Irrigation Development Support Project (IDSP)
Ministry of Agriculture
Government of the Republic of Zambia

Environmental and Social Management Plan

Irrigation Development Support Project (IDSP) Remedial Works

Remedial Works on Nachibanga Dam

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Prepared by UNOPS for the Government of the Republic of Zambia

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AF	Additional Financing
CoC	Code of Conduct
COVID-19	Corona Virus Disease 2019
DWRD	Department of Water Resources Development, previously Department of Water Affairs, WRDP implementer
E&S	Environmental and Social
EIA	Environmental Impact Assessment
EPB	Environmental Project Brief
EPP	Emergency Preparedness Plan
ESA	Environmental and Social Audit
ESMP	Environmental and Social Management Plan
ESSAT	Environmental and Social Standards Advisory Team
EPBs	Environmental Project Briefs
FAO	Food and Agriculture Organization of the United Nations
fsl	Full Surface Level
GBV	Gender Based Violence
GRM	Grievance Redress Mechanism
GRZ	Government of the Republic of Zambia
HSSE	Health Safety Social and Environmental
IBAT	Integrated Biodiversity Assessment Tool
ICOLD	International Commission on Large Dams
IDA	International Development Agency
IDSP	Irrigation Development Support Project
IDSP AF	Irrigation Development Support Project Additional Financing
ILO	International Labor Organization
ISDS	Integrated Safeguard Data Sheet (World Bank)
IUCN	International Union for Conservation of Nature
KBA	Key Biodiversity Area
LMP	Labor Management Plan
MAR	mean annual runoff
MWDSEP	Ministry of Water Development Sanitation and Environmental Protection
msl	mean sea level
NGO	Non-governmental Organization
ODI	Overseas Development Institute
OP	Operational Policy (World Bank)
OPCS	Operational Policy and Country Services (World Bank)
PAD	Project Appraisal Document (World Bank)

PAP	Project Affected Person
PDO	Project Development Objective
PGA	Peak Ground Acceleration
PIU	Project Implementing Unit
SEF	Safety Evaluation Flood
SEA	Sexual Exploitation and Abuse
SEP	Stakeholder Engagement Plan
TEVETA	Technical Education, Vocational and Entrepreneurship Training Authority
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
UNOPS	United Nations Office for Project Services
USD	United States Dollar
VIP	Ventilated Improved Pit
VSU	Victim Support Unit
WARMA	Water Resources Management Authority
WRDP	Water Resources Development Project
YWCA	Young Women Christian Associates
ZABS	Zambia Bureau of Standards
ZEMA	Zambia Environmental Management Agency
ZMD	Zambia Meteorological Department

Executive Summary

Nachibanga Dam, located in Pemba District of the Southern Province of Zambia is one of ten dams that have been selected for remedial works under the World Bank funded Irrigation Development Support Project (IDSP) implemented by the Ministry of Agriculture and effective since 2011.The Dam was first constructed in 1968 and rehabilitated in 1998. It was built exclusively for livestock watering and thus has no outlet. In 2016 further construction works on the Dam were undertaken, including raising the embankment and the spillway and constructing new drop structures. The works were undertaken under the Zambia Water Resources Development Project (WRDP), which was funded by the World Bank. The WRDP was classified as a 'Category B' project under the World Bank safeguards policies, and several operational policies (OPs) were triggered. However, the World Bank's mid-term review of the WRDP identified non-compliance issues with safeguards policies and poor quality of construction works at the dam. Despite efforts to bring the project back on track, the project continued to remain out of safeguards compliance. The WDRP was closed in 2018.

The World Bank has provided Additional Financing (AF) to the IDSP, to support remedial works on the Nachibanga Dam. UNOPS is tasked with overseeing works and prepare this Environmental and Social Management Plan (ESMP) on behalf of the Government of the Republic of Zambia to guide the remedial works on the dam, mitigating imminent identified risks to the environment, safety of communities, and their associated livelihoods, and to bring the dam in compliance with World Bank Safeguards Policies. The key structural legacy issues of the Nachibanga Dam include a large catchment area for a 'small dam' requiring a non-erodible spillway; inadequate abutments that can be impacted by floods; a drop structure constructed on a weathered granite that has been undermined and temporarily propped with sand bags; lack of a rock toe and seepage issues; one single drop structure posing erosion risks; as well as embankment and slope stability issues.

UNOPS has developed detailed designs for the remedial works on Nachibanga Dam. The works will not change the nature and scope of the existing dam operation activities. The works will be implemented in two forms: construction and demobilization activities and the existing sites' remediation activities.

Institutional Arrangements: The sub-project works on Nachibanga Dam will be managed and implemented by the Ministry of Agriculture of Zambia. The Ministry hosts a Project Implementation Unit (PIU) for the IDSP. While the PIU of the IDSP will manage and implement the broader AF activities, it has contracted UNOPS to oversee and implement the remediation works on ten dams, including the Nachibanga Dam. UNOPS will procure and oversee a contractor for the remedial works on the Dam.

The dam community is expected to own this project and report any grievance or misconduct by the contractor or contractor personnel to the IDSP-PIU through the Project Grievance Redress Mechanism (GRM). Upon completion of the works, the management, operation and maintenance of the dam will therefore be handed over to the Nachibanga dam committee. In order to successfully operate the dam, and limit impacts on people and environment, the dam committee members will receive capacity building and training.

The ESMP addresses the environmental and social risk and impacts identified through extensive field assessments. This includes a Construction Works Management Plan, containing the mitigation measures and monitoring performance indicators for non-hazardous waste; hazardous waste; soil; land use and aesthetics; surface and groundwater pollution; air quality and noise; sanitation; traffic; biodiversity and

flow; community health and safety; gender equality and Gender Based Violence (GBV); labor and working conditions; decommissioning and rehabilitation measures; maintenance and monitoring.

A separate rehabilitation and remediation plan has been included in order to identify, rehabilitate and remediate the existing previous dam construction areas, which have environmental and safety issues; as well as existing incomplete dam construction works and sites to enable completion; and to outline the requirements to return previously disturbed sites to a state which is similar to the state prior to construction.

Health and safety and non-structural risks related to legacy issues of the dam include unrehabilitated contractor sites posing health and safety issues for the community; inability to monitor and assess downstream ecological effects of dam operation; stagnant water ponds within the spillway that can be vector breeding areas and may cause drowning risks; poor water quality; and lack of access across the river; as well as several injury and drowning risks for community members related to lack of awareness.

Social concerns include a failure to stock the dam with fish posing risks of food insecurity; uncontrolled stock watering; and a lack of capacity / training for community members to benefit fully from irrigation water supply.

The remedial works are planned to be completed in 4-6 months.

Lastly, the ESMP includes a capacity building and training plan lays out the capacity building requirements and planned training for communities and other stakeholders in relation to the construction and operation phase of the planned works at Nachibanga Dam. Similarly, a Stakeholder Engagement Plan lays out the detailed modes of engagement with a variety of stakeholders in order to ensure appropriate dissemination of all information regarding the works; and to allow for consultation of stakeholders on dam-related environmental and social issues. A Grievance Redress Mechanism (GRM) has been designed to allow stakeholders to file any feedback or grievances and receive appropriate responses from the IDSP.

1. Introduction

Nachibanga Dam, located in Pemba District of the Southern Province of Zambia, is one of ten dams that have been selected for remedial works under the World Bank funded Irrigation Development Support Project (IDSP). According to OP 4.37, the dam is classified as a small dam because its height is less than 15m. The current structural integrity of Nachibanga Dam has been heavily compromised, which has become a threat to the safety of the local community and downstream users. UNOPS has been tasked to prepare this Environmental and Social Management Plan (ESMP) on behalf of the Government of the Republic of Zambia to guide the remedial works on the dam, mitigating imminent identified risks to the environment, safety of communities, and their associated livelihoods, and to bring the dam into compliance with World Bank safeguards policies.

UNOPS has conducted environmental, social and dam engineering studies based on desk reviews, interviews and consultations with key sub-project stakeholders, and collection of field data at the dam site using field specific equipment. Initial field screening visits by the team have revealed that an in-depth biodiversity assessment of the dam site is required. A Biodiversity Management Plan will be prepared separately from this ESMP, based on the findings from the Biodiversity Assessment.

Dam construction will commence after ESMP approval and disclosure. The ESMP will then be communicated to the stakeholders prior to the remedial works. Dam construction is anticipated to take 6 months.

1.1. Project Background and Description

The Nachibanga Dam was first constructed in 1968 and rehabilitated in 1998. It was built exclusively for livestock watering and thus has no outlet. In 2016 further construction works on the Dam were undertaken, including raising the embankment and the spillway and constructing new drop structures. The works were undertaken under the World Bank funded Zambia Water Resources Development Project (WRDP) (P114949).

The Water Resources Development Project (WRDP)

WRDP became effective in 2013 and was closed in 2018. The PDO of the WRDP was 'to support the implementation of an integrated framework for development and management of water resources in Zambia'. The WRDP project had three components: Component A: Water Resource Management; Component B: Water Resources Development; and Component C: Institutional Support. Component B included the support for the design, rehabilitation and construction of 100 small dams. Of these, only 12 dam sites were procured for construction or rehabilitation. Nachibanga Dam was one of the construction sites. However, concerns were raised about foundation conditions at two of the sites and these were subsequently excluded from construction and rehabilitation resulting in 10 dams included in WRDP.

***WRDP E&S Safeguards*:** The Project was classified as a 'Category B' project under the World Bank safeguards policies. Several World Bank safeguards policies were triggered. As a result, the following instruments were prepared, consulted and agreed upon: i) Environmental and Social Management Framework with provision for cultural resources management and protection; ii) Pest Management Plan; and iii) Resettlement Policy Framework. The World Bank Integrated Safeguard Data Sheet (ISDS) indicated that the project would not finance the construction of large dams and required only generic dam safety measures contained in existing operational procedures and the application of the 2010 Food and

Agricultural Organization (FAO) Technical Guide for Small Earth Dams for compliance with safeguards on Dam Safety.

The World Bank's mid-term review of the WRDP identified non-compliance issues with safeguards policies and poor quality of construction of the Nachibanga and other dams. As a result, the Project Management Unit prepared Environmental Project Briefs (EPBs) for the dams, which were finalized between March and June 2016 and approved by Zambian Environmental Management Agency (ZEMA) between January and May 2017. However, these EPBs were not compliant with World Bank safeguards policies and despite efforts to rectify the issues, the non-compliance persisted. As a consequence, on March 26, 2018, the World Bank issued a Partial Suspension of the Project. The suspension limited project expenditure to addressing safeguards issues and remediating the dams that were built or rehabilitated under the WRDP. Although EPBs and an ESMP were in place, remedial works at the ten dam sites had not taken place at the time of closure in 2018. Since the closure of the WRDP, the World Bank and GRZ have worked to address the outstanding issues, given the responsibilities and obligations of the parties set out in the WRDP's Financing Agreement. On October 10, 2019, the World Bank and the GRZ agreed on remedial actions to ensure the safety of the ten dams that were constructed/ rehabilitated under the WRDP. To address the shortfalls, remedial works would be financed under the Irrigation Development Support Project (IDSP).

Irrigation Development Support Project (IDSP)

The Irrigation Development Support Project (IDSP) (P102459) was approved and became effective in 2011. Two restructurings of the original project changed the Project Development Objective (PDO), the number of components and the closing date. The current PDO of the IDSP is to 'provide improved access to irrigation services in selected sites in the Recipient's territory'. The Project consists of three components:

- Component 1: Public Infrastructure Investment;
- Component 2: Development of irrigation management capacity; and
- Component 3: Project management and coordination

As part of the 2019 agreement it was decided that the remedial work of these dams will be carried out through the) following a two phased approach. The first phase is financed by the IDSP parent project, the second phase by the AF.

Phase 1 covers preparatory activities that will facilitate the works to remediate dam safety and integrity and to realise its original intent, which was to the benefit of the local community and the department of agriculture. The scope of Phase 1 consists of a) undertaking the necessary investigations for remediation, including in regards to dam safety and environmental and social safeguards; b) prepare an ESMP and Biodiversity Assessment and Management Plan; c) undertaking immediate, limited, structural and non-structural interventions to minimize immediate risks to communities caused by the dam.

IDSP Additional Financing (AF)

The AF extends the original deadline of the IDSP, 30 November 2020, to 30 November 2021. It consists of three distinct sets of activities: Activity 1: Completion of ongoing works under the IDSP and cost replenishment; Activity 2: Remedial works for the ten WRDP dams; Activity 3: Drought Emergency Response. The remediation of Nachibanga Dam and nine other dams will be implemented under Activity 2.

Phase 2 of the 2019 agreement and Activity 2 of the AF provide remedial activities to reduce the risks/impacts related to construction and operation of the Nachibanga Dam; and support through training

and capacity building required to safely operate the dams and reduce the downstream environmental impacts. It is envisaged that the activities associated with the works will not change the nature and scope of the existing scheme and will not increase the dam's existing capacity. With this, it is projected that the remedial measures will not adversely change the quality or quantity of water flows downstream to other areas.

The scope of Phase 2 for Nachibanga Dam consists of:

a) Civil works on the dam to ensure the safety of dam and downstream communities;
b) Establishment of operation and maintenance arrangements;
c) Continuation of surveillance;
d) Upon completion of the works, hand-over of the management, operation and maintenance of the dam to a dam committee comprising people from the beneficiary communities;
e) Implementation of the Environmental and Social Management Plan (ESMP), including remediation of environmental legacy areas such as borrow pits, excavation pits, spoil areas, hazardous wastes areas, etc.; and
f) Training of communities on how to operate the dam and conserve the catchment.

1.2. Objectives of the ESMP

This ESMP has been prepared to guide all the works on Nachibanga Dam during Phase 2 of the IDSP AF. The main objectives of this ESMP are to implement remedial works to mitigate imminent identified risks to the environment, safety of communities, and their associated livelihoods, and to bring the dam's operational management into compliance with World Bank Safeguards Policies.

1.3. Methodology

This ESMP is based on a desk review of available information and field data collection, which included consultations with members of the Nachibanga dam community, the local government authorities, GRZ, and the World Bank and IDSP teams. Field visits were conducted to the Nachibanga dam site for detailed on-site assessments of the environmental and social impacts of the sub-project. This ESMP has been guided by the Zambian Environmental Management Act EIA Regulations (1997), as well as by the World Bank's OPs. Reference is made to the initially prepared and approved EPBs (DWRD 2017), the Remedial ESMP (COWI 2018), the Environmental and Social Audit (April 2020), and current dam assessments in order to determine environmental and social requirements for rehabilitation and restoration measures. The EMSP follows the format laid out in the Environmental and Social Audit (April 2020).

In summary the following activities were undertaken by UNOPS:

- Literature review, including data and documentation provided by the IDSP to UNOPS:
  - Remedial Environmental and Social Management Plans of Eight (8) Dams Under the Water Resource Development Programme (2018)
  - Approval Decision letters by Zambia Environmental Management Authority (2017)
  - Environmental Project Briefs (EPB) prepared under WRDP (2017)
  - Environmental and Social Audit (ESA) of 10 Dams (2020)
- Field studies by the UNOPS Environmental and Social (E&S) safeguards and engineering teams

in July 2020, accompanied by the IDSP team.
    - Site environmental and social assessments.
    - Site and analytical geotechnical studies
    - Site surveying
    - Site and desk terrestrial and aquatic biodiversity studies
    - Site and desk hydrological studies
- Public participatory interviews, Focus Group Discussions and community consultations.
- Environmental quality monitoring – water quality sampling and analysis.
- Ad hoc, matrix and checklist methods of impact assessment.

The ESMP has included the preparation of the following plans and reports:

- Policy, legal and institutional framework
- Baseline conditions
- Remedial design with
    - Geotechnical information
    - Survey information
    - Hydrology information
- Safety reports-operations and maintenance/ emergency preparedness plan
- Basic biodiversity management plan (to be updated through a separate Biodiversity Assessment and Management Plan
- General construction works management plan
- Rehabilitation plan
- Training plan and stakeholder engagement
- Grievance redress mechanism
- ESMP implementation process

2. Policy, Legal and Institutional Framework

Environmental and social sustainability is vested in international and national policies, laws, regulations, guidelines and standards that guide the implementation of this sub-project. The below table outlines key legislation that regulates the environmental and social aspects during dam rehabilitation through to the operational phases. The sub-project activities must fully comply with the relevant legislation of the Republic of Zambia as well as with the World Bank Safeguards Policies.

2.1. National Policy and Legislative Framework

These policies and others are actively implemented through compliance with the legislative frameworks described below. Table 1 outlines the various laws of the Republic of Zambia that are relevant to the proposed works.

Table 1: Laws relevant to the sub-project

Legal Instrument	Relevance to the Sub-Project	Responsible Institutions	Action required for compliance
Environmental and Natural Resource Management			
Environmental Management Act No.12, 2011	To protect the environment and control pollution, so as to provide for the health and welfare of persons, animals, plants and the environment. This Act provides for the management of effluent discharge, air and noise pollution, the parameters which are relevant to this sub-project.	UNOPS to ensure the relevant regulations are mainstreamed in the ESMP and enforced IDSP to monitor compliance throughout sub-project lifespan	The various activities to be undertaken as remedial measures to Dam's safety and integrity are likely to have environmental impacts. Provisions for mitigation measures for identified sub-project impacts are put in place in order to eliminate or reduce the effects of these impacts. The measures are consistent with the requirements in the Environmental Management Act of 2011. As an example, some of the works to be undertaken may result in environmental discharges that will require ZEMA licenses for compliance and monitoring. Relevant pieces of regulations have been mainstreamed in this ESMP to ensure the contractor's compliance with the regulations during the rehabilitation of the dam.
Environmental Impact Assessment (EIA) Regulations, Statutory Instrument No. 28 of 1997	Under these regulations, a developer shall not implement a project for which a project brief or an environmental impact statement is required, unless the project brief or an environmental impact assessment has been		At the national level, the Environmental Impact Assessment (EIA) regulation of 1997 gives guidance, schedules and categories for the various project types and the relevant EIA studies to be undertaken. It further gives provision on post- EIA approval management of projects and guidelines for developing ESMPs.

Legal Instrument	Relevance to the Sub-Project	Responsible Institutions	Action required for compliance
	concluded in accordance with these Regulations and the Council has issued a decision letter.		
Solid Waste Management Act of 2018	To ensure disposal of generated solid waste to designated sites	UNOPS to ensure the regulation is enforced through the ESMP IDSP to monitor compliance throughout the sub-project lifespan Local Municipal Authority	The ESMP has taken into consideration solid waste management at work sites by introducing a parameter that will compel the contractor to take care of all the generated solid waste at their worksites and appropriately dispose of the same.
Natural Resources Conservation Act, Cap 315, 1970	To conserve and protect both natural and cultural heritage, e.g. waterfalls, in perpetuity and other resources within the boundaries of the site for the benefit of the present and future generations.	UNOPS to ensure enforcement during preparation and construction phase IDSP to monitor compliance throughout sub-project lifespan	The ESMP takes into consideration biodiversity studies, details specific conservation and mitigation measures to ensure sub-project activities promote the conservation and protection of both natural and cultural heritage in the sub-project affected areas, and compliance with the regulation.
Fisheries Resources Management			
Fisheries Act, Cap 200, 1974	Provides for development of commercial fishing and the registration of fishermen and their boats and the protection of endangered fish species.	IDSP Monitoring: Ministry of Agriculture and Livestock	The proposed dam shall be used for fishing; commercial fishing may be eventually developed by communities. The provisions of this Act will be complied with in the management of these fish resources. Fishing shall be conducted according to the regulations and the Fisheries Department will be involved to educate the community activity.

Legal Instrument	Relevance to the Sub-Project	Responsible Institutions	Action required for compliance
			NOPS on behalf of the GRZ has included actions to ensure species are protected with the involvement of the relevant Fisheries Department in the District.
Lands Management			
The Lands Act, 1995 (CAP 292, CAP 289, CAP 288)	The Department of Lands administers the Land Act, 1995 (CAP 292, CAP 289, CAP 288) and the Lands Acquisition Act, 1995 for the allocation and alienation of land under statutory leaseholds. The Department is also responsible for the administration of lands and deeds registration and land surveys and mapping.	UNOPS to ensure enforcement during preparation and construction phase Monitoring: Ministry of Lands, Natural Resources and Environment Protection	No additional land is expected to be required for this sub-project. If any land acquisition be required, UNOPS/ IDSP will comply with this regulation which governs the acquisition of the land to be used for various developmental activities.
Urban and Regional Planning Act, No. 3 of 2015	Provides for the appointment of planning authorities, the preparation approval and revocation of development plans, and the control of development and subdivision of land.	UNOPS to ensure enforcement during preparation and construction phase Monitoring: Ministry of Local Government and Housing Local Authorities	The land falls within traditional tenure. UNOPS on behalf of the GRZ will comply with this regulation for the approvals of construction and development plans within a locality if required.
Local Government Act, 1990	Provides for the establishment of Councils in districts, the functions of	Ministry of Local Government and Housing Local Authorities	The function of the municipalities is guided by the provision of the Local Government Act. UNOPS will on behalf of the GRZ comply with the requirements of this Act for measures related

Legal Instrument	Relevance to the Sub-Project	Responsible Institutions	Action required for compliance
	local authorities and the local government system.		to pollution control and environmental protection functions which are handled by the local council. It will ensure that the council and stakeholders are involved in the planning, rehabilitation and operation activities.
Agricultural Lands Act No 13 of 1994 (Cap. 187)	The Act establishes the Agricultural Land Board and provides for its functions which inter alia includes; keeping under review the use that is being made of state land, outside urban and peri-urban areas and to make recommendation to the Minister responsible for agriculture. The Act provides for tenant farming schemes.	UNOPS to ensure enforcement during preparation and construction phase Monitoring: Ministry of Agriculture	The sub-project construction work and dam operation activities may be carried out on agricultural lands and thus assessment of the impacts of these activities on the agricultural areas in the sub-project area was undertaken. UNOPS, contractors and stakeholders will comply with this law in relation to rehabilitation and operation of the dam.
Traffic Management			
The Road Traffic Act No. 11 of 2002	Establishment of the Road Transport and Safety Agency (RTSA). It also provides for a system of road safety and traffic management in Zambia.	Contractor Monitoring: UNOPS	The transportation of construction materials has the potential to cause accidents, hence traffic control measures must be employed and the development must comply with provisions of the Act. UNOPS and contractors will comply with all the regulations under this Act, traffic safety rules for communities, traffic management. This ESMP includes a traffic management plan.
Tourism Management			
Zambia Wildlife Act No. 14 of 2015	Management and Protection of National Parks and Wildlife respectively	UNOPS to ensure enforcement during preparation and construction phase	The dam is located in a remote rural area; hence all activities by UNOPS will comply with the requirements of this regulation on behalf of the GRZ if protection of wildlife is required. The ESMP determines appropriate action to ensure preservation of national parks and protected areas, wildlife,

Legal Instrument	Relevance to the Sub-Project	Responsible Institutions	Action required for compliance
		Monitoring: Ministry of Tourism	and protected and endangered species by including ecologists on the team. A biodiversity assessment has been conducted and a separate Biodiversity Management Plan is being prepared.
Employment and Labor			
Workers' Compensation Act No. 10 of 1999 **Employment Act**	All employment regulations and laws.	Contractor UNOPS Monitoring: Ministry of Labour	UNOPS will on behalf of the GRZ ensure that the contractor comply with provisions of these regulations during the course of employment.
Occupational Health and Safety Act	Provides for the health and safety of persons at work and for the health and safety of persons in connection with the use of plant and machinery.	Contractor UNOPS Monitoring: Ministry of Labour	UNOPS will on behalf of the GRZ ensure that the contractor complies with the occupational health and safety requirements of the Act, promote safety, putting in place all measures required to ensure the well-being of the workers.
Worker's Compensation Act No. 10 of 1999	Establishment and administration of a Fund for the compensation of workers disabled by accidents to, or diseases contracted by such workers in the course of their employment, and for the payment of compensation to dependants of workers who die as a result of such accidents or diseases.	Contractor UNOPS Monitoring: Ministry of Labour	This Act is relevant to the sub-project because workers are at higher risk of suffering from injuries that could lead to disabilities or contracting diseases due to the nature of their work environment. In the event of work-related accidents, the provisions of this Act shall be triggered. UNOPS and its contractors will comply with regulations under this Act by registering with the workers compensation Board and being compliant providing safe working sites.
Community Health and Safety			

Legal Instrument	Relevance to the Sub-Project	Responsible Institutions	Action required for compliance
The Public Health Act of 1995	Prevention and suppression of diseases and regulation of all matters connected with public health. This law may be read together with the Local Government Act, Cap 281 of the laws of Zambia. The Act empowers the Ministry of Health and the Councils to prevent diseases and pollution dangerous to human health, as well as prevention of pollution to any water supply for domestic use.	Contractor UNOPS Monitoring: Ministry of Health	The sub-project is likely to cause pathogens due to human activities. Measures to prevent diseases and pollution particularly during the rehabilitation and operation phases will be instituted. UNOPS will on behalf of the GRZ take measures to prevent diseases and pollution dangerous to human health by ensuring that there are good sanitation and waste disposal systems on the working premise, prevention of vectors etc. COVID-19 prevention and management measures are included in this ESMP.
The Gender Equity and Equality Act, 2015	Taking of measures and strategic decisions to ensure gender equity, equality and integration of both sexes in society; promotes gender equity and equality as a cross cutting issue in all spheres of life and stimulate productive resources and development opportunities for both sexes; prohibits harassment, victimization and harmful social, cultural and religious practices; provides for public awareness and training on issues of gender equity and	Contractor UNOPS Monitoring: Ministry of Gender Ministry of Community Development and Social services	Sub-project works and operation will require gender mainstreaming and prevention and mitigation measures for GBV UNOPS and its contractors will comply with all the regulations under this Act. This ESMP includes a Gender Equality and GBV Action Plan.

Legal Instrument	Relevance to the Sub-Project	Responsible Institutions	Action required for compliance
	equality; provides for the elimination of all forms of discrimination against women, empowers women and achieve gender equity and equality		
The Anti-gender-based Violence Act, 2011	The Act provides for the protection of victims of gender-based violence; constitutes the Anti-Gender-Based Violence Committee.	Contractor UNOPS Monitoring: Ministry of Gender Ministry of Community Development and Social services	Worker influx bears risks of GBV cases. UNOPS and its contractors will comply with all the regulations under this Act. Sensitisation, reporting and referral pathways will be put in place.
Disaster Management			
Disaster Management Act, 2010	Establishes and provides for the maintenance and operation of a system for the anticipation, preparedness, prevention, coordination, mitigation and management of disaster situations and establishes the Disaster Management and Mitigation Unit (DMMU).	UNOPS to ensure enforcement during preparation and construction phase Monitoring: Office of the Vice president District Commissioner Office	Dam safety risk and emergency response measures need to be in concordance with the Act and should involve the necessary stakeholders. UNOPS engineering and safeguards teams will work together for remedial actions that promote safety. The UNOPS and IDSP will involve the DMMU in implementing safety and emergency measures.

2.2. World Bank Operational Policies

This sub-project will fully comply with the World Bank OPs. In addition, it will be guided by the WBG Environmental, Health and Safety Guidelines (EHS Guidelines); The World Bank's Good Practice Note on 'Addressing Gender Based Violence in Investment Project Financing Involving Major Civil Works'[1]; as well as World Bank guidance on 'Managing the Risks of Adverse Impacts on Communities from Temporary Project Induced Labor Influx[2].

Table 2 describes the applicable triggered policies and actions to be followed by the IDSP AF/UNOPS and the constructor. The ESA indicated 6 triggered policies for the project, but the Nachibanga dam subproject has not triggered the OP 4.12 **(**Involuntary Resettlement), because there is no anticipated resettlement for the subproject; and is has not triggered OP 4.09 (Pest management) because it is a livestock dam.

Table 2: Relevant World Bank operational policies

OP	**Name**	**Actions to be followed by the IDSP AF / UNOPS**
OP 4.01	Environmental Assessment:	The project was classified EA Category B and an Environmental and Social Audit (ESA) was prepared to comply with OP 4.01. The policy is triggered because of the potential impacts the remediation works on Nachibanga Dam could have on the environment and people. Some of the potential impacts include: soil excavations, borrow pits, construction waste, clearing of vegetation, noise, sedimentation, downstream flows etc. For the remediation works at Nachibanga Dam, UNOPS has prepared this ESMP, following the requirements defined in the ESA. The sub-project will implement all measures described in both instruments to mitigate all defined negative impacts.
OP 4.04	Natural Habitats:	This policy is triggered because the construction of the dam has caused impacts in natural and modified habitats. Also, the impact of the operation of the dam on downstream flow and the induced impacts of

[1] World Bank, Good Practice Note. Addressing Gender Based Violence in Investment Project Financing involving Major Civil Works, September 2018

[2] World Bank, Managing the Risks of Adverse Impacts on Communities from Temporary Project Induced Labor Influx, OPCS and ESSAT, December 2016.

		increasing human populations on both aquatic and terrestrial ecosystems was identified in the ESA as an area of weakness in the previous safeguard instruments that must be rectified. The previous ESMP prepared for the dam listed some of the ecological impacts associated with dam and flow regulation but argued in favor of the dam as a means of guaranteeing flow in the downstream system in the dry season and during times of drought. This presupposes that flows will be managed to benefit downstream ecology, which, given capacity limitations and cost, is far from certain; and while there may be benefit in supplementing ecological base flows in dry periods, this does not necessarily outweigh other negative considerations. Cumulative changes brought about by the dam may negatively affect the downstream aquatic and wetland environment, including creating a barrier to the movement of aquatic species. The opportunity to properly address the above issues, as required by OP 4.01, has to some extent passed. The dam is already built. There are, however, some options for impact minimization, as well as actions to make the most of the potential benefits of flow regulation. This ESMP provides measures to mitigate negative impacts on terrestrial and aquatic ecosystems in the area of influence of the dam, which include impacts that will be caused by the current construction teams in their day to day activities and those caused by the previous construction works (see remediation plan in this ESMP). UNOPS has further conducted a biodiversity assessment and is preparing a Biodiversity Management Plan.
OP 4.37	Safety of the dam	This policy is triggered because the remediation works at the dam are necessary to ensure dam safety. The dam is considered a small dam because it has a height less than 15m. UNOPS and its contractors will follow Good International Industry Practice (GIIP) to determine and implement corrective actions that mitigate dam safety issues. For the sub-project a *Plan for construction supervision and quality assurance*, *Operation and Maintenance (O&M) plan*, and an *Emergency Preparedness Plan (EPP)* have been prepared.
OP 7.50	Project on International Waterways	The policy is triggered because the remediation of the dam site was not previously part of the IDSP umbrella, and Nachibanga Dam is a tributary of the Zambezi river.

	However, the AF is requested for an exception to notification according to paragraph 7a[3] of the policy. The project qualifies for an exception given that works and activities would not exceed the original scheme, change its nature, or alter or expand its scope and extent as to make it appear a new or different scheme. The dam remedial works consist of strengthening and stabilizing existing dam embankments and completing and reinforcing existing spillways to ensure dam safety. The activities will not change the nature and scope of the existing schemes and will not increase the dam's existing capacity. Therefore, these remedial measures will not adversely change the quality or quantity of water flows to the other riparian users; and will not be adversely affected by the other riparian users' possible water use. Further, the sub-project also includes measures identified in this and other ESMPs (for the other nine dams), which will help mitigate impacts on flows and water quality.

The WBG EHS Guidelines contain the following guidelines included in the ESMP to be applied on the subproject:

- Environment- air emissions and quality; energy conservation; wastewater and ambient water quality; water conservation; hazardous materials management; waste management; noise and contaminated land.
- Occupational health and safety- facility design and operation; communication and training; hazards; PPE and monitoring.
- Community health and safety- water quality and availability; infrastructure structural safety; life and fire safety; traffic safety; transport of hazardous materials; disease prevention and emergency preparedness and safety.
- Construction with decommissioning –environment, occupational health and safety and community health and safety.

[3] The following exceptions are allowed to the Bank's requirement that the other riparian states be notified of the proposed project: (a) For any ongoing schemes, projects involving additions or alterations that require rehabilitation, construction, or other changes that in the judgment of the Bank (i) will not adversely change the quality or quantity of water flows to the other riparians; and (ii) will not be adversely affected by the other riparians' possible water use. This exception applies only to minor additions or alterations to the ongoing scheme; it does not cover works and activities that would exceed the original scheme, change its nature, or so alter or expand its scope and extent as to make it appear a new or different scheme. In case of doubt regarding the extent to which a project meets the criteria of this exception, the executive directors representing the riparians concerned are informed and given at least two months to reply. Even if projects meet the criteria of this exception, the Bank tries to secure compliance with the requirements of any agreement or arrangement between the riparians.

3. Institutional Arrangements for E&S Management of the Sub-Project

The Nachibanga Dam remedial works will be managed and implemented by the Ministry of Agriculture of Zambia. The Ministry hosts a Project Implementation Unit (PIU) for the IDSP. While the PIU of the IDSP will manage and implement the broader AF activities, it has contracted UNOPS to oversee and implement the remediation works of the ten dams, including Nachibanga Dam. The IDSP-PIU E&S Team is responsible for all E&S aspects of the IDSP. It will supervise and monitor all E&S aspects of all activities of the UNOPS Sub-PIU and UNOPS contractor at the Nachibanga dam site. The UNOPS Sub-PIU E&S Team is responsible for the implementation of the E&S mitigation measures laid out in this ESMP. Where implementation is conducted by contractors, the UNOPS Sub-PIU E&S Team supervises and monitors all E&S related aspects of the contractor's works. The institutional arrangements are summarized in Figure 1.

