mombose Bar.	—	
10	HAWA ATHUMANI	—11—	B/RANI	— - -	H.A.
11	CHRISTINA J. NIKANORY	-11-	SHULENI	-	
12-	SALMA RAMADANI	—1--1	B/RANI	— -	S.R
13.	PAULINA M. SIGALA	—1-1-	B/RANI	— -	P.M.S
14.	YOSEPH NIKANORI JOHN	—11-	B/RANI	— - -	Y.N.J
15.	TATU RAMADHANI	—MJUMBE	B/RANI	— - -	T.R
16.	ROZANTINA ANDREA	—11—	B/RANI	— - -	R.A
17-	HAWA SALUMU MASAKA	—11—	B/RANI	— - -	H.S.M
18.	SALMA RAMADHANI	—11—	B/RANI	— - -	S.R.
19.	ELIZABETI SALUMU	—11-	B/RANI	— - - -	E.S.
20	PASKALI P. NILUNGU	— 11—	B/RANI	— - - -	
21	SALMA ISA	—11—	B/RANI	— - - -	S.I
22.	ASUMANI ABDALA	— - -	B/RANI	- - - -	A.A
23.	RASHIDI RAMADHANI	- - -	B/RANI	- - - -	R.R.

24	INYASI JOHNI	—11—	SHULENI	- - - -	I J
25	SALUMU BAKARI	MSUMBE	SHULENI	- - -	[illegible]
26	SIMINGORI ALOIS	[illegible] —	BARABARANI, 0789189534		Salois
27	JAFARY AMAFITA	- - -	- - - - -		[illegible]
28	JUMA ALMASI	—11—	B/RANI	— -	J.A
29	PAULO ROMANI	—11—	B/RANI	- - -	P.R
30	RAMADHANI SWALEHE	—11—	B/RANI	- - - -	R.S
31	ATHUMAN S. JUMA	— —	SAWEE	0683392668	[illegible]
32	CORNELI AGUSTINO	- - - -	B/RANI	- - - -	C.A
33	RASHIDI ALLY	- —	31 SH —	0624059[illegible]	[illegible]
34	ASUMANI ABDI JUMA	—11—	B/RABI	— —	A.A.J
35	MABWAYI SANGULA	——	BARABARANI	0785504974	M.S.
36	NAIBU HARUNA GONA	-	BARABARANI	0683236843	[illegible]
37	ALOIS MGALI ALOIS	- -	BARABARANI		A.M. Alois
38	ABDULL ABDILLAH	- - -	BARABARANI	0685497788	[illegible]
39	MOHAMED S. ABRAHAMANI	- - -	AFISA MTENDAJI KIJIJI	—	[illegible]
40	WILA MATISA	- -	MOMBOSE - CHEMBA	- -	W.H
41	SHABANI ALLI	—11—	B/RANI	— — -	S.A
42	JAFARI A. GAWA	—11—	B/RANI	- - -	[illegible]
43	MICHAELI JOSEPH	- - -	B/RANI	- - -	M.J.
44	SIMONI M. SAMADE	- - -	B/RANI	- - -	S.M.S.
45	PASKALI M. DANIEL	=11=	M/SHULENI	- - - -	[illegible]
46	VELANTINI HANAA	—11—	SHULENI	- - -	V.H
47	AMBROSE JEREMIA		BARABANI		A J BOGA
48	ANTANAS PIUSI	—11—	SHULENI B/RANI	- - -	A.P
49	BENVTURA NONGOLO	—11—	B/RANI	- - -	B.N
51	VERONIKA P. SONGO	—11—	B/RANI	- - - -	V.P.S
52	EMANUEL JOHN	11	B/RAN	- - -	E.J.A
53	ABDALA BAKARI	—11—	SHULENI	- - -	A.B

S/NO	JINA KAMILI	WADHIFA	KITONGOJI	SIMU	SAHIHI
54	GERADI. JOHN. MAHZA.	- - -	SHULENI.	- -	G.J. M.
55	AGUSTINO CONZAGA LAURENI	Mjumbe	BARABARANI	0682013517	[illegible]
56	RAMADHANI SAIDI SONO	MJUMBE	" "	- -	[illegible]
57	ABRAHAMANI A. GAWA	- " - "	M/BARABARANI	0784197236	[illegible]
58	AGUSTINO RWEGERERA	- " -	M/BAR	-	[illegible]
59	CHRISTOPHE MURINI	- - -	M/RANI	- - -	C.M.K
60.	SALUMU SONGO TEGEMEO	- - -	B/RANI	- - -	S.G.T
61	MICHAELI P. MLUNGU	- - -	B/RANI	- - -	M.P.M
62.	HEHEMA A. GAWA	TEJUMBE	B/RANI	" "	[illegible]
63	KORADI DOMINICK	MJUMBE	B/RANI.	" "	[illegible]
64	INYASI YUVENS	MJUMBE	SHULENI	-	[illegible]
65	MARIAMU MORONGE	- " -	B/RANI	- -	M.M
66.	ASUMANI OMARY	- " -	B/RANI	- -	A.O
67	MERIDA JOSEPHU	- " -	B/RANI	- - -	M.J
68.	PILI PASKALI	- - -	SHULENI	- - -	P.P
69.	SKOLA JOHNI	- " -	B/RANI	- - -	S.J.
70.	ELIZABETI MORANDO		SHULENI	- -	E.M
71.	SESILIA JOHNI	- - -	B/RANI	- - -	S.J.
72.	EMILIANA JOHNI	- -	B/RANI	- - -	E.J
73.	ASHA SAIDI SONO	- -	B/RANI	- -	A.S.S
74.	ARAFA IDDI ABDALA	- - -	B/RANI	- - -	A.I.A
75.	LUSIA FABIUSI	- - -	B/RANI	- - -	L.F
76.	NASRA IDDI	- - -	B/RANI	- - -	N.I
77.	AZIZA ATHUMANI	- - -	B/RANI	- - -	A.A
78.	ZUENA SALUMU SONGO	- - -	B/RANI	- - -	Z.S.S.
79.	PILI MATEI MARTINI	- - -	B/RANI	- - -	P.M.M
80.	TATU HAMISI MRISHO	- - -	B/RANI	- - -	T.H.M
81	ASHA BAKARI ATHUMANI	- - -	B/RANI	- - -	A.B.A
82.	ERIMINA JOSEPH	- - -	B/RANI	- - -	E.J
83.	ELIZABETI JOSEPH	- - -	B/RANI	- - -	E.J
84.	YASUMINI A. GINDAE	- - -	B/RANI	- - -	Y.A.G
85.	ZAINABU BAKARI	- - -	SHULENI	- - -	Z.B

AFISA MTENDAJI KIJIJI
MOMBOSE-CHEMBA

S/NA	JINA KAMILI	WADHIFA	KITONGOJI	SIMU	SAHIHI
86.	ROZI MICHAELI	—11—	M/SHULENI	----	R.M.
87.	JOHNI SIMONI	MJUMBE	B/RANI	--	[signature]
88.	ANTONI ALOIS	MJUMBE	M/SHULENI	---	A.A
89.	JUMANNE MUNYAWE	----	B/RANI	----	J.M
90.	JUMA ALLY	MKULIMA	—	—	[signature]
91.	JOSEPHU KOSELE	—	—	—	[signature]
92	Salumu Daudi	MKULIMA	—	—	S.D.M
93.	DANIELI S. DANIELI	—11—	B/RANI	---	A.S.D
94.	HURUMA NKAYA	—11	B/RANI	—	H.N
95	MAJANI JUMMA	---	B/RANI	—	M.J
96.	KOLRA JOHNI	---	B/RANI	---	K.J
97.	JUMAPILI PETER	---	B/RANI	---	J.P
98.	ALFRED YUVENCE	MKULIMA	SHULENI	----	A.Y
99	RAMADHANI IDDI	----	SAWEE	---	Ram
100	YANDRA MOMBA	---	SAWE	--	Y.M
101	NATALE LAZARO	MKULIMA	BARABARANI	— —	[signature]
102	AMINA AYOUB	— AFISA MTENDAJI KIJIJI MOMBOSE-CHEMBA	B/RANI	— —	A.A Gauny
103	KHADIJA AMIRI		B/RANI	---	H.A.Gauny
104.	FATIMA MARTINI	----	B/RANI	---	F.M
105	ERNESTA ANDREA GINDRE	MJUMBE	BARABARANI	0692395390	[signature]
106	AHASTAZIA MATA MPATISI	----	SHULENI	----	A.P.M
107	MARY PAULO	—	B/RANI	---	M.P
108	FIRIMINI MELENGA	---	B/RANI	..	F.M
109	STEPHANI CORNELI	---	B/RANI	---	S.C
110	ALLY IDDI ABDALA	---	B/RANI	---	A.I.A
111	MWANAIDI SALUMU	---	B/RANI	--	M.S
112.	ANJELINA ZEMBAU	---	SHULENI	---	A.Z
113	HAWA VELANTINI MUNA	---	B/RANI	---	H.V.M
114	RASKALI MATHIASI PAULO	----	B/RANI	—	M.P
115	LENGURO SHANGA ---	---	B/RANI	---	L.S
116.	LAULAU MERERA	---	SHULENI	—	L.M
117.	PAULO FESTO	---	SHULENI	---	P.F

AFISA MTENDAJI
KIJIJI CHA BUBUTOLE
TAREHE ______

MAHUDHURIO YA MKUTANO WA HADHARA KATIKA KIJIJI CHA BUBUTOLE KUHUSUSUALA LA MRADI WA BUSTANI LA TAREHE 03/08/2021

	JINA KAMILI	WADHIFA	SAINI
1	HOSSE · N · KADASO	M/KITI	[signature]
2	GODBLESS – C · MCHAKY	VEO	[signature]
3	JUMAA – I SAIDI	MWE/KITONGOJI	[signature]
4	SALIM IDD ATHUMANI	MJUMBE	[signature]
5	HASSANI ALLY SANGE	MJUMBE	H.A. Sange
6	JULIUS N. MASUNGA	— " —	[signature]
7	MIGWEO NDAMO	— " —	[signature]
8	RASHIDI SALIMU	M/	[signature]
9	SALUM SEIF ATHUMAN	Mwanakijiji 0655770042	[signature]
10	YAMAWE SAWAKA	" "	[signature]
11	FUMBUKA ROBATI 0622477673	" "	[signature]
12	Paskali sindano	" "	[signature]
13	MILIGWA JAFETI 0782096074	" "	[signature]
14	AMRY SEIF	MKULIMA	[signature]
15	Antony Samba	" "	Samba
16	Gele Ramadhani	" "	[signature]
17	ABEL Nyanda	" "	[signature]
18	Buyamba Makena	" "	[signature]
19	ELIBARIKI GINAWE		
20	NGASA MAGIBA	" "	[signature]
21	MWANDE N BASSA 0655...4886	– –	[signature]
22	JIKURUNONHO Sabuni	– –	[signature]
23	BOLOLO ng'atida		

24 Magida Miyambelele -0688-128874	Mwanakijiji	
25 Peter Jackioni - 0621-800207	" " "	
26 Hamisi Donald - 0682879436	"	
27 Chaleco Makigo - 0684751905		
28 Salum Sagji - 0629-551154	" "	
29 ILIXIBE N CLASTA 0785811155		
30 MASUNGA JULIUS. 0626494175	"	
31 SAMSONI - TUMBUKA 062880710	Mkulima	
32 MAGEMBE JAPHET 0626375808	MKULIMA	
33 LAMAZAN GAWA	SEIRA MTENDAJI KIJIJI CHA BUBUTOLE TAREHE	
34 LIAS - MAGEMBE		
35 Buhilo Jenipa 0628138057	Mkulima	
36 DAUDI MAGANGA	MKULIMA	
37 MADUHU MASUNGA	Mkulima	
38 MABURA BONIPHACE 062877035	Mkulima	
39 SHAMBAN ABULATHAMAN	Mkulima	
40 BASANDA MASUNGA	BABOS	
41 CHALYA JULIAS	MUKULIM	
42 baRaka SELEMANI	MUKULIMA	
43 PAULO CHRISTOPHER	MKULIMA	PCBY
44 GIJE HAYUMA	MKULMA	
45 KAPELEKA LUKELESHA	MKULIMA	
46 ANTONI DAUMO	Mkulima	
47 MANANI SAYI 0628679178		
48 IADI JUMA 0629005395		
49 JUMAA SHABAN 0628861386	MKUMA	
50 KWARUBA		

51	OMARI HASANI		O.H
52	ELIBARIKI GINAWE 0784716799		[illegible]
53	MARKO BALAGI		MKM
54	NACHAN GIGIKA		MKM
55	ROBERT ABEL 0622421335	MKL	[illegible]
56	NGWALA SAMOLA 0621536608	XAKL	
57	FAUSTIN AKONAAY	mklm	[illegible]
58	JUMANNE JOSEPH	MK	[illegible]
59	MANGNU LEO	—	mea
60	KANUDA MASUGA	—	[illegible]
61	Hamza Shaban	mlcu	[illegible]
62	ASUMANI ASU	mllm	[illegible]
63	IDI [illegible]	mllm	[illegible]
64	SHABANI R. TUTA	MKULIMA	[illegible]
65	MWANDU FUMBUKA	MKULIMA	[illegible]
66	MALUNDE — KULWA	MKLIMA	[illegible]
67	KWANAIDI OMARY	—	MW. O
68	HAMIS M. 0628680161	M	[illegible]
69	Matahi Ali	M	[illegible]
70	MSEKWA ALLY	M.	M. ALLY
71	HAMISI KIHONGOA	M	H.K
72	SUSANA KASHINJE	M	S.K
73	LUSIA SHADIRAKA	M	L.S
74	MWANAHAMIS HUSEN	M	M.H
75	LEBA ISSA	M	L.I
76	GINDU LUHENDE	M	G.L
77	SHIJA KASODE	M	S.K

OFISA MTENDAJI KIJIJI CHA BUBUTOLE TARAFA

78	HAMISI	YOHANA	M
79	NDALA SABA	Samuli	[signature]
80	mohamedi	Athumani	M.A
81	Joswa	Kimagati	J.K.
82	Hamisi	RASidi	H.R
83	yusufu	Ramadhani	Y.R
84	DEO	BURA	[signature]
85	JOSEPH	ONESMO	[signature]
86	DUMBIKO	SILASI	
87	MAGUNA	KATAMBI	
88	TUNGU	HEGE	
89	WANDE	MUSA	
90	NCHAMA	MADUKA	
91	JUMA	LAMAZAN	
92	SAN	Bunimila	
93	MACHUYA	MICHEMBU	
94	MELI	KATEI	
95	RAHELI	NKUBA	
96	FELISTA	BUNZALI	
97	TABU	SHABON	
98	MAPINDUZ	COSTA	
99	NCHIMWA	NKUBA	
100	DIA	MUHOJA	
101	NDAMO	MAKUZA	
102	RAGA	SHABO	
103	RASHID	SALUM	[signature]
104	SALIM	ONESMO	

PHASE 1 CONSULTATION ACTIVITIES

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENTFOR THE PROPOSED CONSTRUCTION OF FARKWA DAM AND WATER CONVEYANCE SYSTEM TO DODOMA CITY,DODOMA REGION, TANZANIA

Name and Signature of Consulted Stakeholders

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/ SAHIHI
5/11/2013	BERNADETHA K. JANUARY	BAHI DC	P.O BOX 2993 Mobile 0752-167569	[signature]
05.11.2013	SYLVATUS B. KASHAGA	BAHI D.C	0784 926831	[signature]
"	NICHOLAUS LUPINDU	"	0754-566366	[signature]
"	AHMED NGAJENI	WEO MPAMANTWA	0766446854	[signature]
"	TALITHA NJAMASI	VEO - MPAMANTWA	0719293861	[signature]
	JUMA M. KWELA	VEO BAHI/MAKULU	0756510743	[signature]
"	NICHOLAUS D. MOSEY	M/KITI - MTIBA	0716955936	[signature]

