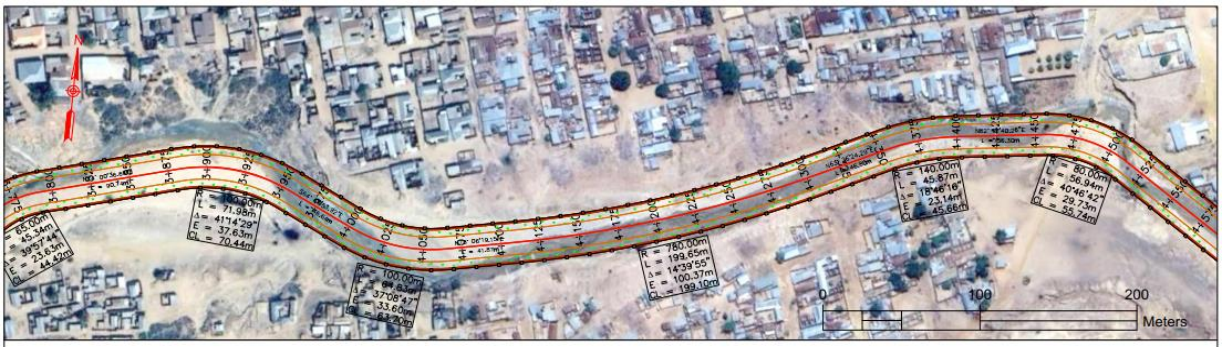
FEDERAL GOVERNMENT OF NIGERIA
GOMBE STATE GOVERNMENT

Agro-Climatic Resilience in Semi-Arid Landscapes Project

(ACReSAL)

(World Bank Assisted Project)



Draft Report for

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

GGC Doma/Bogo Erosion and Flood Control Site

in Gombe, Gombe State

Nigeria

JUNE 2024

DRAFT REPORT

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

FOR

GGC DOMA/BOGO EROSION AND FLOOD CONTROL, GOMBE STATE

SUBMITTED BY

THE STATE PROJECT MANAGEMENT UNIT (SPMU)

GOMBE STATE AGRO-CLIMATIC RESILIENCE IN SEMI-ARID LANDSCAPES (GM-ACReSAL) PROJECT

OPPOSITE NNPC DEPOT
NEAR WAMLARA GUEST HOTEL
TUMFURE GOMBE
GOMBE STATE

JUNE 2024

Prepared by Murtala Muhammad Tel: +234 (803)7051250**;** (mmbadamasi@gmail.com)

Table of Contents

TABLE OF CONTENTS I
LISTS OF TABLES V
LISTS OF FIGURES I
LISTS OF PLATES II
ACRONYMS I
EXECUTIVE SUMMARY IV

CHAPTER ONE: GENERAL INTRODUCTION 1

1.1 BACKGROUND 1
1.2 ACRESAL PROJECT DEVELOPMENT OBJECTIVE AND COMPONENTS 1
1.2.1 The Project Development Objective 1
1.2.2 The ACReSAL Project Components 2
1.3 DESCRIPTION OF SUB-PROJECT/ INTERVENTION SITE 2
1.4 SUB-PROJECT ACTIVITIES AND RELATED SPECIFIC WORKS 5
1.4.1 Structural and Construction Requirements. 6
1.5 ESMP RATIONALE, OBJECTIVE AND PREPARATION APPROACH 8
1.5.1 ESMP Rationale and Objectives 8
1.5.2 Approach and Methodology for ESMP 10
1.6 SUB-PROJECT PHASES COVERED BY THE ESMP 10
1.7 STRUCTURE OF THE REPORT 13

CHAPTER TWO: INSTITUTIONAL AND LEGAL FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT 1

2.1 INTRODUCTION 1
2.2 WORLD BANK ENVIRONMENTAL AND SOCIAL STANDARDS 1
2.2.1 World Bank Environmental and Social Standards triggered by the ACRESAL Project 1
2.3 INTERNATIONAL CONVENTIONS AND AGREEMENTS 5
2.3 NATIONAL LEGISLATIVE ENVIRONMENTAL REGULATORY INSTRUMENTS 6
2.3.1 National Policy on Environment (1988) 6
2.3.2 Environmental Impact Assessment (EIA) Act No. 86 of 1992, CAP E12, LFN 2004 6
2.3.3 National Climate Change Policy (2021-2030) 7
2.3.4 Land Use Act of 1978 (CAP L5 LFN2004) 8
2.3.5 National Environmental Standards and Regulation Enforcement Agency (NESREA) ACT 2007 8
2.3.6 The Harmful Waste (Special Criminal Provision Etc.) Act 1988 9
2.3.7 National Guidelines on Environmental Management Systems (1999) 9
2.3.8 National Guidelines on Environmental Auditing (2001) 10
2.3.9 Natural Resources Conservation Council Act 286 of 1990 10
2.3.10 Forest Law 10
2.3.11 National Policy on Flood and Erosion Control 2006 (FMEnv.) 10
2.3.12 Nigeria's Local Agenda 21 10
2.3.13 The Agricultural Promotion Policy 2016-2020 11
2.3.14 Water Resource Act 101 11
2.3.15 Labour Act (1990) 12
2.3.16 Criminal Code 12
2.3.17 Public Health Law (L.N 47 of 1955, Cap 103) 12
2.3.18 The Endangered Species Act, CAP E9, LFN 2004 12