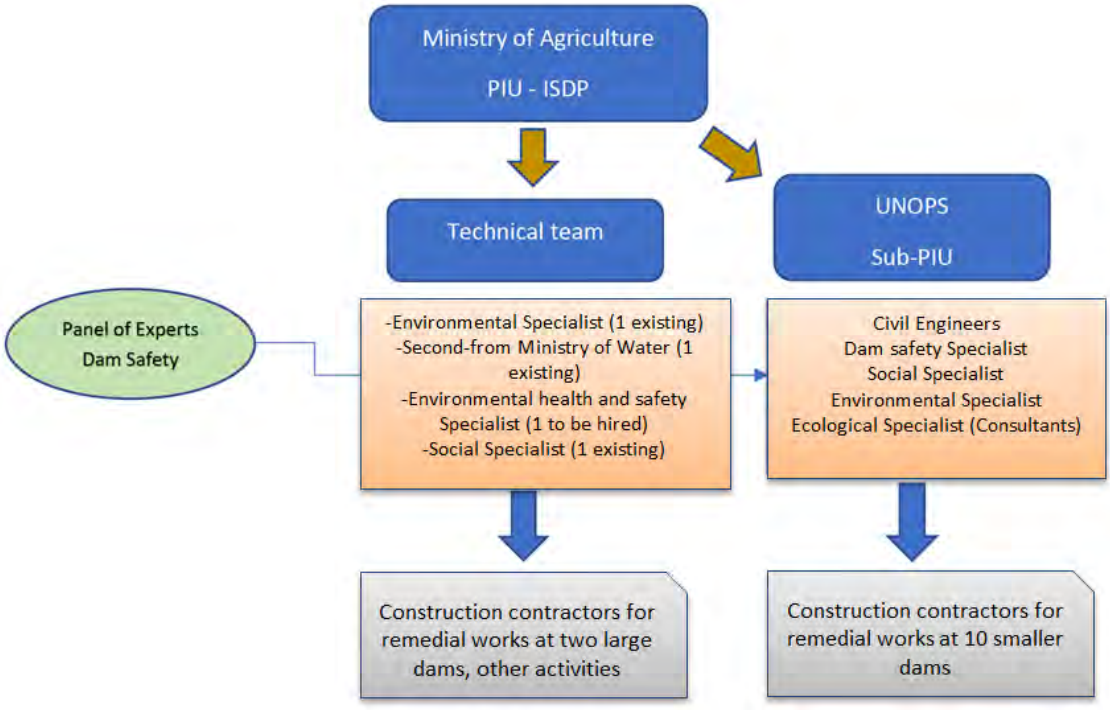


Figure 1: Institutional arrangement for sub-project implementation

3.1. Ministries / IDSP-PIU

The IDSP-PIU is situated within the Ministry of Agriculture and will have overall oversight of the implementation of this EMSP and for the dam remediation works.

The IDSP-PIU will therefore include one environmental specialist, one environmental health and safety specialist, and one social specialist to support the overall supervision of the remedial works.

The IDSP-PIU will further provide support to the dam remediation activities through a dam safety panel of experts who will have oversight over the works, remediation plans, safety plans, etc.

The IDSP-PIU shall retain the primary responsibility for ensuring that environmental and social commitments for the Nachibanga Dam are met throughout the sub-project lifespan vis-à-vis the World Bank.

The IDSP-PIU will establish a schedule of supervision and monitoring for the environmental and social management of the Nachibanga Dam site. Environmental and social issues are the responsibility of all personnel, from the management to the operator, but day-to-day supervision and monitoring for the planning and implementation of the whole sub-project lies specifically with the environmental specialist, the environmental health and safety specialist and the social specialist (Figure 1). Furthermore, at least one additional MoA field staff member with HSSE responsibilities will be located at Nachibanga dam site for continuous onsite monitoring and reporting during remediation of the dam and its operation – for the lifespan of the IDSP.

The three specialists will supervise all E&S related matters for the works under the AF. This includes supervision of UNOPS and the UNOPS contractor at the Nachibanga dam site. This E&S supervision includes the operationalization of the dam, during which period the IDSP personnel will be working with the respective local authorities, dam committee and local communities, in preparation for smooth handover when IDSP ceases to exist as a project.

The PIU will implement capacity building and training of local stakeholders to ensure their informed cooperation in E&S matters during the remedial works and during the operational phase of the dam as well as advising the dam committee.

3.2. United Nations Office for Project Services (UNOPS)

The IDSP-PIU has contracted UNOPS to implement the remediation sub-project of Nachibanga Dam under the AF, including the day-to-day environmental and social management and implementation of the measures described in this ESMP. UNOPS has been tasked with the design of the remedial works and the preparation of this ESMP. UNOPS will further be responsible for the preparation of the tender document and supervision of the contractor for the remedial construction works including the implementation of E&S mitigation measures. Supervision will involve the management of the contractor and liaison with and reporting to the IDSP-PIU throughout the contract period.

The UNOPS technical team will include civil engineers and a dam safety specialist. Environmental and social issues will be the responsibility of one environmental specialist, one social specialist and one ecologist. This technical team will be located at the UNOPS Sub-PIU in Lusaka, with frequent travel to the Nachibanga dam site.

The environmental specialist and the social specialist will be involved in the environmental and social management of Nachibanga Dam. In addition, the team will supervise and monitor the implementation of environmental and social mitigation measures by the contractor. The team will establish a regular supervision and monitoring schedule, including site visits, and will prepare and submit quarterly environmental and social monitoring reports to the IDSP-PIU.

3.3. The Contractor and Sub-Contractors

The Contractor will be responsible for carrying out the work at the site in compliance with this ESMP, in accordance with applicable Zambian laws and regulations governing environmental and social impact management, pollution control, waste management, occupational health and safety, and the World Bank OPs.

The Contractor shall appoint one full time HSSE Officer to serve at the construction site throughout the entire period and ensure implementation of the ESMP. Among other obligations, the Contractor shall comply with all labour and gender equality requirements on site, as specified in the ESMP, and shall brief the Nachibanga dam committee and relevant Government officials through regular meetings.

The Contractor is required to prepare method statements for implementing aspects of the sub-project, and to operationalize all action and management plans as defined in this ESMP (including non-hazardous waste, hazardous materials and waste, surface and groundwater pollution, protection measures for terrestrial and aquatic fauna and flora, air quality and noise, labour and working conditions, sanitation, gender equality, gender based violence, stakeholder engagement, provision of flow during construction, environmental remediation and rehabilitation, maintenance and monitoring). This will be outlined in the procurement documentation provided to the contractor. The Contractor's method statements shall be submitted to UNOPS for approval prior to commencement of work.

3.4. The Community

As owners of the dams, the dam community (see baseline section 4.2.) will be encouraged to be active partners during the construction. It will be regularly consulted on a variety of issues (see stakeholder engagement section). It will further be asked to report any misconduct by the contractor or contractor's personnel to the IDSP-PIU, through the Grievance Redress Mechanism (GRM), which has been designed for the AF activities. Community members will be appointed by the dam committee to verify that the works do not cause harm to people and nature. Furthermore, stakeholder engagement, as laid out in the Stakeholder Engagement Plan (SEP) below, will be conducted by UNOPS, IDSP and the contractor, to ensure that community engagement informs the sub-project, that dam communities are well informed about the remedial works and the environmental and social mitigation measures undertaken. The implementation of the SEP ensures that dam community members are consulted throughout the construction and operational phases.

The dam is operated by a dam committee, which consists of community members. The Nachibanga dam committee is active, consisting of three women and seven men. The Nachibanga dam committee composition and positions are shown in Appendix F. The dam management committee is a locally developed, decentralised organisation where user communities have been ceded rights and have responsibilities for managing their own resources, typically using a mix of traditional or more formalised mechanisms of contract and enforcement to define, access, exploit, maintain and share dam resources or benefits. Due to the complexity of managing dams, the management structure is widened to include public agencies such as agriculture, water resources, fisheries and forestry departments as advisors and trainers. The committee has been/will be involved during planning, construction and operation phases. Its role will include involvement in stakeholder engagement, auxiliary sites selection, employment, ESMP implementation, operation guidelines and monitoring, operation maintenance and dam safety. The level of involvement in the maintenance and management will depend on the type of technology, the range of maintenance activities and capacity building offered to the committee. Therefore, UNOPS and IDSP have and will further inform communities of their expected obligations and contributions during consultations and training.

In Nachibanga, the Headmen and the Dam Committee conduct the monitoring and sensitization around dam issues. The committee has set rules, which are communicated to the users. These include tree and vegetation conservation rules around the dam, which has resulted in a good number of trees being protected. Cultivation around the dam is limited to minimize soil erosion, especially upstream. The dam has no security measures in place except Dam Committee constitutional regulations, which have been adhered to so far.

Upon completion of the remedial works, there will be a hand-over of the management, operation and maintenance of the dam to the Nachibanga dam committee. In order to successfully operate the dam, and limit impacts on people and environment, the dam committee members require further capacity building and training. Training will include issues such as dam safety management/ structural deterioration; gender equality; health and safety issues, erosion control and conservation (see training plan below).

MoA has representatives at the dam site who will periodically report to IDSP.

4. Environment and Social Baseline Conditions

4.1. Physical Conditions

4.1.1. Geology

Geology around the Nachibanga dam site is characterized by metamorphic (essentially undifferentiated schist and quartzite) rocks of the Basement Complex from the older Pre-Cambrian age. This can be seen along the spillway drop structures, where significant erosion has taken place that has created a deep channel (Figure 2). Soft schist and hard quartzite bands can also be observed in locations like the spillway return channel.

Figure 2: Deep eroded rock structures in the spillway bed

4.1.2. Topography

The area around Nachibanga is typically undulating plateau and the altitude at the dam is 1,245 masl. Land use in the area is characterized by forest, grassland, agriculture, rural settlement and water bodies. Local communities practice mixed farming with cattle and crop production as the most important economic activities.

4.1.3. Groundwater

The main aquifer is within Muva schists and minor quartzites, in which groundwater flow is mainly in fissures, channels and other discontinuities. This aquifer provides limited sustained water yields for the local Nachibanga community, which depends on ground water for drinking water.

4.1.4. Surface Hydrology

Nachibanga Dam is located on the Lunywamakubi River, a tributary of the Zambezi River located within the Zambezi basin. The catchment is 2.15 km^2 (Figure 3). Most streams in the area are seasonal, including the Lunywamakubi River. The dam was constructed in 1968 and has become an important source of supply for livestock watering. It is not used for community household water. The climate section (4.1.7) gives the seasonal climatic patterns in the area. Local communities indicate that the area mostly experiences low rainfall. The benefit of the dam is that it retains water for their animals throughout long periods of the year during which the Lunywamakubi River is largely dried up.

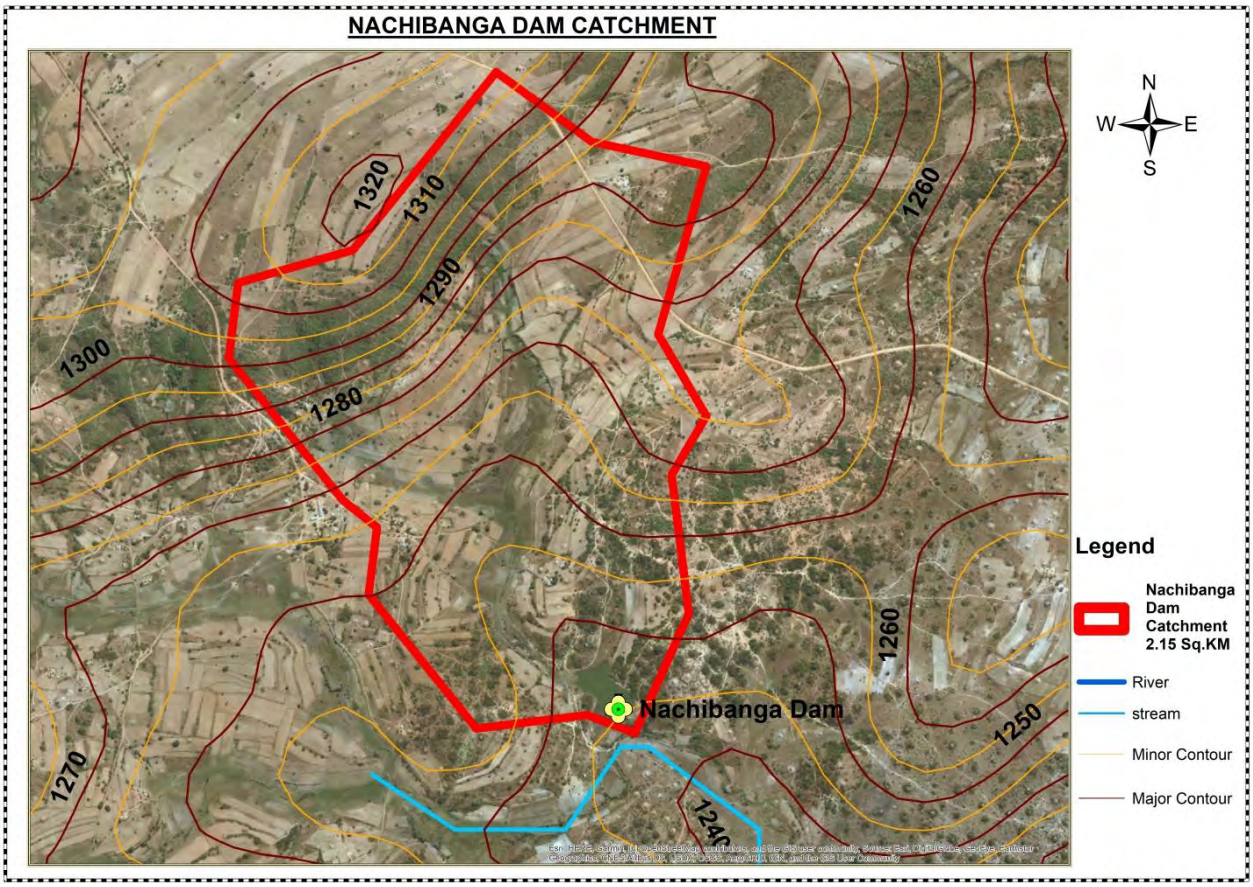


Figure 3: Catchment area

Given a Mean Annual Precipitation (MAP) of 760 mm, the mean annual runoff for the area is 65 mm/a.[4] Based on the above data, the average annual inflow at the dam site is 2,150,000 x 0.065 = **139,750m^3.**

[4] The MAR used is in accordance with the Zambia National Water Resources Master Plan. Also taken into consideration is work done by Imagen Hydrological Consultants on the Luezi Dam near Zimba in 2014 where a MAR of 70mm per year runoff was calculated.

4.1.5. Surface Water Quality

Water samples were collected at the upper end of the dam at coordinates 16°42'41.52"S; 27°20'33.27"E and analysed at the University of Zambia. It was observed during the sampling that water in the dam is turbid, which was confirmed by the water quality analysis. In the region upstream, where the river enters the dam, and downstream below the drop structures, the water appears clearer (Figures 4 & 5).

Figure 4: Reservoir water with high suspended solids

Figure 5: Water quality improvement further downstream due to sediment retention in the dam

Table 3 show the results of the 2020 water quality sample taken in Nachibanga Dam compared with other dams of the project. The turbidity level in Nachibanga Dam is beyond the WHO guidelines' maximum permissible level for drinking water limit. Compared to the COWI 2018 water quality results (Table 4), the basin water's turbidity level has increased from 3.48 to 44.4 in two years. The cause of turbidity could be the transfer of sediment from the

extensively deforested and cultivated upstream catchment, but is probably also connected to the large numbers of livestock that cause physical disturbance around the edge of the dam and in the shallows. Algae, plankton and decaying faecal material could also be contributing to turbidity. However, the levels of phosphates, sulphates and Chemical Oxygen Demand are within the statutory limit, which implies that the cause of high turbidity is possibly the inorganic matter, such as the silt from stock watering activities, exposed cultivation soils, deforestation/ overgrazing and lack of catchment management.

The 2018 results show the presence of coliforms in the basin. This can be attributed to animal defecation and runoff. Open defecation is usually a case in rural villages, though the communities did not confirm this.

Table 3: Water quality analysis for Nachibanga Dam compared with the other dams

SCHOOL OF ENGINEERING
CIVIL ENGINEERING DEPARTMENT
ENVIRONMENTAL ENGINEERING LABORATORY

P.O Box 32379, Lusaka

PHYSICAL/CHEMICAL EXAMINATION OF WATER

Attn : UNOPS Lusaka
Sampled by : Client
Report date : 15.01.2021

Laboratory Results

	Ndondi Dam Reservoir Pemba 17.07.2020	Kawiko Dam Mwinilunga Dam Reservior 15.07.2020	Kanyika Dam Kasempa Dam Reservior 17.07.2020	Nabowa Kaoma Dam Reservior 19.07.2020	Chikowa Dam Drinking Point 09.07.2020	Katembula Lufwanyama Dam Reservior 13.07.2020	Chibalashi Dam Mansa Dam Reservior 09.07.2020	Ngolongozya Dam Dam Basin Zimba 14.07.2020	Makaba Dam Namwala Dam Reservior 15.07.2020	Nachibanga Dam Pemba Dam Reservior 17.07.2020
pH	6.97	5.37	6.26	5.80	6.76	6.82	6.46	6.29	6.90	6.72
Conductivity (µs/cm)	85	15	186	80	352	194	36	76	72	92
Sulphates (mg/l)	<0.01	<0.01	<0.01	<0.01	2.50	1.70	<0.01	<0.01	<0.01	<0.01
Nitrates (as NO_3–N mg/l)	0.20	<0.01	<0.01	0.40	<0.01	<0.01	<0.01	<0.01	<0.01	0.30
Total Dissolved Solids (mg/l)	42	8	93	40	176	97	18	38	36	46
Ammonia (as NH_4-Nmg/l)	<0.01	<0.01	<0.01	<0.01	0.07	<0.01	<0.01	<0.01	<0.01	0.10
Phosphates (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Suspended Solids (mg/l)	3.9	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	4.6	5.2	12.8
Chemical oxygen demand (as mg O_2/l)	5	8	10	12	4	7	5	5	7	8
Chlorides (mg/l)	4.0	3.0	17.0	9.0	14.0	8.0	7.0	6.0	15.0	8.0
Turbidity (NTU)	10.50	2.63	1.26	3.11	1.18	1.59	0.86	9.76	10.40	44.40
Hydrocarbons (mg/l)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Tests carried out in conformity with " Standard Methods for the Examination of water and Wastewater APHA, 1998".

UNIVERSITY OF ZAMBIA SCHOOL OF ENGINEERING

Tested by: D. Mkandawire ..... Checked & Approved by: Joshua Liyungu .....

Element	Nachibanga Dam	WHO Guidelines maximum permissible levels for drinking water	WB Irrigation Water Quality Standard[56]
pH	6.72	6.5-8.5	6.00 – 9.00
Conductivity (µg/cm)	92	1500	
Sulphates (mg/l)	< 0.01	250	

[5] The World Bank, Water Resources and Environment. Technical Note D1, Water Quality Assessment and Protection, 2003, p. 32, accessed at: http://documents1.worldbank.org/curated/en/514141468768597679/pdf/multi0page.pdf.

[6] The World Bank, General Environmental Guidelines, Pollution Prevention and Abatement Handbook, 1998, p. 438; accessed at: https://www.ifc.org/wps/wcm/connect/77a4c571-c743-48a8-9c6d-21d6ce77d017/genenv_PPAH.pdf?MOD=AJPERES&CVID=jqeDiLg.

Nitrates (as NO_3-N mg/l)	0.30	500	
Total Dissolved Solids (mg/l)	46.00	1000	
Ammonia (as NH4-Nmg/l)	0.10	1.5	10
Phosphates (mg/l)	< 0.01	-	
Total Suspended Solids (mg/l)	12.80	-	50
Chemical Oxygen Demand (as mg O2/l	8.00	-	250
Chlorides (mg/l)	8.00	250	
Turbidity (NTU)	44.40	5	
Hydrocarbons (mg/l)	< 0.005	-	10

Table 4: Water quality results for Nachibanga Dam, COWI, 2018

SCHOOL OF ENGINEERING
CIVIL ENGINEERING DEPARTMENT
ENVIRONMENTAL ENGINEERING LABORATORY

P.O Box 32379, Lusaka
Direct Telefax: 260-1-290962

PHYSICAL/CHEMICAL EXAMINATION OF WATER

Attn : COWI
Lusaka
Sampled by : Client
Receipt date : 04.07.2018
Report date : 10.07.2018

Laboratory Results

Parameter	Nachibanga Dam	WHO Guideline (Maximum Permissible value for drinking water)
pH	7.90	6.5 – 8.5
Turbidity (NTU)	3.48	5.0
Conductivity (µs/cm)	129	1500
Total Dissolved Solids (mg/l)	65	1000
Total Suspended Solids (mg/l)	4.9	-
Total hardness (as mg $CaCO_3$/l)	66	500
Calcium hardness (as mg $CaCO_3$/l)	30	500
Alkalinity (as mg $CaCO_3$/l)	60	500
Iron (mg/l)	0.46	0.30
Ammonia (as NH_4-Nmg/l)	0.20	1.50
Sulphates (mg/l)	<0.01	250
Chlorides (mg/l)	11.0	250
Nitrites (as NO_2-Nmg/l)	0.012	0.100
Nitrates (as NO_3-Nmg/l)	2.70	10.0
Acidity (as mg $CaCO_3$/l)	Nil	500
Total phosphates (mg/l)	0.10	5.0
Magnesium (mg/l)	8.64	-
Calcium (mg/l)	12.0	200
Fluorides (mg/l)	0.13	1.50
Potassium (mg/l)	2.32	-
Sodium (mg/l)	7.26	200
Manganese (mg/l)	<0.01	0.50
Bacteriological Results		
Total coliforms (#/100ml)	46	0
Feacal coliforms (#/100ml)	21	0

Tests carried out in conformity with " Standard Methods for the Examination of water and Wastewater APHA, 1998"

Dr. J. Kabika
Co-ordinator- Environmental Engineering Laboratory

4.1.6. Seismology

Earthquakes can result in damage to and failure of man-made structures, such as dams. When constructed in areas of high seismicity, dams may pose a significant risk to downstream life and property. Seismic waves may cause deformation of dam embankments, a loss of foundation strength and instability of the dam.

For Zambia, previously conducted studies on seismic hazard assessments estimate the Peak Ground Acceleration (PGA), which is the maximum ground acceleration during an earthquake shaking at a location, to be between 0.3 to 0.9g[7] (equal to magnitudes 2.943 to 8.829m/s^2). This poses a very low risk. Only three major occurrences have been recorded in Southern Zambia between 1910 and 2016. Two of them took place around Lake Kariba and one in Southern Province (Table 5).

DATE	TIME	LAT	LONG	MAGNITUDE	REGION
13/12/1910	11:34	8	31	7.1	South Of Tanganyika
13/12/1942	13:40	11.4	34.5	6.7	Western
25/09/1963	07:03	16.73	28.4	6.4	Lake kariba
18/07/1986	15:07	16.36	28.48	5.4	Lake kariba
10/05/1991	01:12	17.35	24.98	4.8	sw of Mulobezi
13/02/2010	16:00	13.4	30.84	5.3	Serenje
18/01/2011	16:31	8.6	31.74	5.7	Mbala
21/07/2011	15:55	15.96	25.98	5.2	Itezhi-tezhi
02/10/2013	14:23	13.4	31.8	4.5	West of Chipata
3/11/2014	18:25	10.97	29.69	5.3	Lubwe, Luapula
19/08/2015	00:15	9.66	28.61	5.1	Luapula Province
09/01/2016	03:05	16.046	28.55	4.6	Lusaka & southern Provinces

Table 5: Major earthquakes in Zambia (Zambian Seismic Network Country Report, 2017)

According to the US Geological Survey, the seismic hazard level is very low around the Nachibanga dam site, falling within the range of 0.4-0.8 m/s^2 (with 10% excess probability in 50-year PGA), as shown in Figure 6. Unlike large dams, small dams do not induce seismicity.[8] Furthermore, historical data on the performance of previously studied dams have shown that embankment dams perform well even under strong ground motions. Well-built and well compacted embankment dams improve dam safety and can withstand moderate earthquake shaking with a PGA greater than 0.2g or 1.96m/s^2.

[7] g= Gram force 1g=9.81m/s^2

[8] https://www.intechopen.com/books/earthquake-engineering-from-engineering-seismology-to-optimal-seismic-design-of-engineering-structures/earthquakes-and-dams

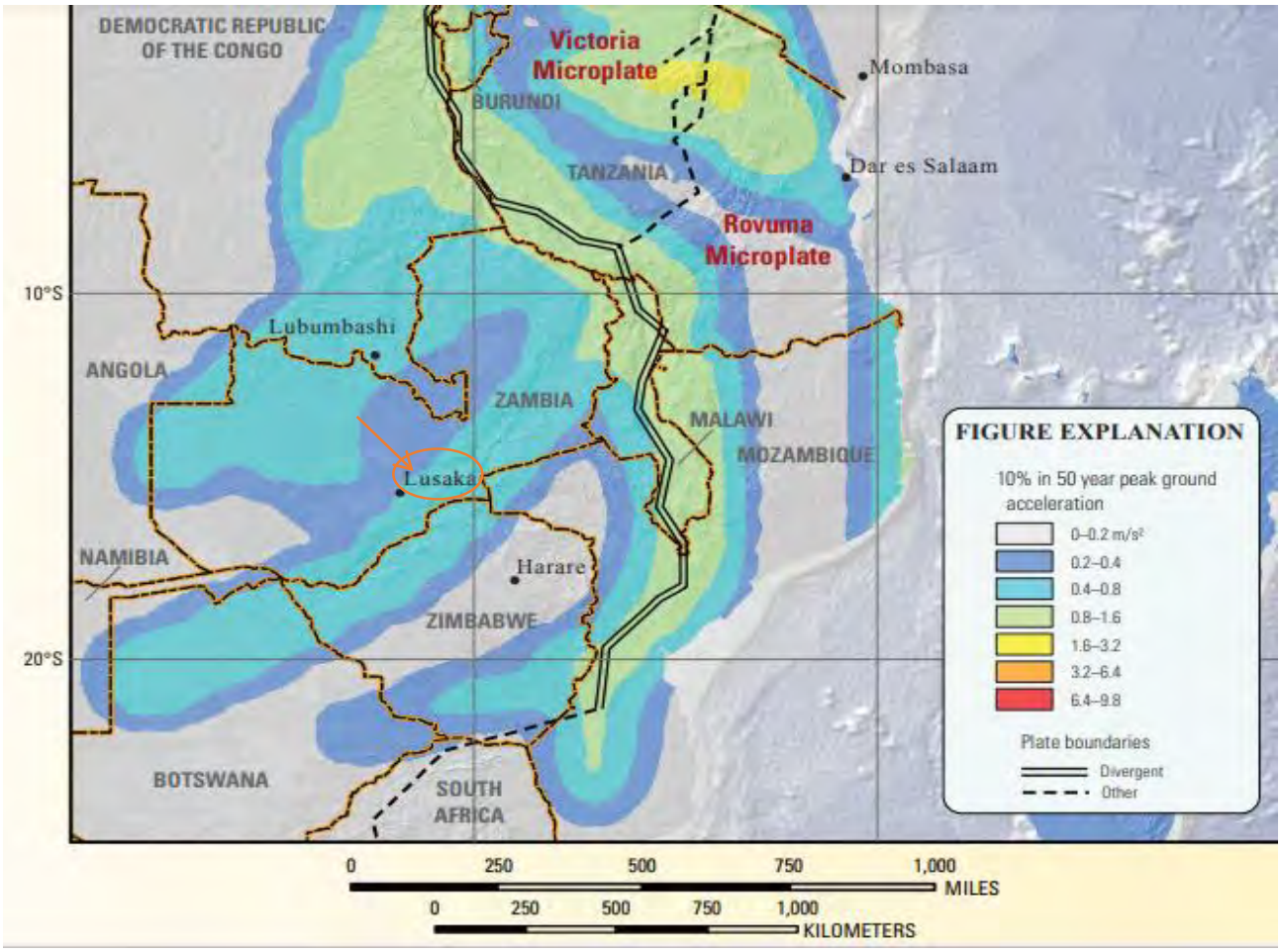


Figure 6: Seismic hazard, US Geological Survey 2013

4.1.7. Climate and Climate Change

The climate in the Southern Province of Zambia can be described as humid subtropical, with dry winters and hot summers. Three distinct seasons are observed:

- a rainy season - a warm wet season from October to May
- a cold season - a mild to cool dry season from May to August
- a hot season - a hot and dry season from September to November.

Rainfall: The Southern Province lies in the Agro ecological Zone[9], which is characterized by an annual average rainfall of less than 800mm. According to data obtained from four Zambia Meteorological Department (ZMD) stations in Southern Province, the mean seasonal rainfall from October to May varies between 700 and 800 mm. The graph below shows values of average monthly rainfall and average temperatures for Choma, which is the nearest station to Nachibanga Dam, 40 km to the west.

[9] These are 3 zones based on rainfall amounts in Zambia, but also incorporate soils and climatic characteristics. Zone I receives less than 800mm annual rainfall, Zone II receives between 800-1000mm of annual rainfall and Zone III receives between 1000-1500mm of annual rainfall.

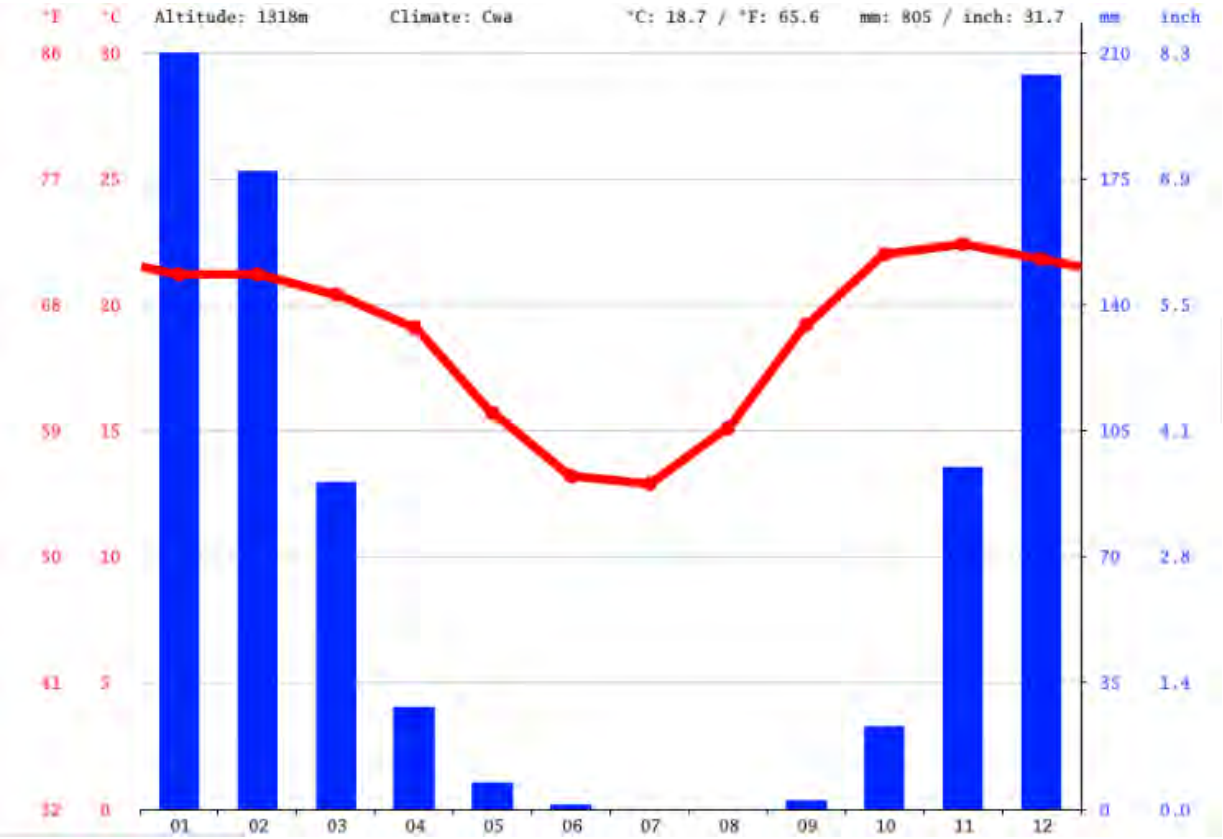


Figure 7: Average monthly rainfall and temperature for Choma (Source: Climate-data.org)

Temperature: The mean annual temperature measured at Choma is 18.7°C. The average monthly temperature throughout the year is shown in Figure 8. The hottest month is November and the coldest is July.