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENTFOR THE PROPOSED CONSTRUCTION OF FARKWA DAM AND WATER CONVEYANCE SYSTEM TO DODOMA CITY,DODOMA REGION, TANZANIA

Name and Signature of Consulted Stakeholders

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/ SAHIHI
8/11/2013	ERNEST N. KABATA	DAS - CHEMBA	BOX 126	[signature]
8/11/2013	GERVAS A. AMSTA	Ag DPLO - CHEMBA DC For DED	BOX 830	[signature]
8/11/2013	DR. W.D MAGWALE	DED CHEMBA	BOX 830	[signature]
08/11/2013	GREGORY KAHUMANI	WEO FARKWA	BOX 830	[signature]
08/11/2013	SULEYMAN A. GAWA	DIWANI-FARKWA	0785457926 BOX 830 0756823189	[signature]
09/11/2013	JOHN L. WENGA	VEO-MOMBOSE	BOX 830 0786731150	[signature]
9/11/2013	PASKALI MARINI	M/KITI - MOMBOSE	BOX 830 0786692457	[signature]

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENTFOR THE PROPOSED CONSTRUCTION OF FARKWA DAM AND WATER CONVEYANCE SYSTEM TO DODOMA CITY,DODOMA REGION, TANZANIA

Name and Signature of Consulted Stakeholders

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/ SAHIHI
09/11/2013	PASKALI D MARINI	M/KITI H/KUU MOMBOSE	S.L.P 830 0756652057	
09/11/2013	JOHN .L. WENGA	VEO - MOMBOSE	S.L.P. 830 0786731150	
09/11/2013	STEPHAN JOHN GELLE	MJ-HAL/MOMBOSE	— —	
09/11 2013	LAURENTI PAULO	MJ-HAL/MOMBOSE	— —	
— " —	GEOFREY KAFACHU	— " —	0752730067	
- " -	JOSEPH. ANNBEE	— 11 —	S.L.P. 994	
9/11/2013	GERALD JULIA	M/KITI KITONGOJI MOMBOSE SHULE	0753466089	

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/ SAHIHI
09/11 2013	ALLY IDDI SOMANI	M/KITI ~~YAA~~ KITONGOZI SHULE	—	A.A.S.
09/11/2013	REHEMA A. GAMA	MOMBOSE (B)	0785057635	
09/11/2013	HAFIJA S. KUCKUS	MOMBOSE	—	
9/11/2013	MATHEW NIKANORI	MOMBOSE	0768353776	
9/11/2013	AUGUSTINI C. GWERENZA	MOMBOSE	—	

Name and Signature of Consulted Stakeholders

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/ SAHIHI
9.11.2013	BIRA M. BIRA	VEO BUBUTOLE	0786650116	
9.11.2013	SALIM I. JETA	K/VEO	0786-090152	
9.11.2013	SHABANI R. TOTA	M/KIJIJI-BUBUTOLE		

Name and Signature of Consulted Stakeholders

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/ SAHIHI
9/11/2013	RAMADHANI SOGOI	MH. MWANI-GWANDI	0683572524	
9/11/2013	MOHAMEDI ALLY ITASO	VEO - TUMBAKOSE		
	HERMAN PAGAZA	MEK. GWANDI	0755824009	
	AMINA H. TITA	VEO ROBASI	0754265605	

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENTFOR THE PROPOSED CONSTRUCTION OF FARKWA DAM AND WATER CONVEYANCE SYSTEM TO DODOMA CITY,DODOMA REGION, TANZANIA

Name and Signature of Consulted Stakeholders

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/ SAHIHI
6/11/2013	JOHN N. MAKASI	VEO B/SALONI	078777 228	
05/NOV/2013	SIMON JOHN NKALU	VEO MHELELA	P.O BOX 2993 0763-818548	
13/11/2013	AGUSTIN. P KASERA	G/W !!	0783808461	
15/11/2013	JACOB BARNABA MALENGO	VEO - ZANKA	0752-604767	

PHASE 2 CONSULTATION ACTIVITIES

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENTFOR THE PROPOSED CONSTRUCTION OF FARKWA DAM AND WATER CONVEYANCE SYSTEM TO DODOMA CITY,DODOMA REGION, TANZANIA

Name and Signature of Consulted Stakeholders

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/ SAHIHI
12.03.2014	ROBERT M. KITIMBO	DODOMA M C	MD 0784694526	
12.03.2014	AKENGARAMI URASSA	DODOMA M C	0753-378929	
12.3.2014	ZAKARIA KUSUMBELE	TRL DODOMA	0714260600	
12.3.2014	MICHAEL Y. MKUNYA	AG DAS - BAHI	0763241253	
12.03.2014	Eng. PASKASI D MMARI	Ag. DG - CDA	0755696984	
12.03.2014	Mtemi John G.L.	DG - DPCDO	0752786609	

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENTFOR THE PROPOSED CONSTRUCTION OF FARKWA DAM AND WATER CONVEYANCE SYSTEM TO DODOMA CITY,DODOMA REGION, TANZANIA

Name and Signature of Consulted Stakeholders

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/ SAHIHI
11.3.2014	AMEDE AMANI	BAHI D.C.	Inst⇒ 0767 793570 026 2961400 Box 2993 DOD	
—11—	JOVIN BARARATA	BAHI D.C	0717-095760 0783-175356	
—11—	SOLOMON R. CHASHA	BAHI D.C	0753702977 0717099799	
—11—	KULWA J. NKWAMA	BAHI D.C	0713 939479 0787 855648	
—11—	STANSLAUS. M. MALIMA	SENIOR ENGINEER TANESCO-DODOMA	0713-[illegible]32	
—11—	LEONARD S. KABONGO	TANESCO-DODOMA	0753-246246	
12.03.2014	SAID.H. MNKENI	SWAGASWAGA G. RESERVE Box 840 DODOMA	0753-321062 0784-866024	

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
10/3/2014	KISENA LUHENDE	mkulima	–	
"	MAZIKU NTENDELE	mkulima	–	MN
"	MALANDALA	MKULIMA ~~KHAZEBA~~		M.K
"	RAMADHNI mohamed	mkulima MOMEPI	–	RM
"	FORTUNATA JAMSI	mkulima	–	F. Jems.
"	SUZANA JAMES	MKULIMA	–	James
"	BOTO MAHONA	mkulima	–	T. M
	ZENA ATHUMANI	msumbe	–	Z. ATHUMANI
	ABEL NYANDA	MSIMBE	—	[illegible]
	EMANUEL SAUSAKA	MKULIMA	–	[illegible]
	NGASA. MARIBA		–	[illegible]

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/ SAHIHI
10/3/2014	LUGOYE MATHIAS	mkulima	–	J.MATHIAS
10/3/2014	CHALA KINAMA ~~CHALID~~ ~~KINDAMA~~	Mkulima DENHA	–	[illegible]
"	HAMISI SHABANI	mkulima.	–	H.Shaw
"	NARAJA MWAJE	mkulima	–	
"	MUSA KIHONGOA	mkulima	–	Musa
"	KOMBA JUMA.	mkulima	—	
"	MIZA JIDAHA	mkulima	—	
"	HAMISI KIHONGOA	mkulima	–	Kihongoa

DATE/TAREHE	NAME/JINA	POSITION & INSTITUTION /TAASISI	ADDRESS/SIMU	SIGNATURES/SAHIHI
10/03/2014	SALUM SEIF ATHUMAN	MKULIMA	0754-777042	Athumani
10/03/2014	ZABRON MAGNA NYIROBI	Mkulima	0767533120	Magna
10/03/2014	NGUNDU LUTAMLA	Mkuma		
10/03/2014	ELISHA HUSENI	Mkulima	0687848	Husen
10/03/2014	Mihayo Juma	Mkulima	—	Jumbe
"	HAMISI MAGANGA	mkulima	0787-270009	H. maganga
"	MAJOBA MNYAGHARA	mkulima	-	
"	LUGOBA BUNDALA	MKULIMA	0788-625756	LBB

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/ SAHIHI
10/3/2014	MPONEJA KASENGA	MKULIMA	-	M. Kasenga
10/3/2014	TUMBE WATA	Mkulima	-	
"	THOMAS MAGAKA	mkulima	-	T.M.
"	EMANUEL TISA	mkulima	-	
"	FAUSTINE K. SOBAJA.	MKULIMA.	0688908027	Faustine Sobaja
10/3/14	MASANJA MADUHU		0785184350	
10/3/2014	Mwandu Waya	Mkulima		
"	OMARI GAIRA	mkulima		

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/ SAHIHI
18/3/2014	ILALI NKURUMAH	MKULIMA	-	ILALI
11	ZENA HAMISI	MKULIMA	-	Z. H.
11	ERNESTA MICHAEL	MKULIMA		
	SIMON SELELI	MKULIMA		
181	JOHN MABUHI	MKULIMA	-	
	ASHA SAIDI	MKULIMA	0674627616	
11	HASSANI A	MKULIMA	- -	H. A
	TABU SHABANI	MKULIMA		T. S

DATE/TAREHE	NAME/JINA	INSTITUTION/TAASISI	ADDRESS/SIMU	SIGNATURES/ SAHIHI
10/3/2014	MELO SIDA	MKULIMA	-	
11	MAGONGO MALIWA	MKULIMA	-	
11	ALI JUMA	MKULIMA	-	
11	RAMADHAN JUMA	MKULIMA	-	
11	JUMAA SHABANI	MKULIMA	-	
11	ELIAS JULIAS	MKULIMA	-	
11	Rozaliya	mkulima	-	
11	SHIJA MWANDU	MKULIMA	-	

STAKEHOLDERS CONSULTATIVE MEETING FOR THE ESIA IN DODOMA

WARSHA YA WADAU KUJADILI RIPOTI YA TATHMINI YA ATHARI ZA MAZINGIRA NA JAMII KWA MRADI WA BWAWA LA FARKWA, TAREHE 19/09/2014 DODOMA HOTEL- DODOMA

MAHUDHURIO: WAJUMBE WAALIKWA

NA	JINA KAMILI	CHEO/ NAFASI	WIZARA/ TAASISI/ ASASI/ HALMASHAURI	NAMBARI YA SIMU	BARUA PEPE	SAHIHI
1	GORSEN NGARYA	M/Kiti	ZANKA DODOMA	0762423805	—	
2	JUMA IDD	WED	BAHI	0784983853	—	
3	MARIMA KIMOLO	WEO	FARQWA	0784312038		
4	MARY BOBA	CDA	DODOMA	0713786927		
5	DR. DAVID MALLOLE	MEWAKE DODOMA MJINI	DODOMA	0768151516	[illegible]@yahoo.com	
6	ASSA ENOCK	M/KITI	BAHI	0768179117		
7	~~PANCRAS FIDELIS~~	~~M/K~~	~~DONSEE~~			
8	SALIM IDD	K/VEO	BUIGIRI 10CE DODOMA	0784020522		
9	SABINA FAYA	LEGAL OFFICER	MoW DSM	0713838598	sabinafaya@yahoo	
10	MWEMINUWA ALLY	RAJABU M/KITI	H/W – CHEMBA	0765721860		
11	SULEYMAN GOMA	DIWANI- FARKWA	H/W – CHEMBA	0756823189.		
12	JOSEPH MAGOBWEA	MH.	MABURO BAHI	0758014870		
13						
14						

NA	JINA KAMILI	CHEO/ NAFASI	WIZARA/ TAASISI/ ASASI/ HALMASHAURI	NAMBARI YA SIMU	BARUA PEPE	SAHIHI
15	RICHARD.G.MHAWI	WEO	BAHI	0758217166	—	
16	GEOFREY.C. LUNYUNGU	VEO-BABAYU	BAHI	0757-815807	—	
17	ENG. DAVID PALANGYO	AG-MD	DUWASA	0754-279901	pdavidos@yahoo.co.uk	
18	HARIBU H. MWILA	K/TARAFA	BAHI	0717630347	[illegible]@hotmail.com	
19	Betty Mkwasa	DC	BAHI	0784-316161	bmkwasa@yahoo.com	
20	GODFREY MAGANGA	FUNDI SANIFU MWANDAMIZI	BONDE LA MAJI	0688503266	Godfreymaganga@Gmail.	
21	Zulfa Kulua	Secretary	MoW	0716189285	Zulfa@yahoo.com	
22	RASHID ATHUMANI	E/TECHN.	MOW	0653254457		
23	Delta Ringo	P/Sec	MoW	0713 697739	ringodl2009@yahoo.com	
24	Faiza Dollah	P/Sec	MoW	0717-536101	dollahfaiza@yahoo.com	
25	Fatuma Mwinyi	S/S	MoW	0752668142		
26	Omari Issa	O/S	MoW	0713-339341		
27						
28						
29						
30						

WARSHA YA WADAU KUJADILI RIPOTI YA TATHMINI YA ATHARI ZA MAZINGIRA NA JAMII KWA MRADI WA BWAWA LA FARKWA, TAREHE 19/09/2014 DODOMA HOTEL- DODOMA

MAHUDHURIO: WAJUMBE WAALIKWA

NA.	JINA KAMILI	CHEO/NAFASI	WIZARA/TAASISI/ASASI/HALMASHAURI	NAMBARI YA SIMU	BARUA PEPE	SAHIHI
1	JACKSON R CHKIMBE	M/KITI H/KIJIJI	DODOM CHEMBA	076276281	—	[signature]
2	Alphonce Kilamle	Hydrologist	MEM	0782507155	mfakasimbagmail.com	[signature]
3	STANLEY DAUDI	CHEMIST	MAJI	0754994957	stadanga@yahoo.com	[signature]
4	JOSEPH LUGENDO	MHARIRI HABARI	HABARI LEO (TSN)	0753 025476	lugendo2000@yahoo.com	[signature]
5	OMARI MAULIDI	VEO KIHURUNGU	CHEMBA (DODOMA)	0783-132696	—	[signature]
6	NAISA KUTHONGA	M/KITI-H/KIJIJI	DODOMA "	0759117898	—	[signature]
7	IGONYA J. NKUBA	POE-member	MAJI	0784 317566	igundoigonya@gmail.com	[signature]
8	DAVID MANYAMA	Hydrogeologist	MAJI	0782 465254	davidimanyama@gmail.com	[signature]
9	RAMADHANI H. SINGANO	Hydrologist	MAJI	078251987	rhsingono.m...@gmail.com	[signature]
10	KARIM F. LICHELA	HYDROLOGIST	MAJI	0658536164	furahakarim2002@yahoo.com	[signature]
11	PAULA M. DOMALU	VEO MAMUMANGO	DODOMA CHEMBA	0783580256		[signature]
12	MATATA I KANYAMALA	VEO BABAYU	DODOMA CHEMBA	0765395465	—	[signature]
13	JOSEPH W. MARIMO	HYDROGEOLOGIST	MAJI-DODOMA	0767-844450	—	[signature]
14	MWANAISHA I. ALLY	MWENYEKITI	BONDE LA KATI	0713 341937	mwanaishaally@yahoo.com	[signature]
15	YUNUSU H. DAU	WEO	DODOMA CHEMBA	0787358395		[signature]
16	Germana Orota	AAS (Mipango)	ofisi ya RC-DODOMA	0754564548		[signature]
17	Saimon G. Mbaga	AO	Wizara ya Kilimo (MAFC)	0715104333	Saimonmbaga@yahoo.com	[signature]
18	Laurent Mazengo	Mrakibu Mfawidhi	BAHI	0714002598	—	[signature]
19	ALOICE KAPONDA	GROUNDWATER UNIT	MOW	0754625308	alloice.kaponda@yahoo.com	[signature]
20	FRANCIS RAS FIRAS	MK.	DONSEE			[signature]
21	D.W.D. MAHAYA	DED-CHEMBA	DED CHEMBA DC	0754476393	hwimafuru@yahoo.co.uk	[signature]
22	FATUMA Y. Hamza	CMEI	MOW-DIM	0756479435	hamzafadel2...@gmail.com	[signature]
23	Francis Isack.	DC-CHEMBA		0754-324253	francisfyunga@yahoo	[signature]
24	PASCHAL MARINI	M/KITI H/KIJIJI	MONGOROSE	0786652057	—	[signature]
25	GREGORY DEGERA	VEO	FARKWA	0686466		[signature]
26	Eng. Kashilimu Mayunga	PDE	DUWASA	0754238864	kashilimu@yahoo.com	[signature]
27	ANTHONY LYAMUNDA	DIWANI (mwenyeki)	CESOPE	0753340650	cosopete@gmail.com	[signature]
28						
29						
30						