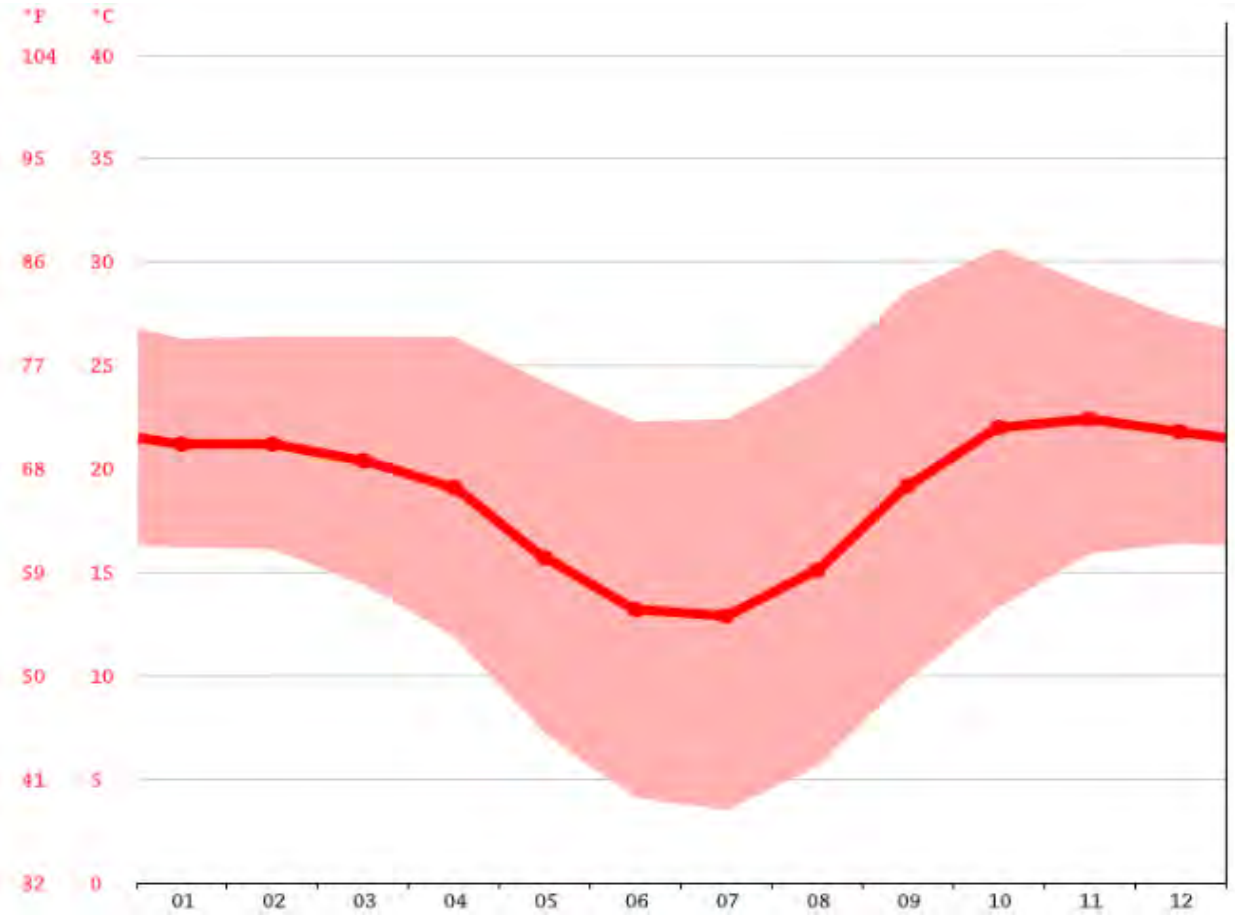


Figure 8: Average monthly temperature for Choma (Source: Climate-data.org)

According to the World Bank[10], Zambia's climate is highly variable and over the last few decades has experienced a series of climatic extremes, e.g. droughts, seasonal floods and flash floods, extreme temperatures and dry spells, many of these with increased frequency, intensity and magnitude. Their impacts on the country are evident in climate-induced changes to physical and biological systems which increasingly exert considerable stress on the country's vulnerable sectors. The adverse impact of climate change has been on food and water security, water quality, energy and the sustainable livelihoods of rural communities coupled with poverty also limit economic development.

According to a UNDP study[11], 2008, climate change is set to increase food insecurity in agro-ecological zones I and II in Zambia. Agro-ecological zone I, which stretches along the southern border, has the least rainfall. Within these regions, since the late 1980s, there has been a tendency for the later onset and earlier withdrawal of rains, as well as more frequent droughts. In the last seven years of this decade, Zambia has had droughts in the rainy seasons of 2000/01, 2001/02 and 2004/5. Floods are becoming more widespread too: over half of Zambia's districts were affected in the last few years – 2005/6, 2006/7 and 2007/8 being the most recent - some for the first time.

[10] World Bank Climate Change Knowledge Portal, Country: Zambia, accessed at: https://climateknowledgeportal.worldbank.org/country/zambia

[11] UNDP Climate Change Adaptation, Adaptation to the Effects of Drought and Climate Change, accessed at: https://www.adaptation-undp.org/projects/ldcf-drought-zambia

With very little infrastructure for water collection, Zambia is overwhelmingly dependent on rainfall. Water needs are met through boreholes and wells where available, or alternatively, through rivers. The Nachibanga Dam is now an important adaptation infrastructure for the near and far communities' water storage and use in a time when climate change is experienced. Climate change projections point to an increase in temperature and a change in patterns of rainfall, leading to prolonged droughts and localized flooding. Zone I is already a marginal area for growing crops due to low annual rainfall. Climate change is super-imposed on unsustainable land-use practices, such as forest clearing for agriculture and charcoal production, and combined with poor livestock management systems has caused severe land degradation. The practices affect the dam sustainability. The communities in Southern Province depend mostly on cattle for their livelihood and also for draught power, including in the Nachibanga dam area.

Climate projections for Zambia[12] are shown in Figure 9 below. The World Bank has used the Coupled Model Intercomparison Project, Phase 5 (CMIP5) models included in the IPCC's Fifth Assessment Report (AR5). Key projected climate trends are summarized below:

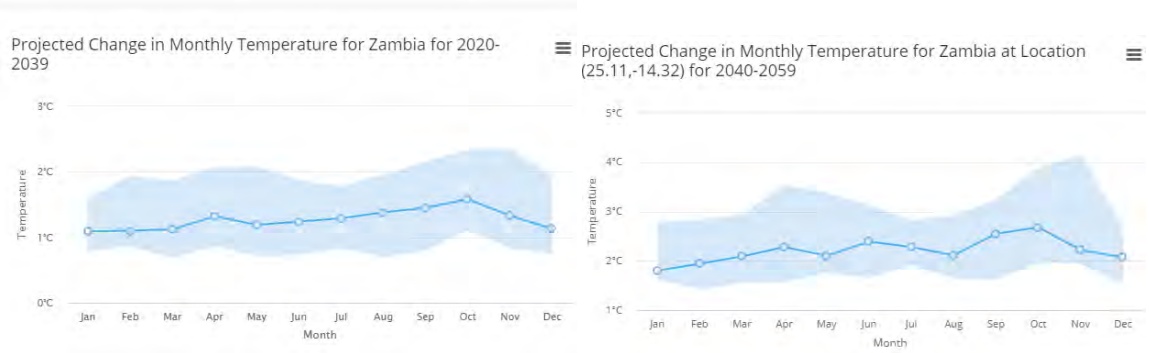
Temperature

- Mean annual temperature is projected to increase by 1.2-3.4°C by 2060.
- Hot days are projected to increase by 15-29%. Hot nights are projected to increase by 26-54%.

Precipitation

- Projections of mean rainfall do not indicate large changes in annual rainfall. Seasonally, the range of projections from different models is large, but indicates decreases in September-November and increases in December-February rainfall respectively.
- The proportion of rainfall from heavy events is expected to increase.

Continued changes in climate may mean continuous impacts on biological, social and physical environments around the dam.



[12] World Bank Climate Change Knowledge Portal, Country: Zambia, accessed at: https://climateknowledgeportal.worldbank.org/country/zambia

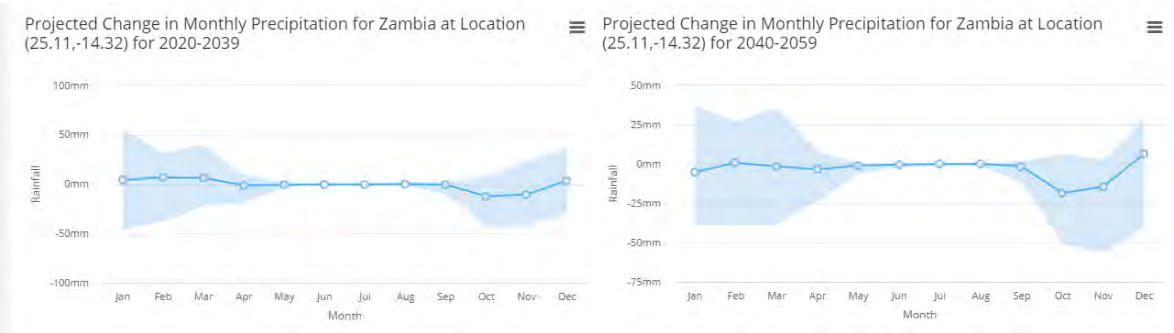


Figure 9: Projected changes in monthly temperatures for Zambia 2020-2059

4.1.8. Land Use

The main land use around Nachibanga Dam (Figure 10) is characterised by agriculture and rural settlement. Local communities practice mixed farming with cattle and crop production as the most important economic activities.

The community uses simple canals and buckets for the irrigation of downstream gardens. Because the areas downstream are inadequately serviced with water from the dam, the community accesses water from one of the streams which feed into the Lunywamakubi River. This stream is more reliable than downstream flows from the dam.

Figure 10: Google map of Nachibanga showing neighbouring infrastructure

4.2. Biological Conditions

4.2.1. Habitats

The area around Nachibanga Dam is situated in modified habitats that have been significantly transformed by cultivation, bush clearing for charcoal and firewood, and overgrazing. Under natural conditions, the area

is in Miombo woodland interspersed with small areas of Munga (savanna) woodland, characterized by Combretum, Acacia and Syzygium tree species. Ground cover is sparse and the dynamics of disturbance and succession are evident, as caused by grazing pressure. Termites are common around the dam, with large termitaria being evident in many places (Figure 11). These have been used as borrow areas in past Nachibanga Dam construction work.

Figure 11: Termitaria around the dam

Dividing the area into zones (see figure below), the following is evident:

- Part 1-Upstream of the dam basin; habitats consist of highly disturbed forest habitat, extensively modified by habitation and farmlands. Most of the woodland has been lost to cultivation. Habitat integrity is low and the area is a potential source of sediment in the basin.

- Part 2-In the dam basin area, there are disturbed patches of Miombo and Munga woodland characterized by small trees to the east and west. Grass cover is typical of disturbed habitats in the area affected by the dam construction, including stunted growth of Rhodes grass (*Chloris gayana),* Common Russet Grass *(Loudentia simpex),* Feather Fingergrass *(Chloris Virgata)*, Sprouting Digit-Grass (*Digitaria eriantha)*, and Rat's Tail Grass (*Sporomburus africanus), found* on the embarkment slopes. Tassel Grass (*Aristida congesta)*, Tangleheads (*Heteropogan)* and Buffelgrass (*Cenchrus ciliaris).* Overall habitat integrity is moderate.

- Part 3-Downstream of the dam basin, vegetation has been cleared for gardens and fields interspersed with rural housing. Habitat integrity is low to moderate. The hills in the area have provided some protection, but thinning of forest cover has still resulted from harvesting for firewood.

Figure 12: Forest cover around the site, Google earth

4.2.2. Protected Areas

Zambia has protected national and local forests in designated areas. The Nachibanga dam site is not in a protected forest reserve. Forest protection is under customary leadership regulated by the Department of Forestry in Pemba.

4.2.3. Terrestrial Fauna

Mammals identified during the field visit (including from information collected from the local community), include waterbuck (*Kobus defassa*), porcupine (*Atherurus africanus*), bush pig (*Potamochoerus porcus*), hare (*Lepus 31mphibio*). There were no terrestrial fauna of conservation concern recorded in the Environmental Project Brief (WRDP, 2016) or the ESMP prepared by COWI (2018), apart from a reference to the African wild dog (WRDP, 2016:3), which is highly unlikely to occur. Local communities have confirmed that the Hippopotamus (*Hippopotamus 31mphibious*), a species of conservation concern listed as 'Vulnerable' is not found resident in or around the dam.

Many bird species inhabit the reservoir area and the riparian and wetland areas along the river. Most of these birds are found in the shallow waters of the dam, embankment, river bank, on bare or poorly vegetated mud habitats, often at the water's edge. The trees along the dam and the remains of drowned trees in the dam also provide perches for birds, most of which are occasional visitors or are migratory. Table 6 provides a list of birds seen at the dam. Some rarely seen bird species that used to be present in the area include the endangered Southern crowned crane '*Balearica regulorum'* and the Vulnerable slaty egret '*Egretta vinaceigula,'* which are currently very rare to absent around the dam.

Table 6: Bird species found on Nachibanga Dam

Common Name	Scientific name
Painted snipe	*Rostratula benghalensis*
Squacco heron	*Ardeola ralloides*
Yellow-billed egret	*Ardea brachyrhyncha*

Black winged stilt	*Himantopus himantopus*
Sacred ibis	*Threskiornis aethiopicus*
Marsh owl	*Asio capensis*
White faced whistling duck	*Dendrocygna viduata*
Fulvous whistling duck	*Dendrocygna bicolor*
	Anas undulata
Malachite kingfisher	*Corythornis cristatus*

Overall, the occurrence of terrestrial fauna around the dam has been heavily impacted by habitat loss, and by intensive hunting and (in the case of reptiles) persecution. Other than the possible occurrence of the threatened birds listed above, there are unlikely to be any threatened species in the near vicinity of the dam. Further afield, the IBAT listing of species of conservation concern within a 50 km radius of the dam provides an indication of their possible occurrence, mainly in protected forest reserves, two of which extend from near the dam towards the upper end of Lake Kariba, covering a combined area of around 892 km^2. IBAT shows 23 potentially occurring terrestrial fauna species of conservation concern, including six mammals and sixteen birds. The large mammals and most of the birds are unlikely to occur in the vicinity of the dam site, where habitats are heavily transformed by cultivation and rural settlement but may be found to the south.

Bird species of conservation concern may also be found in one Key Biodiversity Area (KBA), which falls within the 50 km buffer – the Nkanga River Conservation Area, located some 40 km north west of the dam. This is made up of three private farms which are well known birding destinations, with over 400 species of birds recorded.

4.2.4. Aquatic and Semi-Aquatic Fauna and Flora

Aquatic species in Nachibanga Dam and water-attracted avifauna, reptiles and amphibians as confirmed by the site assessment, local authorities and communities are shown below.

Table 7: Fish and reptiles recorded in Nachibanga Dam and/or the local river system

Common Name	Scientific name	Species of Conservation Concern
Zambezi Bream	*Pharyngochromis acuticeps*	LC
Red breasted Bream	*Tilapia rendallii*	LC
Three spot Tilapia	*Oreochromis andersonii*	VU
Nile Tilapia	*Oreochromis niloticus*	LC
Barbel	*Clarias gariepinus*	LC
Bottle nosed fish	*Mormyrus sp.*	LC
Freshwater crabs	*Potamonautes sp.*	LC
Monitor Lizards	*Varanus niloticus*	LC
Marsh or Swamp Terrapin	*Pelomedusa subrufa*	LC
	Pelusios sinuatus	

One vulnerable cichlid was recorded in the local river system. *Oreochromis andersonii* is of conservation concern, listed as 'Vulnerable' by the IUCN. The population decline among these species occurs mainly due to the introduction of *O. niloticus* by aquaculturalists, which is displacing the other cichlids throughout their ranges.

Aquatic flora consists mainly of creeping hydrophilic plants, particularly on the left side of the dam where there is no cattle watering (Figure 13).

Figure 13: Creepers in the dam basin area

4.2.5. Fishing Practices

The Nachibanga reservoir has fish stocks, a source of food for the local community. Three Cichlids are recorded in the dam, namely *Oreochromis niloticus, Tilapia rendallii* and *Oreochromis andersonii,* but despite ongoing fishing activities by the community over the years, there are no accurate catch statistics. High turbidity which limits light penetration and the production of zooplankton and phytoplankton etc… may be limiting fish breeding in the dam, although local communities indicate that production is still high. Test fishing surveys to determine catch quantities and dam quantities have not been conducted by the Fisheries Department. Communities conduct seasonal fishing to allow for breeding; they adhere to the national fish ban periods which vary (e.g. 2021 February to May). The quantities of fish are limited to family portions and fishing methods are limited to hooks by the dam committee. Nets are not allowed due to the fear of fish depletion.

4.2.6. Ecosystem Threats

Threats to the local aquatic resource include overfishing and harvesting although this does not appear to be a serious problem in Nachibanga Dam. Competition from introduced alien species is a significant threat to the natural fish populations, especially since *O. niloticus* is present in the catchment and is likely to impact negatively on all of the naturally occurring species. The dam poses an uncontrolled breeding environment for the *O. niloticus*.

The barrier created by the dam may be impacting on upstream and downstream integrity of the river system, inhibiting the natural movement of species, restricting flows and causing negative changes in water quality. The extensively farmed areas in the dam catchment, accompanied by the clearing of most of the natural forest cover, are likely to be increasing sediment loads into the dam and river.

Details of the threats to the river system and the threatened aquatic fish species will be more clearly defined by the specialist study.

4.3. Social Conditions

4.3.1. Social Conditions around the Dam

Nachibanga Dam and its catchment fall within Pemba District. Pemba District is serviced by the Choma–Pemba road linking to the Great North Road and the national railway line. There is also an 8 km gravel road and a pontoon linking the district to Itezhi-tezhi District. Access to Nachibanga Dam is by a 5 km feeder road.

Pemba District has one constituency and seven wards. According to the 2010 census of population and housing, the Pemba constituency has a population of 64,918. Nachibanga Dam lies in Nachibanga Ward, which has 1,557 households and a total population of 9,036 (4,278 male and 4,758 female).

Subsistence farmers make up most of the population. Only a few people are engaged in formal employment, mainly as teachers, agricultural or health workers and NGO staff. The administrative part of the district is characterized by commerce with small-scale and emergent farms in peri-urban areas. Cattle rearing is the most important economic activity, followed by crop production. Trust land and traditional land make up the two main forms of land tenure in the district. Most of the trust land is reserved forest area.

A total of six clinics serve the community of Pemba District, namely the Pemba Main Clinic, Kasiya Clinic, Kanchomba Clinic, Muzoka Clinic, Mooya Clinic and Ndondi Clinic. New health posts are currently being established.

Pemba District has a total of 64 schools, of which 61 are primary schools. Three secondary schools are located in the area of the dam – Pemba Secondary School in Pemba ward, Jembo Mission School in Hamaundu ward and Ndondi Secondary School in Nachibanga ward. Kasiya Business and Secretarial College, located 11 km west of Pemba town centre, is graded as a level one college by the Technical Education, Vocational and Entrepreneurship Training Authority (TEVETA).

The main site facilities around the dam include the Clinic, which is located in 8 km distance to the dam; the nearest Primary School, which is located in 2 km distance to the dam (with further schools in 7 km distance).

The main land use around the dam includes gardens, fields, pathways, roads, electricity pylons, unused hills and residential areas. There is no landline or mobile telecommunications network available. Cultivation of farmlands is about 30 m from the reservoir. Cultivation around the dam is limited to curb soil erosion especially upstream. Presently, there is no housing infrastructure near the dam. The former campsite location is vegetated with clearance around the current road. The campsite is located at the end of the current access route left side of the basin, north east of the Dam as seen on the Land use Map.

The access road to the dam (1.5 km) is in poor condition, it has the appearance of a pedestrian path. Furthermore, the previous contractor roads have not been repaired. There is need for road rehabilitation of the road as it has trees and stamps. The road leads through 4 homesteads into a wooded area to the dam. Furthermore, the junction from Ndondi runs under electricity high voltage pylons for about a 600m then diverts away. The road for construction vehicles can be constructed away from the pylons. A shorter route (1.2 km) was suggested by the community, but it is in the same condition. The two roads have the same junction from the main Ndondi Road but split after 730m close to a homestead.

There is one main pedestrian path close the dam, while there is no livestock crossing over the embankment. Tree stalk fencing is in place and effective but requires a permanent solution. There is no pedestrian crossing

infrastructure except over the embankment and over the spillway, which poses a challenge in the rainy season. According to community members, this was not a problem before the dam was built.

There is no water downstream except during the rainy season. Communities use the other stream downstream for garden water supply. The local community draws its drinking water mainly from the boreholes and shallow wells near the Nachibanga Dam. The nearest borehole is located about 700m from the dam. The surface water is used mainly for washing and other domestic and economic uses such as irrigation and livestock watering.

The community uses pit latrines for sanitation. For proposed works, sanitary facilities shall be constructed for the workers. Drinking water for the workers shall be collected from boreholes and shall be treated.

There are no waste dumps or pit latrines around the site. The prior waste dump sites around the previous campsite were buried. The exact spatial location could not be identified. The last contractor did not build toilets but reportedly practiced open defecation. The community buries and burns their waste at their respective households. The proposed works may generate non-hazardous waste such as domestic waste, cement bags, rubble etc. and hazardous waste such as oils, fuels, sewerage etc… which are considered in the ESMP.

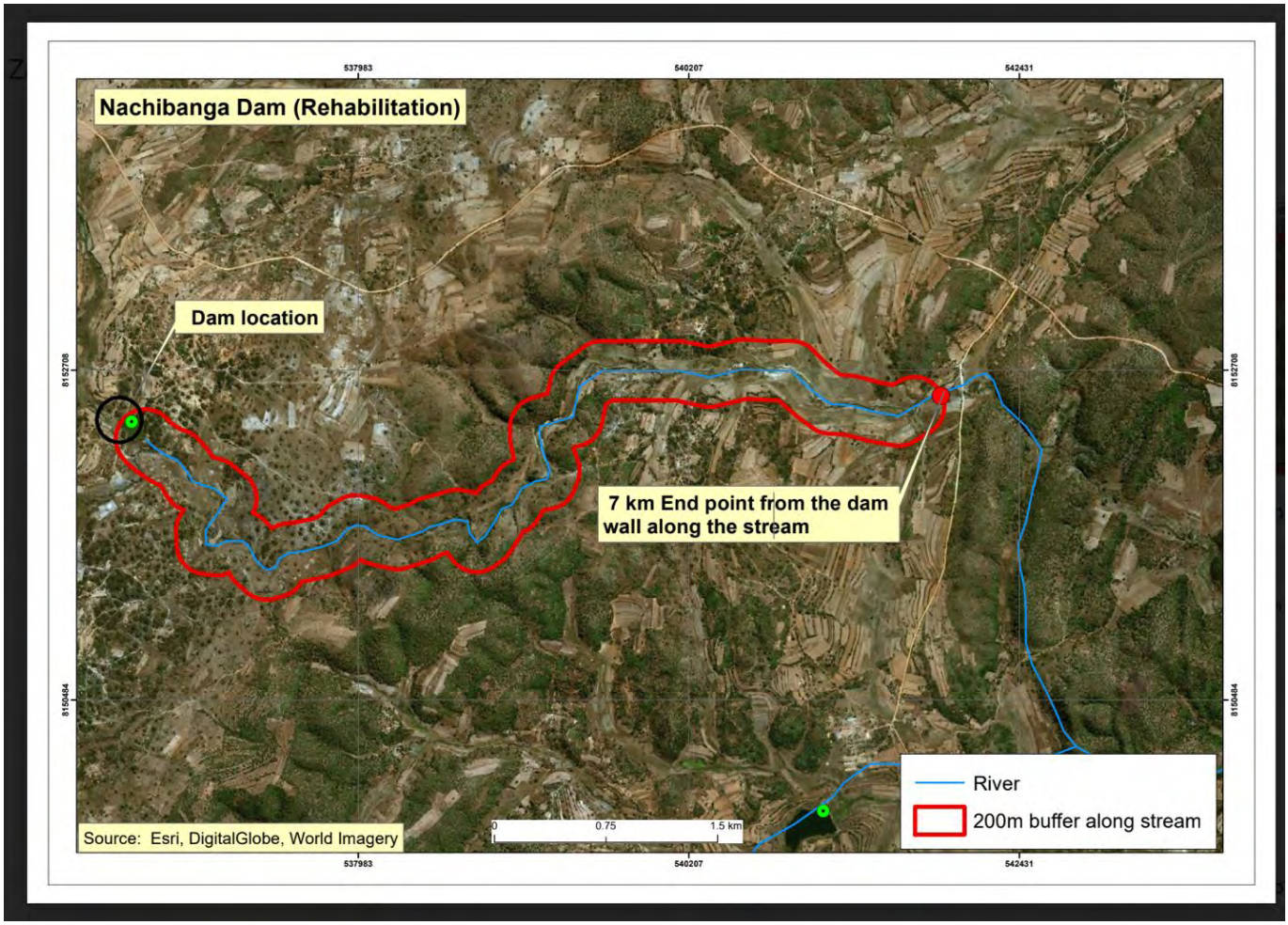


Figure 14: Google map showing access to site

4.3.2. Administration of Water and Dam

A Dam Committee is currently in place, consisting of three women and seven men. However, the committee indicated that it requires further guidance and training in various issues. While the committee is active, it is still to finalize its constitution. Some unwritten regulations are already developed and implemented, including around fisheries, tree and vegetation conservation rules around the dam. It was observed that the dam had a good number of maintained trees around it. The headmen and the Dam committee conduct the monitoring and sensitization.

Strengthening and capacity building of the existing committee can ensure that communities can benefit fully from the irrigation water supply. Similarly, beneficiaries would benefit from increased training to improve their knowledge on irrigation agriculture and promote income generation.

4.3.3. Gender Equality and Gender-Based Violence

In the Nachibanga dam communities, respondents during the field visits claimed that women work as well. They are mostly engaged in charcoal production, gardening and clay pot molding. If there were sufficient opportunities, women could also engage in fishing with cages.

Gender-Based Violence (GBV) exists among the dam communities, but it usually not reported, as reporting comes with significant social stigma. Generally, an estimate of 1 in 5 women in Zambia experience some form of sexual violence at some point in their lives.[13] In the Demographic and Health Survey of 2013-2014, 43% of women age 15-49 claimed to have experienced physical violence at least once since age 15; and 37% experienced physical violence within the 12 months prior to the survey. 47% of married women of the same age category report to have experienced physical, sexual and/ or emotional violence from their current or most recent husband or partner.[14] Alcohol and living in high-density areas have been identified as key issues contributing to higher rates of GBV.[15] Other factors contributing to GBV are sexual cleansing rituals, initiation ceremonies, women's economic dependence socialization of boys and girls, inadequate laws, lack of law enforcement, and intimate partner violence.[16] A baseline study conducted by Overseas Development Institute (ODI) in Zambia captured some key definitions of the types of GBV, such as women being beaten (usually by their spouse), men engaging in forced sexual intercourse with young children, women being forced to have sex, mistreatment of children including through labor, forced early marriage, and women's rights being infringed.[17]

The same baseline mentioned as first address in GBV cases the Victim Support Unit in the Police service, although there seems to be doubt in their efficiency.[18] Key challenges for preventing and responding to GBV are that most cases go unreported, because survivors are reluctant to report them. On the supply side, infrastructure, shelters and transport, have critical gaps. In absence of shelters, the safety of survivors cannot be guaranteed. Prevention activities are still not sufficient to have a significant impact.

In April 2011, Zambia passed the Anti-Gender Based Violence Act no.1 of 2011. The Act offers a comprehensive framework for protection, the prosecution of perpetrators, and supports the means of survival for victims. It established a fund to assist survivors; and it called for the establishment of shelters to support survivors, as well as it regulated monetary relief for them.

[13] Chidoori Rumbidzai Elisabeth, Putting Women First – Zambia's Anti Gender Based Violence Act from 2011, p. 1
[14] USAID, UNICEF, UNFPA, CDC, Zambia: Demographic and Health Survey 2013-2014, p. 273
[15] Z. Ngonga, Factors contributing to physical Gender Based Violence reported at Ndola Central Hospital, Ndola, Zambia: A case control study, In" Medical Journal of Zambia, Vol. 43.3., p. 145-151, 2016.
[16] ODI: Baseline Study, Stamping Out and Preventing Gender Based Violence (STOP GBV) in Zambia, March 2015, p. viii.
[17] Ditto, p. x
[18] Ditto

As a result of the Act, the Government has established 3 shelters across the country; a Police Victim Support Unit, as well as a series of one-stop centers across the country: At Mtendere and Chawama clinics in Lusaka; Buchi Clinic in Kitwe; Chipata Hospital; Mazabuka District Hospital; Livingstone District Hospital; Kabwe District Hospital; Ndola Central Hospital.

UNICEF, Young Women Christian Associates (YWCA) and World Vision have established further one-stop centers and drop-in centers. NGOs provide social services, counseling to victims (e.g. Lifeline Zambia, 24 hrs toll free telephone counseling service).[19] Further services are provided by World Vision, Women and Law in Southern Africa, Zambia Center for Communication Programme. The Project 'STOP GBV Programme: GBV Survivor Services, Access to Justice ended some years ago. A UN Joint Programme on Gender Based Violence, 2012-2016 established an Anti-Gender Based Violence Task Forces in five provinces and at five district levels. It opened village-led one stop shops, trained GBV response groups at the village level, trained community-based care providers in psychosocial care, and established 60 community help desks in districts.

One Stop Centers offer medical services qualified health professionals, psycho-social counseling, legal services, information dissemination, shelter. While there is a Centre in Pemba at the hospital, there is still need for more shelter opportunities.

In Pemba, at a central point in the community a secret grievance lodging box was installed, where survivors can leave their telephone numbers and can be contacted. The Girls Education and Women's Empowerment and Livelihood 'GEWEL' and the community development department, with the support of World Bank funding, provide education and awareness on the fear of discrimination or marriage failures to women. Asked about the line of reporting of GBV cases in the Nachibanga dam communities, respondents stated that survivors would first address the local clinic, then the Police Victim Support Unit, followed by the Government's Community Development Unit, or they would address World Vision, an international NGO operating in their communities and dealing with gender issues. Respondents further stated that more sensitization on this issue was required. Especially in view of public works project, respondents fear that contractors can lure little girls and married women, offering payment for their services.

4.3.4. Cultural Environment

The Nachibanga Dam is located in the Hamaundu's Chiefdom in Pemba Districts.

For the development of this ESMP, stakeholders were consulted, including the members of the Nachibanga dam committee, dam users and district stakeholders (District Commissioners, representatives from Social Welfare Department, Arts and Culture Department, Forestry, Agriculture). Consultations were held in regards to the upstream and downstream communities (nine villages) around the dam.

Stakeholders claimed that the previous public works on the dam have not impacted the communities' cultural practices or heritage, and that there are further no significant or historical features in the area.

Stakeholders indicated that graveyards are located at the respective homes and that there are no distinct community graveyards. No potential cultural environment and cultural heritage impacts are therefore expected as impact of the proposed works and the operational phase.

In case chance finds occur during construction activities, chance find procedures are attached to this ESMP (see appendix B).

[19] Chidoori Rumbidzai, 2011, p. 32

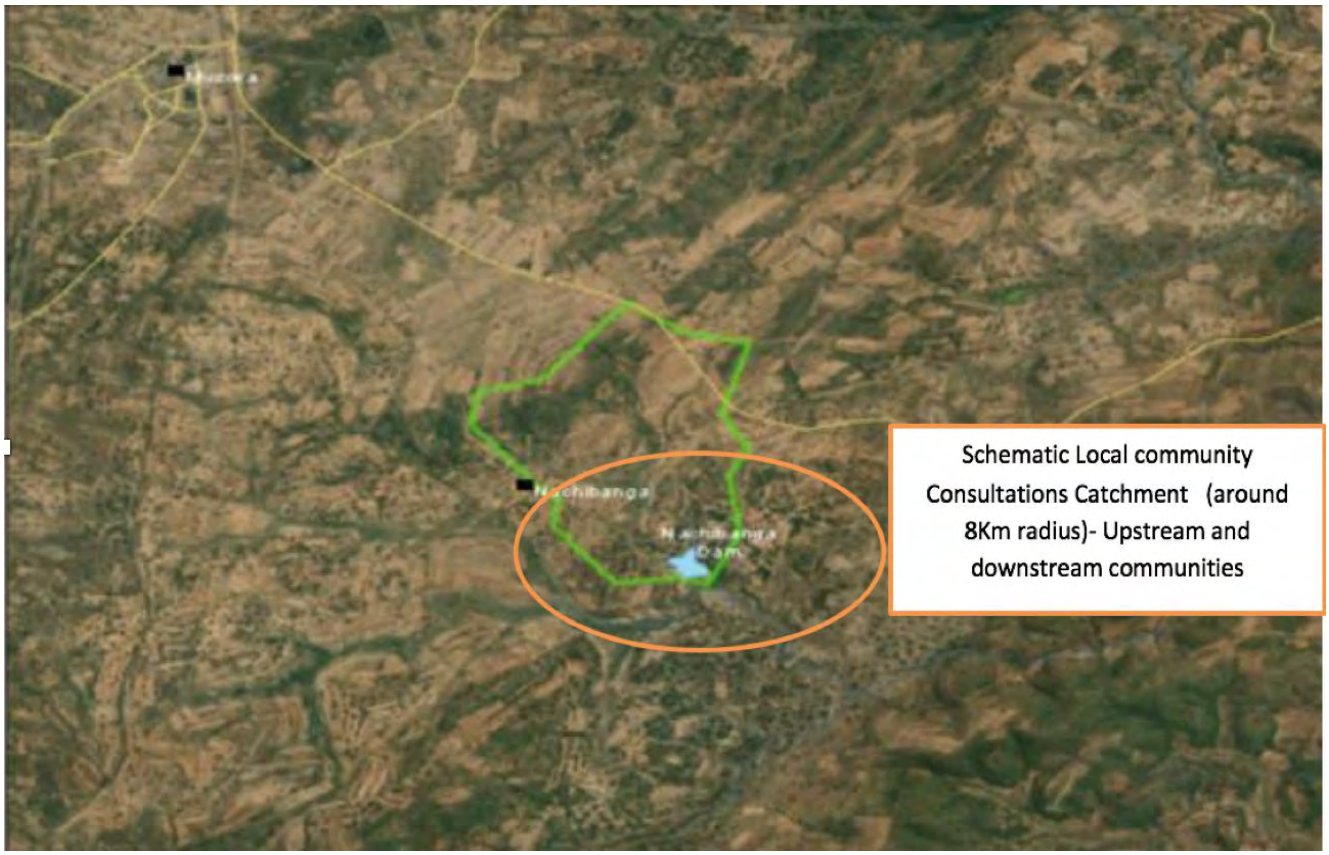


Figure 15: Schematic consultation coverage

5. Sub-Project Characteristics

5.1. Dam Characteristics

Nachibanga is an old earth fill dam that was built around 1968 by the Ministry of Agriculture and then rehabilitated in 1998. It was intended solely for livestock watering. Situated in Nachibanga ward some 21 km south of Pemba along the Muzoka-Moyo road, it is located at the Lunyiwamakubi stream, at latitude S16.71120°and longitude E27.34200°. Access to the site is through the T1 road, off the D363 near the village of Muzoka, following a 1,5 km track. The location is shown Figure 16. The construction works that started in 2016, included the raising of the embankment for additional storage and freeboard by 2m, and raising of the spillway by 1m, as well as constructing the spillway training wall and two new drop structures (COWI, 2018a). The main dam characteristics are shown in Table 8.