NA.	JINA KAMILI	CHEO/ NAFASI	WIZARA/ TAASISI/ ASASI/ HALMASHAURI	NAMBARI YA SIMU	BARUA PEPE	SAHIHI
31	FREDRIK KAMOMBO	[illegible]	BAHI - MWEREW	0713439749	[illegible]	[signature]
32	Benton Nollo	AIIC C UHIZLELA	BAHI	0756-427307	bentonjohn@yahoo...	[signature]
33	F.L. Mugheha	DUWASA. BOARD	DUWASA	0754-366387	Lusilo...@yahoo.c...	[signature]
34	SHABANI RASHIDI	M/KIJIJI	CHEMBA	-		[signature]
35	MARIA HOLLELA	ENV. MGT OFFICER	DUWASA	0757584657	[illegible]	[signature]
36	AHMED NGAJENI	A/MTENDAJI KATA	BAHI DC	0766446854	ahmed.ngajeni@gmail	[signature]
37	SIMONI [illegible]	M/KITI KIJIJI	BAHI	0759-102908		[signature]
38	REGINALDO.F. NDAWA	VEO-ASANGE	BAHI	0788425974		[signature]
39	CHALULA B. CHINGA	M/ KIJIJI	BAHI	0765830738		[signature]
40	ELIAS MAGANGA	M/KITI-SIKIMU	- 11 -	0712694044		[signature]
41	JUMA LIMBE	OFISI YA MAKAMU WA RAIS - MAZINGIRA	VPO	0755960224	jumamanguyas@yahoo.co.uk	[signature]
42	MWAKATUNDU	P/ Secretary	MOW			
43	Eng. Valentine Njau	Katibu wa Waziri wa Maji	MOW	0784 419937	Valefred03@yahoo.com	
44	Eng. Kalunde K. Mdale	Mhandisi Mwandamizi	MOW	0719451607	Kalunde007@yahoo.com	[signature]
45						
46						

APPENDIX 4: RESULTS OF STAKEHOLDER CONSULTATION DURING UPDATING THE ESIA

KEY STAKEHOLERS INVOLVED

Number of stakeholders that contribute their views concerns and/or advice in the compilation of this addendum of Stakeholders consultation as sub-section of the Environmental Impact Assessment for the Farkwa Dam Project are given below as Table 1.

Table 1: Number of participants either asked or commented during the consultative meetings

S/N.	LOCATION/VILLAGE/WARD/LGA	TOTAL NUMBER	DATE	TIME
1.	Bubutole village	104	03 August 2021	12:18 – 13:45
2.	Mombose village	117	03 August 2021	14:21 - 16:40
3.	Tumbakose ward	10	04 August 2021	10:25 - 10:57
4.	Rofati village	8	04 August 2021	11:30 – 12:05
5.	Gwandi village	15	04 August 2021	12:35 - 13:05
6.	LGA	5	03 August 2021	09:07 - 09:47
TOTAL		**259**		

1.0 OUTCOME OF THE CONSULTATIVE PROCEEDINGS

Generally, most stakeholders welcomed the idea of constructing Farkwa dam and associated distribution facilities at Bubutole and Mombose villages in Chemba District. The need to take into account current water scarcity and future demand to local and other stakeholders in Dodoma region. The possibility of utilising the water from the proposed dam and its ecosystems for industrial and domestic uses, irrigation farming, environmental friendly fishing, tourism and trading to boost socio-economic status of nearby communities and Dodoma. Stakeholders stressed that there is a need of having well developed "Farkwa Dam Catchment Integreted Management Plan" for project sustainability. There was a suggestion that reallocation of the Bubutole Primary school to Sankwaleto should be re-assessed by checking for possibility of locating the new school to Manyata sub village in order to accommodate students from Kazamoyo, Manyata and the nearby sub villages. The GoT through the Ministry should resolve all failed compensation claims and trigger evacuation police order for compensated people at Mombosee and Bubutole to pave way for project implementation.

2.0 POSITIVE IMPACTS RAISED BY DIFFERENT GROUPS

- Stakeholders provided the operation of the dam will have an influence on the population size of the area. The dam is anticipated to attract people who are interested in irrigated agriculture thus putting pressure on the available natural resources. Also they added that the project may attract tourism activities in the area;
- With reliable water supply for irrigation throughout the year, others stakeholders were of opinion that will effectively enable the area to increase their crop production levels. This entails enough production to satisfy local demand while at the same time export. As a result, earn the country the much needed foreign exchange thus contribute to overall economic growth.

- A good number of people in the meeting observed that there is a likelihood that livestock keeping will increase.
- The cponstructed dam and provision of irrigation water will provide both permanent and temporal employment to the local people. This means more income for the community in the area resulting into increased economic activities and there are could a lot of food security;
- LGA officials said that the project is likely to increase the value of land and more investors will come to the project area;
- LGA officials and Villagers believed that the project could create job opportunity to jobless youths and reduce banditry rates in the area;
- It was suggested that the project could lead to improved infrastructure i.e., schools, hospitals, roads and water distribution channels in the area and Dodoma in general;
- Many stakeholders believed that the project is likely to bring fish farming in the project area.

3.0 NEGATIVE IMPACTS

- Stakeholders provided that operation of the dam will have an influence on the population size of the area. The dam is anticipated to attract people who are interested in irrigated agriculture thus putting pressure on the available natural resources.
- Stakeholders were of concern that reallocation process did not meet the people's expectation demand and/or requirements as the promised key social services at to be constructed at Sankwaleto up to now are not yet built. However, it was informed that preparation for development of the infrastructure started with land use survey and planning at Sankwaleto after completion the infrastructure will be built. This is a process and the construction of the school will be completed before the old school is demolished.
- Stakeholders pointed out that most of PAPs were not prepared well for compensation exercise and they lacked proper education on how the Valuation and Compensation process were to be effected. This has contributed too much grievances and a number of complains has been filed to the MoW. However, it was responded that before the exercise started a number of team from the Ministry visted the area and a number of meetings were held. All required procedures were followed and involved the village government offices.
- Some Stakeholders admitted that low level of education, ignorance and financial status have costed the PAPs. The money paid for compensation were misused and PAPs were believing they have more money to buy new land and building the houses. Unfortunatly some spent the money on alcohol, buying old vehicles etc and as the result they found out the money were not that much to meet all his/her desires.
- Stakeholders commented that dam construction will halt the flow of the river as a result will reduce the water within the river and this will affect negatively the downstream users. It was responded that the river will not be completely impounded but will allow environmental flows for both the ecosystem and any other activity that may be undertaken downstream at any given time.

4.0 QUESTIONS AND RESPONSES OR DISCUSSIONS

Mombosee and Bubutole villages were also complained about amount of money paid as compensation. They claimed that amount paid was not as per the real value of their assets (land houses, plots and undeveloped forest). Others claiming that they were not given enough education during valuation and compensation processes. They went on by saying most of them due to lack of education misused all the

money paid as compensation because it was the first time on their life to own such big amount of money and thus they didn't manage the money appropriately.

Further stakeholders were worried about the proposed dam as an emergency exists when dam failure occurred. They explained that dam failure may occur during normal conditions, and this failure tends to be the most dangerous because the resulting flood would be sudden. They mentioned that MoW should pay particular attention to indicators of a potential dam failure. In response, the consultant provided that during the bidding of contracts, there are many factors that are considered in giving the tender. This applies to Farkwa dam development project where due process will be followed. Additionally, the dam was designed by a reputable firm that has qualified team of engineers who have worked on many successful dam projects and there was no doubt that the dam could last many decades. Stakeholders expressed their concerns over the ownership of the dam development project and if the locals could have a say to the project.

Table 2: Summary of issues and response for stakeholders meeting held at Mombosee, Bubutole, Tumbakose, Rofati and Gwandi villages

SN	Village/Ward	Issues raised	Response
1.	Mombosee, Bubutole, Tumbakose, Rofati and Gwandi stakeholders	The stakeholder commended the effort done by GoT through the Ministry of Water to solicit fund for the project. They praises and congratulates the general project idea as will solve the existing water scarcity problem along the alignment and Dodoma in general while restoring more time (which were previously lost in collecting water) for other activities.	Study team on behalf of the Ministry received the appreciations and promised that the MoW will work closely with Contractor and Consultant to ensure that the project is timely implemented.
2.	Mombosee and Bubutole stakeholders	Raised concern on low compensation and claimed that violated value for money on their properties. Reported that they are going nowhere as they have all rights to stay there because were not well informed about valuation and compensation processes. They claimed that valuation was done without involving them and other entitlement such as transport, housing and disturbance allowances were not paid.	They were informed that the compensation process followed proper procedures as stipulated by Tanzania Laws and Regulations regarding Valuation and Compensation. Also international standards were adhred too. LGAs leaders from village to district levels were full involved on the process and participated in valuation. Few people who are complaining are those misused their money for unintended issues. They thought that the project will ceased after the death of Late President Magufuli. The Government delayed to evacuate them and that even further boosted their thought.
3.	Bubutole stakeholders	Stakeholders explained that there is a historical hostility between Bubutole and Mombose villagers whereby in the year 2014 it reached to killing each other. So relocating all PAPs at Sankwaleto it is	TRES promised to advice the Ministry to look for other possibilities i.e. reallocate those who are not willing to share the same locality with Mombose people at Sankalento to other villages like Tumbakose, Rofati and Gwandi. Preparations of construction the planned social

		appropriate for security reason. They provided that it propoer for Mombose PAPs to move to Sankwaleto and Bubutole should be relocated to Manyata and Mlimani sub villages. Also pointed out that within the boundaries of Bubutole villages there are areas which will not be affected by the dam and the primary school should be constructed there not Sankwaleto.	facilities at Sankoleto have started.The Government is working on the design.
4.	Mombosee and Bubutole stakeholders	Asked about when they are going to have the answers for their claims.	The Ministry is finalizing reviewing/assessing the submitted claims and soon will get the answers. Every claims will receive just answer. Those with genuine claims will get their full rights and those with un-justifiable will be informed why their claims have been dropped.
5.	Mombosee and Bubutole stakeholders	Stakeholder reported that they paid some money for the land acquisition at Sankwaleto but they didn't receive the receipts for the payment. Also they were promised to get the title / ownership document which until today they haven't received.	District Land Officer requested all villagers who have not yet received the receipt to list down their names and will work on that and will receive their receipt ASAP. Also requested that villagers should report to the village office all concerns about receipts for paid plots and will make a follow up.
6.	Mombosee and Bubutole stakeholders	Stakeholde requested that they need to be informed on advance when they are suppose to vacate the project area.	GoT still working on the project to ensure that all key social facilities are available at Sankwaleto and all PAPs will be informed once the construction of key social service infrastructures at Sankwaleto are finalized as promised.
7.	Mombosee stakeholders	No clear boundary between Farkwa and Mambose villages as a result this can be source of land conflict	DLO responded by saying that, the boundaries between the two villages are already established/demarcated. It was advised that the people who their plots fall within Farkwa village will belong to that village and those who their plots are in Mombosee side should register them in Mombose village to avoid conflicts.
8.	Mombosee stakeholders	Stakeholders claimed that they paid for the plots at Sankwaleto but were not shown the plots.	DLO responded by saying that will make arrangement soon to enable everyone to locate his/her plots BUT emphasize on their punctuality and participation as they have been visiting the area and villagers are to showing up.
9.	Tumbakose, Rofati and Gwandi stakeholders	The stakeholders were concerned about the impact of the project on peoples' properties (disturbances or resettlement might be caused by construction of dam and associate	All construction works will be done to specific areas as per project design. MoW will acquired or compensate only entitled people if project design transverse within their plots. However, some problems may emerge along the

		facilities). Also there were concerns about some houses been built on proposed pipeline system (conveyor). Further stakeholder wanted to know if there will be any possibility of diverting the new distribution system where transverse within clustered residential houses.	distribution lines were people have encroached along the way-leave. MoW will require the current occupy to vacate the way-leave without compensation as they are not entitled with any compensation as they encroached the legally owned way-leave. This implies that, people who their houses built on the road reserve should demolished their structures to allow smooth project implementation.
10.	Tumbakose, Rofati and Gwandi stakeholders	Stakeholder wanted to know if project will install water facilities such as receiving and storage tanks at Tumbakose, Rofati and Gwandi villages.	All villages along the conveyor alignment are part of the proposed project design unless located outside the project area. RUWASA will reassessed their current and future demand during distribution.
11.	Mombosee Tumbakose, Rofati and Gwandi stakeholders	Stakeholder were of concerns that most of the river water collected at the dam came from polluted area and they wanted to know how the water will be treated along distribution channels after the proposed project is completed.	Water Treatement Plant will be installed and all water supply along distribution channels will be first treated before being pumped to the conveyance system. The water supply will be not for freely users will be paying the required fees
12.	Mombosee, Bubutole, Tumbakose, Rofati and Gwandi stakeholders	It was urged that local people within the project areas should get first priority for available job opportunities during mobilization and construction phases.	MoW and/or Contractor understand that villagers need to feel to be part of the project. During the tendering documents the contractor will be advised to use available local labour force where appropriate. Hiring labourers from respect communities has the advantage of bringing the sense of ownership. Also skills gain during the project implementation will remain an asset to communities. However, employment will be made available to people aging 18 years and above.
13.	Mombosee Tumbakose, Rofati and Gwandi stakeholders	Stakeholder were of concern about the preparedness of GoT through the MoW to handle and complete such a huge project in time, considering their huge demand of water in the area.	GoT through the MoW would plan based on experiences acquired from other related projects to accomplish the project in time. Also it was pointed out that the added design of new components like conveyor (from Donsee to Chemba) and water treatment tank will not affect accomplishment of the projects.
14.	Tumbakose, Rofati and Gwandi stakeholders	Stakeholders asked how water will be distributed in their areas and if there will be any charges for water supply and/or services to nearby villages.	Assurance of reliable safe and clean water that meet the demand of all water users will be attained by having well designed and planned distribution channels. MoW will develop the project infrastructure then RUWASA will manage the project thereafter by fixing the water tariffs. There will be community water supply points at each village that will serve general public. However, individuals may apply

			for such service at a certain charges to be fixed by RUWASA after considering a number of factors. Connection charges and monthly billing will be applied.
15.	Tumbakose, Rofati and Gwandi stakeholders	Stakeholder wanted to know if Tumbakose, Rofati and Gwandi are part of the project as those areas have a long-lasting water supply problems	All the named villages are part of the proposed project i.e., Tumbakose, Rofati and Gwandi will be connected or served by the distribution channel that will be fixed at each village.
16.	Rofati and Gwandi stakeholders	How long are they supposed to evacuate after been compensated for those entitled.	According to government laws and regulations people are required to vacate 90 days after been compensated. However, appropriate day will be set and communicated to villagers/PAPs.
17.		Is there any possibility of getting free water from the dam? Is irrigation part of the plan?	This will be confirmed by the Ministry of Watre and will be worked up on on completion of fthe dam construction. However, nearby communities will be much considered to get water for from the dam. All security and safety aspects shall be adhered.
18.		Is there any plan for pastoralist? Are they considered for grazing land?	The reallocation plan was for residential commercial and mixed residential and commercial areas due to limited space. This is a reason why other pastoralist went to other areas to buy their grazing land.
19.		Stakeholders wanted to seek clarification as to whether the dam could develop future problems such as dam failures	During the bidding of contracts, there are many factors that are considered in giving the tender. This applies to Farkwa dam development project where due process was followed. Additionally, the Dam was designed by a firm that has qualified team of engineers who have worked on many successful projects

APPENDIX 5: CORRESPONDENCES WITH NEMC (REGISTRATION AND APPROVAL OF SCOPING REPORT AND TOR)

NATIONAL ENVIRONMENT MANAGEMENT COUNCIL (NEMC)

BARAZA LA TAIFA LA HIFADHI NA USIMAMIZI WA MAZINGIRA

Tel Dir.: +255 22 277 4852
Tel +255 22 277 4889
Mobile: +255 713 - 608930
Fax: +255 22 277 4901
E-mail: dg@nemc.or.tz
Website: www.nemc.or.tz

Regent Estate / Migombani
Plot No 29 / 30
P.O.Box 63154
Dar es Salaam
Tanzania

In reply please quote:

Ref: **NEMC/562/Vol. I/167**

Date: **11/12/2012**

Permanent Secretary,
Ministry of Water,
P.O. Box 9153,
Dar es Salaam.