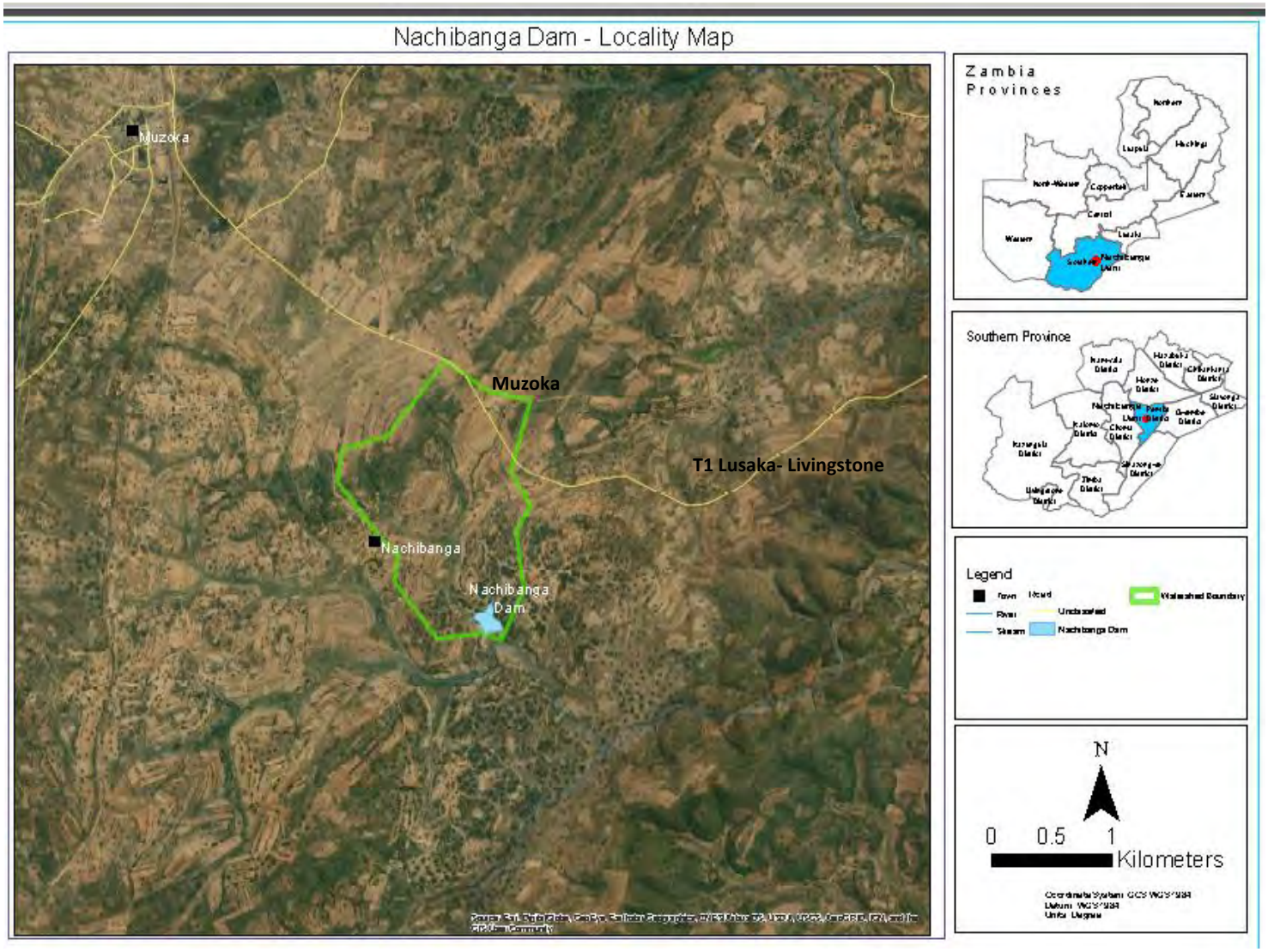


Figure 16: Google map showing location of Nachibanga Dam, UNOPS 2020

Table 8: Main characteristics of Nachibanga Dam

Dam Catchment Data

Catchment Area.

Source Document	Year	km²	Method of calculation
COWI - Aurecon	2018	2.17	Worked from survey undertaken in 2018
Ministry of Agriculture	2020	2.17	Taken from COWI - Aurecon submission
UNOPS	2020	2.15	STRM 3D DEM (NASA) and ArcGIS

For calculation purposes of the remedial design works, the UNOPS 2020 value of **2.15 km²** for the ***catchment area*** has been adopted.

MAP, MAR, Inflow

The Mean Annual Precipitation (MAP) for this area is 760 mm.
The Mean Annual Runoff (MAR) for the area is 65 mm.
The MAR used is in accordance with the Zambia National Water Resources Master Plan. Also taken into consideration is work done by Imagen Hydrological Consultants on the Luezi Dam near Zimba in 2014 where a MAR of 70mm per year runoff was calculated.

Based on the above data, the average annual inflow at the dam site is 2,150,000*0.065 = **139,750m³.**

Dam Capacity

Source Document	Year	m³	Method of calculation
Ministry of M E & WD	2014		Desk study
COWI - Aurecon	2018	45,466	Full basin survey - topographic, UAV and bathymetric
Ministry of Agriculture	2020	50,000	Environmental and Social Audit Report and Remedial Action Plan for Ten Dams

For calculations, the 2018 value of **45,466 m³** has been adopted.

Assuming a 65mm MAR, the average annual inflow is	**139,750 m³**
Current estimated capacity of the dam is	**45,466 m³**

According to these figures, the site has been developed to only **32.53%** of its capacity. This is **3.07** times the current dam capacity.

Sedimentation

The catchment size is **2.15km²** and assuming a sedimentation yield of 5000ppm (a poorly conserved catchment) with an assumed 100% trap efficiency of the dam, the dam will lose approximately 388m³ per year or approximately a third of the storage in 39 years. This equates to 0.85% of its capacity lost on an annual basis.

Geotechnical Investigations: The purpose of limited geotechnical investigations undertaken was to primarily assess

the materials used in the construction of the embankment and to assess the quality or consistency of the compaction in the embankment. In addition, to assess borrow materials for potential remedial works. Samples were taken from the embankment at the location of the SPT test and can be reviewed under item 2.3_*Geotechnical investigations* results in the review folder.

The relevant sample is on the embankment (Sample 4). The SPT results indicate the compaction was variable but the foundation bearing pressures were acceptable. Regarding the Atterberg Limits Result, all the materials sampled were CL i.e. sandy silts. As a rapid guide in assessing the suitability of soils for shoulder material please see the Plasticity Product (PP). If the PP is above 600 it is considered suitable as a core material. Shoulder material would be considered good between 400 and 200. Lower than 200 and either very coarse would still be considered usable depending on the grading. The results below indicate that these are predominantly silts and not ideal material.

Sample	Plasticity Index (PI)	% passing the 75 µ	Soil Classification
4	8%	2%	CL
4	9%	1%	CL
4	12%	1%	CL
4	13%	1%	CL

Observations showed that the embankment is clearly made up of this material which - although not ideal - has not exhibited any signs of slope failure.

Embankment Crest and Slopes

The embankment slopes as per the remedial design drawings from 2015 were given as 3.0:1 on the upstream and 2.0:1 on the downstream, with a crest width of 4m, prior to the 2m raising carried out in 2016. These 2m were merely placed on top of the existing crest and not carried out as a proper downstream raising, resulting in a current crest width of 3m with steeper upstream and downstream slopes for the first two meters thereafter reverting to the flatter slopes.

This change of slope is due to a raising exercise that was carried out during the remedial works of 2016 of rebuilding and raising the spillway by 1m and increasing the freeboard of the embankment by a further 1m.

Checks carried out from the cross sections taken from the recently completed survey of the embankment show the portion of the upstream slope above the current FSL and the downstream slope are not in compliance with the design.

Apart from the top steep sections and narrow crest, the embankment is generally in good condition. Freeboard is checked from the recent survey at 1.66m.

Embankment Crest: This was found to be narrow in most places, with only about 3m wide in some places. There is some evidence of the breakaway of the upstream and downstream crest edges, mainly caused by livestock movement over the embankment. The embankment has hence been temporarily tree log fenced by the community.

Embankment crest

Embankment Upstream Face: The slope from the current waterline to the crest appears slightly steeper than a standard 3:1 upstream slope, but the vertical height of the crest above the waterline can be around 2m. The suitability of the front face slope will be confirmed by sections taken from the resurvey exercise recently completed.

Upstream face slope and condition

There was little evidence of stone pitching (rip-rap) and the fetch of the dam seems to be very small, which implies the wave action at the embankment face should be minimal and grassing would usually be considered a suitable alternative to stone pitching. The last section of the upstream face to the crest has virtually no grass cover and the embankment material is very poor. It is likely that there will be some gullying in this zone during the coming rains.

Portion of front face showing grassing and cattle tracking

The most recent surveys indicate that the slopes of the *upstream raised section* are less than 1:1.5 and the downstream slopes are generally 1:2.0.[20]

Current Upstream slope approximately 1:2.5
Current Downstream slope approximately 1:2.0

Embankment Downstream: There is no evidence of toe drain or rock toe, with evidence of seepage.

No evidence of toe drain or rock toe

Downstream Seepage: There is very little seepage evident along the length of the embankment toe with one section on the upper right flank towards the spillway end of the embankment.

Seepage at the toe and upper right flank

Spillway

The outflow from the stilling basin has been undercutting the spillway structure and temporary repairs have been made in the form of sandbagging. This has been extended down the gulley forming in the center of the return channel to prevent further cutback towards the spillway along this channel.

Remedial works done on the Nachibanga Dam in 2016 included the complete rebuilding of the spillway structure, which incorporated a 1m raising of the full supply level.

The design was for a concrete and masonry structure some 20 m wide across the spillway channel. There are masonry abutments, inclusive of cut off walls and wing walls at either end, with a 3.2m wide stilling basin running the length of the spillway below the sill. The spillway sill is 20m long and 32cm wide and 108cm above the floor of the stilling basin. The abutment walls at either end are 110cm above the spillway sill. The stilling basin is 320cm wide with a 30cm high end wall 150mm wide, which drops straight onto the return channel without any protection.

Service Spillway – Sill and Stilling Basin**:** The concrete service spillway was completely rebuilt in 2016 at the time of the embankment raising. It is 20m in width with substantive abutments on either end, the left-hand abutment linking to the right hand end of the embankment and the right hand abutment linking to right flank.

The lead in wall to the left abutment is cemented stone pitching and does not show any signs of erosion.

Service spillway/stilling basin

The downstream edge of the concrete stilling basin/apron below the sill appears to have a minimal foundation as evidenced by the undercutting along its length, which has been sandbagged in the last rains to prevent further undercutting.

Spillway from downstream showing condition of sandbags from last season

Service Spillway Inflow Channel**:** The service spillway is well located, with a clear path for stormwater entering the dam to pass freely to the spillway.

Service Spillway Return Channel and Drop Structure**:** The service spillway discharge or return channel has been excavated into the right flank of the river valley to achieve the desired relatively flat floor width of 20m. The left bank of the return channel comprises an earthen training wall extending from the right-hand end of the embankment to shortly beyond the concrete drop structure some 100m downstream.

There is a single substantial concrete drop structure across the channel approximately 85m downstream which was designed to regulate the flow down the length of the channel and prevent major erosion and the formation of gullies cutting back to the main spillway.

Aerial view of spillway return channel down to drop structure

Training Wall*:* The first approximately 30m of the upstream side of the training wall has been stone-pitched, with the stones cemented in place. This was part of the latest intervention in 2018, which has prevented any subsequent undercutting taking place in this section, as can be seen in the picture below. The downstream/external face of this portion of training wall has, however, has not been grassed and has experienced substantial gully erosion since its construction.

Gully erosion on external face of training wall

Beyond the first 30 m, the balance of the training wall eroded severely at some stage after construction, with a complete washaway of a portion of the wall, which resulted in the formation of a new return channel back to the river. While this section was repaired and the original return channel reinstated, the subsequent floods in 2019 further eroded the training wall beyond the stone pitched section and the damage to the training wall is almost to the point of total wash away.

Spillway channel showing current state of training wall

Drop structure: Since its construction in 2018, this has been damaged by floods, which have resulted in gullying in the channel.

Drop structure flood damage since 2018.

Flood Design

A 1:100 year flood of 22.7m^3/s, with a Safety Evaluation Flood (SEF) of 26.6m^3/s was used in the original design. It is not known what method was used in obtaining the design flood in the initial design.

The adopted design criteria for this project is based on the Mitchell Formulae used extensively in Zimbabwe for the PMF estimation. The return periods have been checked in comparison with results obtained from the VKE and Pitman. The Design Flood recalculation has been based on the Mitchell Formulae from Zimbabwe and checked in comparison with results obtained from the VKE and Pitman Methods.

Based on the design criteria and current surveys the below is a summary of the spillway details[21]:

Catchment Area.	2.15 km2
Max Probable Flood	83 m3/s
100 year Flood Estimate	38 m3/s
Fetch	0.18 km
Dry Freeboard	0.240 m

[21] The Design Flood adopted does not require any increase in the current freeboard and therefore no increase in the embankment height. There is a need though to carry out remedial works on both upstream and downstream slopes to correct the slope deficiencies introduced during the 2016/2017 raising exercise. There will also be a gravel wearing course of 300mm placed on top of the embankment.

Service Spillway Width	20.0 m
Current Crest Level	1244.00m
Spillway Level	1242.34 m
Current Freeboard	1.660 m
Coefficient of Discharge	1.8
Riverbed Level	1236.60m
Maximum Embankment Height	7.25 m
Maximum Depth of Water	5.74 m

Outlets: There are no pipe outlets through the embankment of the Nachibanga Dam, as its primary purpose was for stock watering. There is a well some 20m downstream of the toe which is used for hand irrigation of vegetable fields between the toe and the river line downstream. Crops are also watered by bucket from the stream.

5.2. Overall Legacy Issues at the Dam

The legacy issues are illustrated below and mitigation measures are shown in Chapter 7 Section 7.2.

1) Structural risks:

Spillway risks:

- Spillway capacity unknown. Spillway not built according to the old design drawings
- Downstream community safety

Return channel drop structures and training wall risks:

- Abutments inadequate and can be impacted by a flood
- Drop structure constructed on a weathered granite has been undermined and temporarily propped with sand bags
- Only one drop structure, erosion risks
- Gullying and erosion in the return channel
- Downstream community safety

Embankment and slope stability risks:

- Erosion hazard and embankment stability
- Heavy livestock use impacts on integrity of the embankment. No stone pitching on U/S side
- Signs of termites on the embankment and the wall along the drop structures. Anthills were used as material source for construction. This is a concern for the embankment structural integrity in the long run.
- Gabion baskets poorly tied into embankment and not horizontal
- Downstream community safety

Rock toe risks:

- Obvious seepage from the dam but uncertain whether there are rock toe drains installed
- Seepage and embankment instability – downstream community safety

The following pictures illustrate the above conditions:

Figure 17: Seepage point towards right flank

Figure 18: Possible seepage point downstream

Figure 19: Fencing at left flank to avoid animal crossing over the embankment

Figure 20: Spillway/ drop structures' state

Figure 21: Termites workings on the crest edge and front face

Figure 22: Gullying in the return channel

2) Health and safety risks

Construction phase

Demobilization and Restoration Plan absence risks:

- Unrehabilitated contractor sites
- Safety and health hazards for the community

Rehabilitation of disturbed works areas risks:

- Erosion and sedimentation

Rehabilitation of community roads risks:

- Loss of community access
- Loss of biodiversity

Rehabilitation of borrow pits risks:

- Erosion and sedimentation
- Weed infestation
- Entrapment risk to wild animals
- Failure to rehabilitate causing increased malaria risks and increased risk of children drowning or injury.

Environmental flow releases risks:

- Inability to monitor and assess downstream ecological effects of dam operation

Community health and safety risks:

- Stagnant water ponds within the spillway bed can be likely vector breeding areas and may cause drowning risks as the spillway gets deeper and wider
- General serious or fatal incidents/drowning

Access across the river risks;

- Lack of a bridge/crossing with increased risk of community injury and drowning

Operation phase

Community health and safety risks:

- Injury or illness caused by lack of knowledge of dam risks.
- Lack of capacity to respond effectively to emergencies related to the dam
- Lack of knowledge about actions to take in emergencies
- Serious or fatal incidents/drowning.
- Increased prevalence of water borne diseases

Photos illustrating some of the conditions above:

Figure 23: Borrow pits, locations


Figure 24: Upstream borrow area partially submerged and forming islands in the basin

Figure 25: Downstream Borrow pit

Figure 26: Downstream borrow pit

Figure 27: Downstream Borrow pit

Figure 28: Downstream borrow pit

Figure 29: Vehicle access route (left) and pedestrian access route (right)

Figure 30: Depressions with stagnant water between drop structures

3) Social risks

Community development risks

- Food security – inadequate fish training for communities, communities do not fish but fish stocks are available

Erosion and sedimentation in the dam:

- Uncontrolled stock watering
- Lack of catchment management

5.3. Potential Communities Affected by Works

The rehabilitation of the dam will benefit at least nine villages, as well as distant farmers coming to use the dam for livestock watering. Each of the nine villages has an average of 40 households resulting in 360 direct beneficiaries. Each household owns a minimum of 20 cows wherefore at least 7,200 cattle will be led to the dam regularly. Since the access to water in the area is limited, the use of the dam is intensive.

The communities engaged during consultations expressed their desire to engage in increased irrigation activities or livelihood improvements. Currently they use an unnamed stream downstream that forms a confluence with the stream downstream of the dam's outflow discharge. The dam has no water downstream in the dry season. During the site visit in June 2020, there was no water flowing downstream except in the unnamed stream, which forms a confluence. The works will therefore have significant socio-economic benefits as it will increase water in the dam that may be used for irrigation. This can include irrigation water supply for downstream communities.

The dams still has fish stocks for the local communities.

Furthermore, the rehabilitation activities will create temporary local employment activities for the duration of the construction and will therefore benefit both, women and men. Contractors will be required to recruit local workers. The total workforce will be approximately 50 people. 15 out of this amount are likely to be externally recruited, including an engineer, a foreman, sitemen, a storekeeper, and those handling heavy machinery and equipment as it is not expected that specialized or skilled workers will be available in the Pemba communities. Approximately 35 workers will be recruited from the Pemba communities. Their tasks will comprise concrete works, work on the embankment, and any other manual tasks. Construction works will approximately take 6 months.

Since the sub-project activities are temporary in size and the amount of externally recruited workers will be small, there is no significant labor influx expected, including impacts on local resources and services. Similarly, risk of exacerbation of local existing conflicts is low. Also, the potential that a workforce meets local communities from different political or factional backgrounds is small.

For the 15 external workers, the contractor will need to have a site office, for meetings and for the storage of materials. However, out of the 15 people, only the foremen, site men and storekeepers, and those handling heavy machinery and equipment are likely to be at the site for the entire course of construction. Hence, 7-8 external workers will be at the site permanently. Workers will be transported to the construction site and likely remain there for the construction period. Staff like the engineer will visit the project site but will not be there the entire time.

The contractor will have to build a campsite for the 12-15 workers, who are not transported to the site on a daily basis and who are not locally recruited, as well as for storage or materials; and will have to provide convenience facilities for the whole workforce. The community respondents and local authorities, during field visits, indicated that the former campsite at the end of the current access route, and at the left side of the basin, north east, can be reused for this purpose. After field assessments and environmental considerations, the proposed site should be before the previous site off the access road around coordinate 16°42'37.92"S; 27°20'34.90"E .

5.4 Dam Safety

The dam safety reports for Nachibanga Dam include the prepared emergency preparedness plan and the Operation and Maintenance document which will be shared with stakeholders.

The primary goals of a preparedness and response plan are as follows:

- To ensure that arrangements are in place for an effective response at the scene and, as appropriate, at District, Provincial and National levels to a dam failure emergency;
- To ensure that, for reasonably foreseeable incidents, inundation consequences are minor;
- That potential emergency scenarios are identified and early detection measures are in place to identify the potential failure;
- To take practical measures that mitigates any consequences for human life, health, property, infrastructure and the environment.

It is incumbent on the dam owner to have an EPP in place and to ensure that the dam is safety evaluated, as prescribed, and that site monitoring and documentation are kept up to date by the operator. It is important that there is adequate training of the operator(s) to identify early signs of failure and the correct notification procedures. The emergency preparedness and responses should be established in advance. The plan should be regularly exercised, to make all parties aware of their roles and responsibilities as well as to identify possible flaws in the plans. A notification flowchart is essential for any EPP and the contacts in particular should be updated regularly.

Communication systems must be robust and have back up alternatives - both in terms of contacts and systems. The notification flow chart has been developed in case of an emergency. The Dam Committee and disaster management authorities have a key role in the plan. Training and sensitization of the parties involved will be undertaken prior and during construction works. The inundation maps, affected infrastructure in case of dam break, training plan, reviews and mitigation measures are included in the report. Documentation accompanying the flowcharts includes the following:

- Owners details
- Dam Committee members
- Disaster Management Authorities Chain
- Dam details and documentation
- Inundation mapping
- Preparedness
- Affected infrastructure

The operation and maintenance planning includes the following:

- Components of the infrastructure that require operation and maintenance, for example, replacement of dam components, flow monitoring, monitoring termite invasion, inspecting for leakage along the dam wall.
- A schedule and procedure for maintenance. These include tasks such as inspections of the components, infrastructure and dam wall, identification of parts requiring replacement, and costing.
- Early warning systems for major maintenance.
- Other managerial, social, institutional and financial tasks such as setting user fees, collecting and accounting for the same.
- Required capacity building.

6. Proposed Remedial Works[22]

6.1. Embankment Remedial Design

6.1.1. Slope Stability

A full slope stability analysis for the downstream embankment slope would require considerably more tests than are warranted for this size of dam. The geotechnical investigation undertook limited SPT, grading samples and a triaxial test, this provided very select information as to the c and ø value from one area of point on the already constructed embankment.

In terms of the ICOLD Manual on Small Dam Design, it is not envisaged that there will be any stability issues, particularly as this dam stores less than 6m of water above riverbed level at the Full Supply Level. Likely issues are addressed by the inclusion of properly constructed toe drains and substantial rock toe to add weight to the downstream toe.

Current Upstream slope approximately	1:2.5
Current Downstream slope approximately	1:2.0

The following is a summary of the slope stability assessment carried out on Nachibanga Dam for both upstream and downstream slopes:

- Factors of safety meet acceptance criteria with and without seismic loading at end of construction.
- The dam meets the acceptance criteria on both slopes at full supply and maximum water levels under both free and seismic loading.
- Under rapid drawdown, the upstream slope is stable and it meets the acceptance criteria.
- The geotechnical parameters of the foundation, sand drain and rockfill are assumed.
- Rocscience Slide-v6 was used to perform both seepage and slope stability assessment. FOS up stream, full supply with no seismic loading (Bishop Simplified) FOS downstream, full supply with seismic loading (Bishop Simplified)

6.1.2. Rock Toe

The original downstream rock toe in the deepest section of the embankment – if there ever was one constructed – has long since been broken up. A more extensive rock toe will have to be placed in this area, extending at least 1.5m vertically up the embankment face and will incorporate a reverse filter on its upstream side to cater for any seepage passing through the embankment at this point.

In addition to controlling riverbed section seepages the rock toe will provide additional weight against the embankment at its deepest section thereby increasing the overall stability. This is depicted in the Figure 23.

[22] Nachibanga Dam Remedial Design Reports and Studies

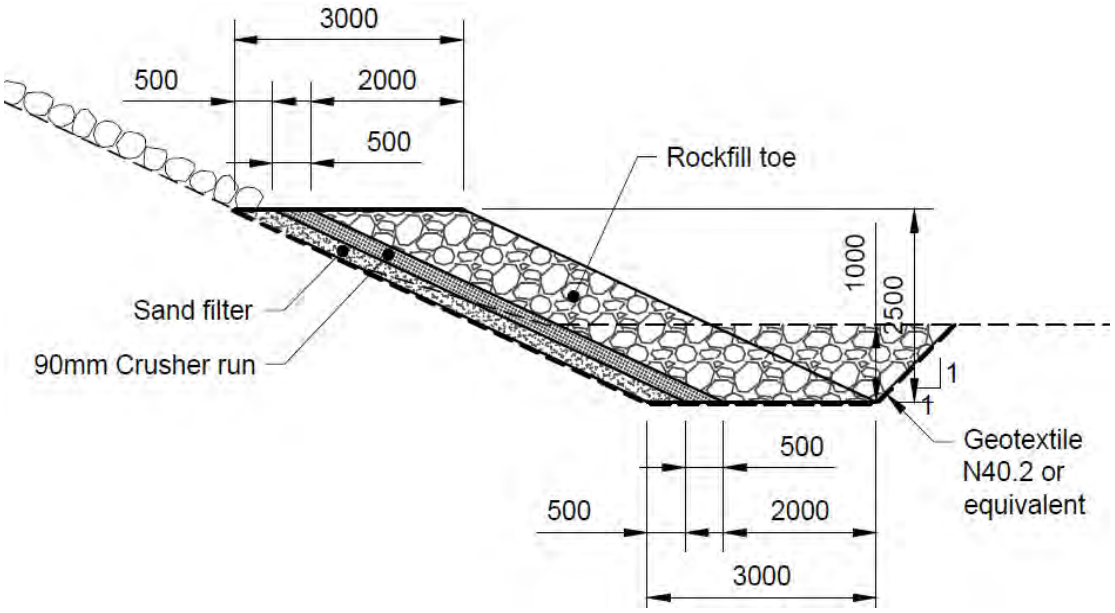


Figure 31: Typical section of rock toe and filter in the riverbed section

Concrete/stone pitched open toe drain

This will collect the outflow from the seepage spots at or beneath the embankment toe as well as runoff from embankment slope. This should be an open concrete lined or stone pitched drain that can be regularly cleaned out when necessary as the open earth drains that are filled with stone invariably soon clog up with silt and become ineffective.

The upstream slope of the drain should match that of the downstream embankment slope - in this case 2.5:1 - and the downstream slope can be cut at 1:1. Refer to Figure 24.

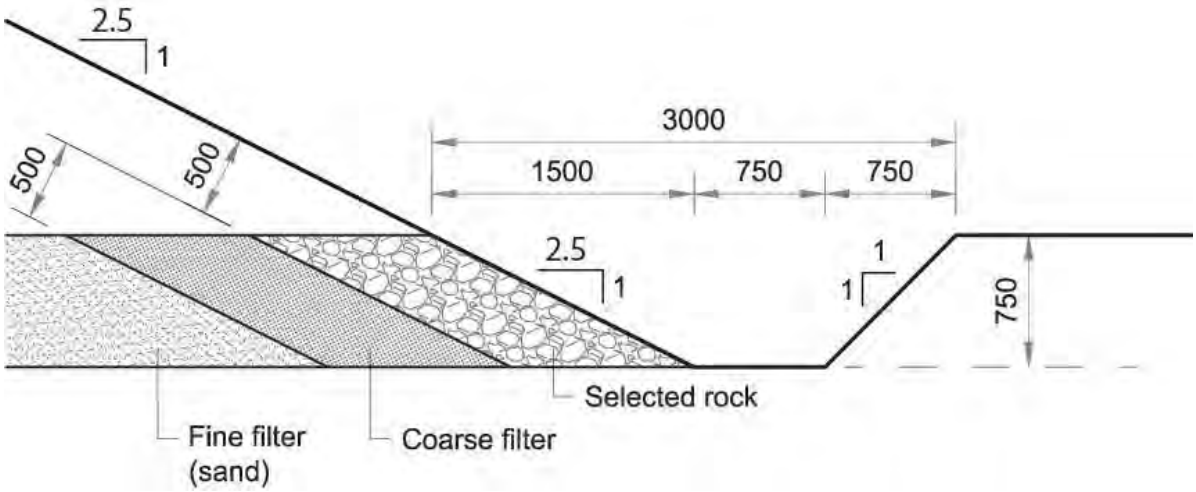


Figure 32: Typical section of toe drain and embankment internal filter

The surface toe drains on either side will end at the start of the rock toe and be diverted along the edges of the rock toe to discharge into the riverbed. Both discharge drains will be fitted with fixed V notches to enable the measurement of the flow in the drains.

Slope Protection

To protect both upstream and downstream slopes from livestock damage it is proposed that stone pitching both faces will preserve the slopes more successfully than any fencing, as this is a communal area.

6.2. Service Spillway, Drop Structures and Training Wall

6.2.1. Spillway

The Current spillway requires little, if any, remedial work on the structure itself. Refer to the Figure below.

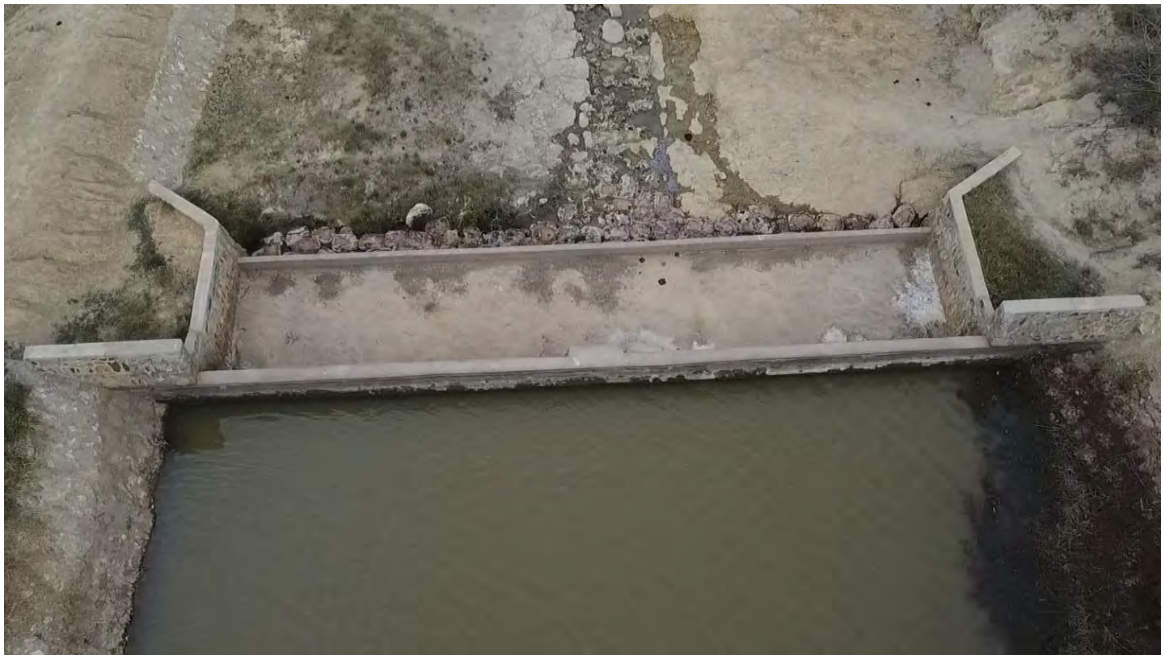


Figure 33: Spillway showing outfall remediation works required

The remedial works will be in the form of excavating the sandbags to a depth of 1.3m below the stilling basin outfall sill and placing a line of gabions against the sill to leave a fall of 300mm onto the gabions. Once backfilled and compacted against the gabions, a 2m wide by 300mm deep foundation below the top of the gabion will be prepared and a Reno Mattress layer will then be place and laced up to the gabions to provide further protection against erosion and undercutting of the channel immediately downstream. Refer to the sketch in Figure 26.

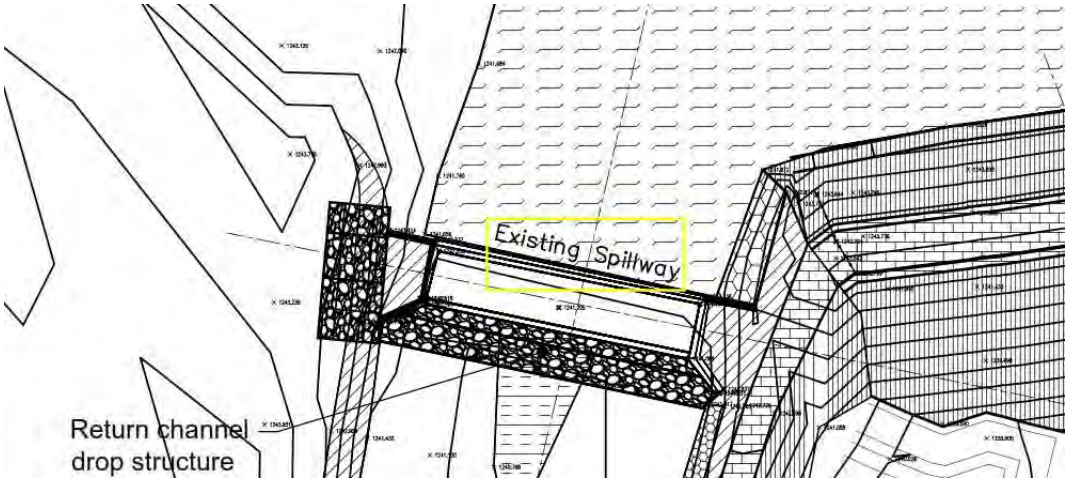


Figure 34: Gabion remedial works on spillway outfall

The right spillway abutment has a low point at the end of the cut-off wall that could conceivably result in a relatively low flood bypassing around the spillway abutment. Refer to Figure 27.

Figure 35: Right abutment potential for bypassing at higher floods

This low section needs to be rectified with an earthfill embankment extending away from the spillway at the level of the embankment crest to merge with the right bank NGL. This will be at or above the level of the cut off wall and needs to be protected from erosion by the use of gabion baskets and Reno Mattresses.

The end walls and the wing walls of the stilling basins are similarly not high enough to prevent serious wash at higher flood levels. These sections must be raised on both abutments to the height of the

embankment crest with stepped gabion baskets and backfilled and compacted with suitable material at the optimum moisture content.

6.2.2. Return Channel Drop Structures

There is currently only the one drop structure in place along the return channel to the river and its sill section is 1m below the level of the base of the exit sill from the stilling basin of the service spillway.

It is proposed to add a second drop structure across the channel close to the end of the stone pitched section of the training wall and upstream of the upper edge of the major gully adjacent to the training wall. The sill of this drop structure will be at the same level as the exit level from the service spillway and the exit level from the drop structure at the same level as the sill of the current drop structure downstream. The effective drop of this new structure will be approximately 0.5m and its construction will be from gabion baskets and Reno Mattresses as depicted in Figure 28.

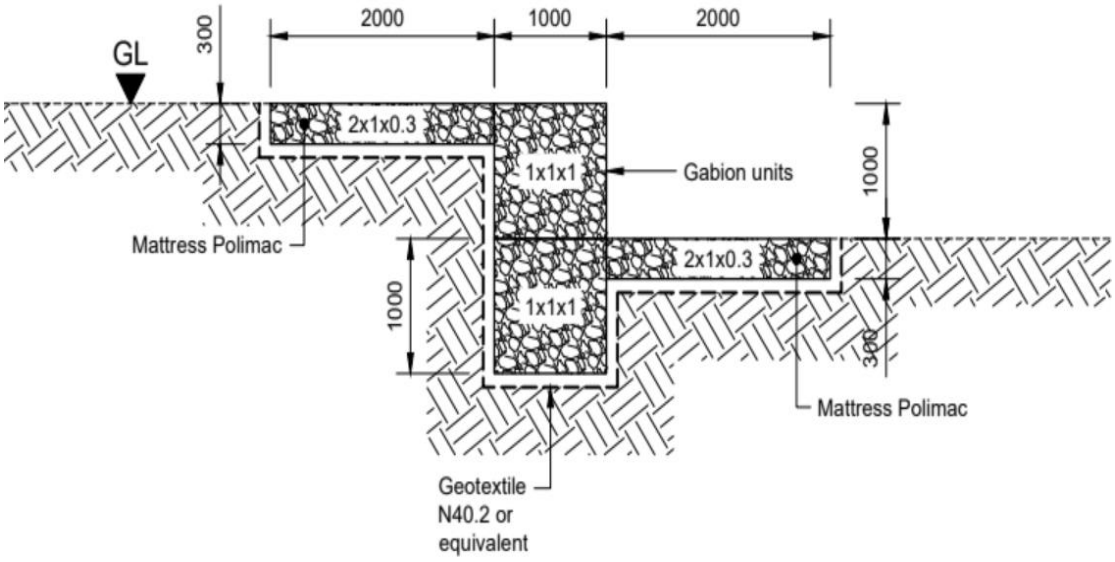


Figure 36: Section along return channel showing gabion drop structure

The portion of return channel between the service spillway and the drop structure will require profiling to the correct grade across its width and between the two structures. The drop of 0.5m will entail the excavation of the channel to the correct profile between this structure and the one downstream at this level. The overall effect will be to greatly reduce the energy of the flow between the service spillway and the lower drop structure. Material excavated in both of these portions of the channel can be utilized in the remedial works required on the left bank training wall and the existing gulley.

The large gulley leading into the upstream face of the drop structure will have to be pumped out and a close inspection made of the foundation of the drop structure to determine the extent of the gabion basket remedial works that will need to be implemented. This will involve excavating against the upstream face to install gabion baskets across the width of the channel and up against the drop structure to the current sill level. These gabions will need to extend upstream at least 4m in the deepest section of the gulley and be stepped up to reach the sill level at the drop structure. They must also extend out to the

height of and beyond the current extent of the cut off wall on both banks to prevent any chance of floods bypassing the structure on either side. Refer to Figure 29.

Figure 37: Drop structure upstream gulley and gabion repair locations

The extent of the undercutting of the downstream foundation of the drop structure across the channel needs to be fully established by the removal of all the sandbags and broken concrete currently obstructing clear view. The left-hand training wall, extending past the energy dissipater section of the structure, will need to be removed completely as it has been severely undermined and it will not be possible to carry out suitable underpinning. Refer to Figure 30.

Figure 38: Drop structure showing undercutting of left hand abutment (to be removed)

In its current position this wing wall is also restricting the outflow, and the replacement wall should be straightened out and properly linked into the channel bank. There is also a channel being eroded down the back of this wall from higher flows over the sill.

Remedial works for both sections will be with gabion baskets against the drop structure and left bank. This must extend into the left bank of the channel to cover where the training wall has been removed. The left-hand training wall should not be reinstated in its current position but the channel wall downstream of the drop structure should be excavated back to widen the exit throat and protected for a distance of 5m beyond the dissipator section.

As the return channel has been eroded from the foundation trench of the second drop structure back to this structure – particularly on the left bank – this will allow for widening of the "throat" at the exit and the whole channel and will improve the flow characteristics of the structure and reduce the erosion pressure.

It is proposed to excavate a trench to a suitable foundation up to 1m deep and 1,5m wide (following the hard rock) across the gully - some 5 - 7 m downstream of the drop structure. This will have a 250mm thick mesh reinforced concrete foundation placed on top of which a 1m wide masonry wall will be built up to a level that crosses horizontally from bank to bank. This is to create a pool immediately downstream of the drop structure exit to reduce further erosion of the channel floor.

Flow over the sill is almost immediately constricted by the training walls from a 15,5m width to an outfall width of 11.8m. At higher flood flows this restriction has resulted in a deepening of the flow in the dissipator section and the training walls have been readily overtopped causing erosion of the banks on either side of the structure, (as is already evident behind the left abutment training wall), with potentially disastrous erosion consequences for the entire structure.

These sections must be raised on both abutments to the height of the drop structure, cut off walls with stepped gabion baskets and backfilled and compacted with suitable material at the optimum moisture content to prevent such an occurrence.

6.2.3. Return Channel and Training Wall

The return channel between the spillway and the drop structure will need to have the current gullying repaired and these repairs will range from simple cutting of the channel width to a constant level and the length of the channel to a uniform grade (to prevent further "channeling" of the water which will cause further gullying) to filling in the deeper gulley sections against the training wall with rock on which to found the gabion basket protection of the reinstated earth training walls.

The first 23m of the training wall from the spillway, where the channel is relatively flat and flow velocity relatively slow, has already been finished with cement grouted stone pitching up the internal face and is in good condition.

It is from this point on, that reconstruction of the training wall will be necessary and with the increase in return channel slope and the attendant higher flow velocity, the gabion basket protection of the reinstated training wall may be necessary along the bulk of its length

The gully along the base of the training wall will have to be reprofiled and filled with rock first and the embankment itself reprofiled to allow the placement of the stepped gabion protection structure along its length. Earthfill will then be placed and compacted against the face of the gabion structure against the training wall. Refer the sketch in Figure 31.

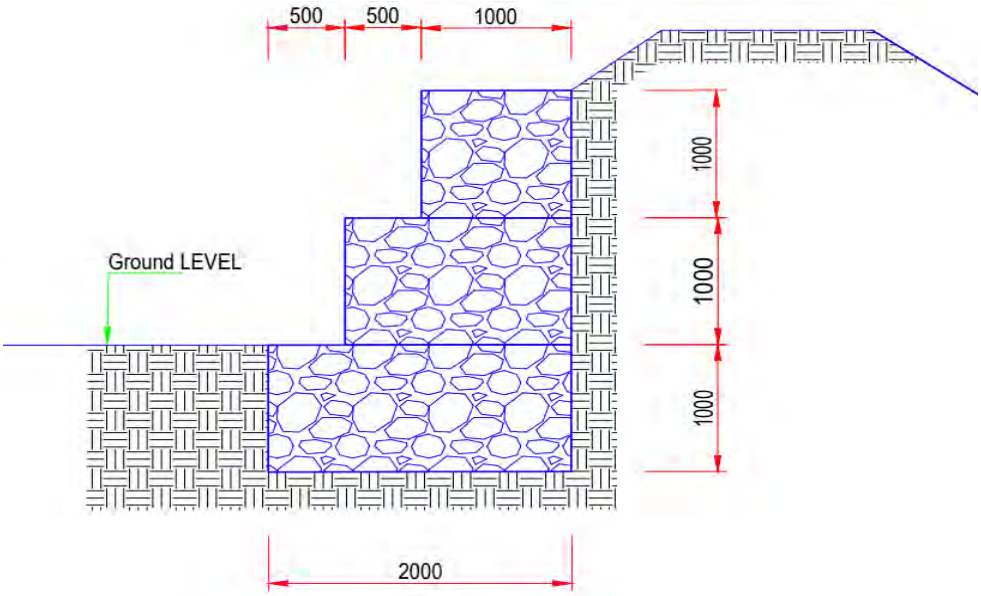


Figure 39: Gabion protection of repaired spillway channel training wall

6.3. Construction Materials and Amenities

Construction materials required for the remedial works as detailed above are as follows:

- Sand and stone for concrete for toe drains
- Stone for gabion basket filling
- Rock for riprap and downstream rock toe
- Sand and stone for reverse filter at rock toe
- Common fill material for embankment maintenance and spillway training wall repairs
- Wearing coarse gravel for pedestrian way on crest

Preferred locations are within 5km of the dam. However some of the sites identified are as follows:

Stones, sand and rock and fill material are found along Muzoka-Mooya road, which leads to the dam. These materials are extracted for sale by the local communities' small scale unregulated miners and heaped along a 10km stretch between Nachibanga and Ndondi dams' turn offs. Location Lat. -16700244; Long. 27.344081. Sand is extracted from the local streams crossing the road; rocks and stones are crushed from collected larger stones in the community and fill material are dug from different sites around the community settlements.

There is a commercial quarry- Universal Quarries Ltd. located at Lat -16.533141; Long. 27.322817 along Muzoka- Pemba Road. These provide commercial quantities of all sizes to clients. They are regulated and environmentally approved miners.

The contractor and the engineer will work together to determine the exact locations of these materials.

The social amenities required by the contractor include (see social conditions section of the ESMP):

Water supply

The contractor shall provide temporary potable water storage facilities and connection to the existing local borehole that is within 1Km downstream of the dam without compromising community access to the water. Water from this well should be tested and if safe for drinking can be used by the contractor and his/her staff. The hand pump borehole location is at Lat. -16.706586; Long. 27.341843.

Campsite

A campsite for 12-15 external workers- to be structurally constructed within the site off the access road around coordinate 16°42'37.92"S; 27°20'34.90"E.
The contractor shall provide the following for the site:

- Washing and sanitation facilities- incl. VIP latrines to be constructed within the site for ca. 50 workers (at least 2 latrines, 2m x 3m per toilet with opposite/alternate access and a privacy screen, one for men and one for women). Each toilet shall have a hand wash basin.
- Cooking facility at the campsite- all the cooking activities will only be conducted at the designed facility. Waste management (non-hazardous waste)- collection from waste receptors within the site, and disposal at council designated site located in Pemba urban at Lat. -16527384; Long. 27.375608.
- Waste management (hazardous waste)- collection within the site under stipulated conditions in the ESMP table. Remediate where necessary or dispose of as per regulations.
- Any hydrocarbon storage facility will require bunded walls according to the stipulated ESMP table requirements. Any recyclers and re-users of waste must be licensed and monitored according to ZEMA

guidelines.

- Temporary accommodation facilities for his staff. The temporary facility shall be made up of local building materials or tents and with a minimum spacing requirement of 4.5sqm living space per staff.
- Office facility, a minimum space of 3m x 3m internal dimensions complete with air conditioning, an office table, at least 2 chairs, a common sink, internet, power connection with at least 1 dedicated power point.
- Vehicle and machinery parking area.

Access roads

Access to Nachibanga Dam is by a 5 km Muzoka-Mooya feeder road with the junction at Lat. -16.699028; Long. 27.343298. The access road which is the current access road is shown on the Land use map.

Labour force

The total workforce will be approximately 50 people. 15 out of this amount are likely to be externally recruited, including an engineer, a foreman, sitemen, a storekeeper, and those handling heavy machinery and equipment as it is not expected that specialized or skilled workers will be available in the Pemba communities. Approximately 35 workers will be recruited from the Pemba communities.

6.4. Construction Programme

Considering the Scope of Works and possible sources of materials as listed under Item 10 - Materials, the rehabilitation works will be completed within 4-6 months.

6.5. Drawings List Available to the Contractor

No.	Description	Drawing No.
1.	Embankment Layout	ZM/DAMS/NC/C01
2.	Embankment Cross Sections	ZM/DAMS/NC/C02
3.	Spillway Layout and Remedial Works	ZM/DAMS/NC/C03
4.	Drop Structure Details and Remedial Works	ZM/DAMS/NC/C04

7. Risk and Impact Mitigation Plan

This section provides the following: common construction works management plans, monitoring requirements and the rehabilitation management plan after the current proposed works. The contractor is expected to operationalize these plans with details of his/her method statement.

7.1. New Remedial Works General Construction Works Management Plan

Construction Phase Risk Mitigation Measures						
Aspect	**Risk/Impact**	**Mitigation measure** (prevent, reduce, mitigate, and compensate)	**Time frame/ frequency of monitoring**	**Monitoring Performance indicator**	**Supervision and Operation Responsibility**	**Cost USD**
Non Hazardous Waste Management						
Campsite **Construction activities**	Solid waste generation and releases into the environment Public health and safety hazards	• The Contractor shall screen the proposed campsite area and should prepare a waste management plan for the site preparation, construction, operation and decommissioning. This shall be reviewed and approved by UNOPS. • The Contractor shall employ the waste management hierarchy in the management of waste at all the work site, including a) waste prevention, and b) waste reduction strategies, waste segregation with reuse and appropriate disposal methods. A record of waste generated and detailed waste transport method with disposal methods shall be kept on site. The contractor is prohibited by law to burn or bury any type of waste. The waste handling procedures and PPE requirements will be detailed in the method statement/ plan.	Construction Phase Daily	• Properly designated waste collection and disposal points. • Training/ sensitization records for 100 % of staff • Waste disposal records and logs • 100% cleaned up sit	Contractor Engineer and HSSE Officer UNOPS/ IDSP	HSSE Officer Cost 2000/month
Hazardous Waste Management						
Construction activities **Vehicular operation**	Hazardous waste generation and releases into the environment	• The Contractor shall screen the proposed storage areas and prepare a plan for the site preparation, construction, operation and decommissioning, as part of a Site-Specific Hazardous Waste Management	Construction Phase Daily	• Properly designated waste storage, collection and disposal points • Temporary storage	Contractor Engineer and HSSE Officer UNOPS/ IDSP	HSSE Officer Cost 2000/month

Sanitary facilities	such as hydrocarbons and sewer Public health and safety hazards	Plan. This shall be reviewed and approved by UNOPS. • The Contractor shall employ the waste management hierarchy in the management of waste at all the work sites, including a) waste prevention, and b) waste reduction strategies, waste segregation with reuse and appropriate disposal methods. A record of waste generated and disposal methods shall be kept on site. The contractor is prohibited by law to burn or bury any type of waste. The contractor shall produce site specific waste management plans and conduct regular waste segregation sensitisation of workers. • The contractor shall dispose of hazardous materials at the Council/ ZEMA approved disposal sites. All bulk hydrocarbon storage tanks must be contained in a concrete bund that can accommodate 110% of the total volume of the product that is stored in the tank, with a concrete floor and no drain outlet. Any rainwater collecting in the bunded area that does not evaporate within a short time must be pumped into drums for disposal through concrete-line mechanical oil separators and the oil recovered and temporarily stored in a waste oil collection tank or sealed drums. The fuel dispensing pumps must also stand in a concreted area, with drains to an oil interceptor. • The Contractor shall not wash vehicles in the sub-project area, to avoid contaminating the surface water with oil leakages from the vehicles.		areas for hazardous wastes concrete-lined and bunded • Treated contaminated sites, 100 % • Training/ sensitization records, 100% of workers • Waste disposal records and logs available • 100 % of sites are cleaned up • 100% of sites specific waste management plans exist		

Soil Management						
Excavation activities during Proposed road rehabilitation, material sources extraction, rehabilitation works	Excavation resulting in release of dust, gas and particulate emissions Public nuisance and health and safety risks Soil destabilization leading to erosion and land subsidence Road surface instabilities	• The Contractor shall prepare borrow pit method statements and management plans for each site to detail the operation of the site and compliance with the ESMP. • The Contractor shall limit excavations and clearing to necessary worksites. • The Contractor shall ensure that site installation, excavations and any other soil movement activity will not be done during the rainy season to avoid erosion of material and gully formation. • The Contractor shall methodically conduct site assessments, selection, and operation of the sites as indicated below: A depth of utmost 2.5m shall be excavated from borrow areas for safety reasons. The excavated slopes shall be reduced to a stable slope, and indicated in the method statements. • The Contractor shall create and maintain topsoil stockpiles. Topsoil depth ranges will be between 150 mm and 500 mm. The exact depth shall be determined from the geotechnical site assessment. Topsoil shall be stripped and stockpiled away from other materials. Topsoil shall be only used for reclamation purposes when pit operation is complete. • The Contractor shall incorporate drainage construction and runoff control at sites. Overburden soil shall be used as a perimeter berm to direct drainage on the site or stockpiled separately from topsoil. • The Contractor shall rehabilitate and restore sites after works. This will include rehabilitating disturbed work areas and	Construction Phase Daily	• Minimized land and soil disturbances at the work sites • Suppressed dust levels and soil movement / erosion • All sites are soil stabilized sites • Separate soil stockpiles to specification • Drainage and run off control • Site restoration, 90% for regeneration • Site Method Statements and management plans prepared	Contractor Engineer and HSSE Officer UNOPS/ IDSP/ Dam Committee	HSSE Officer Cost 3000/month

		restoring as close as possible to original contours. Restore topsoil from stockpiles. Replant with native plant seed mixes, and combine with natural revegetation. Overburden soil can be used for landscaping.				
Land use and Aesthetics Management						
Infrastructure rehabilitation works, Disturbance of sites, campsite construction	Changes in aesthetics, scenic view, visual character and land use	• The Contractor shall maintain consistency with existing land-use features and designs.	Construction Phase Monthly	• Minimised aesthetic impacts • Rehabilitated and restored sites, 100% • Blending land-use	Contractor Engineer and HSSE Officer UNOPS/IDSP	HSSE Officer Cost 2000/month
Surface and Groundwater Pollution Management						
Activities and Works around and on water bodies	Poor water quality Public health and safety risks	• The Contractor shall control siltation, minimise unchanneled runoff and soil erosion by constructing drainage channels. • The Contractor shall provide sanitary facilities in the form of 2 VIP toilets for the workers at the campsite (1 for females and 1 for males). These shall be monitored and properly decommissioned by adding lime. • The Contractor shall inspect machinery and vehicles for spillages and leakages on a daily basis, before use. • The Contractor shall dispose of construction debris and any wooded debris in legally designated site at the council dumpsite. Disposal in the reservoir or water bodies shall be prohibited. • The Contractor shall monitor water quality in the upstream basin and	Construction Phase Monthly Or as required in case of an emergency/ incident	• Refer to water quality results in the ESMP and biodiversity assessment • Water quality results, monthly • The monitoring parameters shall include biological, physical and chemical drinking water quality parameters. These will include parameters analysed in this ESMP: pH, conductivity (µg/cm), sulphates (mg/l), nitrates (as no3-n mg/l), total dissolved solids (mg/l), ammonia (as nh4-	Contractor Engineer and HSSE Officer UNOPS/ IDSP	HSSE Officer Cost 2000/month

		downstream by conducting initial water quality monitoring at commencement with monthly monitoring during construction.		nmg/l), phosphates (mg/l), total suspended solids (mg/l), chemical oxygen demand (as mg o2/l, chlorides (mg/l), turbidity (ntu), hydrocarbons (mg/l) additionally with total and fecal coliform tests. If hydrocarbon contamination is suspected, the test shall be included. The testing shall be done at certified/ approved laboratories after proper sampling methods. • Pollution control structures • Training records, 100% of workers trained • Inspections reports, weekly		
Air Quality and Noise Management						
Transportation, rehabilitation works at all worksites, campsite activities	Biomass burning impacts, dust from the roads and sites, noise from equipment	• The Contractor shall use auxiliary sites close to the dam to minimise haul distances and avoid worksites close to sensitive receptors such as households, clinics, schools etc. • Working hours to be limited to between 06:00 and 18:00. • The community shall be sensitised on working sites and routes. Equipment	Construction Phase Daily	• Complaints records • Inspection sheets • Receptor sites protection	Contractor Engineer and HSSE Officer UNOPS/ IDSP	HSSE Officer Cost 2000/month

		noises below acceptable limits. • The Contractor shall continually water sites and limit soil movements during works by stone pitching sites or vegetation. However, care must be taken to ensure that water used for this activity does not deprive local communities or affect the dam water quantities				
Construction materials (sand, stone, rock, gravel)						
Extraction and transportation activities	Land degradation, falls, waterborne diseases due to collecting water, health and safety injuries during mining, non ZEMA regulated activities, soil erosion, biodiversity loss, traffic accidents, noise and air quality, child labour from unregulated sources	• The Contractor shall source materials from reliable, regulated sources with ZEMA approved operations • The Contractor shall refer to the relevant management plans in the table; traffic, labour, air, noise, water, biodiversity, soil, land, health and safety	Construction phase Daily	• Refer to the remedial design report • Use of approved regulated miners • Constant material supply • Environmentally mitigated operations and keep a copy of their environmental assessment • Refer to the relevant plans' performance indicators	Contractor Engineer and HSSE Officer UNOPS/ IDSP	HSSE Officer Cost 3000/month
Campsite Management						
Construction, operation and decommissioning activities	Non-hazardous Waste management, Hazardous waste	• The Contractor shall refer to the relevant management plans in the table; air, noise, water, waste, biodiversity, soil, land, health and safety • The Contractor shall conserve resources –	Construction phase Daily	• Refer to the relevant plans' performance indicators • Limited vegetation clearance	Contractor Engineer and HSSE Officer UNOPS/ IDSP	HSSE Officer Cost 4000/month

	management, noise, wood fuel forest depletion, energy conservation, air pollution due to dust, water conservation, surface and ground water pollution, soil conservation, land pollution/ degradation, health and safety risks	energy and water. He/she will collect and use what is required in a sustainable way. • The Contractor shall not use firewood/ forest for energy. • The Contractor shall not deprive the communities of their resources. • The Contractor shall not start wild fires or a fire in an undesignated area. Fire safety shall be adhered to with extinguishers and assembly points on site.		• Campsite operations inspection reports • Well kempt campsite • Decommissioned site after operations as indicated in the decommissioning plan		
Traffic Management						
Transportation of materials, vehicle and equipment movements, pedestrian movements	Poor road surfaces, conflict of use with the community, safety hazards	• The Contractor shall assess available access, rehabilitate if needed and provide appropriate signage where relevant to inform the local community. If any road infrastructure is closed due to the works, alternative routes must be assessed and constructed with minimal impacts on the community social and environment aspects. • Contractor shall prepare the traffic management method statement which will be reviewed and approved by UNOPS in collaboration with IDSP. The method statement will firm procedures and include cost. • Contractor shall include hazard identification, risk assessment, safety measures such as signage, routes, parking areas, loading, unloading, reversing,	Construction Phase Daily	• Safety inclusion • Existing community access infrastructure • Training records for communities and workers • Inspection reports • Complaints records	Contractor Engineer and HSSE Officer UNOPS/ IDSP/ Dam committee	HSSE Officer Cost 2000/month

		crossings, sensitisations, fencing, competent drivers, working hours, operating low speed (about 10 to 20km/h). • In summary the contractor traffic management plan shall include: the desired flow of pedestrian and vehicle movements, the expected frequency of interaction of vehicles and pedestrians, illustrations of the layout of barriers, walkways, signs and general arrangements to warn and guide traffic around, past, or through a work site or temporary hazard, and how short term, mobile work and traffic situations will be managed. • Responsibilities of people managing traffic in the workplace, responsibilities of people expected to interact with traffic in the workplace, and instructions or procedures for controlling traffic including in an emergency shall also be included by the contractor.				
Basic Biodiversity Management and Flow Management (a separate Biodiversity Management Plan is under preparation)						
Aquatic biodiversity **Works within habitats**	Biodiversity loss and ecological flow limitations	• The contractor shall implement the Biodiversity Management Plan (BMP) which is developed separately to this document. • The Contractor will minimize impacts on notable species and loss, fragmentation, alteration, disturbance and disruption of sensitive habitats indicated in the BMP. • The Contractor shall avoid introduction of alien species that may affect other resident species in the waters. • The Contractor and communities shall avoid exploiting biological use of resources and invasive methods by following regulations and training.	Construction Phase Daily	• Number and extent of undisturbed areas • Species register • Flow measurement inclusion • Water quality results • Training registers and species protection regulations	Contractor Engineer and HSSE Officer UNOPS/ IDSP/ Fisheries Forestry	HSSE Officer Cost 2000/month UNOPS ecologist consultant costs

		• Contractor shall review the BMP and prepare and communicate to the contractor workforce an aquatic biodiversity site/ habitat specific method statement for works which will include: o Location of the specific works; o Any details obtained in the pre-works services; o Explicit details of mitigation measures which should be applied in the area; o Details of any specific construction practices which should be applied in the area to protect biodiversity; o Details of any timing restrictions which apply to works in the area; o Restoration details for the habitats within the area where the method statement applies. • The Contractor is required to ensure that all employees receive appropriate training in relation to biodiversity issues, so that the activities do not generate impacts on biodiversity. The Contractor shall maintain ecological services and ecologically rich areas, protect vulnerable and endangered species, and protect nests The Contractor shall protect flows and reservoir water levels during rehabilitation works, allow for movement of aquatic species and sediments from the upstream to the downstream and avoid and minimise pollution of waters and quality degradation, minimising soil movements and sedimentation. • The Contractor shall report all incidents to				

		UNOPS and to authorities.				
Terrestrial Biodiversity Works within habitats	Biodiversity and habitat loss	• The Contractor shall adhere to the Mitigation Hierarchy: avoid, reduce, rehabilitate and offset • The Contractor shall minimize impacts on notable species and loss, fragmentation, alteration, disturbance and disruption of sensitive habitats indicated in the Baseline section. • The Contractor is required to ensure that all employees receive appropriate training in relation to biodiversity issues, so that the activities do not generate impacts on biodiversity • The Contractor shall avoid clearing unnecessary areas for works and disturbances to the habitat and ecology. Wherever possible the felling of significant/mature trees will be avoided and connectivity between areas of forest habitats will be maintained. Avoid displacements and killing species for biological use. Protect nests and breeding areas. • The Contractor shall take measures to avoid wildfires, and any use of firewood from the cutting of trees around the dam. The contractor must organise alternative energy sources. • The Contractor's works, rehabilitation of roads, operation of material sites and campsites should minimise on destruction of terrestrial biodiversity. • Contractor to prepare an aquatic biodiversity site/ habitat specific method	Construction Phase Daily	• Rehabilitation records and extents • Extents and number of disturbed sites and species • Maintain a fauna sighting and fatality register. Conduct regular monitoring of works to ensure compliance • Training records and fauna register	Contractor Engineer and HSSE Officer UNOPS/IDSP/ Fisheries Forestry	HSSE Officer Cost 10000 UNOPS ecologist consultant costs

		statement which will include: o Location of the specific works; o Any details obtained in the pre-works services; o Explicit details of mitigation measures which should be applied in the area; o Details of any specific construction practices which should be applied in the area to protect biodiversity; o Details of any timing restrictions which apply to works in the area; o Restoration details for the habitats within the area where the method statement applies. • The Contractor shall report all incidents to authorities and UNOPS				
Community Health and Safety						
Lack of safety measures **Dam use Crossings**	Public health risks And diseases Drowning Injury	• The Contractor shall install safety signage around the dam reservoir, embankment, crossings, material sources, roads, depressions, pits and other sensitive sites. • The Contractor shall monitor traffic and road safety throughout the operations in order to maintain a safe working environment, including that workplaces, machinery, equipment and making sure processes under their control are safe and without risk to health. • The contractor shall sensitise communities on safety and response, including sensitise communities on vector and waterborne diseases prevention and management • The Contractor shall decommission stagnant water points, provide good quality drinking water, and practice	Construction Phase	• Adequacy of safety signage • Training records • Refer to the technical safety reports	Contractor Engineer and HSSE Officer UNOPS/ IDSP Ministry of Health	HSSE Officer Cost 15000

		hazardous waste management to promote health • Contractor shall prepare the site emergency preparedness response plan which will be in a report and process flow format. This will include training, emergency personnel/ contacts, emergency numbers, hazards identified (chemical, biological, physical or natural disasters), risk levels, evacuation and routes mapping, response-emergency reporting and evacuation procedures, critical operations.				
Gender Equality and GBV						
Gender Mainstreaming	Work force does not have gender parity	• The Contractor shall recruit 50% women among their locally recruited workforce	Construction Phase	• Contractor recruitment plan includes 50% women	Contractor UNOPS	

GBV/SEA	Sexual Abuse, Exploitation (SEA) and Harassment of work force vis-à-vis the local communities	• The IDSP and UNOPS shall conduct stakeholder consultations held with a focus on GBV/SEA and child protection risk • The Contractor shall ensure that all workers understand and sign a Code of Conduct (CoC) that reference zero tolerance in regards to GBV/SEA/SH. This also includes consultants and suppliers. • All CoCs shall be disclosed through appropriate means (see SEP) – including in the local languages • The Contractor shall ensure community and stakeholder awareness on GBV/SEA and child protection response mechanisms. • UNOPS to train senior GRM staff in GBV/SEA appropriate responses and referral mechanisms. Training of the GBV/SEA community focal point persons • The Contractor shall ensure that all sub-project-relevant cases are reported to UNOPS (establish agreements with relevant entities, distribute contacts for reporting), if the survivor agrees, based on informed decision making. • UNOPS shall monitor developments in the sub-project areas and conduct continuous assessments to understand trends in GBV/SEA/SH and child protection related issues	Construction Phase	• Reports on results of stakeholder consultations • Field monitoring missions are implemented at least once every month • All CoCs have been disclosed through appropriate means • Contractors has been provided with a standard CoC to use as a minimum • 100% of all workers have been trained in the CoC and GBV/SEA risks and obligations • Community awareness sessions have been implemented at least once • 100% of senior GRM staff has received training session on GBV/SEA responses and referral mechanisms • Agreements have been reached with GBV service providers/ reporting entities	Contractor UNOPS / IDSP	Gender Consultant UNOPS, 16.000/year
GBV/SEA	Sexual Abuse, Exploitation and	• The Contractor shall ensure the application of a system to prevent SEA in the company	Construction Phase	• Field monitoring missions are implemented at least	Contractor/UNOPS	Gender Consultant UNOPS, 16.000/year

	Harassment at the workplace	• The Contractor shall ensure that all workers understand and sign CoCs, including consultants and suppliers. • The Contractor shall ensure all CoC are disclosed through appropriate means and will also be conveyed in the local language, for easy comprehension. • The Contractor shall ensure that all sub-project-relevant cases are reported to UNOPS (establish agreements with relevant entities, distribute contacts for reporting), if the survivor has agreed based on informed consent.		once every month • All CoCs have been disclosed through appropriate means • 100% of all workers have been trained in the CoC and GBV/SEA risks and obligations		
Labour and Working Conditions						
Labour and Working Conditions	General Risks and Impacts	• Contractors to recruit local workers where possible • IDSP shall establish and implement effective GRM (including address of GBV cases). • Adequate Occupational Health and Safety requirements. This will be in compliance with the local Factories Act and OSHA Act. This includes complying with the safe working conditions and safe acts on site. • The Contractor shall incorporate strict COVID-19 prevention and management measures (See Appendix D and F)	Construction Phase	• At least 60% of workforce at dam site is locally recruited • Contracts contain labour influx provisions • All workers have signed a Code of Conduct	Contractor UNOPS / IDSP	Included in GRM costs (not specific for labor influx UNOPS staff costs Contractor budget (awareness sessions in communities and for workers): 5.000 USD / 6 months
Labour Influx	Conflicts between local community members and workers based on cultural differences	• UNOPS/IDSP shall conduct local community consultations during the sub-project design and implementation stage, as per SEP • The Contractor shall disseminate rigorous information dissemination about sub-project details and GRM, as per SEP (see below) • This will include awareness raising among local communities and workers	Construction Phase	• Monthly reports received on consultations and key issues identified • Information on CoC has been translated in local language • 100% of workers from outside have received training	Contractor UNOPS	UNOPS staff costs / travel budget of Safeguards staff 20.000 USD / year Contractor budget (costs for awareness sessions / training 5.000 USD / 6 months