RE: SCREENING DECISION ON THE PROPOSED CONSTRUCTION OF FARKWA DAM AND WATER CONVEYANCE SYSTEM IN FARKWA VILLAGE, KONDOA DISTRICT, DODOMA REGION

The above caption refers.

We acknowledge receipt of a letter from Jamal Kiama on your behalf, dated 30th November, 2012 attached with a Registration Form and the Project Brief as an application for Environmental Impact Assessment clearance of the above mentioned project.

The Council has screened the submitted documents and found that this project falls on the list of projects which EIA is mandatory. Therefore you are required to do a scoping exercise and prepare the scoping report and the Terms of Reference (ToR) for the EIA study. The scoping report and the draft ToR should be submitted to the Council for review and approval before the commencement of the EIA study.

Be reminded that Regulation 13(1) of Environmental Impact Assessment (EIA) and Audit Regulations, 2005 states that "*EIA shall be conducted in accordance with scoping and the terms of reference developed during the scoping exercise by the developer*". Please adhere to the requirements of the *EIA and Audit Regulations of 2005* when preparing the Scoping Report and ToR.

Please do not hesitate to contact us in case you need further clarification on this matter through Tel No. 0714508171.

Yours Sincerely,

F.C.N Rugiga
For: Director General

Cc: Managing Director,
JRES Consult (T) Limited,
P.O. Box 31155,
Dar es Salaam.

All correspondence should be addressed to the Director - General

NATIONAL ENVIRONMENT MANAGEMENT COUNCIL (NEMC)

BARAZA LA TAIFA LA HIFADHI NA USIMAMIZI WA MAZINGIRA

Tel: Dir: +255 22 277 4852
Tel: +255 22 277 4889
Mob: +255 713 - 608930
Fax: +255 22 277 4901
E-mail:nemc@nemctan.org

Regent Estate Plot No. 29/30,
P.O.Box 63154,
DAR ES SALAAM
TANZANIA

In reply please quote:
Ref: NEMC/562/Vol.IV/45

Date: 22/05/2014

Permanent Secretary,
Ministry of Water,
P.O. Box 9153,
Dar es Salaam.

RE: SCOPING REPORT AND DRAFT TERMS OF REFERENCE (ToR) FOR UNDERTAKING AN EIA OF THE PROPOSED CONSTRUCTION OF FARKWA DAM AND WATER CONVEYANCE SYSTEM IN FARKWA VILLAGE, KONDOA DISTRICT, DODOMA REGION

We acknowledge receipt of your letter with Ref. No. TRES/MOW/ESIA/2014/01 of 15th January, 2014 attached with three copies of Scoping Report and the draft Terms of Reference (ToR) for undertaking an Environmental Impact Assessment (EIA) of the above-mentioned project.

The Council has noted that, the Scoping Report and the draft ToR are adequate enough to guide the EIA study. However, the following should also be taken into consideration to improve the ToR;

i. Stakeholders' consultations should be done adequately and the raised concerns addressed in the EIS;
ii. The project alternatives should exhaustively be analyzed and the reasons given for the preferred alternative; and
iii. Baseline information should be specific to the project area and should address the most current physical, biological, socio-economic and cultural environment.

Please, work on these amendments and the improved ToR should be appended in the final EIS to be submitted to NEMC for review. The budget for these review activities amounts to Five million five hundred and thirty three thousand shillings **(Tshs. 5,533,000/=)** as elaborated on the attached sheet **(Attached AA)**. The funds can be paid by Cheque or in Cash to NEMC`s Account **No. is 2011100084.**

F.C.N Rugiga
For: Director General.

APPENDIX 6: COMMUNICATION WITH OTHER STAKEHOLDERS

JAMHURI YA MUUNGANO WA TANZANIA
OFISI YA WAZIRI MKUU
TAWALA ZA MIKOA NA SERIKALI ZA MITAA

Mkoa wa Dodoma
Anwani ya Simu REGCOM
Simu Nambari: 2324343
E-Mail No.
rasdom2002tz@yahoo.com
Fax No. 255 026 2320046
Unapojibu tafadhali taja:

Ofisi ya Mkuu wa Mkoa
S.L.P 914,
Dodoma.

Kumb Na. DA. 336/480/01/C/92 04 Novemba, 2013

Mkurugenzi wa Manispaa,
S. L. P. 1249,
DODOMA.

Wakurugenzi Watendaji,
Halmashauri za Wilaya,
Bahi, Chamwino na Kondoa.

YAH: **KUITAMBULISHA KAMPUNI YA TRES CONSULTING (T) LIMITED**

Husika na kichwa cha habari hapo juu.

Kampuni tajwa hapo juu imeajiriwa na Wizara ya Maji kwa ajili ya kufanya utafiti wa Athari za Mazingira zinazoweza kutokea au kusababishwa na ujenzi wa bwawa la Farkwa katika Kijiji cha Farkwa Wilayani Kondoa.

Bwawa hilo linatarajia vilevile kuhudumia wakazi wa Dodoma Manispaa wakati litakapokamilika. Utafiti huo unakusudia kugusa Vijiji vyote ambavyo vinaweza kuathiriwa na ujenzi wa bwawa hilo.

Vijiji vitakavyohusika ni vile ambavyo viko chini na juu ya Bonde la Mto Bubu pamoja na Vijiji vyote ambavyo bomba kuu la kusafirishia maji litapita.

Kwa barua hii unaombwa kuipatia ushirikiano wa karibu katika kufanikisha zoezi hili. Hii ni pamoja na kuipatia taarifa zote muhimu zinazohitajika na kuitambulisha katika Vijiji itakavyohitaji kutembelea na kuonana na jamii husika kwa ajili ya kufanikisha zoezi zima la utafiti.

Nakutakia ushirikiano mwema.

Bazil Mwiserya
Kny: **KATIBU TAWALA MKOA**
DODOMA

HALMASHAURI YA WILAYA CHEMBA

Barua zote zitumwe kwa Mkurugenzi Mtendaji (H/Wilaya)

WILAYA YA CHEMBA
FAX/ SIMU 026-2360175
E - MAIL: dedchemba@yahoo.com

S. L. P 830
CHEMBA.

Kumb. Na. CDC/W.10/3 VOL.I/2 08 Novemba, 2013

Maafisa Watendaji Kata,
Kata ya Farkwa, Gwandi na Makorongo
Halmashauri ya Wilaya,
CHEMBA.

YAH: KUITAMBULISHA KAMPUNI YA TRES CONSULTING (T) LIMITED

Husika na kichwa cha habari hapo juu.

Kampuni tajwa hapo juu imeajiriwa na Wizara ya Maji kwa ajili ya kufanya utafiti wa athari za mazingira zinazoweza kutokea au kusababishwa na ujenzi wa bwawa la Farkwa katika Kijiji cha Farkwa Wilayani Chemba.

Kwa barua hii unaombwa kuipatia ushirikiano wa karibu katika kufanikisha zoezi hili. Hii ni pamoja na kuipatia taarifa zote muhimu zinazohitajika na kuitambulisha katika Vijiji itakavyohitaji kutembelea na kuonana na jamii husika kwa ajili ya kufanikisha zoezi zima la utafiti.

(Gervas A. Amata)
Kny: MKURUGENZI MTENDAJI
HALMASHAURI YA WILAYA
CHEMBA

Kny: MKURUGENZI MTENDAJI

Nakala: Wah. Madiwani,
Kata ya Farkwa, Gwandi na Makorongo – Kwa taarifa.

" Maafisa Watendaji wa Vijiji,
Mombose, Bubutole, Gonga, Farkwa, Tumbakose,
Rofati, Khubunko, Makorongo na Babayu – Wapeni ushirikiano.

HALMASHAURI YA WILAYA BAHI

(Barua zote ziandikwe kwa Mkurugenzi Mtendaji)

Namba ya Simu Ofisini kwa
Mkurugenzi:- +255 26 2961400
Fax Na. +255 26 2961401
E -mail: bahidc @gmail.com

S. L. P 2993
DODOMA
TANZANIA

Kumb. Na HW/U 30/2/142 05/11/2013

AFISA MTENDAJI WA KIJIJI ,
KIJIJI CHA. BAHI SOKONI, NAGURO BAHI, MHELELA, na BAHI MAKURU.

YAH: KUITAMBULISHA KAMPUNI YA TRES CONSULTING (T) LIMITED

Husika na kichwa cha habari hapo juu.

Kampuni tajwa hapo juu imeajiriwa na Wizara ya maji kwa ajili ya kufanya utafiti wa athari za mazingira zinazoweza kutokea au kusababishwa na ujenzi wa bwawa la Farkwa katika kijiji cha Farkwa wilayani Kondoa.

Kwa kuwa kijiji chako ni moja kati ya vijiji vilivyopo katika eneo la Bahi (Bahi Swamp) ambapo utafiti utafanyika, unaombwa kuwapa wahusika ushirikiano wa karibu ili kufanikisha zoezi hili, na kuwapatia takwimu zote muhimu endapo zitahitajika.

Asante

B Kimaji

Bernadetha K. January
KAIMU MKURUGENZI MTENDAJI (W)
BAHI

DISTRICT EXECUTIVE DIRECTOR
BAHI DISTRICT COUNCIL
P. O. BOX 2993
DODOMA.

Nakala : Afisa Mtendaji Kata
Kata ya... BAHI na MPAMANTWA.

" : Mhe. Diwani,
Kata ya... BAHI... na MPAMANTWA.

APPENDIX 7: LARGE AND MEDIUM SIZED MAMMALS RECORDED DURING THE STUDY

Common name	Scientific name	Order	Family	IUCN status (CITES)	Evidence / Method		
					Direct observation	Signs	Others
Scrub hare	*Lepus saxatalis*	Lagomorpha	Leporidae	Least concern	×	×	Droppings
Olive baboon	*Papio spp.*	Primate	Cercopithecidae	Least concern	×		Droppings
Rock hyrax	*Procavia capensis*	Hyracoidea	Procaviidae	Least concern	×		Droppings
Slender mongoose	*Herpestes sanguineus*	Carnivora	Herpestidae	Least concern	×	×	Interview
Honey badger	*Mellivora capensis*	Carnivora	Mustelidae	Least concern			Interview
Dik dik	*Madoqua kirkii*	Artiodactyla	Bovidae	Least concern			Interview
Vervet monkey	*Cercopithicus aethiops*	Primate	Cercopithecidae	Least concern	×		Interview
Warthog	*Phacochoerus africanus*	Artiodactyla	Suidae	Least concern	×		Interview
Wild dog	*Lycaon pictus*	Carnivora	Canidae	**Endangered**			Interview
Leopard	*Panthera pardus*	Carnivora	Felidae	**Near threatened**			Interview
Bush pig	*Potamochoerus larvatus*	Artiodactyla	Suidae	Least concern			
Black backed jackal	*Canis mesomelas*	Canivora	Canidae	Least concern			Interview
Lion	*Panthera leo*	Carnivora	Felidae	**Vulnerable**			Interview
Porcupine	*Hytrix cristata*	Rodentia	Hystricidae	Least concern		×	Interview
Eland	*Tragelaphus oryx*	Artiodactyla	Bovidae	Least concern			Interview
Hyena	*Crocuta crocuta*	Carnivora	Hyaenidae	Least concern			Interview
Aardvark	*Orycteropus afer*	Tubulidentata	Orycteropodidae	Least concern			Interview
Ground pangolin	*Manis temminckii*	Pholidota	Manidae	**Endangered**			Interview
Klipspringer	*Oreotragus oreotragus*	Artiodactyla	Bovidae	Least concern			

APPENDIX 8: CHECKLIST OF BIRDS RECORDED DURING THE STUDY

Species Common name	Scientific name	IUCN Category
Brown headed parrot	*Poicephalus cryptoxanthus*	Least concern
Flappet lark	*Mirafra rufocinnamomea*	Least concern
Rufous-naped lark	*Mirafra africana*	Least concern
Cardinal woodpecker	*Dendropicos fuscescens*	Least concern
Lesser honeyguide	*Indicator minor*	Least concern
African grey hornbill	*Tockus nasutus*	Least concern
Red-billed hornbill	*Tockus erythrorhynchus*	Least concern
Square-tailed nightjar	*Caprimulgus fossii*	Least concern
Black-headed weaver	*Ploceus cucullatus*	Least concern
Superb starling	*Lamprotornis superbus*	Least concern
Greater blue-eyed starling	*Lamprotornis chalybaeus*	Least concern
Black-headed heron	*Ardea melanocephala*	Least concern
Racket-tailed Roller	*Coracias spatulatus*	Least concern
Boehm's Bee-eater	*Merops boehmi*	Least Concern
Pale-billed Hornbill	*Tockus pallidirostris*	Least Concern
African Green-tinkerbird	*Pogoniulus simplex*	Least Concern
Brown-breasted Barbet	*Lybius melanopterus*	Least Concern
Pale Batis	*Batis soror*	Least Concern
Chestnut-fronted Helmet-shrike	*Prionops scopifrons*	Least Concern
Four-coloured Bush-shrike	*Telophorus quadricolor*	Least Concern
Yellow Flycatcher	*Erythrocercus holochlorus*	Least Concern
Rufous-bellied Tit	*Parus rufiventris*	Least Concern
Tabora Cisticola	*Cisticola angusticauda*	Least Concern
Fischer's Greenbul	*Phyllastrephus fischeri*	Least Concern
Yellow-bellied Greenbul	*Chlorocichla flaviventris*	Least Concern
Kretschmer's Longbill	*Macrosphenus kretschmeri*	Least Concern
Black-bellied Glossy-starling	*Lamprotornis corruscus*	Least Concern
Kurrichane Thrush	*Turdus libonyanus*	Least Concern
Lesser Seed cracker	*Pyrenestes minor*	Least Concern
Red cheecked Cordonbleu	*Uraeginthus bengalus*	Least concern
Evergreen Forest Warbler	Bradypterus lopezi	Least Concern
African paradise fly catcher	*Terpsiphone viridis*	Least Concern
Bearded Scrub Robin	*Cercotrichas quadrivirgata*	Least Concern
Mottled Swift	*Tachymarptis aequatorialis*	Least concern
Speckled Mousebird	*Colius striatus*	Least concern
Common Bulbul	*Pycononotus barbatus*	Least concern
White-tailed crested Flycatcher	*Trochocercus albonotatus*	Least concern
Collared Sunbird	*Hedydipna collaris*	Least concern
Lesser Masked Weaver	*Ploceus intermedius*	Least Concern
Yellow-throated Petronia	*Petronia supercilliaris*	Least Concern
House Sparrow	*Passer domesticus*	Least concern
Fork-tailed Drongo	Dicrurus adsimilis	Least concern
Pied Crow	*Corvus albus*	Least concern