		• The Contractor shall provide information on CoC (in local languages) • Contractor to conducts cultural sensitization of workers				
Conflicts	Conflicts between workers, based on cultural or other differences Risks of disagreements between local workers and employers	• The contractor shall design and implement a workers' GRM • The Contractor shall operate workers' GRM	Construction Phase	• Monthly reports on Workers' GRM received • Reports received on Workers' GRM	Contractor UNOPS	Contractor budget Staff costs and travel budget
Labour Influx	Increased risks of communicable disease, e.g. HIV/AIDS, STDs	• The Contractor shall implement awareness raising on HIV/AIDS and STD for the workforce	Construction Phase	• Every workers has received training	Contractor UNOPS	Contractors' budget (training costs, awareness raising in community costs, translation costs for COC) 5.000 USD / 6 months
Occupational Health and Safety	Occupational Health and Safety Risks	• Occupational health and safety requirements shall include hazard identification-elimination, substitution, controls, communicate risks, training, emergency preparedness and response, adequate and relevant personal protective equipment, incident investigations, monitoring • COVID-19 spread at the construction site to be mitigated through attached plan (see appendix D)	Construction Phase	• Emergency preparedness and response plan for occupational emergency situations • Report on COVID-19 mitigation plan implementation	Contractor UNOPS	HSSE Officer costs
Decommissioning and Rehabilitation Measures (Structured management to minimise environmental risk of dam construction impacts)						

Erected infrastructure **Demobilization of the contractor's services and equipment used in performing the work required under the contract**	Residue impacts Aesthetic impacts Safety hazards	• The Contractor shall review of the types of activities carried out on the site, including material extraction, machinery, buildings erected, waste handling and recovery operations. • The Contractor shall conduct identification of potential hazards, including an evaluation of the raw materials and waste products typically stored on-site, site hydrogeology, ecological effects, control measures for dam safety to prevent incidents, all items of plant and other materials, including buildings that may be decommissioned, rendered safe or removed from site for disposal or recovery in the event of demobilisation and closure. • The detailed rehabilitation plan will be in the contractor's site method statement	Construction Phase After conclusion of works	• Rehabilitated and restored site	Contractor Engineer and HSSE Officer UNOPS/ PIU	HSSE Officer costs 40,000
Disturbed work areas, material sites and Borrow pits	Soil erosion, aesthetics, drainage, safety hazards	• The Contractor shall conduct detailed site inspections, define and map disturbed areas where rehabilitation/erosion control is required. • The contractor shall develop costed method statements for each area, including problem statement, method of rehabilitation, resources needed and responsibilities. • The Contractor shall rehabilitate areas disturbed during construction activities and during previous construction activities. Disturbed areas shall be restored as close as reasonably possible to pre-construction state and the soils shall be restored to a condition consistent with other resource uses. Disturbed areas, slopes shall be replanted with native plant seed mixes suited to the area. Topsoil that	Construction Phase After conclusion of works	• Rehabilitated and restored site	Contractor Engineer and HSSE Officer UNOPS/ PIU	In rehabilitation cost

		has been stripped and stored as part of the construction activities is to be levelled out as part of stabilization and rehabilitation activities. Correctly preserved topsoil provides viable sources of seeds stock, biological life and nutrient conditions that lead to vegetation establishment in addition to native species that will be purchased for full rehabilitation use. For every tree removed three will be planted. The rehabilitation plan will be in the contractor's site method statement. • Borrow pit rehabilitation – The Contractor shall partially fill borrow areas with acceptable material (approved by the supervisor's ESS staff) to form a safe landform and covered with topsoil. Drainage should be ensured to avoid accidents and public health risks. The areas of disturbance and steep slopes must be stabilized. The rehabilitation plan will be in the contractor method statement and borrow management plan. • The contractor shall implement rehabilitation and monitor effectiveness over three years.				
Access roads and paths used	Soil erosion, aesthetics, watershed restoration, safety hazards	• The contractor shall conduct detailed site inspections, define and map disturbed areas where rehabilitation/erosion control is required. • The contractor shall develop method statements for each area, including problem statement, method of rehabilitation, resources needed and responsibilities. • These roads accelerate erosion and	Construction Phase After conclusion of works	• Rehabilitated and restored site	Contractor Engineer and HSSE Officer UNOPS/ PIU	In rehabilitation cost

		contribute to siltation of the dam as well as water turbidity of the reservoir especially in the rainy season. The Contractor shall repair of any existing roads used in accessing the dam site for decommissioning activities. Some of the unnecessary paths around the dam should be closed by ripping and planting of vegetation. Restoration of any over ground access areas through replanting of native plant seed mixes suited to the area at three trees per one removed tree. Local/ native species are indicated in this ESMP. • The Contractor shall create an ideal and safe crossing over the embankment or downstream • Natural regeneration and adequate full area coverage assisted vegetation using native vegetation species shall be implemented and monitored by the Contractor. • The Contractor shall ensure that the rehabilitation plan will be in the contractor's site method statement and management plan • The Contractor shall implement rehabilitation and monitor effectiveness over three years.				
Campsite	Land use and aesthetics	• The Contractor shall remove all campsite facilities retaining those that need to be handed over to the community /dam committee (if there will be any), for use. After accomplishing the dam construction works and before handing over, the campsite should be rehabilitated in an environmentally sound and acceptable	Construction Phase After conclusion of works	• Rehabilitated and restored site	Contractor Engineer and HSSE Officer UNOPS/ PIU	In rehabilitation cost

		manner to satisfy ZEMA regulations.				
Contaminated materials and hazardous waste	Soil and water Pollution safety hazards	• The contractor shall conduct detailed site inspections and prepare a snag list. Prepare snag list defining each area where remedial action is necessary, including location of waste oil drums and/or other hazardous chemicals, location of oil-contaminated soils and the required actions • The Contractor shall where possible return some materials to the suppliers, e.g. diesel and disinfectants for resale or reuse. The remaining materials be disposed of as waste, some of which may be deemed hazardous waste due to their composition e.g. oils. Such materials will be disposed of off-site in accordance with appropriate waste management regulatory requirements and facility waste management procedures. Soil contaminated with hydrocarbons shall be excavated up to clean material beneath the base of the to the contamination plume and bio-remediated in a land farm. Where the contamination plume is shallow, in-situ bio-remediation will be conducted using nutrients and enzymes. Such sections shall be mapped and backfilled with fresh soils. The rehabilitation plan will be in the Contractor's site method statement.	Construction Phase After conclusion of works	• Rehabilitated and restored site	Contractor Engineer and HSSE Officer Supervisor/ PIU	In rehabilitation cost
Pit Latrines	Pollution of groundwater and soil, safety hazards	• The Contractor shall decommission all VIP pit latrines that will be constructed by dismantling and the pits buried after applying lime. The rehabilitation plan will	Construction Phase	• Rehabilitated and restored site	Contractor Engineer and HSSE Officer UNOPS/ PIU	In rehabilitation cost

		be in the contractor's site method statement.	After conclusion of works			
Waste heaps and non hazardous waste	Landscape impacts, safety hazards	• The Contractor shall develop a snag list and conduct site inspections. • The Contractor shall ensure that rubble including vehicle and machinery parts and derelict components are removed from the site and transported for disposal at a ZEMA/ local authority certified dump site. All the heaps of soil shall be levelled and areas that were used as workstations will be re-vegetated. The rehabilitation plan will be in the contractor's site method statement.	Construction Phase After conclusion of works	• Rehabilitated and restored site	Contractor Engineer and HSSE Officer UNOPS/ PIU	In rehabilitation cost
Stock piling	Land use and aesthetics safety hazards	• The Contractor shall ensure that all heaps of overburden material should be used to back-fill the borrow pits and the sections properly levelled to suit the natural landscape. • Stock-pilling/preservation of the felled trees - The recommended practice is that The Contractor is required to stockpile all the felled trees. There will be no burning of burying any felled trees.	Construction Phase After conclusion of works	• Rehabilitated and restored site	Contractor Engineer and HSSE Officer UNOPS/ PIU	In rehabilitation cost
Reservoir Water Quality	Ecological services and aesthetic impacts	• The Contractor shall set up a designated livestock area on the upstream that will be stone pitched for controlled livestock movement and watering to prevent soil movements. • The ground shall be prepared and then pitching will be done before vegetation is planted.	Construction Phase	• Livestock watering area at the basin	Contractor Engineer and HSSE Officer UNOPS/ PIU	In rehabilitation cost
Embankment fencing	Forest cover loss threats	• The Contractor shall install metallic poles in a liner fashion for the animal barricade at the ends of the embankment wall to replace the temporary log fencing.	Construction Phase	• Permanent fencing to keep animals away from the embankment	Contractor Engineer and HSSE Officer UNOPS/ PIU	In rehabilitation cost

Embankment structural works	Embankment failure	• The Contractor shall completely dig out ant habitants and their tunnels exposed and broken down then backfill and compact with suitable fill material				
Environmental Flow	Ecological flows	• The Contractor shall install the user friendly durable flow gauge for regular flow measurements. • Ensuring balancing of flows and ecosystem needs, as suggested in the BMP. • UNOPS shall conduct training for the Dam Committee on flow reading and management. • The Contractor shall install additional outlets in the infrastructure for ecological flow. • A rock toe will be incorporated into the design of the downstream embankment drainage. A suitably sized rock toe should be considered to be incorporated into the remedial design. This should have a double filter layer along its intersection with the current downstream face at the toe to allow for safe drainage.	Construction Phase	• Training and flow monitoring	Contractor Engineer and HSSE Officer UNOPS/ PIU	In rehabilitation cost

Operation Phase Risk Mitigation Measures						
Aspect	**Impact**	**Mitigation measure (prevent, reduce, mitigate, and compensate)**	**Time frame/ frequency of monitoring**	**Monitoring Performance indicator**	**Supervision and Operation Responsibility**	**Cost USD**
Non Hazardous Waste Management						

Construction and Operation activities	Waste releases from local communities Public health and safety hazards Potential waste types include domestic solid waste due to activities around the dam- plastics, containers, boxes, papers	• The dam committee shall be trained on household waste management. There will be no disposal or storage of waste at the Nachibanga dam site.	Operation Phase	• Properly designated waste collection and disposal points • Training/ sensitization records • Waste disposal records and logs • 100% of sites are cleaned up	Dam Committee/ Water User Committee Ministry of Agriculture DWRD	500/month
Hazardous Waste Management						
Operation activities- pest management, fertilisers	Hazardous waste generation and releases into the environment- Chemicals	• IDSP, Ministry of Agriculture, Department of fisheries shall train the communities on operation activities that minimise pollution of water. These are outlined in the capacity and training program.	Operation Phase Monthly	• Non-polluting farming, animal watering and fishing methods (e.g. farmers not to push nitrate-based fertilizers into the surface water/dam) are applied • Training/ sensitization records, 100% • Water quality monitoring records	Dam Committee/ Water User Committee Ministry of Agriculture DWRD IDSP	100/month
Surface and Groundwater Pollution Management						
Livestock watering and activities in the water	Siltation Poor water quality	• The IDSP shall conduct and promote community farming methods that will not pollute the water- chemicals or runoff and soil erosion	Operation Phase Quarterly	• Water quality results from the dam and main tributaries in the catchment • Pollution control	Dam Committee Ministry of Agriculture Forestry	Once off- 20,000 700/month

		• The Department of Forestry, Community Development, Water Resources and IDSP shall conduct catchment management sensitisations during community trainings to promote raw water quality in all catchment sources, review land use practices/ social needs, biodiversity conservation and minimise run off on a catchment scale. This shall focus on creating a catchment management scheme. • Communities will continue sensitizing the farmers on catchment management practices, stock watering control and soil conservation		structures • Training and sensitisation records	IDSP	
Sanitation Management						
Community sanitation	Environmental pollution, public health risks	• The Community will be trained in the impacts of open defecation	Operation Phase	• Existing adequate sanitary facilities	Dam committees Ministry of Health	500/month
Pedestrian Infrastructure Management						
Maintenance of access infrastructure	Deterioration of access infrastructure, increased chronic sediment delivery, disturbed hill slope hydrology, and impacts to aquatic, riparian, and terrestrial ecosystems of roads crossings	• IDSP shall sensitise the community on appropriate use of the infrastructure to avoid and minimise failure. It will carry out regular inspection and maintenance of the infrastructure, and maintain the infrastructure and safety measures • IDSP shall train Dam committee on use, maintenance and monitoring requirements	Operation Phase Quarterly	• Training records • Inspection records • Maintenance records	Dam committee IDSP	3000/year

	Safety hazards					
Basic Biodiversity Management and Flow Management						
Aquatic biodiversity Operational activities	Biodiversity loss and ecological flow limitations, population increases	• The Biodiversity Management Plan (BMP) shall be implemented • Maintain ecological flows all year round and integrity of the ecological function • UNOPS to increase basin water holding capacity by rehabilitating the structure in order to enable constant downstream flows and basin water levels. Otherwise the basin may run dry. This would also relocate the aquatic species from the dam. A system for equitable allocation of water is based on available supply. • Include gauge levels monitoring facilities. Dam Committee to strictly monitor inflows, retention water and outflows in order to have a balanced system • UNOPS to include outlet infrastructure for downstream flows • Dam Committee to monitor the erosive capacity of the streams downstream for sediment barrier occurrence upstream • Dam Committee to monitor flow level changes downstream. Natural flows and dam controlled flows. • Communities to protect vulnerable and endangered species • Avoid exploiting biological use of resources and invasive methods • Secondary developments to take aquatic biodiversity into consideration	Operation Phase	• Ecological flows monitor • Relevant quantity, quality and timing of water flows required to sustain ecosystems and the human livelihoods and well-being that depend on these ecosystems	Dam Committee Fisheries Forestry UNOPS IDSP	10000/year

Terrestrial biodiversity, operational activities	Biodiversity and habitat loss	• The Biodiversity Management Plan (BMP) shall be implemented • Active control of invasive and alien species after trainings by government departments The community shall incorporate catchment management measures habitats around the dam. Avoid displacements and over exploitation of species	Operation Phase	• Biodiversity conservation measures in place	Fisheries Forestry Ministry of Agriculture	1500/year
Communication and Community Engagement						
Communication to Stakeholders	During operational phase, dam is not managed well by local communities	• IDSP to train Dam Committee in E&S issues indicated in the UNOPS and contractor training plans	Operations Phase	• Dam committee exists • Dam committee has been trained	IDSP local authorities	5.000
Community Health and Safety						
Lack of safety measures **Dam use Crossings**	Public health risks and diseases Drowning Injury Dam failure	• The communities will be trained by IDSP and government departments in maintenance of safety signage around the dam reservoir, embankment, crossings, material sources, roads. • The Contractor safety signage plan, location and type shall be presented for approval to the supervisors and PIU by the contractor. Safety areas will include undesignated or risky crossing points or activities around the dam, community warning prior to opening any valves, flooding, health, safety, planning, prevention and response, reporting faults and security measures at the dam.	Operation Phase	• Inspection reports • Training records • EPP revisions and reviews • Safety signage Plan and records • Refer to the technical safety reports	Dam Committee Ministry of Agriculture DWRD IDSP	2000/year
Gender Equality and GBV Action						

Gender Mainstreaming	Dam Committees do not have female members	• UNOPS shall define gender parity in constitution of the dam committee and include gender equality training in the training of dam committees	Operation Phase	• Dam Committees have 50% female members	UNOPS	Included in training costs above
Maintenance and Monitoring Management						
Dam maintenance	Structural deterioration Dam Management	• The IDSP shall conduct further dam committee trainings on dam maintenance and dam safety • The dam committee shall ensure incidents are reported to the resident IDSP staff and responded to • UNOPS and IDSP shall conduct Maintenance and Flow inspections trainings for communities and District Officers • IDSP shall conduct periodical Dam safety assessments • IDSP shall employ Record Keeping for the Dam maintenance works done by the department and by the community	Operation Phase Bi annual	• Dam committee Quarterly meetings and resolutions • Flow measurements and action plans • Training records • Dam maintenance records and monitoring records • Refer to technical safety reports	UNOPS IDSP DWRD Dam Committee	3000/ year
Monitoring measures	Lack of monitoring	• IDSP shall conduct water quality measurements for parameters indicated in this ESMP • IDSP shall conduct and follow up on flow measurements • The Ministry of Fisheries and Forestry shall conduct biodiversity monitoring as indicated in the BMP	Monthly	• Refer to the biodiversity assessment and BMP • Monitoring records • Pictures • Training records • Flow measurements • Water quality results, monthly The monitoring parameters shall include biological, physical and chemical drinking water quality parameters. These will include parameters analysed in this ESMP:	UNOPS IDSP DWRD Dam Committee	4000/ year

				pH, conductivity (µg/cm), sulphates (mg/l), nitrates (as no3-n mg/l), total dissolved solids (mg/l), ammonia (as nh4-nmg/l), phosphates (mg/l), total suspended solids (mg/l), chemical oxygen demand (as mg o2/l, chlorides (mg/l), turbidity (ntu), hydrocarbons (mg/l) additionally with total and fecal coliform tests. If hydrocarbon contamination is suspected, the test shall be included. The testing shall be done at certified/ approved laboratories after proper sampling methods.		

7.2. Rehabilitation and Remediation Plan for the Previous Works' Sites

This plan is prepared in reference to the ESA Table 9-2 'Requirements for rehabilitation plan' which requires that rehabilitation specifications for embankments, borrow pits, access roads / tracks created during past construction/ and any areas of downstream erosion / embankment destabilization that has been caused by the previous construction works and the initial operation of the dam are prepared.

The main purpose of this plan is to:

- identify, rehabilitate and remediate the existing previous dam construction areas, which have environmental and safety issues;
- identify, rehabilitate and remediate existing incomplete dam construction works and sites to enable completion;
- outline the requirements to return previously disturbed sites to a state which is similar to the state prior to construction.

One limitation of this plan is that full restoration may not be possible, therefore rehabilitation and remediation with the aim to meet continuing or changing uses is foreseen. This rehabilitation is part of the main project construction works. Therefore implementation of this ESMP applies with an active dam committee role during and after construction for maintenance and monitoring.

The rehabilitation works are elaborated in the table below.

Aspect	Condition/ risks	Remedial measures	Schedule for Implementation	Monitoring	Performance indicators	Estimated Cost
Structural risks						
Slope stabilization	Location: Embankment slopes, piping, eroding/ gullying return channel and training wall Images: Section 5.2 'Dam characteristics' Open unstable and/ or eroding slopes Risks: structure failure, soil loss	Refer to the dam design reports. Remedial works will include trimming the upstream slope and extending the downstream slope with a filtered rock toe and toe drains. . The return channel between the spillway and the drop structure will need to have the current gullying repaired and these repairs will range from simple cutting of the channel width to a constant level and the length of the channel to a uniform grade (to prevent further "channeling" of the water which will cause further gullying) to filling in the deeper gulley sections against the training wall with rock on which to found the gabion basket protection of the reinstated earth training walls.	*Timing:* Commencement of contraction activities so that recovery is demonstrable by the end of the contractor's liability period Implementation Role: Construction Contractor Supervisor: UNOPS *Materials and equipment* Earthworks Sand- quantities 260m^3. Rock quantities 500m^3. Crusher runner from a commercial quarry , quantities 260m^3 The equipment required includes: backactor; tractor dumpers; and haul truck for materials as well as a concrete mixer and poker vibrator *Workmanship* Up to 10 machine operators and 15 laborers as per above and up to 4 months for the equipment	Contractor liability period Site inspections Pictures Continuous maintenance	Trimmed, extended and stabilized slopes Gullying and erosion protection	In BoQ

Spillway and drop structures	The structures have temporary sandbags to control erosion Risks: structure failure, soil loss, continuous water loss from the basin	Refer to the dam design reports. The remedial works will be in the form of excavating out the sandbags to a depth of 1.3m below the stilling basin outfall sill and placing a line of gabions against the sill to leave a fall of 300mm onto the gabions. Once backfilled and compacted against the gabions, a 2m wide by 300mm deep foundation below the top of the gabion will be prepared and a Reno Mattress layer will then be place and laced up to the gabions to provide further protection against erosion and undercutting of the channel immediately downstream.	*Timing:* Commencement of contraction activities so that recovery is demonstrable by the end of the contractor's liability period Implementation Role: Construction Contractor Supervisor: UNOPS *Materials and equipment* Rock, quantities 150m^3 Equipment backactor; tractor dumpers; and haul truck for materials as well as a concrete mixer and poker vibrator. *Workmanship and timeline:* upto 3 machine operators and 25 labourers as per above and upto 4 months	Contractor liability period Site inspections Pictures Continuous maintenance	Rehabilitated walls and adequate gabion presence	In BoQ
Non-structural risks						
Waste and rubble snag list	Not present on site					
Hazardous waste snag list	Not present on site					

Borrow pits	Location: two existing borrow areas. 1 Upstream partially submerged (next to the dam basin and the 1st drop structure with dimension about 30mx20m) and another one downstream (next to the left embankment flank with dimension about 40mx30m each). Refer to the Map in the Section 5.2 and the Land use Map. Coordinates: Downstream Borrow area- 16°42'44.30"S, 27°20'34.73"E; Upstream Borrow area- 16°42'43.27"S, 27°20'30.10"E Images: Section 5.2	Remedial works will include earthworks, rehabilitation of the sites to promote drainage, aesthetic uniformity, revegetation by seeding and natural succession vegetation, slopes and safety. This will be done by partially filling borrow areas with acceptable material to form a safe landform and covered with topsoil (there are some top soil vegetated heaps around the downstream borrow pit) or grading to a desired landform slope and drainage. The existing vegetated sites' soils must be stocked during borrow rehabilitation and placed back when works are done. Native seeds shall be planted in addition to the replacement of top soil to ensure coverage. Appropriate surface slopes with drainage channels shall be constructed to prevent water from collecting at the site. Final slopes within the site shall be a maximum horizontal to vertical slope (H:V) of 3:1 or 33% grade. Drainage should be ensured to avoid accidents and public health risks. The areas of	*Timing:* Day works- Commencement of construction activities so that recovery is demonstrable by the end of the contractor's liability period Implementation Role: Construction Contractor Supervisor: UNOPS Remedial works will include earth ripping to enable regrowth of natural vegetation. Assisted vegetation (seeding and soil fertilization with watering) will be included on all sites to supplement possible natural vegetation. The unnecessary roads should be close by scarifying the roadway, ripping and recontouring. Re-establish natural drainage patterns on the closed roads. *Materials and equipment* Earthworks Spoil Soils for top soiling within the borrow area stockpiles Grass seeds- approved noncompetitive native species Watering equipment Fertilisers/ soil fertility promoters Equipment backactor; tractor dumpers; and haul truck	Contractor liability period Site inspections Pictures Continuous maintenance during the 3 year maintenance period	Contouring Drainage Stabilized slopes Desired landform	In provisional sum Day works

	Risks: community health and safety , biodiversity loss	disturbance and steep slopes must be stabilized. Reinstatement by natural succession will be implemented together with full cover assisted vegetation seeding interventions, which will require intense monitoring and maintenance within the 3 years maintenance period. This will include sub-base preparation, top-soiling, fertilizing and seeding for each area which requires rehabilitation.	*Workmanship and timeline:* upto 6 machine operators and 5 local workers for less than 4 months.			
Access routes	Location and Condition of the sites: 2 existing narrow gravel roads (about 2.5m wide) leading to the dam. One is 700m and the other is 500m (extents shown on the Land use Map). Images: Section 5.2 Risks: biodiversity loss	The roads, which will not be used by the current construction contractor will be rehabilitated and closed. Remedial works will include earth ripping to enable possible regrowth of natural vegetation even as assisted vegetation will be implemented on full coverage of the areas. The unnecessary roads should be close by scarifying the roadway, ripping and recontouring. Creating an environment supporting over ground with natural regeneration is encouraged to	*Timing:* Day works- Commencement of construction activities so that recovery is demonstrable by the end of the contractor's liability period Implementation Role: Construction Contractor Supervisor: UNOPS *Materials and equipment* Earthworks Limited gravel utilising existing surface to form with a grader and tractor dumpers Grass seeds- approved noncompetitive local/ native species Watering equipment	Contractor liability period Site inspections Pictures Continuous maintenance during the 3 year maintenance period	Ripped roads for revegetation Revegetation	In provisional sum Day works

		support the assisted vegetation. Assisted vegetation will included seeding, watering and maintenance of locally adapted vegetation. Re-establish natural drainage patterns on the closed roads.	Fertilisers/ soil fertility promoters *Workmanship and timeline:* 4 Operators and 8 labourers as per above equipment 4 days per equipment			
Eroded and disturbed areas	Open areas around the basin, material area slopes Livestock watering contributes to soil loosening and siltation of the basin Risk: dam basin siltation, poor water quality contribution, limiting water use, soil movements and loosening	Reinstatement by natural succession will be implemented with assisted vegetation seeding interventions, which will require intense monitoring and maintenance within the 3 years maintenance period. This will include sub-base preparation, top-soiling, fertilizing and seeding for each area which requires rehabilitation. The contractor will develop a costed method statement for disturbed sites. Livestock watering points to be designated and soil stabilization to be promoted by stone pitching, compacting and/ or trough creation as an alternative watering mechanism to keep some animals from the dam basin. The last option is the more expensive one of the two.	*Timing:* day works- Commencement of construction activities so that recovery is demonstrable by the end of the contractor's liability period Implementation Role: Construction Contractor Supervisor: UNOPS *Materials and equipment* Earthworks Compacting, stone pitching material and native vegetation seeds for soil stabilization method Concrete trough, pump, tank Tractor dumpers; and haul truck for materials *Workmanship and timeline:* 10 labourers and 1 month use of the equipment	Contractor liability period Site inspections Pictures Continuous maintenance	Soil stabilization and livestock watering points	In provisional sum Day works

Community health and Safety	Lack of safety signage around the dam Lack of safety and health sensitization over the dam Risk: accidents and waterborne diseases due to lack of knowledge and signage warning	Remedial works will include a method statement for the design of signage and location mapping. This will be approved by the supervisor. These will be design approved standard dam safety signage around the dam and contractor sites for construction and operational phases. The community sensitizations and training planned in the ESMP will be finalized and administered by the contractor. These include drinking water health, water borne diseases, avoidance of dangerous spillway crossings, swimming risks, emergency preparedness in floods or dam failure, EPP, safety signage, etc.	*Timing:* Day works-Commencement of construction activities so that recovery is demonstrable by the end of the contractor's liability period Implementation Role: Construction Contractor Supervisor: UNOPS *Materials and equipment* Training plans Signage design and subcontractor Signage installation *Workmanship and timeline:* One trainer persons Signage installation 3 labourers	Contractor liability period Site inspections Pictures Continuous maintenance Dam committee regulation	Training records in all stipulated topics Existing correct signage Signage method statement	In provisional sum Day works
Livestock watering	Location and Condition of the sites: Tree log fenced embankment ends to avoid animal access on the embankment. This	Remedial works will stone pitching and gabion design options Training in livestock management and watering	*Timing:* day works-Commencement of construction activities so that recovery is demonstrable by the end of the contractor's liability period Implementation Role: Construction Contractor, dam committee Supervisor: UNOPS	Contractor liability period Site inspections Pictures Continuous maintenance Dam committee Livestock regulation and control	Existing permanent structure protection from livestock movements Watering planning	In provisional sum Day works

	method is unsustainable. Risk: embankment damage/ failure due to crossing Biodiversity loss due to the continuous use of tree logs		*Materials and equipment* Gabions Stones *Workmanship and timeline:* as shown under embankment remediation- structural risks section			
Flow gauges	Downstream flows	Flow monitoring	*Timing:* day works- Commencement of construction activities so that recovery is demonstrable by the end of the contractor's liability period Implementation Role: Construction Contractor, dam committee Supervisor: UNOPS *Workmanship and timeline:* 1 operator and 4 laborers Equipment: concrete mixer and poker vibrator equipment	Contractor liability period Site inspections Pictures Continuous maintenance and biodiversity monitoring	Installed monitoring gauges Training records	In provisional sum Day works

Implementation Role: Construction Contractor, dam committee
Supervisor: UNOPS

8. Capacity Building

Community / Stakeholder Health and Safety training plan

In compliance with the policy and legal framework, the environmental and social assessment recognized some training and knowledge gaps in relation to construction and operation phases of the Nachibanga Dam. Capacity building will be the process used by which individuals and departments obtain, improve, and retain the skills, knowledge, tools, and other resources needed for dam safety and environmental management at the dam. The training plan in Table 12 has been proposed for capacity building of district government staff, Dam Committee members and community members (upstream and downstream). The implementation and execution of the sub-project shall include additional training of relevant staff and communities, stationed in the various sites, in environmental and social due diligence during construction and operation. UNOPS shall supervise the training on behalf of IDSP. Identified trainers include: staff of Local Health Centre, District department representatives, UNOPS E&S Team, UNOPS Dam safety Team, IDSP and the contractor.

In addition, the contractor shall include in their work plans and carry out training of workers on the required safeguards they are expected to implement as part of the daily activities. The training material shall be derived from the ESMP and the sub-project's Technical Dam Safety documents, and other sources. This section does not cover the Contractor's training requirements, which are detailed in Appendix H.

Training monitoring shall be conducted by the IDSP and UNOPS by reviewing the training materials, filing training records and noting feedback and following up on recommendations/ action plan.

The training topics include:
For District Officers;

- Policy and legal framework
- Dam safety management
- Maintenance and ESMP requirements/ roles
- Monitoring measures and procedures
- Stakeholder Engagement Plan
- Dam operation and roles

For Communities;

- Policy and legal framework
- Dam safety management including Emergency Preparedness and Response
- Community health and safety, including drinking water and water borne diseases, avoidance of dangerous spillway crossings, emergency preparedness in floods or dam failure, swimming and drowning risks, first aid in the event of potential drowning, risks of crossing at the dam spillways, management of livestock around the dam, malaria prevention and management, bilharzia prevention and management, management of other water borne diseases, use of dam water for drinking and emergency preparedness interactions with wild animals
- Grievance Redress Mechanism (GRM) and GBV
- Maintenance and ESMP requirements/ mitigation measures and monitoring.
- Dam operation and environmental flow
- Catchment management

- Biodiversity management and monitoring

The proposed training plan is shown in Table 12[23]:

Table 9: Training plan

Training Content	Number of Days, Time, Frequency	Trainers / Supervision	Participants
Dam Safety-Emergency preparedness, and Community health and safety			
Emergency preparedness: Key Training Concepts: Hazards, floods and dam failure, roles and responsibilities, emergency preparedness, emergency response procedures and grievance redress mechanism *Community health and safety:* *Key Training Concepts: Pedestrian access infrastructure, Construction safety, Gender based violence, swimming risks, drowning risks, dam security, spillway crossing risks, management of livestock around the dam, use of dam water for drinking, wild animals, malaria prevention and management, bilharzia prevention and management, water borne*	5 **After ESMP disclosure prior to construction works** **Repeated after 3 months and at completion**	5 **After ESMP disclosure prior to construction works** **Repeated after 3 months and at completion**	100 community members 15 District DMMU members Dam committee

[23] UNOPS to have overview over planning and execution of training on behalf of the IDSP/P

diseases, dam maintenance and ESMP monitoring *First aid: First aid basics and response*			
Estimated Costs: 2,000 USD per session			
Grievance Redress Mechanism and ESMP monitoring requirements			
Key Training Concepts: Sharing of the Environmental and Social Management Plan (ESMP) by IDSP/ Contractor to the stakeholders	Key Training Concepts: Sharing of the Environmental and Social Management Plan (ESMP) by IDSP/ Contractor to the stakeholders	UNOPS: Environmental Specialist Environmental health and safety Specialist Dam Safety Specialist IDSP: Dam safety Specialist Environmental Specialist	18 District Officers 2 officers from each of the following Departments: • Town Council • Ministry of Chiefs and Traditional Affaires • DWRD • Ministry of Health • Forestry Department • Ministry of Gender • Community Development • Ministry of Fisheries and Livestock • Ministry of Agriculture
Estimated Costs: 1,500 USD			
Dam operation activities			
Key Training Concepts: Fishing regulations, species, fisheries conservation, catchment management, environmental protection, forestry regulations and biodiversity	3 **At works commencement and repeated annually**	UNOPS: Environmental Specialist Environmental health and safety Specialist Government: Agriculture Fisheries Forestry	100 community members

conservation measures, dam sustainability, nurseries, farming methods and dams, sustainable irrigation, pest management, water pollution, crop selection, soil conservation methods		Community Development IDSP: Dam safety Specialist Environmental Specialist	
Estimated costs: 1,000 USD per session			

9. Stakeholder Engagement

The Stakeholder Engagement Plan seeks to define a structured, purposeful and culturally appropriate approach to consultation and disclosure of information during the preparation of the ESMP and implementation stage. UNOPS and IDSP recognise the diverse and varied interests and expectations of stakeholders and seek to develop an approach for reaching each of the stakeholders in the different capacities at which they interface with the sub-project. The aim is to create an atmosphere of understanding that actively involves project-affected people (PAPs) and other stakeholders leading to improved decision making.

Overall, this Plan defines the stakeholder engagement requirements in regards to a) engagement prior to remedial works about the immediate dam safety concerns; b) engagement during (and related to remedial works dealing with construction impacts; and c) engagement in regards to the long term use of the reservoir, maintenance of infrastructure, ensuring vulnerable groups benefit from the sub-project, community health and safety, etc.

While COVID-19 restrictions are still in place, strategies will be employed to include smaller meetings, small FGDs to be conducted as appropriate taking full precautions on staff and community safety. Where meetings are not permitted, traditional channels of communications such as radios and public announcements will be implemented.