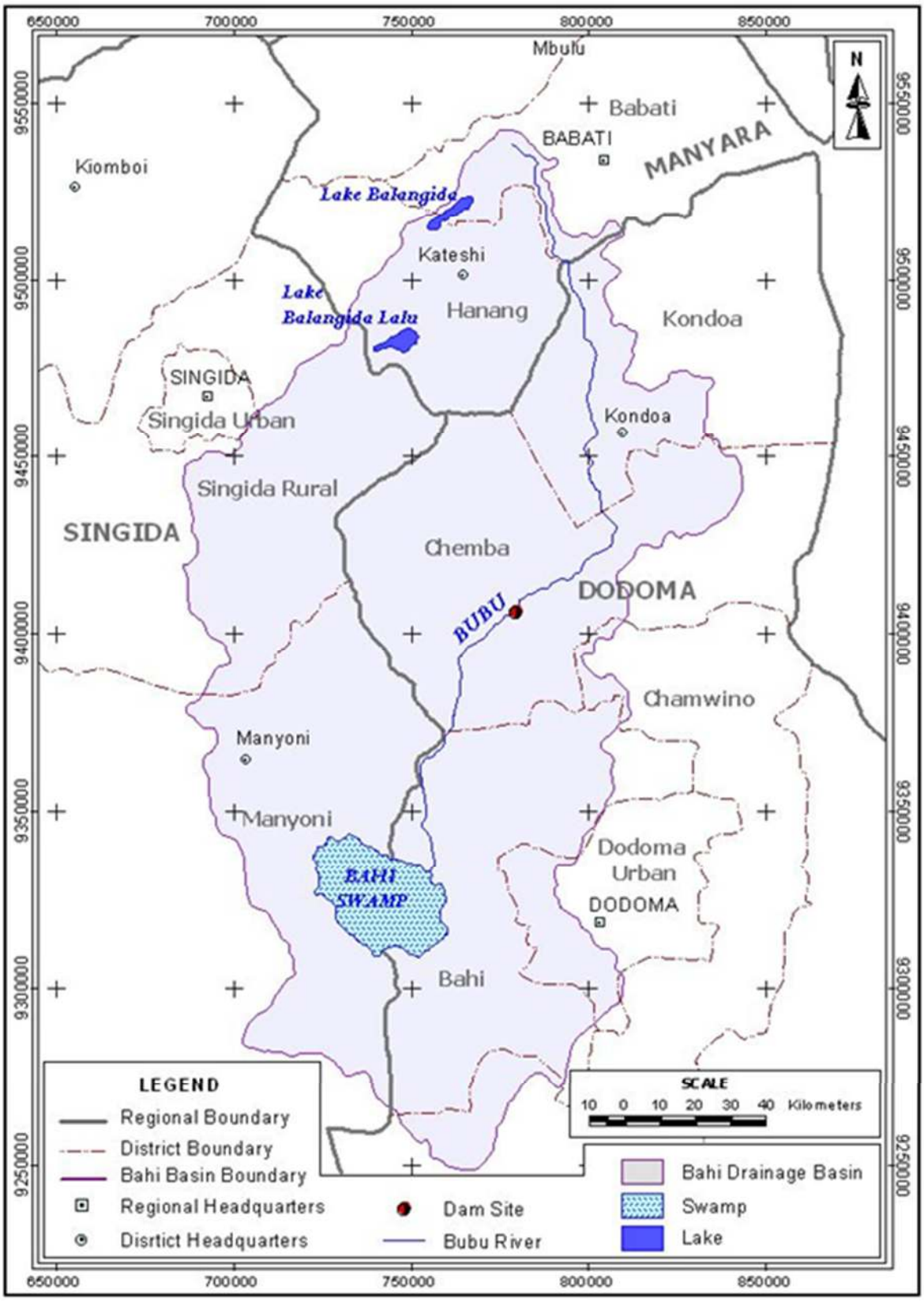
Grey-headed Bush-shrike	*Malaconotus blanchoti*	Least concern
Brown-crowned Tchagra	Tchagra senegala	Least concern
Black-backed Puff back	*Dryoscopus cubla*	Least Concern
Olive Sunbird	*Cyanomitra olivacea*	Least Concern
African Paradise-flycatcher	*Terpsiphone viridis*	Least concern
Grey backed-Camaroptera	*Camaroptera brachyura*	Least concern
Red-capped Robin-Chat	*Cossypha natalensis*	Least concern
Common bulbul	*Pyconotus barbatus*	Least concern
African pied Wagtail	*Motacilla aguimp*	Least concern
Lesser Striped Swallow	*Hirundo abyssinica*	Least Concern
Crested Barbet	*Trachyphonus vaillantii*	Least Concern
Yellow-rumped Tinkerbird	*Pogoniulus bilineatus*	Least concern
Swallow-tailed Bee-eater	*Merops hirundineus*	Least concern
Little Bee-eater	*Merops pusillus*	Least concern
Malachite Kingfisher	*Alcedo cristata*	Least concern
Narina Trogon	*Apaloderma narina*	Least concern
Eurasian Swift	*Apus apus*	Least Concern
Little swift	*Apus affinis*	Least Concern
Helmeted Guineafowl	*Numida meleagris*	Least concern
Hildebrandt's Francolin	*Francolinus hildebrandti*	Least concern
African Hawk -Eagle	*Hieraaetus spilogaster*	Least concern
Common Buzzard	*Buteo buteo*	Least concern
Little Egret	*Egretta garzetta*	Least concern
African Barred Owlet	*Glaucidium capense*	Least Concern
White-faced Scops-Owl	*Otus leucotis*	Least Concern
White-browed Coucal	*Centropus superciliosus*	Least concern
Red-cheeked Cordon bleu	*Uraeginthus bengalus*	Least concern
Red-billed Firefinch	*Lagonosticta senegala*	Least concern
Bronze Mannikin	*Lonchura cucullata*	Least concern
Ring-necked Dove	*Streptopelia capicola*	Least concern
Red-eyed Dove	*Streptopelia semitorquata*	Least Concern
African-mourning Dove	*Streptopelia decipiens*	Least Concern
Emerald-spotted wood dove	*Turtur chalcospilos*	Least concern

APPENDIX 9: LIST OF REPTILE SPECIES RECORDED DURING THE STUDY

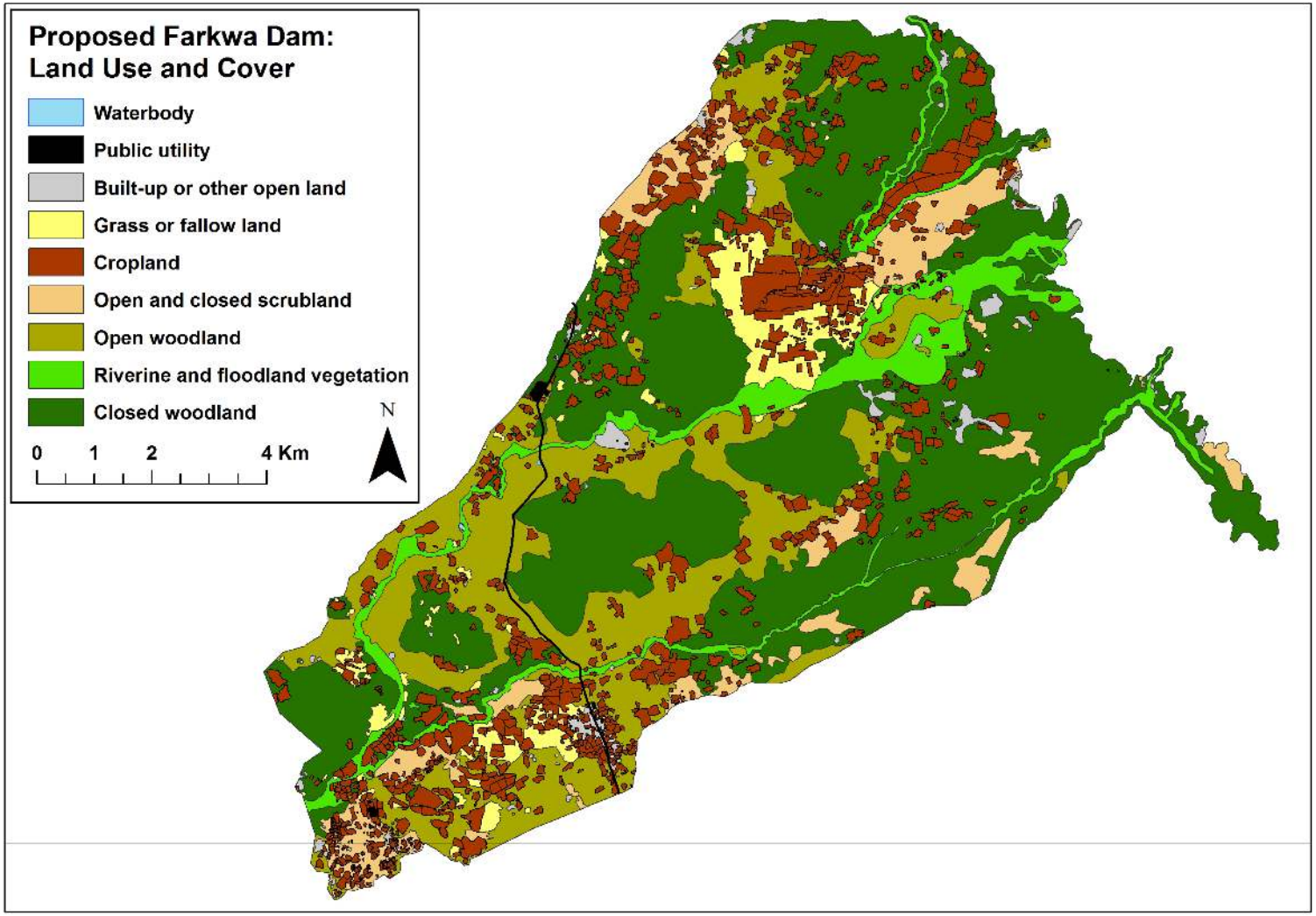
Common name	Scientific name	Family	IUCN Status	Trap	Direct obsrv.	Other
Monitor lizard	*Varanus niloticus*	Varanidae			×	Interview
African burrowing snake- Cape centipede-eater	*Aparallactus capensis*	Atractaspididae	Least concern		×	Interview
Common egg-eater	*Dasypeltis scabra*	Colubridae	Least concern			Interview
Boomslang	*Dispholidus typus*	Colubridae	Least concern			Interview
Brown-house snake	*Lamprophis fuliginosus*	Colubridae	Least concern			Interview
East African shovel-snout	*Proysymna stuhlmanni*	Colubridae	Least concern		×	Interview
Spotted Bush snake	*Philothamnus semivariegatus*	Colubridae	Least concern		×	Interview
Rufous Beaked snake	*Rhamphiophis rostratus*	Psammophiidae	Least concern			Interview
Olive sand snake/hissing sand snake	*Psammophis mossambicus*	Psammophiidae	Least concern			Interview
Black-necked spitting cobra	*Naja nigricollis*	Elapidae	Least concern			Interview
Savanna Vine Snake	*Thelotornis mossambicanus*	Colubridae	Least concern			Interview
Striped skink	*Mabuya striata*	Scincidae	Least concern	×		
Tropical house gecko	*Hemidactylus maboui*	Gekkonidae	Least concern		×	
Black-lined plated lizard	*Gerrhosaurus nigrolineatus*	Gerrhosauridae	Least concern	×	×	
Yellow-throated plated lizard	*Gerrhosaurus flavigularis*	Gerrhosauridae	Least concern	×	×	
Red-headed rock agama	*Agama agama*	Agamidae	Least concern		×	Interview
Green snake	*Philothamnus sp*	Colubridae	Least concern		×	Interview

Puff adder	*Bitis arietans*	Viperidae	Least concern			Interview
Gaboon viper	*Bitis gabonica*	Viperidae	Least concern			Interview
Black mamba	*Dendroaspis polylepis*	Elapidae	Least concern		×	Interview
Southern African Rock python	*Python natalensis*	Pythonidae				Interview
Variable skink	*Mabuya varia*	Scincidae	Least concern	×	×	

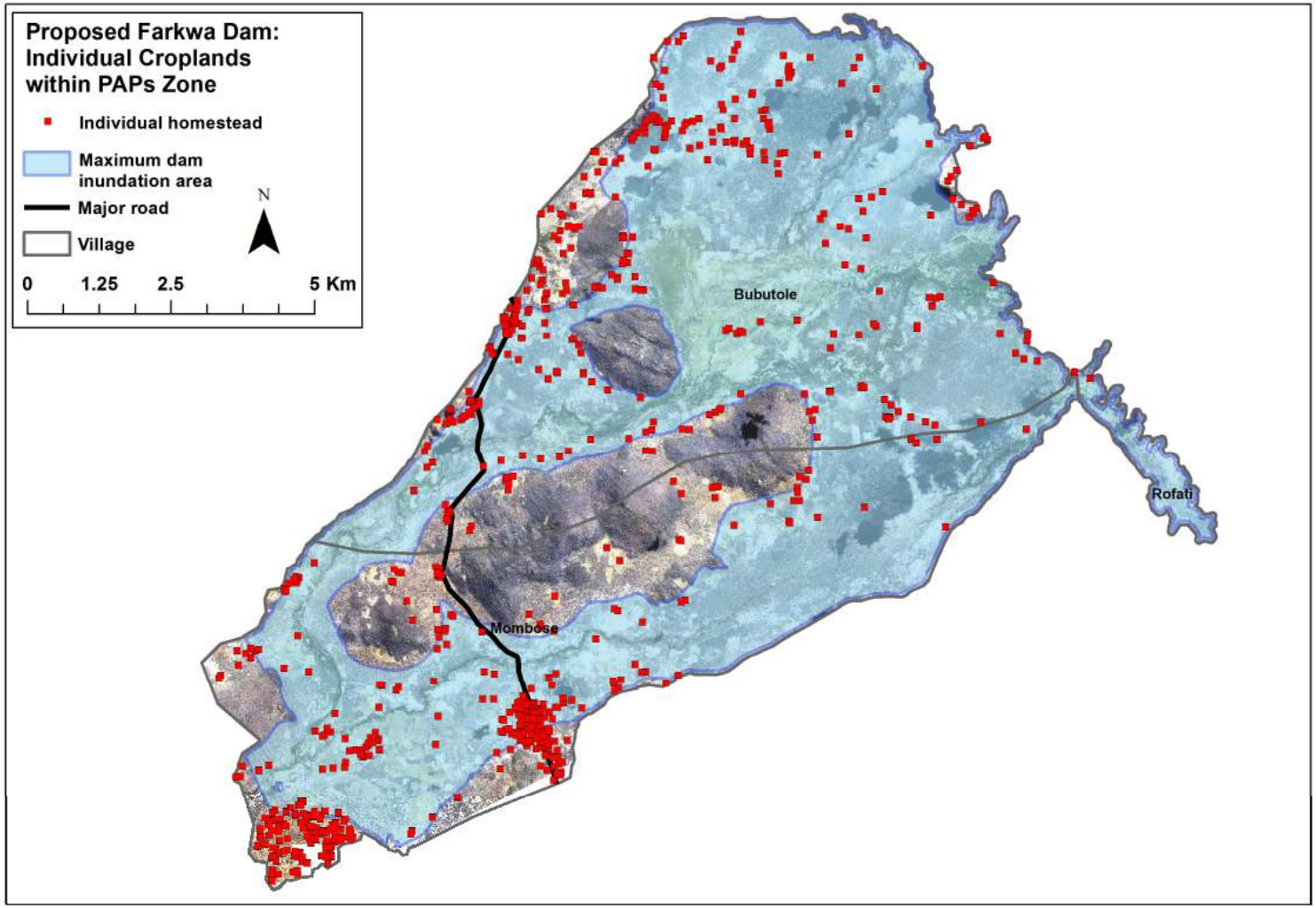
APPENDIX 10: BAHI DRAINAGE BASIN



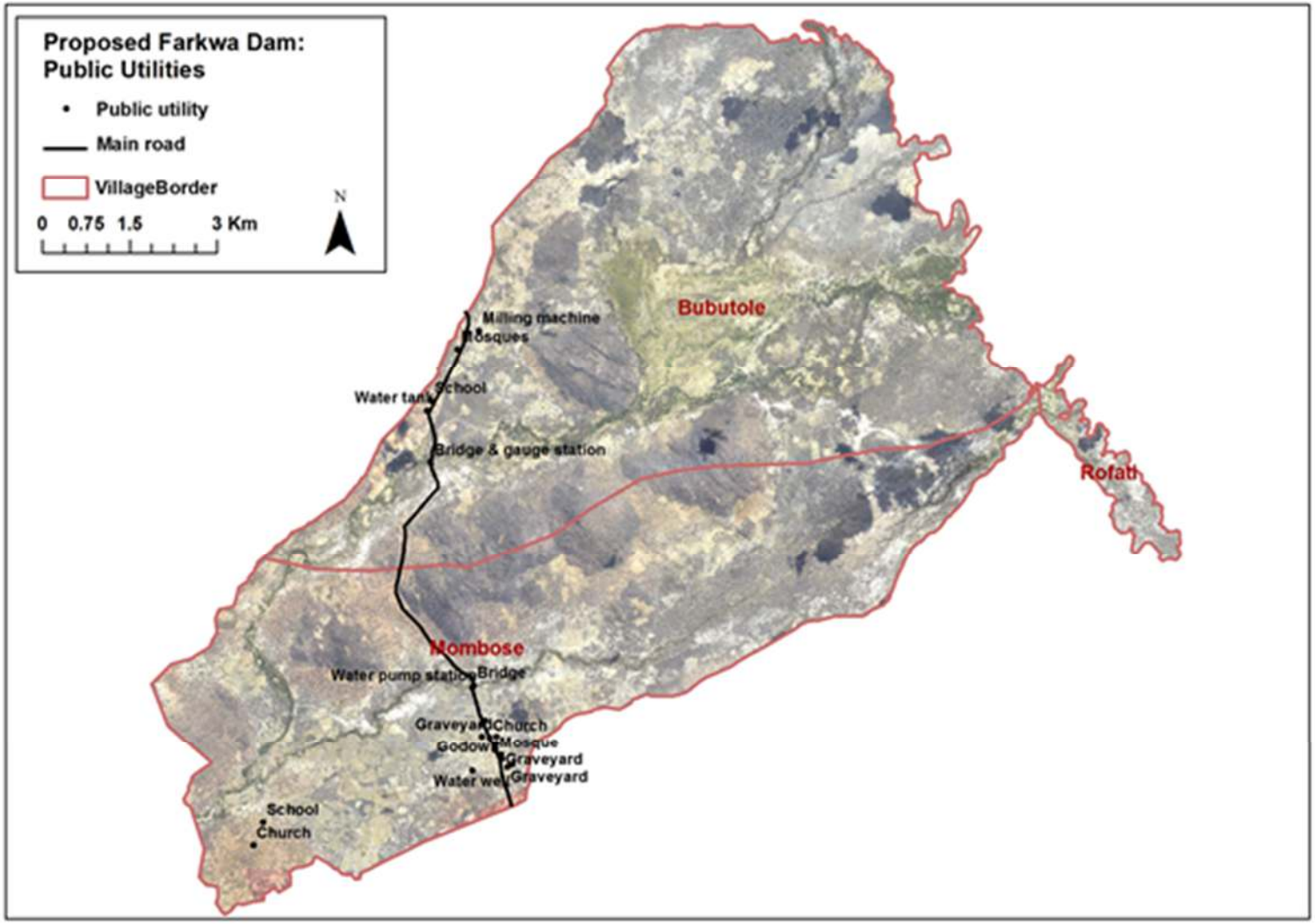
APPENDIX 11: LAND USE AND COVER



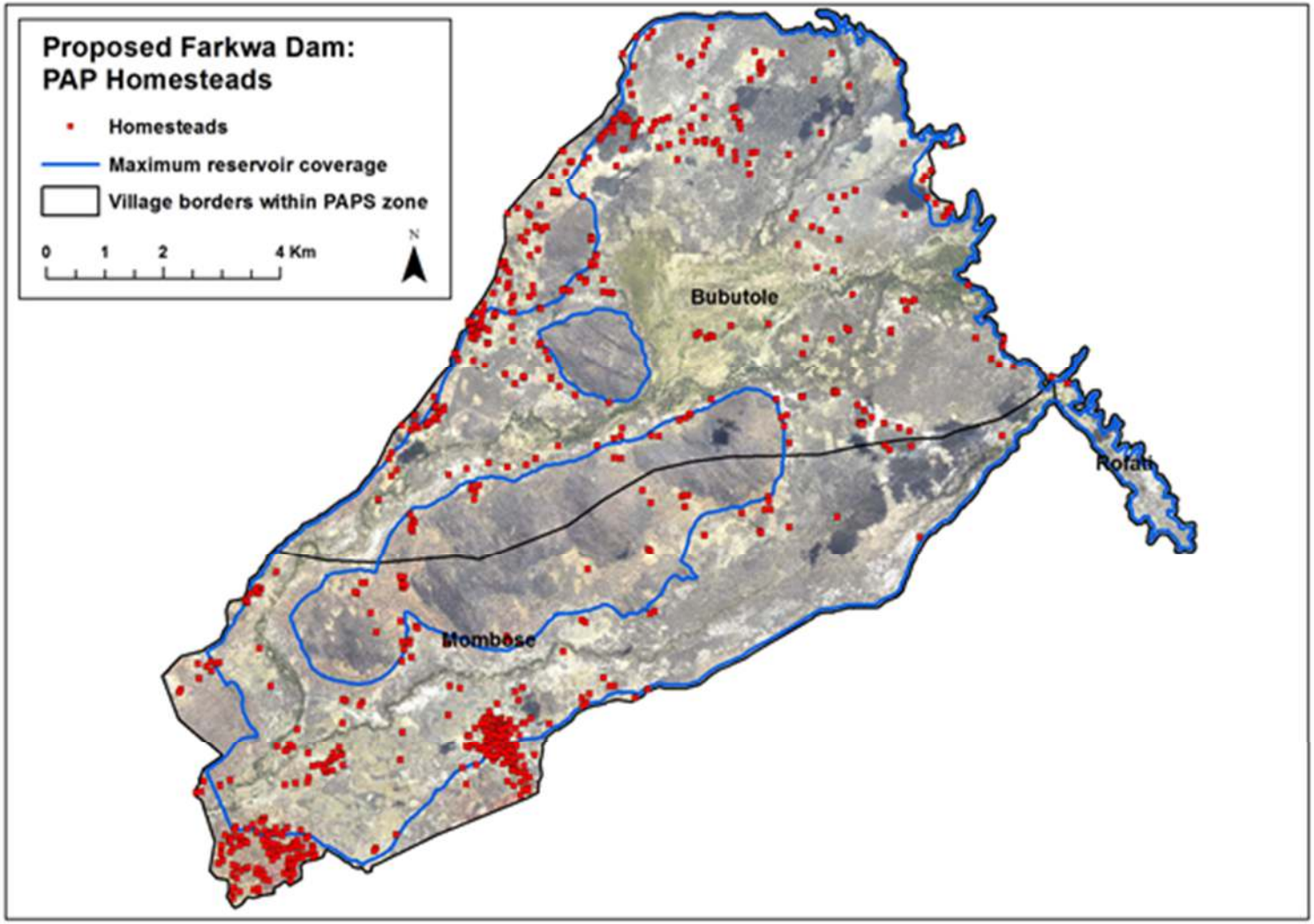
APPENDIX 12: INDIVIDUAL CROP LANDS WITHIN PAPS ZONE



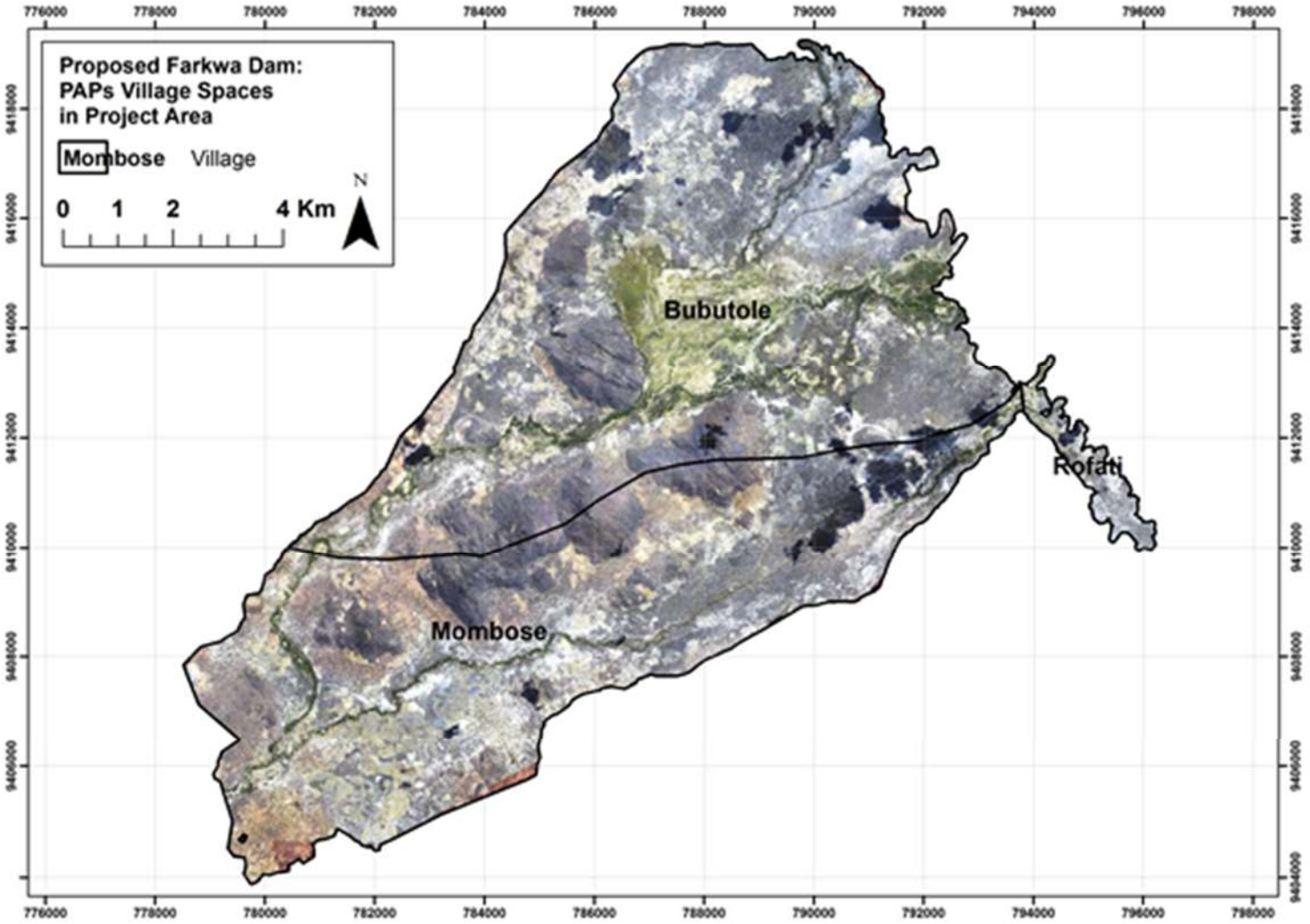
APPENDIX 13: PUBLIC UTILITIES WITHIN THE PROJECT AREA



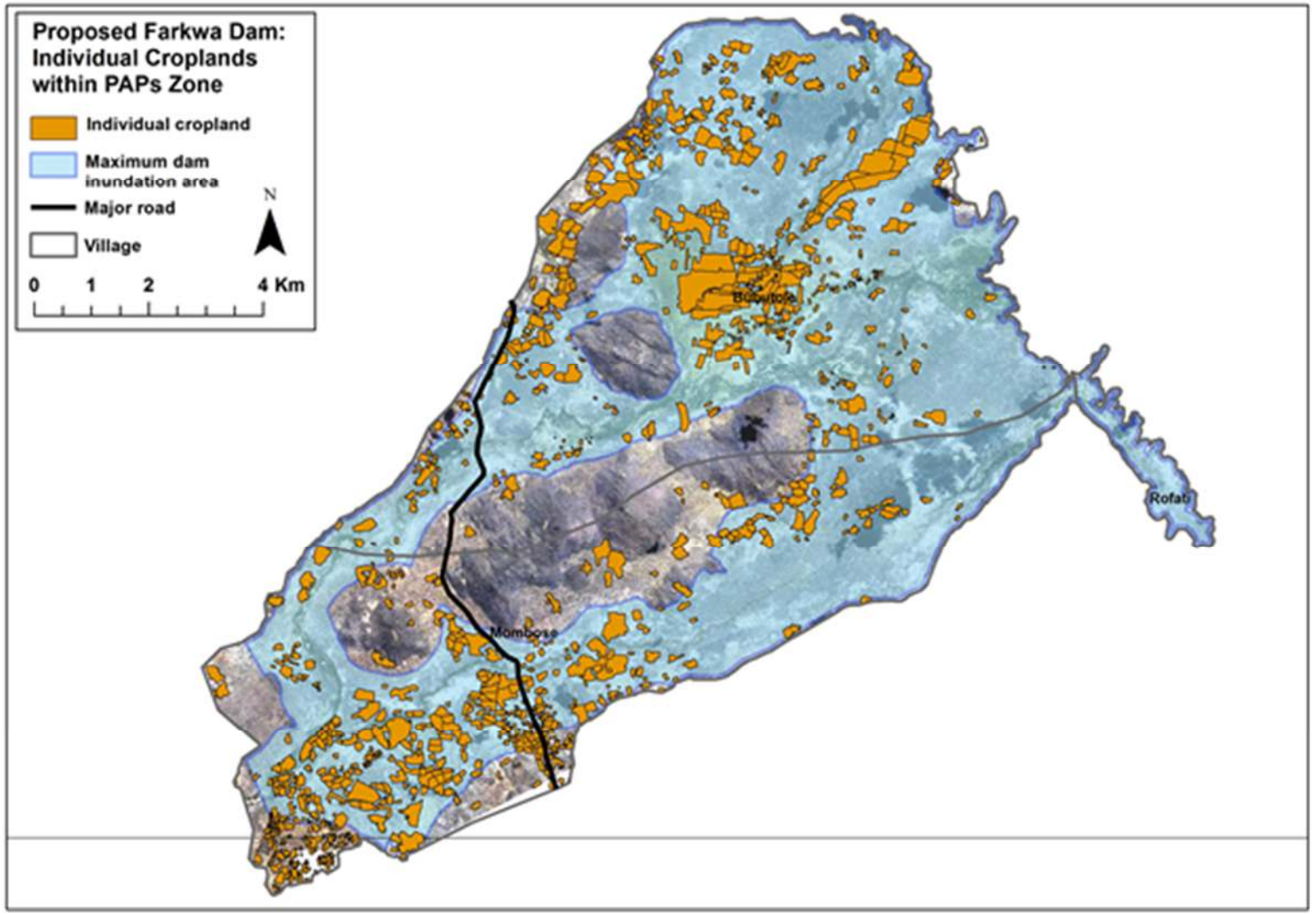
APPENDIX 14: PAP HOMESTEADS



APPENDIX 15: PAP VILLAGES SPACES IN PROJECT AREA



APPENDIX 16: INDIVIDUAL CROPLANDS WITHIN PAPS ZONE



APPENDIX 17: WATER TREATMENT PLAN PROCESS DESCRIPTION

1.1: Summery of WTP

Items	Description
Capacity	128,156 m3/day
Process	Complete multimedia pressure filtration with pre-treatment
Basic Dosing System	Alum dosing for pH adjustment (Feed water pH 6.35)
Estimated Electrical Load	Total Electrical load will be 250 KW

1.2: Basis of Design

- **Process: Multimedia pressure vessel system**
- **Flow capacity: Total flow was considered 128,156 m3/day**

1.3 Raw water characteristics

The design for the water treatment plant has been made based on the following parameters.