9.1. Grievance Redress Mechanism

Stakeholder engagement includes access to a Grievance Redress Mechanism (GRM) implemented by IDSP. The GRM is designed ensure that feedback can be received in relation to the remedial works for the Nachibanga Dam. It is set up to respond to concerns and grievances of all PAPs and to receive feedback related to the environmental and social performance of all activities.

Stakeholder engagement forms a fundamental element to ensure that the GRM process and relevant contact details are well communicated to the respective communities in the dam areas, and that communities are consulted on the performance of the GRM to allow for potential adjustments where needed. This Stakeholder Engagement Plan lays out how the GRM protocols are disseminated to all stakeholders.

Dam Committee members thereby play a key role in the GRM, as they receive grievances or feedback from PAPs in person; hold the keys to suggestion boxes and regularly empty them; assess and clarify grievances; provide feedback to PAPs; investigate grievances; provide appeals mechanisms for unsatisfied PAPs; document all grievances in a log/register; and report all grievances and their processes on a monthly basis to IDSP.

The District Disaster Response Committee can also receive grievances or feedback from PAPs in person. It further receives grievance reports from dam committees and local headman; assesses and clarifies the grievances; provides feedback to the PAPs; investigates grievances; provides appeals mechanisms; documents all grievances; and reports all grievances and their processes on a monthly basis to IDSP.

The IDSP National Project Coordinator oversees the GRM and is responsible for the overall implementation of the GRM. The IDSP Social Specialist and the M&E Specialist are responsible for stakeholder engagement and the provision of information to the Nachibanga dam communities; they are accountable for the implementation of the GRM; receive grievances from dam committees, local headman and Disaster Response Committees that require appeals; receive grievances from an additional Hotline Operator; register, assess and investigate grievances; provide feedback to PAPs; monitor and report on the GRM; analyze trends and lessons learnt from the GRM; and suggest amendments to the GRM where necessary.

The Social Specialist and the M&E Officer at IDSP are further responsible for monitoring the availability of sub-project information at the community level, the implementation of the Stakeholder Engagement Plan, as well as the Dam Committees, local authorities and District Disaster Response Committees in their ability to receive grievances. They will include the GRM into supervision and monitoring missions to the field and conduct spot checks regarding its implementation.

Dam committees, local headman and Disaster Response Committees will provide logs with all grievances to IDSP. IDSP will analyze the grievance data and will provide analytical synthesis reports on a monthly basis, including the number, status and nature of grievances. IDSP will further provide an excel sheet summary of the feedback and grievances reported, which will be linked to the Project's Management Information System (MIS) and to the M&E Results Framework. It will further maintain a documented record of stakeholder engagements, including a description of the stakeholders consulted and a summary of the feedback/grievances received during community consultations.

The Social Specialist will further extract lessons learnt from the GRM and implement analysis on the overall grievances and share them with the World Bank, and will initiate potential amendments to procedures. The Safeguards Specialist will further analyze input from stakeholder engagements, and provide trends and lessons to the sub-project teams.

A supervision and monitoring report will be prepared every month by the ISDP. The contents of this report will include number of filed grievances, solution of the grievances and analysis of trends.

9.2 . Stakeholder Participation

The preparation of the ESMP has relied significantly on local level stakeholder engagement in order to gain understanding of the needs of the dam communities, and potential risks and impacts as well as mitigation measures of the planned rehabilitation activities.

Stakeholder consultation was conducted through review of previous engagement notes from the WRDP reports, key informant interviews with government stakeholders, and focus group discussions and community consultations held during sub-project preparation. COVID-19 regulations were adhered to during engagement. The attendance sheets are shown in Appendix F.

It is important that affected communities and other stakeholders are given the opportunity to continually participate in the process during the remedial works. Therefore, consultations were held:

- To provide information about the previous and current sub-project and to get stakeholder information on key environmental and social baseline information at the sub-project site;
- To receive information on legacy site impacts of the previous project in relation to non-rehabilitated sites;
- To provide opportunities to stakeholders to discuss their opinions and concerns;
- To identify specific interests and to acme potential roles and responsibilities of stakeholders and ensure their approval and participation in the development of the ESMP; and
- To inform the process of developing appropriate management measures as well as institutional arrangements for effective implementation of the ESMP.

A summary of the views and concerns raised during the consultations and field visits to the Nachibanga dam communities are stated below:

Department/ organisation	Concerns/ input
District commissioner	• The priority criteria must try to consider that Nachibanga is in a climate change vulnerable area and is water stressed
Social welfare	• Vulnerable persons must benefit from the infrastructure – female headed households, chronically ill, child headed households, aged and disabled. Ensure it is usable by all persons e.g. access routes, irrigation and water use • Men take part in most income generating activities including employment • Females and the vulnerable benefit more than the men from the government's resource park through the department for gender equity • The sub-project should involve employment of both men and women • The Zambia Police's Victim Support Unit VSU, Government Community Development and World Vision NGO deal in gender matters in the district. • There have not been many local initiatives or programmes due to lack of funding
Arts and Culture	• Engage the locals during rehabilitation so that they adopt the ownership of the dam and they empower themselves. Use the local structures in all the programmes
Forestry	• Afforestation and reforestation are vital for dam sustainability • Locals have to embrace tree planting and should undergo training • Southern province and Pemba in particular is facing deforestation at a rapid pace and that threatens such projects and infrastructure • The department has a number of indigenous seedlings for tree planting • The line ministries must be involved in the dam activities including site visits as they have not been to the dam sites. that way they will better contribute to the mitigation measures of the sub-project

Agriculture

- The sites have sparse vegetation with significant disturbance to the natural ecosystem
- Cut off drains, silt traps and contour bands around the reservoir must be considered
- Nachibanga Dam has siltation problems. Traps in the catchment area must be developed
- The communities should be involved all the way to sustain the dam as their activities matter in the protection and conservation of nature

Communities

- The Dam has been beneficial to most communities even distant and unanticipated ones
- Dam's structural structure problems have to be sorted out- Spillway capacity, drop structures integrity, erosion along drop structure surface, riprap and re-grassing, siltation in the basin, fishes leaving the basin due to low spillway structure, seepage
- Access route require rehabilitation
- The dam's water holding capacity is low
- It is the main water reservoir in the area
- Irrigation is needed as a livelihood source, canals must included
- Dam safety is not in place
- Access point upstream or downstream must be erected
- Training is needed for the Dam Committee
- Employment should involve the locals

9.3. Stakeholder Communication Plan

Information disclosure will rely on the following key methods: community meetings in coordination with local authorities (headmen, dam committee, and district administration), community notice boards, phone communication (SMS), and radio broadcasts. At the national level information will be disclosed mainly by email and on the IDSP and UNOPS websites. Information will be disclosed in English, which is the official language of Zambia. Local authorities, such as the District Administrator, Local Headmen, the Nachibanga dam committee and the District Disaster Committee will be requested to inform communities in community meetings and through disclosure on social media where feasible.

Table 10: Stakeholder communication plan

Phase	Item to be disseminated	Actions	Responsibility	Registry Format
Information dissemination prior to remedial works about the immediate dam safety concerns	GRM	Community meetings with Local Headmen, Dam Committee, District Disaster Committee, community members – with social distancing Community notice boards Radio announcement / broadcast Email – national level stakeholders	IDSP Social Specialist	Minutes of meetings Messages produced for notice boards Message sent to radio broadcaster Email message
	ESMP	Community meetings with Local Headmen, Dam Committee, District Disaster Committee, community members, other relevant District Authorities, e.g. fisheries, agriculture, social welfare etc… – with social distancing Community notice boards Radio announcement / broadcast Email / website – national level stakeholders	UNOPS Social Safeguards Specialist and IDSP Social Specialist	Minutes of meetings Messages produced for notice boards Message sent to radio broadcaster Email message, website
	Information on dam safety concerns	Community meetings with Local Headmen, Dam Committee, District Disaster Committee, community members – with social distancing Community notice boards	UNOPS Social and Environmental Safeguards Specialists; UNOPS Engineer	Minutes of meeting Messages produced for notice boards
	Information on construction	2 weeks before entrance of contractor – Meeting with local headmen, dam committee members, other relevant District Authorities, e.g. fisheries, agriculture, social welfare etc. – with social distancing	UNOPS Social and Environmental Safeguards Specialists; UNOPS Engineer; Constructor	Minutes of meeting

Information Dissemination during remedial works	ESMP	Community meetings with Local Headmen, Dam Committee, District Disaster Committee, community members, other relevant District Authorities, e.g. fisheries, agriculture, social welfare etc. – with social distancing Community notice boards Radio announcement / broadcast Email / website – national level stakeholders	UNOPS Social Safeguards Specialist	Minutes of meeting Messages produced for notice boards Message sent to radio broadcaster Email message, website
	Any works-related information (on activities, details of construction activities, labor)	Community meetings with Local Headmen, Dam Committee, District Disaster Committee, community members, other relevant District Authorities, e.g. fisheries, agriculture, social welfare etc. – with social distancing Community notice boards	UNOPS Social and Environmental Safeguards Specialists; UNOPS Engineer; Constructor	Minutes of meeting Messages produced for notice boards
	GRM	Community meetings with Local Headmen, Dam Committee, District Disaster Committee, community members – with social distancing Community notice boards Radio announcement / broadcast Email – national level stakeholders	IDSP Social Specialist	Minutes of meetings Messages produced for notice boards Message sent to radio broadcaster Email message
Information Dissemination in regards to the long term use	GRM	Community Meetings – with social distancing Community Notice Boards	Dam Committee; District Disaster Response Team; Local Headmen	Minutes of meeting Messages produced for notice boards
	Information on dam safety concerns	Community Meetings – with social distancing Community Notice Boards	Dam Committee; District Disaster Response Team; Local Headmen	Minutes of meeting Messages produced for notice boards

9.4. Stakeholder Consultation Plan

In addition to information dissemination, the sub-project will ensure consultations of PAPs in view of all sub-project activities, including environmental and social aspects. Consultations will mainly take place through community meetings. The GRM will be another means of consultation, as complaints received will be filed, assessed and responded to (see separate document).

Consultations during ESMP preparation

Project stage	Topic of consultation	Suggested Method, Time and Venue	Target stakeholders	Responsibilities
Consultations prior to remedial works about the immediate dam safety concerns	Overall sub-project activities / E&S mitigation measures	Community meetings – with social distancing	Community level stakeholders, including vulnerable groups	UNOPS
		Meetings with women's groups of other vulnerable groups – with social distancing	Vulnerable community members	UNOPS
		Consultation meetings with local headmen, dam committees and district authorities Venue: community meeting venue at the dam Time: June 2020 and April 2021	local headmen, dam committees and district authorities	UNOPS

Consultations planned for the implementation stage

Project stage	Topic of consultation	Suggested Method	Target stakeholders	Responsibilities
Consultations during remedial works	Sub-project Activities / E&S Mitigation Measures ESMP Disclosure	Community meetings (all interested community members)	Community level stakeholders	UNOPS
		Suggestion Box at district office, school, church	Community members, including vulnerable groups	IDSP Social Specialist
		Stakeholder meetings – with social distancing	Dam Committee and district level stakeholders	UNOPS
		email	National level stakeholders	UNOPS

	Venue: community meeting venue in the village or the school District council hall Time: to be agreed with the community and other stakeholders After document clearance and before construction works commence	Telephone Hotline	All stakeholders, including vulnerable groups	IDSP Social Specialist
		Dam Committee, Local Headmen, and District Disaster Committee to receive feedback in person	Community level stakeholders, including vulnerable groups	IDSP Social Specialist
		email	National level stakeholders	UNOPS

9.5. Proposed Strategy to incorporate the Views of Vulnerable Groups

UNOPS and IDSP will ensure that women, persons with disabilities, other members of vulnerable groups are participating effectively and meaningfully in consultative processes and that their voices are not ignored. This may require specific measures and assistance to afford opportunities for meetings with vulnerable groups in addition to general community consultations. For example, women may be more outspoken in women-only consultation meetings than in general community meetings. Similarly, separate meetings may be held with young people, persons with disabilities. Further, it is important to rely on other consultation methods as well, which do not require physical participation in meetings, such as social media, SMS, or radio broadcasting, to ensure that groups that cannot physically be present at meetings can participate.

In view of promoting gender equality, it is most important to engage women's groups on an ongoing basis throughout the lifetime of the sub-project. Women voicing their concerns and contributing in the decision-making process on issues such as community infrastructure should be encouraged, especially in various fora that predominantly consist of men.

GRMs are designed in such a way that all groups identified as vulnerable have access to the information and can submit their grievances and receive feedback as prescribed.

9.6. Reviews of Comments

IDSP will gather all comments and inputs originating from community meetings, suggestion boxes, GRM outcomes, and surveys. The information gathered will be submitted to the Social Specialist in the PIU, to ensure that the sub-project has general information on the perception of communities, and that it remains on target. It will be the responsibility of IDSP respectively to respond to comments and inputs, and to keep open a feedback line to the communities, as well as the local authorities. This SEP provides the overarching guidelines for the rolling out of stakeholder engagements.

10. ESMP Implementation Process

Step 1: Procurement and Bidding Process

Based on this ESMP and the designs for the Nachibanga Dam works developed, UNOPS will prepare bidding documentation to procure a contractor to implement the project works at the Nachibanga dam site. Specifications for environmental and social safeguards derived from the ESA and the ESMP shall be included in the tender documents. Bidders receive key documentation outlining the requirements of the ESMP, as well as UNOPS Health & Safety requirements (see UNOPS Health & Safety Management Plan). The bidding documents will contain a general reference to the necessity to comply with this ESMP and will detail key tasks/mitigation measures/trainings, which the contractor will be obliged to undertake as part of his deliverables. These will include the required contractor's plans, COCs for workers, reference to workers' GRM the contractor will need to provide, compulsory workers and community trainings the contractor needs to implement. The bidding documents will contain requests for a detailed budget from the contractor for the implementation of all necessary actions to comply with this ESMP and specifically risk/impact mitigation measures laid out.

Step 2: Contractor Management

UNOPS will contract the contractor. The selected contractor shall comply with all stipulations in this ESMP for the duration of the contract. These requirements equally apply to sub-contractors. It is the contractor's responsibility to ensure that subcontractors comply and demonstrate such compliance in submittals and during verification processes by UNOPS. The contractor shall engage competent Health, Safety, Social and Environmental staff on site to carry out Environmental and Social mitigation measures set out in the ESMP. The Officer will be responsible for implementation and monitoring the contractor's compliance with the ESMP requirements and the environmental specifications.

The duties of the Officer shall include but not be limited to the following: a) carry out health, safety, social and environmental site inspections to assess and audit the contractors' site practice, equipment and work methodologies with respect to pollution control and adequacy of environmental mitigation measures implemented; b) monitor compliance with mitigation and protection measures, pollution prevention and control measures and contractual requirements; c) monitor the implementation of environmental mitigation measures; d) prepare monthly status reports for the site environmental conditions; e) advise the contractor on health, safety, social and environment improvement, awareness and proactive pollution prevention measures; d) recommend suitable mitigation measures to the contractor in the case of noncompliance; e) carry out additional monitoring of noncompliance instructed by the supervisor; f) inform the contractor and supervisor of environmental issues, submit contractor's plans to the supervisor and relevant authorities, if required; and g) keep detailed records of all site activities that may relate to health, safety, social and environment.

If pre-bid meetings, site visits and / or contract commencement meetings are carried out, the social & environmental and health & safety requirements and submittals should be discussed, both for day-to-day work and for social and environmentally critical stages or activities.

- E&S/GBV Codes of Conduct are required of contractors and subcontractors and their workers (equivalent to sample in appendix C);
- Contractors provide details on contractor's oversight on environmental, social, health and safety performance;
- Contractor and sub-contractors to deploy a workers' grievance mechanism to handle the concerns

of their workers;

- Contractor shall prepare and affirm all plans and method statements required in this ESMP prior to construction activities
- Borrow pits and material sites
- Contractor emergency response plan
- Waste management
- Campsite activities
- Excavation works and stock piling
- Sanitation and water management
- Traffic management and access routes management
- Biodiversity management
- Signage design and plan
- Training, engagement and sensitization

- Contractor shall work within the requirements of legislative requirements and standards
- Contractor shall carry out any corrective actions instructed by UNOPS and IDSP. In case of non-compliances/discrepancies, the contractor shall carry out investigation and submit proposals on mitigation measures and implement remedial measures to reduce environmental impact.
- Non-compliance by the contractor may cause for suspension of works and other penalties until the non-compliance has been resolved to the satisfaction of UNOPS.

Step 3: Monitoring and Reporting Structures

UNOPS and IDSP will assign qualified and experienced environmental and social experts, as defined in the section on Institutional Arrangements. They will be responsible for routine supervising and monitoring all construction activities and for ensuring that contractor complies with the requirements of the contract.

- UNOPS will be responsible for and will oversee, supervise and monitor the works of the contractor, including the contractor's E&S performance.
- UNOPS will ensure regular supervision and monitoring of the implementation of all E&S mitigation measures laid out in this ESMP, as well as all trainings and other required activities.
- UNOPS will use the indicators all mitigation measures, as listed above in this ESMP, for its monitoring activities.
- A supervision and monitoring report will be prepared every month and shared with the PIU of ISDP and the World Bank. The contents of this report will include: progress of the civil works, implementation of the ESMP, confirmed the supervision of environmental and social specialist on site, photos records of works, camp areas, use of PPE, waste management, restoration efforts, grievances, accidents, communication, and training, among others.
- UNOPS will monitor and review all method statements prepared by the contractor to ensure that all areas that require remediation/ rehabilitation are covered and that the proposed methodologies are appropriate.
- UNOPS will take measures in the case of non-compliance. It will immediately liaise with the contractor, assess the risk level, significant and severe risks shall cause for suspension of works until the non-compliance has been resolved to the satisfaction of UNOPS. Any significant loss of time caused by the contractor's non compliance situations shall be dealt with in accordance with the set procedures in the contract.

The contractor must report on all HSSE matters related to this ESMP to UNOPS on a monthly basis. UNOPS will administer the monthly reports from the contractor, and will prepare its own quarterly reports, based

on its supervision and monitoring activities, as well as designated UNOPS activities in this ESMP to IDSP. Quarterly progress reports will include the status of the implementation of risk mitigation measures, trainings, workers' GRM, as well as lessons learnt, any adjustments made to improve E&S management and performance and corrective actions undertaken, if applicable. Quarterly reports will also be made available to the local Dam Committee and local authorities. The monitoring roles and responsibilities of the key parties/ stakeholders regarding the implementation of the ESMP shall be communicated to relevant ministries indicated.

IDSP will implement its own monitoring and supervision activities as they apply for all AF activities, including the remediation of Nachibanga Dam. IDSP has the overall responsibility for monitoring and reporting, but is supported by UNOPS' monitoring and quality assurance activities. IDSP and UNOPS will jointly discuss any necessary amendments to activities, where necessary.

Step 4: Incident Reporting

The Contractor, UNOPS, and IDSP are required to report on any incidents related to the sub-project activities. The contractor will form the incident investigation team and shall provide incident reporting on a monthly basis to UNOPS, and UNOPs will include summaries of incidents in its regular reporting to IDSP. Any incidents classified as 'severe' must be reported to the World Bank within 48 hours.

Incident reporting will follow the management and reporting process in Figure 32:

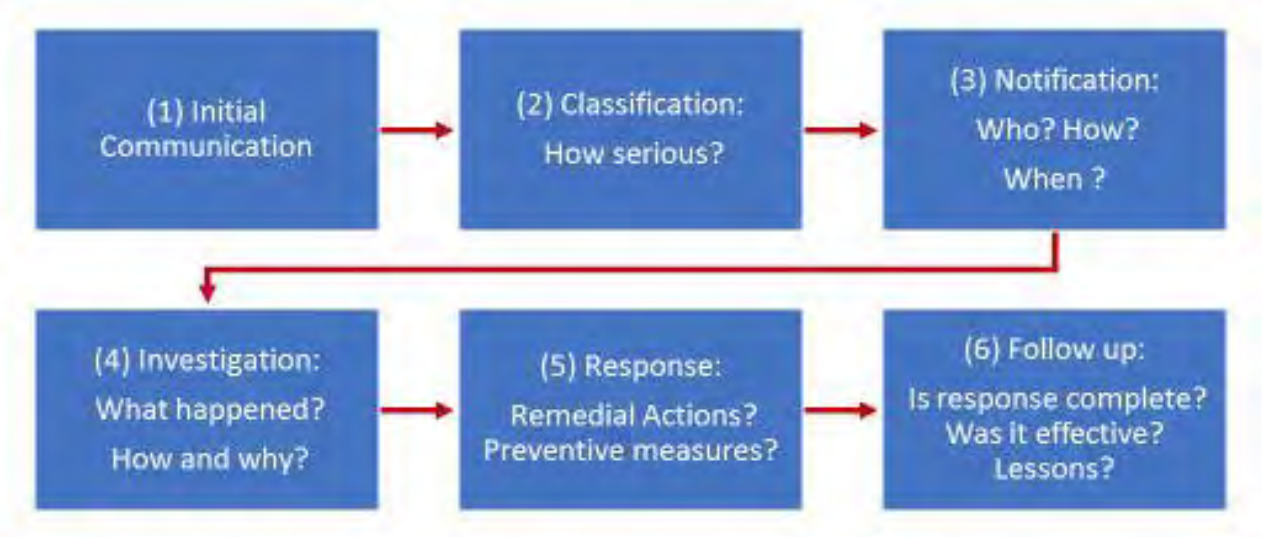


Figure 40: Incident reporting process

Incidents should be categorized into 'indicative', 'serious' and 'severe' (See Appendix G for World Bank classification of incidents).

- 'Indicative' incidents are minor, small or localized that negatively impact a small geographical area or a small number of people and do not result in irreparable harm to people or the environment.
- A 'significant' incident is one that causes significant harm to the environment, workers, communities, or natural resources and is complex or costly to reverse (see below for World Bank incident classification guide).
- A 'severe' incident causes great harm to individuals, or the environment, or presents significant reputational risks to the World Bank. Incident reports should use the format in Appendix G.

Severe incidents (an incident *that caused significant adverse effect on the environment, the affected communities, the public or workers*, e.g. fatality, GBV, forced or child labor) will be reported within 48 to UNOPS, IDSP and the World Bank.

Step 5: Handover for Operation

Once construction works and trainings are completed, UNOPS and IDSP will declare the works final. The dam will be handed over to the Nachibanga dam committee who are part of the local community and local authorities.

Remedial actions that cannot be effectively carried out during construction must be carried out on completion of the works and before issuance of the acceptance of completion. UNOPS will be responsible for accepting the final works from the contractor and receiving approvals from IDSP. IDSP will manage the handover to the local entities and ensure that the dam communities have all capacities necessary to manage the dam. IDSP will be continually engaging with the communities and local authorities until the end of its lifespan.

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Appendix A: Completed Checklist

IDENTIFICATION OF ENVIRONMENTAL AND SOCIAL RISKS RELATED TO THE REMEDIATION OF TEN - LEGACY DAM - IN ZAMBIA: Nachibanga Dam

1-Date of the visit: 16th and 17th July 2020		
Name of the Environmental Specialist filling this checklist: Pilila Chongo		
Job Position: HSSE Analyst		
Have completed training in the Environmental and Social Safeguards of the World Bank: Yes / No…Yes		
Have read the Environmental and Social Audit report and the ISDS prepared for the Additional Financing of the project: Yes / No…a Yes		
Have you read the information available of this dam: Yes / No…Yes		
Note: if you marked No in any of these questions, you are not ready to fill this checklist. Please coordinate with the PIU team to provide you with these reports.		
2-Information about the Dam		
Name of the Dam: Nachibanga Dam		
Location Pemba	**Region** Southern Province	**District** Pemba
Villages /communities	Nachibanga	
Geographical location	**Coordinate South** S16.71120°	**Coordinate East** E27.34200°
3-Remediation works- please indicate the main proposed works that could cause environmental and social impacts		
Slope works	Material sourcing	Access routes
Outlets	Erosion/ soil loosening	
Infiltration	Site preparations/ clearing	
Other	Waste management	

4.MATERIALS NEEDED		
Does the project need aggregate or a new borrow pit	Yes	
Indicate potential sources to buy or extract the construction materials:	Within the Community	
Aggregates	Within the Community	
Sand/ clay	Within the Community	
Wood	Not Applicable	
Diesel for transportation	Pemba Town	
Water source for the construction	Within the Community	
Water source for drinking for workers	Within the Community	

Contractors/builders		and Pemba Town
Estimated Number of workers to be hired for the construction works 15		**Who will pay in case of accidents or fatal accidents ……**The Contractor
Who will hire the workers	The Contractor	
Insurance provided to the workers	**Yes** ☐☐ No ☐☐Are contractors registered in Zambia in case compensations for accidents are needed	
		Contractors not yet engaged

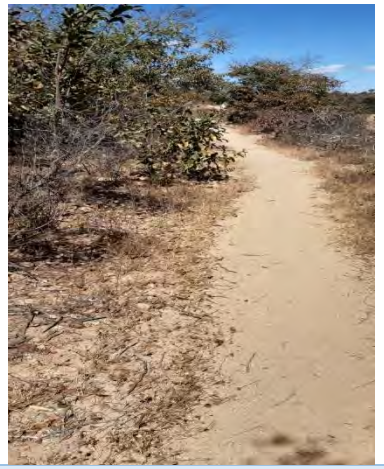
5-General environmental conditions		
Is the dam is located within a protected area, KBA, or other sensitive location?	Yes ☐ **No** ☐☐	Name of the protected area:
What are the conditions of the forest or natural vegetation in the project site	Explain: Disturbed by various anthropogenic activities	
6-Evaluation of impacts and mitigation measures to be included in the ESMP (you can use additional paper)		

Main environmental and social impacts: describe	Possible mitigation measures
Vegetation:	Re vegetation of open sites and around the Dam Minimized disturbance of forest cover
Will the construction works needs to cut trees	**Yes** X No o
If the project needs to cut trees – the project will need to plant 3 trees per 1 tree cut	Indicate local native species and fruit species that the contractor will need to plant Location Number of trees Access route and material sourcing areas- 3 trees per cut tree
Water:	Maintain water quality during works and minimize further siltation in the basin Construct VIP toilet and safely decommission
Roads:	Rehabilitate roads after works Promote community health and safety
Safety	Erect safety signage, sensitize the communities, minimize public health threats
Hazardous waste	Storage in concrete bund without an outlet to the environment. Collection of any spillages Approved disposal method.
Other:	
7-LEGACY ISSUES /REMEDIATION	
PLEASE INDICATE. Any of these legacy issues that are environmental legacies that need to be resolved by the project, costed and included in the contract of contractors. Recommend measures so the engineering team can include them in the remediation plans.	
Legacies	**Measures to be included in the ESMP**
o **Solid waste (Wood, plastic, etc)**	
o **Hazardous wastes (diesel containers, old machinery, batteries, paints, metals, contaminated waters or soil,**	
o **Borrow pits**	Decommissioning and rehabilitation of two borrow pits
o **Unsafe paths**	Rehabilitation of former contractor roads

o **Unfinished crossing points for communities**	Crossing point over the spillway and embankment is not safe Construction of animal watering points around the basin Embankment fencing
o **Other: Environmental flows and outlets**	Inclusion of outlets, flow monitoring gauges
8- Ecological Flow. Have you to coordinate with the technical team the options to improve ecological flows below the dam Yes No (you need to coordinate) Yes	
What is the flow below the dam (m^3/s)	To be confirmed-
Are wetlands below the dam No	**Are critical species present in the wetland or rivers: Yes (indicate below species)** The initial assessment using IBAT indicates presence of species that may be endangered or may require special attention. The full Biodiversity Assessment has been conducted and a BMP is being prepared.
Are people using the water below the dam? What for?	Not all year round. Only in rain season when there are downstream flows
Based on these findings, please indicate if it is possible to install a structural solution to improve the ecological flow **No** **Explain:**	**Yes Explain:** Though inlet flows upstream are low in the dry months **Structural measures** Outlets, gauges, spillway rehab **Operational measures** Flow measurements, training
9) Biodiversity. It is expected that you performed survey to the area or collect data with experts on diversity of the area for each dam. Please indicate what groups have been investigated in the project area and preliminary observations.	
Plants	Mammals
Fish	Amphibians
Macroinvertebrates	Other groups
Please indicate issues of poaching, illegal trade, and other issues affecting the area	

Presence of sensitive species:	
Critically Endangered species:	**Endangered species:**
Vulnerable species	**Migratory species:**
Protected species in Zambia:	**Endemic/rare/globally important species:**
Based on the results of the field observation, data collected and the OP 4.04 definitions	This project has natural habitat YES / NO The project area has critical habitats YES /NO
Based on the project area and the risk and potential impacts, you have identified for biodiversity –	

1-Please indicate the recommend measures to protect these species and Prepare in a separate document a Biodiversity Action Plan (BAP) **2.In the area contains critical habitat and there is ecological flow needs please request to Prepare in a separate document as a Biodiversity and Ecological Management Plan (BMP)**	
10-Final recommendation	
Name Pilila Chongo,	**Date: 20 July 2020**
Signature P.C	
Comments for the preparation of the ESMP and BAP incl. Ecological flow measures. Detailed environmental and social studies and inclusion of such matters in the designs. Further Ecological surveys	
Field visits registration	

Photo **Embankment log fencing** 	Photo ‘ Access road 
Photo **Borrow pit** 	Photo Seepage and sand bags-Spillway 
Photo	Photo

Appendix B: Chance Find Procedures

This procedure was developed to protect and preserve both tangible and intangible cultural heritage records of Zambia. This procedure is included as a standard provision in the implementation of sub-project public works contracts to ensure the protection of cultural heritage (archaeological and historical sites). All contractors as well as sub-contractors and implementers will be required to observe this procedure as documented hereafter.

Excavation in sites of known archaeological interest will not be allowed under this sub-project. Where historical remains, antiquity or any other object of cultural or archaeological importance are unexpectedly discovered during construction in an area not previously known for its archaeological interest, the following procedures should be applied:

- Stop construction activities;
- Delineate the discovered site area;
- Secure the site to prevent any damage or loss of removable objects. In case of removable antiquities or sensitive remains, a full-time guard should be present until the responsible authority takes over;
- Notify the responsible foreman/archaeologist, who in turn should notify the responsible authorities (Ministry of Tourisms and Arts), the concerned governmental officers and local authorities (within less than 24 hours);
- Responsible authorities are in charge of protecting and preserving the site before deciding on the proper procedures to be carried out;
- An evaluation of the finding will be performed by the concerned officers from the Ministry of Tourism and Arts. The significance and importance of the findings will be assessed according to various criteria relevant to cultural heritage including aesthetic, historic, scientific or research, social and economic values;
- Decision on how to handle the finding will be reached based on the above assessment and could include changes in the sub-project layout (in case of finding an irrevocable remain of cultural or archaeological importance), conservation, preservation, restoration or salvage;
- Implementation of the authority decision concerning the management of the finding;
- Construction work can resume only when permission is given from the Ministry of Tourism and Arts after the decision concerning the safeguard of the heritage is fully executed;
- In case of delay incurred in direct relation to archaeological findings not stipulated in the contract (and affecting the overall schedule of works), the contractor may apply for an extension of time. However, the contractor will not be entitled for any kind of compensation or claim other than what is directly related to the execution of the archaeological findings works and protections.

Appendix C: Sample Code of Conduct for Workers

United Nations Charter: The values enshrined in the United Nations (UN) Charter, *respect for fundamental human rights, social justice and human dignity, and respect for the equal rights of men and women*, serve as overarching values to which suppliers of goods and services to the UN1 are expected to adhere.

Global Compact: The Global Compact is a voluntary international corporate citizenship network initiated to support the participation of both the private sector and other social actors to advance responsible corporate citizenship and universal social and environmental principles to meet the challenges of globalization. The UN strongly encourages all suppliers to actively participate in the Global Compact. And to that end, this Code of Conduct has been developed with recognition of the importance of the ten principles of the UN Global Compact and is viewed as an important means of integrating the Compact into the operations of the UN. The Code of Conduct addresses the issues included in the Compact in the areas of human rights, labor, environment and anti-corruption and interpretation of the Code should be undertaken in a manner consistent with the Global Compact. Suppliers interested in supporting the Global Compact and obtaining more information on the ten principles, can visit the Global Compact website at www.unglobalcompact.org.

International Labor Conventions and Recommendations: The International Labor Standards (i.e., Conventions and Recommendations) as established by the tripartite UN specialized agency, the International Labor Organization (ILO), have served as the foundation on which much of this Code of Conduct is based. It is the UN´s expectation that any supplier providing products or services to the UN will, in addition to the values of the UN Charter, adhere to the principles concerning International Labor Standards summarized below in paragraphs 4 – 9.2

1. Scope of Application:
The UN expects that these principles apply to suppliers and their employees, parent, subsidiary or affiliate entities and subcontractors. The UN expects suppliers to ensure that this Code of Conduct is communicated to their employees, parent, subsidiary and affiliated entities as well as any subcontractors, and that it is done in the local language and in a manner that is understood by all. In order for a supplier to be registered as a UN supplier or to do business with the UN, the supplier is required to read and acknowledge that this Code of Conduct provides the minimum standards expected of UN Suppliers. In addition, suppliers should note that certain provisions of this Code of Conduct will be binding on the supplier in the event the supplier is awarded a contract by the UN pursuant to the terms and conditions of any such contract. Failure to comply with certain provisions may also preclude suppliers from being eligible for a contract award, as reflected in the solicitation documents of one or more organizations in the UN. Prospective suppliers are invited to review the specific terms and conditions of contract and procurement policies of the organization(s) within the UN with which they would like to do business in order to ascertain their current and future eligibility.