SN	Parameters	Unit	WHO standard	Tanzania Bureau of standard
1	pH ……. 6.35	pH	6.5 - 8.5	6.5 - 8.5
2	Turbidity	mg/l	5.00	10.00
3	Hardness as CaCO3	mg/l	…….	200 - 500
4	Iron, Fe	mg/l	0.30	0.30 - 1.00
5	Manganese, Mn	mg/l	40	10
6	Arsenic, As	ug/l	10.00	50.00
7	Chloride, Cl	mg/l	250.00	150 - 600
8	Total dissolved solids	mg/l	1000	1000

1.4 Required Land Area

To construct the WTP, 600 sqm (Approximately) land will be required. All of the required land is available within the project area down-stream of the dam. All construction activities for the WTP and network laying will take place only within the designated site. There will be no need for land acquisition or for displacement of any households or structures within the project area. There will be no adverse impact on the livelihoods.

1.5 Detail description of process flow of WTP

A water treatment plant is a facility to treat the raw water generated from the proposed Farkwa Dam. A WTP is an arrangement to treat water from the proposed dam through the intake to be constructed. From the intake water will be pumped to a grit removal chamber where the sand and grit are removed. After that the raw water will be treated by aeration for oxidation and by dosing system of Alum for pH adjustment using feed pump which will be passing through Multimedia Pressure Filter (MPF) for filtration using different types of stone chips in column of the chamber. The removed grit will be pumped directly back to the river, downstream the impoundment. Clear water will be pumped by low lift pumps to a flow division chamber where will be distributed to the clarifiers after coagulants dosage. The chemical sludge will be

collected at the bottom of the clarifiers, and will be pumped to sludge lagoons. There, the supernatant water leaves the lagoons through an outlet and will be discharged back to the river. This project shall construct dried sludge disposal pits, to accommodate the 1,000 m3/year from the ponds to accommodate sludge to be generated. The pits shall be well sealed to avoid percolation of chemicals to soil and ground water.

The proposed WTP will comprise of different units to provide pre-treatment which are:

- water intake point
- raw water collection networks
- raw water pump station,
- coagulation and sedimentation units (clarifies),
- filtration units,
- Oxidation chamber with air compressor
- disinfection units,
- a treated water tank and a
- treated water pump station, which will be pumping water to the main water storage tank. chemical feeding units
- flow controlling units.
- electrical sub-stations with control system

APPENDIX 18: ENVIRONMENTAL FLOW COMPONENT
1.0 ENVIRONMENTAL FLOW

1.1 Introduction

The Environmental Flow (EF) for this particular project is defined as the amount of water that are to be allowed to flow downstream of the Farkwa dam to sustain riverine ecosystem, Bahi swamp ecosystem as well as livelihoods that depends on the river flows and the ecosystems services.

In this respect three key aspects were studied upon and these include; the riverine and swamp ecosystems, the paddy irrigation and livestock water uses, as the main and representatives of water uses/users downstream of the dam site.

1.2 Situation of Bubu River

In the course of the study it was noted that the studied Bubu River is seasonal in the project site and further downstream to Bahi swamp area (recipient of Bubu River). Also it was leant that the River originates from Manyara Region and traverses two distinct climatic areas which are wet tropic in higher altitude and semi-arid in central regions of Tanzania. Thus major contribution (>80%) of this River to the project site and further downstream is mainly from wet tropical areas upstream other than from within the semi-arid areas. Further, it was leant that the Bubu River catchment is 54% of the entire Bahi catchment area and among of the two main inflows to the Bahi Swamp the other being Mponde River, both of which originates from northern highlands i.e. wet tropic areas (M. McCartney, 2007).

1.3 Existing Ecosystems condition

The riverine and swamp ecosystems study included the representative parts of the river stretch downstream of the dam site and the Bahi swamp area(s) respectively. Based on the study it was leant that, generally the area have low aquatic species diversity some of the notable ones include fish species in the family Clariidae (*Clarius spp.*) and Cichlidae (*Oreochromis spp.*) and amphibian (*Ptychadema mascariensis*). These species were found in shallow pools in the few stretches of Bubu River and dug ponds within Bahi Swamp area during dry season period. The features of Clariidae fish family have enabled them to survive and live in this environment as they can live long period out of water. With conditions of flow during wet season and total zero flow during dry season no any other fish family species without these features can survive in this environment. Out of the recorded fauna aquatic species none was recorded as Threatened (IUCN, 2011). However, the area is having a good number of terrestrial fauna which also depends on the remaining pools within the river stretches for drinking water during dry season. Within these pools during dry season residents depends for protein through subsistence fishing. Commercial fishing though in small scale is practiced in Bahi swamp during wet season.

Riparian vegetation studied have a linear and narrow form as they are paralleled the stream channel of Bubu River, and are either diffuse or sharp edges attributable to the nature of species interactions across the ecotone and disturbances. The dominant species recorded include *Ficus sycomorus*, *Ficus thoningii, Ficus lutea, Ficus sur, Kigelia africana, and Acacia spp.* The Bahi swamp was noted to be covered by an extensive area dominated by *Cyperus spp.* During the study, the entire swamp was dry and composed mainly of remnant patches of *Cyperus spp*. Among of these, no any species is regarded as rare or endemic as per IUCN – near threatened list and CITES Appendix II category. Most of the species that were

recorded are of low conservation concern, however they form important part of the riverine vegetation and through river bank protection against erosion.

1.4 **Livelihoods condition**

1.4.1 Paddy irrigation

The paddy irrigation is one of the livelihoods that depend on the river flows and thus this was studied upon in the Bahi area. The study reveals that the area under irrigation in Bahi area is more than 10,000 hectares however a small part of it is directly depending on the Bubu River. Based on the data from the Central Zonal Irrigation Office under the Ministry of Agriculture and Food Security, the total area that is directly depending on Bubu River is 3,658 hectares under seven schemes with 7,316 farmers (See table 1.1 below). The part which is directly depending on Bubu River is located upstream of the actual Bahi Swamp/flood area and thus water is diverted from the river directly to the farms before reaching the Bahi swamp area (see Plate 1.1 below).

Plate 1.1: Diversion channels/infrastructures in the Bubu River

TABLE 1.1: BAHI IRRIGATION SCHEMES DEPENDING ON BUBU RIVER DATA

S/N	SCHEME	AREA (Ha)	FARMERS	DISCHARGE (m^3/s)
1	Bahi Sokoni	2,000	4,000	2.5
2	Nguvumali	250	500	0.6
3	Matajira	345	690	1.5
4	Mtazamo	165	330	1
5	Uhelela	167	334	1
6	Nagulo Bahi	325	650	1.1
7	Bahi Makulu	406	812	1.8
		3,658	**7,316**	**10**

Source: Bahi District Council, 2014

According to Central Zone Irrigation Office, the water consumption for paddy irrigation in Bahi area is 2.2 l/Ha/s with the irrigation practice of 2 days for the rest of 4 days. Thus, based on this the water required per day and per month as well as per entire irrigation period of wet season (4 months of the year i.e. from Mid-December to Mid-April) was obtained, as covered hereunder;-

Irrigation mitigation flow

Water requirement/Demand (D) = 3,658 Ha x 2.2 l/Ha/s

= 8,047.6 l/s
= 8,047.6 l/s x 60 sec. x 60 min x 24 hours
= 695,312,640 l/day
= 695,312,640 l/day x 2 days x 5 times per month
= 6,953,126,400 l/month x 4 months of the year
= 27,812,505,600 l/year
= 27,812,505.6 m3/year

1.4.2 Livestock keeping

Likewise, the livestock keeping is one of the livelihoods that depend on water resources in terms of drinking water as well as fodder. In this respect the livestock drinking water was taken on board by the study as one of consumptive water users of the Bubu River in the villages just along the river upstream of the Bahi swamp area. The data obtained from the Bahi District Council office shows that in 2006 Livestock Census there were 64,895 cattle, 12,500 Goats and 2,492 Sheep in the villages along the Bubu River (See table 1.2 below). Based on this, the present livestock data was obtained and the water demand was also calculated as shown in the subsequent paragraphs;-

Table 1.2: Bahi Livestock Data (as per censor of 2006)

S/N	WARD	VILLAGE	CATTLE	GOAT	SHEEP
1	Bahi	Bahi Sokoni	3,330	280	183
		Nagulo Bahi	5,208	620	151
		Uhelela	2,906	413	88
2	Chali	Chali Igongo	2,273	834	251
		Chali Makulu	2,107	580	70
		Chikopelo	5,619	1,189	179
		Chali Isangha	3,472	779	155
3	Chipanga	Chipanga A	2,626	403	180
		Chipanga B	2,726	673	116
		Chiguluka	3,809	856	255
4	Makanda	Chonde	2,980	320	63
		Makanda	3,830	650	174
5	Mpamantwa	Mkakatika	4,490	972	136
		Mpamantwa	2,562	682	67
		Bahi Makulu	5,144	1,007	80
6	Chikola	Chikola	2,809	577	153
		Chimendeli	6,522	1,025	107
		Nghulugano	2,482	640	84
	Total, 2006		**64,895**	**12,500**	**2,492**
	Total 2014		**81,119**	**15,625**	**3,115**

Bahi DC, 2010

The Water design manual suggests a livestock growth rate of 50% after 20 years (Section 4.6.4.1 of the design manual). Thus from 2006 to 2014 a 25% livestock growth rate was used in this case to come up with the present livestock population in the area (Table 1.2 above, last row).

Table 1.3: Livestock Consumption Rates

Livestock	Consumption Rate (l/head/d)
Cattle	25

Sheep/Goats	5
Donkeys	12.5

MoW, 2009: Water Design Manual Guidelines.

Table 1.4: Livestock Water Requirement *(Livestock mitigation flow)*

Livestock	Consumption Rate (l/head/d)	Livestock	Water requirement-current l/d
Cattle	25	81,119	2,027,975
Goats	5	15,625	78,125
Sheep	5	3,115	15,575
			2,121,675 l/d
			2,121.675 m³/d
			63,650.25m³/Month
			381,901.5m³/year

***Note**: Year is calculated based on the river flowing period which is six months of the year (i.e. from mid Dec- mid-June)*

1.4.3 Other water uses

Downstream of the Dam site water is also being used for domestic purpose e.g. drinking, washing and cooking. However it is used in small amount, almost negligible as there is no water supply scheme. Residents along the River are individually fetching directly from the River. Currently, water is an issue during dry season as wells and shallow boreholes tend to dry out, while during the wet season some wells and borehole contain water. Thus, domestic water requirements have been left out due to its negligible amount to the River flow which can simply be covered by the recommended environmental flow without impacting other water uses/users.

1.5 Environmental flow

The in-stream flow requirements to sustain the riverine ecosystem demands will fully be covered by the irrigation and livestock mitigation flows as the two are located downstream part of the river just before the Bahi swamp. However, a flow for the ecosystem to the Bahi swamp is considered independently of the later flows, as the irrigation and livestock mitigation flow are to be abstracted / consumed before reaching the Bahi swamp. Based on the study conducted to the Bahi swamp area and the discussions among the experts formed ESIA team, it was estimated that 10% of the natural flow of the Bubu River will contribute to the sustenance of the Bahi Swamp ecosystem and its associated ecological services (such as fishing). As it has been noted earlier the Bahi swamp is being contributed by a number of streams/rivers and precipitation, the latter being reported to account 60% of the total swamp water sources (M. McCartney, 2007).

Thus, the amount of water required to flow downstream of the Dam site in this case is the summation of the irrigation mitigation flow **(27,812,505.6 m3/year)**, livestock mitigation flow **(381,901.5 m³/year)** and 10% of the natural flow of the Bubu River (**14.79 MCM/year**). The flow shall follow the natural regime of the river with exception of irrigation mitigation flow which will be confined within four months of irrigation period (i.e. from mid-December to mid-April). In this case the water from the Dam will only be released during wet season as per natural river flow condition (see Table 1.5 below). The flow to be released as environmental flow from the details above is detailed covered under Table 1.5 below;-

Table 1.5: Bubu River mean flow and the recommended Environmental flow

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Annual
Inflows (MCM)	0.29	12.63	23.95	27.25	43.06	29.95	8.29	1.84	0.38	0.28	0.02	0.00	147.94
% Monthly inflows over Annual Inflow	0.2	9	16	18	29	20	6	1.2	0.3	0.2	0.0	0.0	100 %
Ecological flow - 10% of mean flow (MCM)	0.029	1.263	2.395	2.725	4.306	2.995	0.829	0.184	0.038	0.028	0.002	0	14.79
Mitgn flow [Irrigation + Livestock] (MCM)	0	2.814	5.067	5.631	8.736	5.916	0.022	0.005	0	0	0	0	28.191
E.Flow Release (MCM)	0.029	4.077	7.462	8.356	13.042	8.911	0.851	0.189	0.038	0.028	0.002	0	42.981

Source for monthly mean flow data: Farkwa Dam Feasibility, Interim Report (Table 35) pp. 99

Table 1.6: Details of the each flow

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Annual
Inflows (MCM)	0.29	12.63	23.95	27.25	43.06	29.95	8.29	1.84	0.38	0.28	0.02	0.00	147.94
% Monthly inflows over Annual Inflow	0.2	9	16	18	29	20	6	1.2	0.3	0.2	0.0	0.0	100 %
Ecological flow -	0.029	1.263	2.395	2.725	4.306	2.995	0.829	0.184	0.038	0.028	0.002	0	14.79

10% of mean flow (MCM)													
Irrigation flow(MCM)	0	2.781	5.006	5.562	8.621	5.84	0	0	0	0	0	0	**27.81**
Livestock flow(MCM)	0	0.033	0.061	0.069	0.115	0.076	0.022	0.005	0	0	0	0	0.381
Mitgn flow [Irrigation + Livestock] (MCM)	0	2.814	5.067	5.631	8.736	5.916	0.022	0.005	0	0	0	0	28.191
E.Flow Release (MCM)	0.029	4.077	7.462	8.356	13.042	8.911	0.851	0.189	0.038	0.028	0.002	0	42.981

Note: MCM = Million Cubic Meters

APPENDIX 19: MAPPING PROPERTY, LAND USE AND COVER OF THE PROJECT-AFFECTED PEOPLE (PAPS)

APPENDIX 20: FAUNA BASELINE SURVEY REPORT

APPENDIX 21: FLORA BASELINE SURVEY REPORT

APPENDIX 22: FARKWA DAM ESIA STUDY - WATER RESOURCES COMPONENT

APPENDIX 23: RESSETLEMENT ACTION PLAN

APPENDIX 24: MINUTES FOR THE JOINT MEETING OF MINISTRY OF WATER, TANROADS AND TANESCO

MINISTRY OF WATER, TANROADS AND TANESCO JOINT MEETING AND SITE VISIT ON THE PROPOSED DAM CONSTRUCTION PROJECT AND CONVEYANCE SYSTEM TO DODOMA CITY, CHEMBA, BAHI AND CHAMWINO DISTRICT COUNCILS IN DODOMA REGION FOR IDENTIFICATION OF PENDIND ISSUES TO BE UNDERTAKEN JOINTLY

1.1 Background and nature of the project

The Ministry of Water (MOW) through the Water Sector Development Programme is looking at developing a water supply for the Dodoma City. The MOW carried out pre-feasibility studies, which identified Farkwa Dam as a possible reliable source for the Dodoma water supply. The Ministry engaged Tractebel Engineering and Howard Humphreys to prepare a feasibility study and detailed design for this dam and associated conveyance system to Dodoma City. Moreover TRES Consult (T) Limited was also assigned to do Environmental and Social Impact Assessments (ESIA) to identify possible challenges related to dam construction and conveyance system and suggests the appropriate mitigation measures against. This effort is geared to resolve the inadequate water supply to Dodoma town with respect to the current prevailing water demand for domestic use, livestock and other investments with regard to future needs.