2. Continuous Improvement:
The provisions as set forth in this Code of Conduct provide the minimum standards expected of suppliers to the UN. The UN expects suppliers to strive to exceed both international and industry best practices. The UN also expects that its suppliers encourage and work with their own suppliers and subcontractors to ensure that they also strive to meet the principles of this Code of Conduct. The UN recognizes that reaching some of the standards established in this Code of Conduct is a dynamic rather than static process and encourages suppliers to continually improve their workplace conditions accordingly.

3.Management, Monitoring and Evaluation:
It is the expectation of the UN that its suppliers, at a minimum, have established clear goals toward meeting the standards set forth in this Code of Conduct. The UN expects that its suppliers will establish and maintain appropriate management systems related to the content of this Code of Conduct, and that they actively review, monitor and modify their management processes and business operations to ensure they align with the principles set forth in this Code of Conduct. Supplier participants in the Global Compact are strongly encouraged to operationalize its principles and to communicate their progress annually to stakeholders.
Labour:

4. Freedom of Association and Collective Bargaining: The UN expects its suppliers to recognize the freely-exercised right of workers, without distinction, to organize, further and defend their interests and to bargain collectively, as well as to protect those workers from any action or other form of discrimination related to the exercise of their right to organize, to carry out trade union activities and to bargain collectively.

5. Forced or Compulsory Labor: The UN expects its suppliers to prohibit forced or compulsory labor in all its forms.

6. Child Labor: The UN expects its suppliers not to employ: (a) children below 14 years of age or, if higher than that age, the minimum age of employment permitted by the law of the country or countries where the performance, in whole or in part, of a contract takes place, or the age of the end of compulsory schooling in that country or countries, whichever is higher; and (b) persons under the age of 18 for work that, by its nature or the circumstances in which it is carried out, is likely to harm the health, safety or morals of such persons.

7. Discrimination: The UN expects its suppliers to ensure equality of opportunity and treatment in respect to employment and occupation without discrimination on grounds of race, colour, sex, religion, political opinion, national extraction or social origin and such other ground as may be recognized under the national law of the country or countries where the performance, in whole or in part, of a contract takes place. The UN expects its suppliers to take all appropriate measures to ensure that neither themselves nor their parent, subsidiary, affiliate entities or their subcontractors are engaged in any gender-based or other discriminatory employment practices, including those relating to recruitment, promotion, training, remuneration and benefits.

8. Wages, Working Hours and Other Conditions of Work: The UN expects its suppliers to ensure the payment of wages in legal tender, at regular intervals no longer than one month, in full and directly to the workers concerned. Suppliers should keep an appropriate record of such payments. Deductions from wages are permitted only under conditions and to the extent prescribed by the applicable law, regulations or collective agreement and suppliers should inform the workers concerned of such deductions at the time of each payment. The wages, hours of work and other conditions of work provided by suppliers should be not less favorable than the best conditions prevailing locally (e.g. collective agreements covering a substantial proportion of employers and workers / arbitration awards / applicable laws or regulations) for work of the same character performed in the trade or industry concerned in the area where work is carried out.

9. Health and Safety: The UN expects its suppliers to ensure, so far as is reasonably practicable, that: (a)

the workplaces, machinery, equipment and processes under their control are safe and without risk to health; (b) the chemical, physical and biological substances and agents under their control are without risk to health when the appropriate measures of protection are taken; and (c) where necessary, adequate protective clothing and protective equipment are provided to prevent, so far as is reasonably practicable, risk of accidents or of adverse effects to health.

Human Rights:

10. Human Rights: The UN expects its suppliers to support and respect the protection of internationally proclaimed human rights and to ensure that they are not complicit in human rights abuses.

11. Harassment, Harsh or Inhumane Treatment: The UN expects its suppliers to create and maintain an environment that treats all employees with dignity and respect. The UN further expects that its suppliers, as well as their parent, subsidiary and affiliated entities along with any subcontractors, will neither use or engage in, nor allow their employees or other persons engaged by them to use or engage in, any: threats of violence, verbal or psychological harassment or abuse, and/or sexual exploitation and abuse. Sexual exploitation and abuse violate universally recognized international legal norms and standards and have always been unacceptable behavior and prohibited conduct for the UN. Prior to entering into agreements with the UN, suppliers are informed of the standards of conduct with respect to the prohibition of sexual exploitation and abuse, expected by the UN. Such standards include, but are not limited to, the prohibition of: (i) engaging in any sexual activity with any person under the age of 18, regardless of any laws of majority or consent, (ii) exchanging any money, employment, goods, services, or other things of value, for sex, and/or (iii) engaging in any sexual activity that is exploitive or degrading to any person. The UN expects its suppliers to take all appropriate measures to prohibit their employees or other persons engaged by the suppliers, from engaging in sexual exploitation and abuse. The UN also expects its suppliers to create and maintain an environment that prevents sexual exploitation and abuse. United Nations contracts will contain provisions concerning a supplier´s obligation to take appropriate measures to prevent sexual exploitation and abuse. The failure by a supplier to take preventive measures against sexual exploitation or abuse, to investigate allegations thereof, or to take corrective action when sexual exploitation or abuse has occurred, constitute grounds for termination of any agreement with the United Nations. Moreover, no harsh or inhumane treatment coercion or corporal punishment of any kind is tolerated, nor is there to be the threat of any such treatment.

12. Mines: The UN expects its suppliers not to engage in the sale or manufacture of anti-personnel mines or components utilized in the manufacture of anti-personnel mines.

Environment:

13. Environmental: The UN expects its suppliers to have an effective environmental policy and to comply with existing legislation and regulations regarding the protection of the environment. Suppliers should wherever possible support a precautionary approach to environmental matters, undertake initiatives to promote greater environmental responsibility and encourage the diffusion of environmentally friendly technologies implementing sound life-cycle practices.

14. Chemical and Hazardous Materials: Chemical and other materials posing a hazard if released into the environment are to be identified and managed to ensure their safe handling, movement, storage, recycling or reuse and disposal.

15. Wastewater and Solid Waste: Wastewater and solid waste generated from operations, industrial processes and sanitation facilities are to be monitored, controlled and treated as required prior to discharge or disposal**.**

16. Air Emissions: Air emissions of volatile organic chemicals, aerosols, corrosives, particulates, ozone depleting chemicals and combustion by-products generated from operations are to be characterized, monitored, controlled and treated as required prior to discharge or disposal.

17. Minimize Waste, Maximize Recycling: Waste of all types, including water and energy, are to be reduced or eliminated at the source or by practices such as modifying production, maintenance and facility processes, materials substitution, conservation, recycling and re-using materials.

Ethical conduct:

18. Corruption: The UN expects its suppliers to adhere to the highest standards of moral and ethical conduct, to respect local laws and not engage in any form of corrupt practices, including but not limited to extortion, fraud or bribery.

19. Conflict of Interest: UN suppliers are expected to disclose to the UN any situation that may appear as a conflict of interest, and disclose to the UN if any UN official or professional under contract with the UN may have an interest of any kind in the supplier's business or any kind of economic ties with the supplier.

20. Gifts and Hospitality: The UN will not accept any invitations to sporting or cultural events, offers of holidays or other recreational trips, transportation, or invitations to lunches or dinners. The UN expects its suppliers not to offer any benefit such as free goods or services, employment or sales opportunity to a UN staff member in order to facilitate the suppliers´ business with the UN.

21. Post-employment restrictions: Post-employment restrictions may apply to UN staff in service and former UN staff members who participated in the procurement process, if such persons had prior professional dealings with suppliers. UN suppliers are expected to refrain from offering employment to any such person for a period of one year following separation from service.

Appendix D: Managing COVID-19 risks

UNOPS Guidelines for Construction Sites[24]

These requirements should be mandatory for UNOPS and all contractors, they should be issued in a formal, written instruction to the contractor using the template provided below.

Requirements: Construction sites should be treated like offices, with the following steps to be discussed with the Contractor and enforced by the UNOPS site supervisor.

General

1. Ensure that the people meeting the following criteria will not come to site:
    - any personnel showing symptoms of coughing, difficulty in breathing, fever, tiredness, aches and pains, nasal congestion, runny nose, sore throat or diarrhea, until a medical certificate is provided;
    - vulnerable persons (by virtue of their age, underlying health condition, clinical condition or are pregnant)
    - any person living with someone in self-isolation or a vulnerable person.
2. In the case that a worker is detected with COVID-19 the site will be closed and workers in contact with the individual will be required to self-isolate for 14 days until medical all-clear is granted.
3. Social distancing of at least 1 meter should be maintained at all times between personnel. Handshakes, hugs and other close contact interactions are therefore prohibited on site.
4. Hand washing station posted at the site entrance, with soap for all workers and people entering the site, and additional stations at locations in the site that make it possible for workers to frequently wash their hands. Hand sanitizers should be provided where hand washing facilities are unavailable to point.
5. A focal point to implement and monitor prevention measures should be designated.
6. No masks are needed on site for work unless hazardous materials are being used.
7. In case of any infringements, UNOPS will stop work of the contractor and delays that incur penalties will be the responsibility of the contractor.
8. UNOPS will refuse access to the site to any individuals seen breaking the hygiene protocols and may require the contractor to stop all works immediately.
9. UNOPS must cooperate with the Zambia country directives in response to the COVID-19 pandemic.
10. All cases should be reported to UNOPS as soon as detected, as well as to local health authorities.
11. These protocols are to be recorded as part of the HSSE requirements for the site.

Travel to sites

12. Wherever possible, workers should travel to site alone using their own transport.
13. Risk assessments should be used to determine the risks for local travel to sub-project sites and precautionary measures should be applied if these are deemed necessary.
14. Sites need to consider:
    - Parking arrangements for additional cars and bicycles

[24] This document was developed by field personnel and added to by construction personnel all over UNOPS. It should continue to be commented on by everyone, as we understand more about the virus and think of better ways to protect.

- Other means of transport to avoid public transport e.g. cycling
- How someone taken ill would get home.

Site Access Points

15. Focal point appointed by UNOPS or the contractor, with the site supervisor, will check the temperature and ensure hand washing prior to site entry of all personnel.
    - Focal point should have a thermometer to do so.
    - For larger sites, a nurse or medical staff may be provided, however, the goal is not to treat personnel who may have COVID-19, but identify any symptoms and ensure personnel are immediately removed from the site.
16. Focal point should ask the following questions to the staff:
    - Have you had a fever or other symptoms of the COVID-19 in the past 2 weeks?
    - Is there anyone in your household who has the symptoms or is ill with COVID-19?
    - Is there any person in your neighborhood or community who has been diagnosed with COVID-19?
    - Have you been abroad or in contact with travelers from different countries?
17. Ensure personnel wash or clean their hands before entering or leaving the site.
18. Stop all non-essential visitors.
19. Introduce staggered start and finish times to reduce congestion and contact at all time, if possible. Take into consideration appropriate timings for men and women, according to their other responsibilities. If there are fewer workers on sites ensure safety of female workers from sexual harassment (PSEA issues).
20. Monitor site access points to enable social distancing – site supervisor may need to change the number of access points, either increase to reduce congestion or decrease to enable monitoring.
21. Remove or disable entry systems that require skin contact e.g. fingerprint scanners
22. Reduce the number of people in attendance at site inductions and consider holding them outdoors wherever possible, also ensure 1 meter distance between participants during the inductions.
23. Drivers should remain in their vehicles if the load will allow it and must wash or sanitize their hands before unloading goods and materials.

Communication and awareness

24. Daily briefing on how to prevent exposure to COVID-19 and on the control measures in the site should be delivered.
25. Post posters about proper handwashing and respiratory hygiene at different sub-project sites (work fronts, temporary offices, and the sub-project operations campus)

Canteens and Eating Arrangements

26. Hand washing is enforced before mealtimes.
27. All personnel should be advised to observe safe distances during eating times.
28. All personnel should avoid sharing food and drinks with colleagues
29. The workforce should be asked to bring pre-prepared meals and refillable drinking bottles from home.
30. Site eating areas will be disinfected daily by the contractor.
31. All rubbish should be put straight in the bin and not left for someone else to clear up.
32. Where catering is provided on site, it should provide pre-prepared and wrapped food only. Where possible payment arrangements should be made such there will be no need to exchange money

e.g. contactless cards or pre-arranged monthly payments. Crockery, eating utensils, cups etc. should not be used.

Changing Facilities, Showers and Drying Rooms

33. Introduce staggered start and finish times to reduce congestion and contact at all times. Take into consideration appropriate timings for men and women, according to their other responsibilities.
34. Consider increasing the number or size of facilities available on site if possible.

Avoiding Close Working

There will be situations where it is not possible or safe for workers to distance themselves from each other by 1 meter. The following general principles should be applied:

35. Safety critical work should still be carried out with adequate personnel and under adequate levels of supervision to avoid incidents that may lead to loss of life.
36. Non-essential physical work that requires close contact between workers should not be carried out.
37. Work requiring skin to skin contact should not be carried out.
38. Plan all other work to minimize contact between workers.
39. Establish working groups to minimize the movement of people in the sub-project area to facilitate traceability and control, in case any possible contagion is identified.
40. Re-usable PPE should be thoroughly cleaned after use and not shared between workers. Ensure that female workers are given PPE purposefully designed for women.
41. Single use PPE should be disposed of so that it cannot be reused.
42. Stairs should be used in preference to lifts or hoists.
43. Increase ventilation in enclosed spaces.
44. Regularly clean the inside of vehicle cabs and between use by different operators.

Site Meetings

45. Only absolutely necessary meeting participants should attend.
46. Attendees should be 1 meter apart from each other.
47. Rooms should be well ventilated / windows opened to allow fresh air circulation.
48. Consider holding meetings in open areas where possible.

Cleaning

49. Enhanced cleaning procedures should be in place across the site, particularly in communal areas and at touch points including:
    - Taps and washing facilities
    - Toilet flush and seats
    - Door handles and push plates
    - Hand rails on staircases and corridors
    - Lift and hoist controls
    - Machinery and equipment controls
    - Food preparation and eating surfaces
    - Telephone equipment
    - Key boards, photocopiers and other office equipment
50. Rubbish collection and storage points should be increased and emptied regularly throughout and at the end of each day
51. Hired vehicle vendors should be informed to sanitize the interior of their vehicles daily. Drivers to be informed about the preventive measures as well.

52. Personnel using motorbikes should also sanitize the areas of the bike most touched.

Procedure in case of contagion

Any worker with symptoms of the COVID-19 should:

- Notify the supervisor that he/she is not fit to work
- Stay home for at least 14 days
- Maintain a minimum temperature control twice a day
- Report any person in his/her household of these symptoms and inform the supervisor
- Notify the doctor or health service if symptoms do not disappear or worsen.

Any personnel who is confirmed to be diagnosed with COVID-19 should report to the Health and Safety Advisor and the Manager on the site immediately. The reporting procedure should be in line with the EOI.CSG.2017.02 on Reporting and Management of Health & Safety and Social & Environmental incidents.

UNOPS Construction Site Supervision

Guidance: UNOPS personnel are expected to continue to work with contractors and other site personnel, unless there is a stop work order issued by the government. In the case that UNOPS personnel need to visit home in order to support family / relatives, this is understood and personnel may take leave. The sub-project will, if possible, seek additional UNOPS personnel to cover the gap in supervision, to ensure the quality of work continues to be maintained and that work site safety and COVID-19 procedures are followed.

Field Offices < 6 People and Field Monitoring

Requirements: In the general case that personnel are working and living in the same office, "work from home" is similar / same in terms of people as the office. In this case, personnel may continue to work in the office that they live in, however, "Reduced Contact Work" is advised. For field monitoring this involves:

- Ensure when visiting sub-project sites, physical distancing is maintained.
- Avoid consultations, meetings, gatherings which involve a large number of people, beyond the government advice, both for organizing and being a part of. For essential business requirements, limit the number of people (below 10) ensuring physical distance.
- Minimize travel which requires personnel traveling in a partner's vehicle or vice versa. Ensure adequate measures are taken.
- Any discussions with home owners or contractors are outdoors, at 1 meter distance.
- Offices maintain the same protocols with washing hands prior to entry.

In case travel restrictions involve being restricted from any movement at all, personnel will be encouraged to work from home.

Short monitoring/handover missions (for multiple sites)

- Create clusters of 10/15 sites to visit. Sites should be geographically close and visitable in a one (long) day mission.
- Prepare maps of those clusters of sites, including travel distances.
- Prepare mission timetables with detailed timing for each activity (visit of site A, movement, visit of site B, etc.).
- Ask the contractor to submit pictures and videos of sites ready for handover in a pre-handover evidence folder of the teamdrive shared with the contractor.
- Review submissions in detail and pre-clear the sites ready for handover.
- Coordinate with the client and make precise appointments for handover activities, update the mission timetable according to availability of client's representatives.

- Arrange cars for standalone trips of our Site Supervisors (cars should be provided with water tanks, soap, sanitizer, PPE, lunchboxes, etc.).
- Brief and debrief our Site Supervisors prior/after each handover mission.

For HSSE specific guidance and support, please see the following UNOPS intranet links, or write to hse@unops.org:
https://intra.unops.org/operations/oversight/risk-management/hsse
https://intra.unops.org/news/announcements/update-on-the-coronavirus-covid-19-outbreak
https://intra.unops.org/operations/oversight/risk-management/hsse/covid19-response-update

IRRIGATION DEVELOPMENT SUPPORT PROJECT (IDSP)

COVID-19 Response Planning and Monitoring

August 21, 2020

Project Name, P#, and contract #	Contract/ activity	Impact of Corona virus on operation	Action identified	Responsible for Action	Anticipated Impact Colour Coding levels of Risk: High = RED; Substantial = Orange; Moderate = Yellow and Low = Green Likelihood: Highly Likely=HL; Extremely likely=EL; Not likely=NL Timing: Short-term=ST; Mid-Term; Long-Term=LT			
					Description	Level (H, S, M, L)	Likelihood HL/ EL /NL	Timing (ST/ MT/LG)
IDSP								

Appendix E: Template for Conditions of Contract

DIRECTION TO IMPLEMENT HEALTH AND SAFETY MEASURES - COVID 19 EPIDEMIC

Dear Sir
[*insert name of contract*] ("Contract")
This is a Notice served under Sub-Clause xxx of the Contract.
Taking into account the circumstances arising out of the Covid-19 pandemic, the Employer's Representative, hereby, instructs you to implement the Health and Safety measures that are listed in appendix 1 of this notice.
These measures are deemed to be reasonable precautions to maintain the health and safety of the Contractor's Personnel and as such are not additional to your existing obligations under the Contract and shall not be considered as a Variation.
The Employer's Representative also reminds the Contractor of its obligations under Sub-Clause 6.16 which states that:

> *In the event of any outbreak of illness of an epidemic nature, the Contractor shall comply with and carry out such regulations, orders and requirements as may be made by the Authorities or local medical or sanitary authorities for the purpose of dealing with or overcoming the epidemic.*

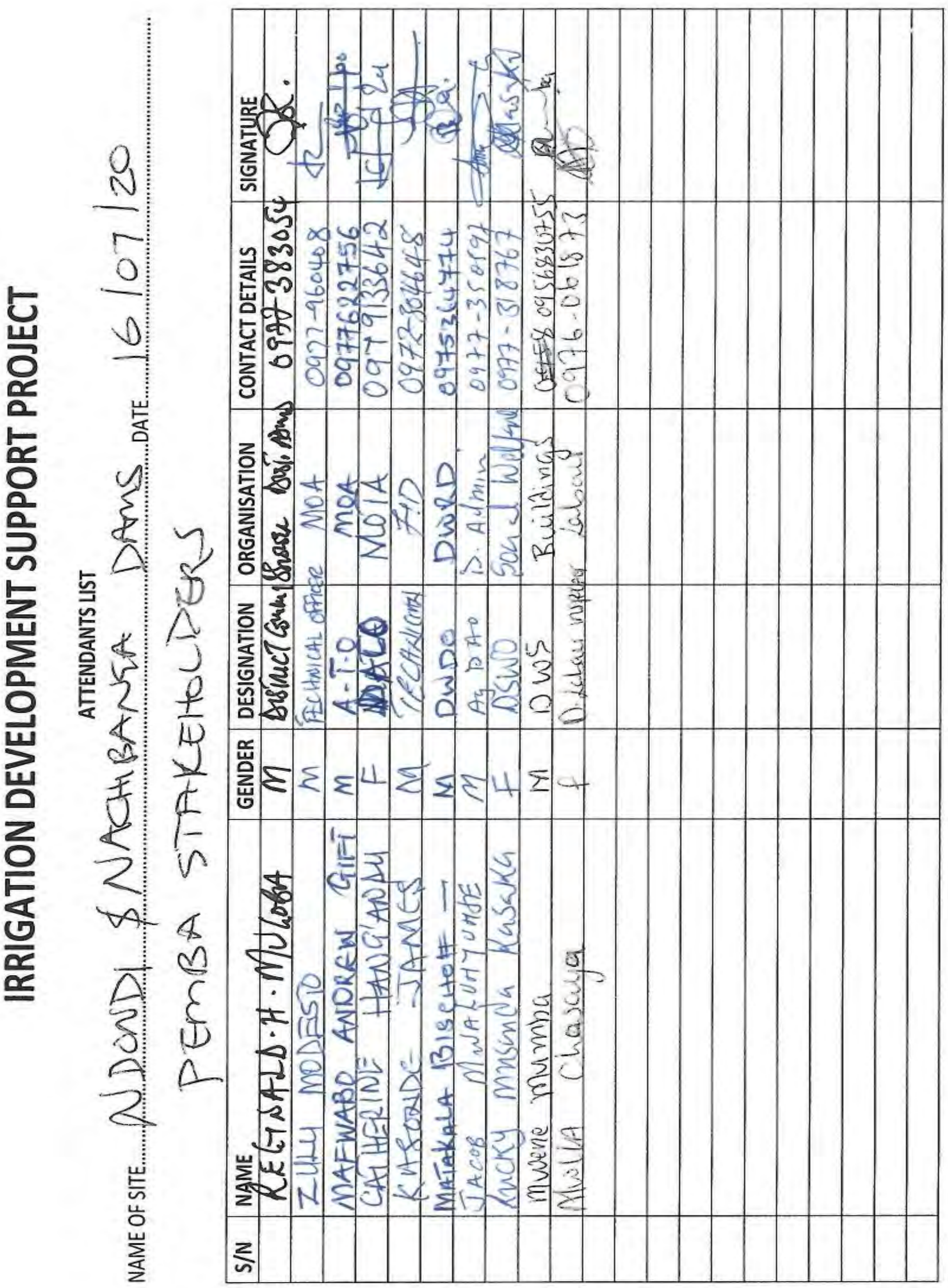
The Contractor is required to submit evidence of its compliance with the above health and safety measures by [*insert date*].

Yours faithfully

……
[*Employer's Representative*]
for and on behalf of UNOPS

Appendix F: Attendance Sheets Stakeholder Consultations and Dam Committee

Attendance sheet



IRRIGATION DEVELOPMENT SUPPORT PROJECT

ATTENDANTS LIST

NAME OF SITE: NDONDI & NACHIBANGA DAMS DATE: 16/07/20

PEMBA STAKEHOLDERS

S/N	NAME	GENDER	DESIGNATION	ORGANISATION	CONTACT DETAILS	SIGNATURE
	REGINALD H. MULOBA	M	District Comm.	Dist. Admin	0977-383054	
	ZULU MODESTO	M	TECHNICAL OFFICER	MOA	0977-960408	
	MAFWABO ANDREW GIFT	M	A-T-O	MOA	0977622756	
	CATHERINE HANG'ANDU	F	DACO	MOIA	0979133642	
	KASONDE JAMES	M	TECHNICIAN	FD	0972-304648	
	MATAKALA BISCHOFF	M	DWDO	DWRD	0975364774	
	JACOB MWALUNYUNDE	M	Ag DAO	D. Admin	0977-350197	
	LUCKY MUSONDA KASAKA	F	DSWO	Social Welfare	0977-318767	
	Mwene Mumba	M	DWS	Buildings	0956830755	
	Mulila Chasaya	f	D. Labour Officer	Labour	0976-061873	

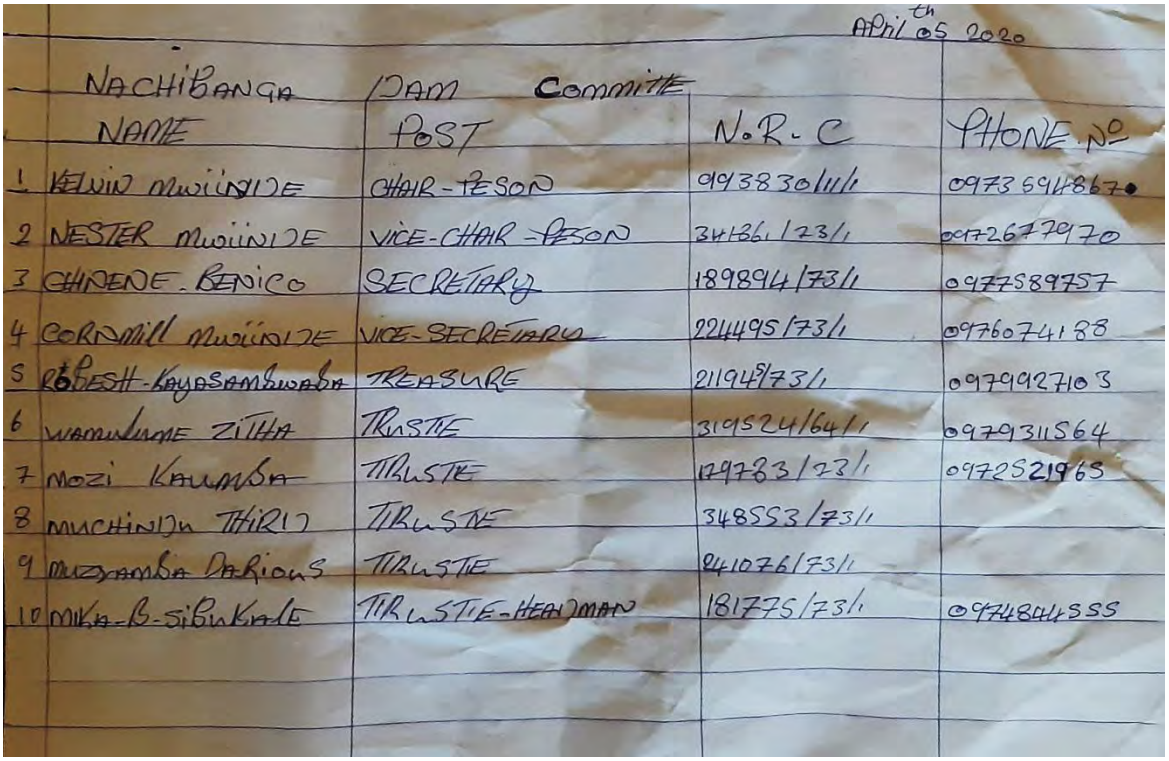
IRRIGATION DEVELOPMENT SUPPORT PROJECT

ATTENDANTS LIST

NAME OF SITE: NACHIBANGA DAM DATE: 16-07-2020

S/N	NAME	GENDER	DESIGNATION	ORGANISATION	CONTACT DETAILS	SIGNATURE
01	MWILINDE KELVIN	M	CHAIRMAN		0973594867	
02	CHINENE BENICO	M	SECRETARY		0977589757	B. Chinene
03	SIBUKALE KENNEDY A	M			0977444629	
04	ALICK Mukonka	M			0978897450	AMka
05	ELVIS LILANDA	M			0953005487	
06	STOBIA MUMKOMBWE	M			0954557150	
07	EMISON SIMALUMBA	M			0976902576	
08	Miyanda Mazzi Kooma	F	Committee		0975965615	
09	Florence Mudenda	F				F. Mudenda
10	priscar mwiindi	F			0979237333	P. Mwiindi
11	Brendah Chibomba	F			0975882172	F. Chibomba
12	Clarence sibukali	F			0977619962	C. Sibukali
13	Getrude Malundu	F			0972860102	G Malundu
14	Vestina chamana	F				V. Chamana
15	Beauty Munsanje	F				B. Munsanje

Dam committee



April 05th 2020

NACHIBANGA DAM COMMITTE

	NAME	POST	N.R.C	PHONE NO
1	KELVIN MUSIINDE	CHAIR-PESON	994383011/1	0973594867
2	NESTER MUSIINDE	VICE-CHAIR-PESON	341861/23/1	0972677970
3	CHINENE. BENICO	SECRETARY	189894/73/1	0977589757
4	CORNMILL MUSIINDE	VICE-SECRETARY	224495/73/1	0976074188
5	BESH-KAYOSAMBWABA	TREASURE	211948/73/1	0979992703
6	WAMULUME ZITHA	TRUSTIE	319524/64/1	0979311564
7	MOZI KAUMBA	TRUSTIE	129783/23/1	0972521965
8	MUCHINJA THIRIJ	TRUSTIE	348553/73/1	
9	MUZAMBA DARIOUS	TRUSTIE	941076/73/1	
10	MIKA-B-SIBUKALE	TRUSTIE-HEADMAN	181775/73/1	0974844555

Appendix G: World Bank Incident Classification Guide and Incident Report Form

Indicative

- Relatively minor and small-scale localized incident that negatively impacts a samll geographical areas or small number of people
- Does not result in significant or irreparable harm
- Failure to implement agreed E&S measures with limited immediate impacts

Serious

- An incident that caused or may potentially cause significant harm to the environment, workers, communities, or natural or cultural resources
- Failure to implement E&S measures with significant impacts or repeated non-compliance with E&S policies incidents
- Failure to remedy Indicative non-compliance that may potentially cause significant impacts
- Is complex and/or costly to reverse
- May result in some level of lasting damage or injury
- Requires an urgent response
- Could pose a significant reputational risk for the Bank.

Severe

- Any fatality
- Incidents that caused or may cause great harm to to the environment, workers, communities, or natural or cultural resources
- Failure to remedy serious non-compliance that may potentially cause significant impacts that cannot be reversed
- Failure to remedy Serious non-compliance that may potentially cause severe impactsIs complex and/or costly to reverse
- May result in high levels of lasting damage or injury
- Requires an urgent and immediate response
- Poses a significant reputational risk to the Bank.

An incident report should contain the following information:

Incident Report Form

Please report any incident within 24 hours to UNOPS:

Contractor	
Dam Site	
Report Date	
Reported By (Name and Title)	

i. Details of Incident

Incident Date	
Incident Time	
Incident Place	

ii. Identification of Type of Incident and Immediate Cause

1. Select the type of the incident from the list below. An incident can be classified at the same time as health&safety/environmental/social.

Type of Incident: (and incident can cover more than one type):

Type of Incident – Health & Safety		Type of Incident – Social	Type of Incident - Environmental
Moving Machinery/vehicles at project site	Dust, Fumes, Vapours that impact the population and/or environment	Misuse of UNOPS property	Chemical/Oil Spill with impact on population and/or environment
Powered Hand tools	Noise	Damage to Cultural Heritage	Improper Disposal Waste
Hand Tools	Temperature or heat	Occurrence of infringement of labor rights	Disasters (Earthquake, Flood, etc)
Animals or insects	Overexertion	Occurrence of infringement of human rights	Water Pollution/ Sedimentation
Fire or Explosion at sub-project site	Structural Failure	Strike, demonstration	Damage to ecosystems (e.g. damage to flora/fauna)
Trips & smaller falls	Chemical/biological	Other (please specify)	Odor air Emissions
Drowning	Stress	GBV/SEA or Child Risks	Dust, Fumes, Vapors, Air pollution with impact on population and/or environment
Borrow-pit Management	Other (please specify)		Other (please specify)

2. For each type of incident, select the relevant descriptor(s) from the list. You can select up to 5 descriptors for each type of incident. If a descriptor is not listed below, please type in short descriptor in "Other". Add more rows as necessary.

Incident Type	Descriptor 1	Descriptor 2	Descriptor 3	Descriptor 4	Descriptor 5	Other
Health & Safety						
Social						
Environmental						

Provide a description of the immediate cause of the incident:

iii. Description of the Incident

Record all facts prior to and including the incident, if it was a planned activity, describe/list material, ecosystem and property damaged, etc:

iv. Root Cause Analysis

Select the root cause(s) of the incident from the list below. If 'Other', please specify:

Root Cause	Yes	No
Improper Planning		
Poor Maintenance		
Poor Supervision		
Poor Quality of Equipment		
No rules, standards, or procedures		
Lack of knowledge or skills		
Improper motivation or attitude		
Failure to comply with rules		
Other		

Additional Questions:
- Is the incident still ongoing or is it contained?
- Is loss of life or severe harm involved?
- What measures have been or are being implemented by the Implementer?

Appendix H: Summary of Construction Contractor Training Requirements

Training content	Number of days	Trainers/Supervision	Participants
Dam Safety-Emergency preparedness, and Community health and safety			
Emergency preparedness: Hazards, and dam failure, roles and responsibilities, emergency preparedness, emergency response procedures and grievance redress mechanism *Community health and safety: Safety talks, Pedestrian access infrastructure, Construction safety, Gender based violence, waste management, swimming risks, drowning risks, dam security, spillway crossing risks, management of livestock around the dam, use of dam water for drinking, malaria prevention and management, pollution prevention, bilharzia prevention and management and water borne diseases* *First aid: First aid basics and response*	Throughout	Construction Contractor Supervision UNOPS: Environmental Specialist Environmental Health and Safety Specialist Dam Safety Specialist IDSP: Dam Safety Specialist Environmental Specialist	All staff Community members Contractor's first aiders
Grievance Redress Mechanism and ESMP requirements			
Sharing of the Environmental and Social Management Plan (ESMP) by Contractor to site accessing persons *Environmental management plans* *Grievance redress mechanism*	Throughout	Construction Contractor Supervision UNOPS: Environmental Specialist Environmental health and safety Specialist Dam Safety Specialist IDSP: Dam safety Specialist Environmental Specialist	All staff Community members