Chemba, Bahi and Chamwino districts are among the Dodoma Region Districts facing a tense lack of enough water because of their current expansion and being in semi-arid region of Tanzania as well as challenges of climate change in place. The Client MoW later observed a need of appropriate reservoir simulations to be able to include an additional rural water demands to Bahi, Chemba and Chamwino districts including the villages along the conveyance system to Dodoma City of which was out of the initial scope of the assignment. The two projects are both at final draft and are readily available at the Ministry of Water Head Quarters.

The aim is to complement the present water supply to Dodoma city of installed capacity 37,000 m^3/day from Makutopola source and upgrade it to meet the future demand up to 2035 due to anomalously expansion of Dodoma city. This current source in Dodoma is regarded not to be reliable enough to supply for the growing population in future. However Chemba, Bahi and Chamwino district are also put in the current plans due to their expected rapid expansion in future. In this respect the Ministry of Water identified Farkwa Ward in Chemba District to be suitable site for the proposed Dam Construction Project across the downstream of the Confluence of both Bubu and Mkiki rivers.

1.2 Project description and its Extent

The project is located in Central Tanzania in Dodoma Region in Internal Drainage Basin at about 130 km from Dodoma Township towards Kondoa District. The project area experiences of only seasonal rivers/streams with mean annual rainfall of 500mm/year – 900mm/year. The proposed project of dam construction and conveyance systems to Dodoma city, Chemba, Bahi and Chamwino District councils has undergone a full Environmental Impact Assessment (EIA) and it is at final design stage.

Extent of the project includes; construction of main dam of height 32m of composite RCC and earth materials with a capacity and a saddle dam of height 15m of full earth fill dam. The capacity of the reservoir is 470Mm^3 at Full Supply Level (FSL) and conveyance system of 115 km to Dodoma and about 100 km conveyance systems to Chemba, Bahi and Chamwino the

EIA of which is underway. The Conveyance system in totality requires a minimum power of 12MW, 33KV transmission line and 16MVA generator. The Minimum power required for the pump house is 9MW and that for Treatment plant is 3MW. The treatment plant is located about 15km at the highest elevation downstream of the dam along Dodoma – Kwamtoro regional road. The construction of the project is estimated to take 3 years for undertaking the three major components namely Main dam, Saddle Dam and Conveyance Systems to Dodoma.

1.3 Current issues with regard to Farkwa Dam Project

During execution of the dam Design and ESIA of the Farkwa project it was revealed that about 4 km of the existing Dodoma – Kwamtoro regional road will be inundated by the reservoir after dam construction. Due to the gaps in the initial terms of references (TORs) prepared by the Ministry of Water, the road to be inundated was initially not considered. In order to keep the connectivity within the region, demand for diversion of the Dodoma – Kwamtoro regional road of about 16-20 km length flying over the main dam embankment and Saddle dam and reconnect to the original existing alignment on the other side of the embankment crest is inevitable. Such change of road configuration led into the following additional items of works to be taken jointly with other relevant stakeholders (TANROADS and TANESCO):

i. Environmental and Social Impact Assessments (ESIA) for the diversion portion of the road that will clearly identify the impacts associated with such new road construction and suggest the respective mitigation measures as well as the detail design of the diversion road.
ii. A transmission line that can serve a minimum of 12MW, that will harness energy to drive water to Dodoma city and the district councils of Bahi, Chemba and Chamwino

1.4 Ministry of Water Way forward

Ministry of Water observes the items i and ii need other Ministries for consultation. With due respect, Consultations started at TANROADS and TANESCO head quarters respectively with the aim of:

i. Understanding of their current, medium and long term related projects or plans within the Farkwa Dam project site and see if there is any planned project related to the Ministry of Water Farkwa Dam Project so as to see the way of merging them in order to avoid duplication of projects executed by the same Government.
ii. To get consultation from TANROADS the issues related to diversion road at which, the Ministry of water will need to engage a consultants while time is not inline towards implementation of Water Sector Development Programme (WSDP) phase I which will end up in December 2015 (end of project financing). Therefore getting TORs preparation guidance from TANRODS to the related items of work could facilitate execution of the consultant engagement task. Note that due to funding mechanism the Ministry of Water has limited time to undertake the extension of work for diversion road.
iii. Seeking permission for consultation of the TANROADS and TANESCO offices in Dodoma.

From TANROADS and TANESCO Headquarters, the Ministry of Water was referred to TANROADS Regional Manager's office Dodoma and TANESCO Dodoma office for detail and intensive discussion on the matters for possibilities of immediate implementation of the project with simple method of approach and joint approach.

1.5 Joint Meeting and site Visit.

A Joint Venture meeting among MOW, DUWASA, TANROADS and TANESCO was conducted on **08/11/2015** in Dodoma TANROADS - Regional Manager's office after introduction to the subject matter the team held a site visit to see the actual situation on site. The main objective of the site visit was to see the actual situation and site so as to facilitate genuine conclusions. It was also agreed that after the site meeting, the Minutes will be prepared and signed by TANROADS and the Ministry of Water representatives. The following is the list of the participants made a Farkwa dam visit.

No	Name	Organization	Designation	Email/Mobile
1	Benard M. Chikarabhani	IDB-WBO	Basin Water Officer	mchikarabhani@yahoo.com
2	Eng. Edward M. Robert	MoW	Dam Engineer	edmallale@yahoo.com
3	Ramadhani H. Singano	MoW	Hydrologist	rhsingano.mow@gmail.com
4	Jumanne B. Matetero	IDB Staff	Hydro-geologist	matetelojb@tanesco.co.tz
5	Eng. Moses Sulumbi	IDB Staff	Water Engineer	mose_sulumbi@yahoo.com
6	Matilda Tagaya	IDB Staff-Dodoma office	Principal Technician	matilidatagaya@yahoo.com
7	Eng.yared Ngalaba	TANESCO –Dodoma office	Transmission Engineer	yared.ngalaba@tanesco.co.tz
8	Eng.Emannuel Tarimo	TANROADS	Engineer	elisariatarimo@gmail.com
9	Eng.Joseph Homvye	TANROADS	Engineer	josephhomvye@gmail.com
10	Eng.Kisinza A. Nkwabi	TANROADS	Engineer	nkwabikissinza@yahoo.com
11	Eng. Emmanuel Mwakabale	DUWASA	Planning Engineer	emannuel.mwakabale@duwasa tz.go.tz

Three TANROAD Engineers joined the MoW's site trip on **08th October, 2015** under the TANROAD –Regional Manager's office order, one Transmission Engineer from TANESCO and one Planning Engineer from DUWASA. The team could identify the proposed diversion point of Dodoma – Kwamtoro regional road and other several points to be aligned on the main dam body and the saddle dam for ease decisions making (*See the attachement-No.1*)

1.6 Conclusions

i. After the Site Visit it was agreed that, TANROAD Engineers should discuss with their Regional Manager as well as the Consultant (Inter Consult) who is taking both detail design and ESIA of a 461km road from Handen to Dodoma through Kwamtoro which connecting number of villages within the project area to accommodate the diversion of about 16 - 20 km at Farkwa ward as an addendum in his project.

ii. Ministry of Water to be introduced to the Consultant (Inter consult) by TANROADS for further discussions on the addition assignment after agreement with TANROADS managements.

iii. Ministry of Water to submit the coordinates and map for the proposed diversion to Farkwa dam site (main dam and saddle dam) to be able to guide and simplify the discussion making with consultant (*See the attachment No.1 and 2*).

iv. The Consultant Inter Consult may need another site visit towards agreement on the additional assignment to clearly comply with the exact need of TANROADS and Ministry of Water on diversion of the road portion through the dam embankment.

v. Agreed for TANESCO to take care of the demand for electricity need at the dam site as one of their immediate current plans within the project site. Also to share with MoW any design and ESIA documents regarding the Transmission line (past or present) of any stage.

vi. TANROADS or TANESCO may need to share with the Ministry of Water on the existing Farkwa dam documents on feasibility study, detail design and ESIA for conjunctive decision making.

vii. If the agreement between MoW and TANROADS is positive then TANROADS has to share documents regarding both detail design and ESIA of the diversion road at the proposed Farkwa dam project.

1.7 Recommendations

Ministry of Water recommends quick agreements with TANROADS and TANESCO on the additional issues to comply with limitation and deadline of financing options as well as procurement deadlines of the calendar year which ends December 2015.

Signed by:

.....
Bernad Chikarabani
For The Ministry of Water

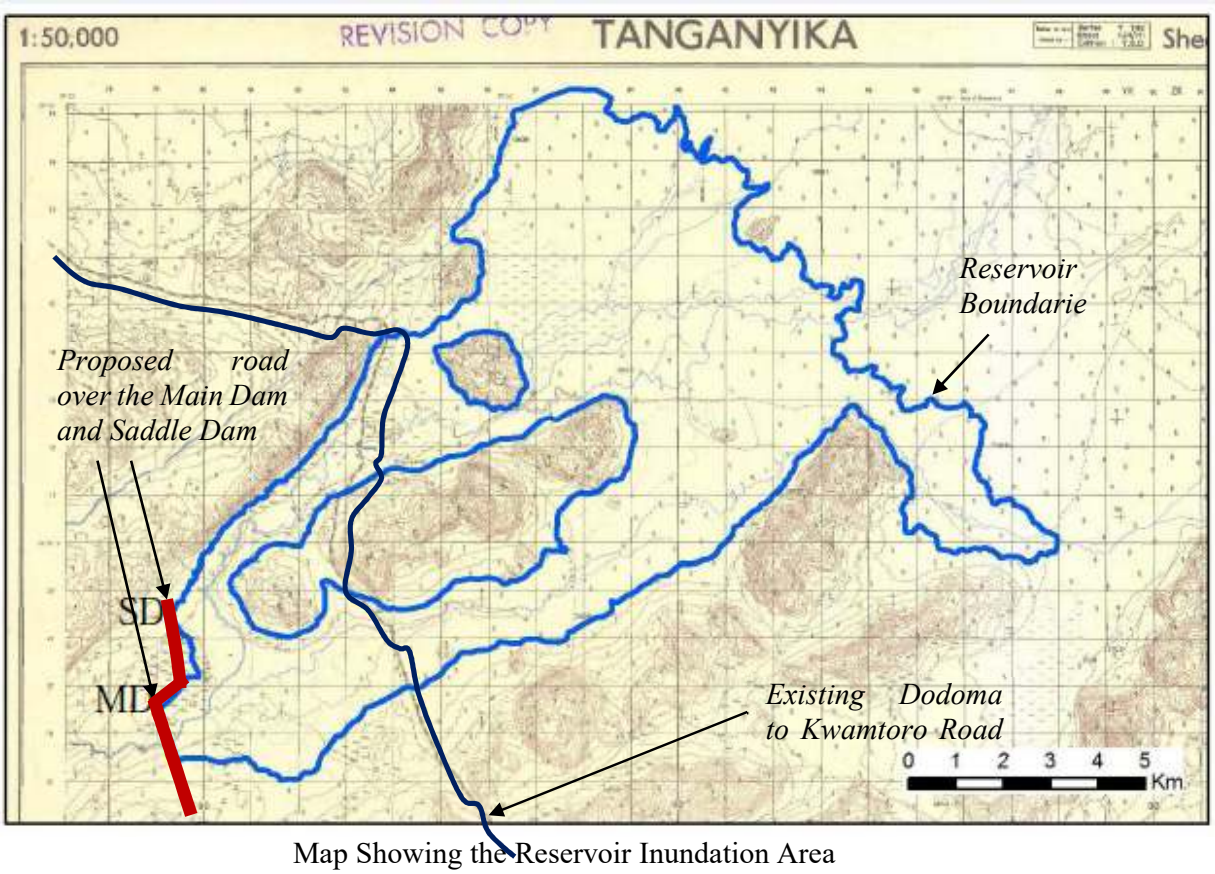
.....
Eng Joseph .F.Homvye
For TANROADS-DODOMA

Attachment No.1 (coordinates of the Main and Saddle dam)

Coordinates of the Road Diversion Route

Points	Easting (X)	Northing (Y)	Elevation (m-amsl)	Remarks
	POINTS ON MAIN DAM			
P_1	0784285	9407033	1127	Mombose Primary school Post, start of the proposed road diversion
P_2	0780254	9405721	1122	Mombose Primary school buildings
P_3	0779569	9505611	1119	Start of main dam MD-001
P_4	0779518	9405727	1100	MD - 002
P_5	0779420	9405972	1092	MD - 003
P_6	0779367	9406077	1096	MD -004
P_7	0779314	9406195	1101	MD - 005
	POINTS ON SADDLE DAM			
P1,1	0779145	9408240	Not recorded	SD-001
P2,2	0779282	9407996	Not recorded	SD-002
P3,3	0779208	940126	Not recorded	Point near the saddle dam

Attachment No.2



Map Showing the Reservoir Inundation Area

LEGEND:
SD = Saddle Dam
MD = Main Dam

APPENDIX 25: STAKEHOLDER GRIEVANCE NOTIFICATION FORM

Grievance title		Case number:
Date/Time/ Location (complaint /Received)	Date (dd-mm-yyyy): Time (24 hr):	Location:
Name		☐ You can use my name but do not use it in public ☐You can use my name when talking about this concern in public ☐ I do not want to give my name.
	Gender (Optional):	Age:
Alternative contact:	I would like the following trusted individual to talk with MOW on my behalf.	
Contact details of the complainant:	☐ Mail: Address where you or your trusted contact receive mail: ☐ Telephone: ☐ E-mail: ☐ I would like to pick up responses at the MOW office. ☐ I would like to pick up responses at …….. specify if applicable	
Location of Residence:	If we would like to talk with you in person, describe where can you normally be found?	
Supporting Documents:	☐ Written (email, invoice, title, commitment, contract, etc.) ☐ Photograph ☐ Voice Recording ☐Other:	
Brief Description: (What happened? Who was involved? Who did it happen to?)		
Follow-up: (How would you like to see this resolved?)		
Acknowledgement of Receipt:	☐ By checking this box, I acknowledge that my grievance has been received by MOW and that I am aware of the grievance resolution process.	

Contact details for witness(es)

Received by _____

Reference No _____

Complainant's Signature _____ Date _____

Name of Witness 1 _____
Signature of Witness 1 _____ Date_____

Name of Witness 2 _____
Signature of Witness 2 _____ Date_____

APPENDIX 26: GRIEVANCE ACKNOWLEDGEMENT RECEIPT FORM

Grievance title _____

Grievance case Number: _____
Date of complaint logged _____
Name of Complainant: _____
Complainant's Contact Address: _____
Village/Community: _____
Phone Number: _____
Date Review Completed: _____
Comments of Review: _____

Signature of the Complainant in acceptance of the Solution to his /her Grievance

Signature _____
Name: _____
ID number: _____
Place _____
Date: _____

Signature of Grievance Officer _____
Name: _____
Place _____
Date: _____