2.3.19 Nigerian Gender-Related Policies *13*
2.3.20 The National Urban Policy Framework and Action Plan (2012) *13*
2.4 State Legislation 13
2.4.1 Gombe State Ministry of Environment and Forest Resources *13*
2.4.2 Gombe State Environmental Sanitation and Protection Agency (GOSEPA) *13*
2.4.3 Gombe State Ministry of Agriculture and Natural Resources *13*
2.5 Comparing National Procedures and World Bank Policies 14
2.5 Institutional/Administrative Framework 15

CHAPTER THREE: BIOPHYSICAL ENVIRONMENT 18

3.1 Introduction 18
3.2 Climate and Meteorology 18
3.2.1 Rainfall *18*
3.2.2 Relative Humidity *20*
3.2.3 Temperature *20*
3.2.4 Wind Speed and Direction *22*
3.3 Micro watershed and Hydrological Analysis 24
3.3.1 Runoff fluxes *1*
3.3.2 Sediment analysis *1*
3.4 Ambient Air Quality Assessment 2
3.4.1 Particulate Matter (PM1.0, PM2.5 & PM10) *5*
3.4.2 Total Volatile Organic Compounds (TVOCs) *5*
3.4.3 Formaldehyde (HCHO) *5*
3.5 Noise Level Assessment 6
3.6 Geology and Relief 8
3.7 Soil Assessment 10
3.7.1 Implications of Changing Soil Properties on Gully Development *12*
3.8 Land use/ Landcover Analysis 12
3.9 Flora and Fauna Assessment 14

CHAPTER FOUR: SOCIO-ECONOMIC CHARACTERISTICS AND CONSULTATION WITH STAKEHOLDERS 19

4.1 Introduction 19
4.2 Demographic Profile 19
4.2.1 Sex and Age *19*
4.2.2 Ethnicity *20*
4.2.3 Marital Status and Education *20*
4.3 Livelihoods and Economic Activities 21
4.3.1 Employment *21*
4.3.2 Livelihood *21*
4.4 Social Infrastructure and Services 23
4.4.1 Building Characteristics *23*
4.4.2 Vulnerability Assessment from Gully Erosion *25*
4.4.3 Impacts of Gully *26*
4.4.4 Mitigation Measures *28*
4.4.5 Support Services *30*
4.5 Health Assessment 32
4.5.1 Common Health Problems and Clinic Visit *32*
4.5.2. Water-Borne Ailment *32*
4.5.3 Access to Healthcare *33*

4.6 SANITATION AND HYGIENE 34
4.6.1 Domestic Water Sources 34
4.6.2 Toilet Characteristics 35
4.6.3 Noise and Air Pollution 36
4.6.4 Vectors 36
4.6.5 Waste Management and Domestic Fuel 37
4.7 STAKEHOLDER ENGAGEMENT AND CONSULTATION 38
4.7.1 Principles of Consultation and Consultation Requirements 38
4.7.2 Key Stakeholders and Consultees 38
4.7.3 ESMP Consultation Activities to Date 39
4.7.4 Future Consultation Activities 43
4.8 TRADITIONAL GRIEVANCE REDRESS MECHANISM 43

CHAPTER FIVE: ASSESSMENT OF POTENTIAL ADVERSE IMPACTS AND ANALYSIS OF ALTERNATIVES 45

5.1 INTRODUCTION 45
5.2 METHODS AND TECHNIQUES USED IN ASSESSING AND ANALYZING THE ENVIRONMENTAL AND SOCIAL IMPACTS 45
5.2.1 Impact Definition and Approach 46
5.2.2 Potential Impact Assessment 47
5.3 KEY ELEMENTS FOR IMPACT ANALYSIS 50
5.3.1 Sources of Impact 51
5.3.2 Valued Environmental and Social Components 52
5.3.3 Interactions between Impact Sources and VESC 54
5.4 PROJECT OPTIONS AND ALTERNATIVES 59
5.4.1 Benefits of the Project 59
5.4.2 Envisaged Sustainability 60
5.4.3 Project Options and Alternatives Selection 62
5.4.4 Future Scenarios Without Intervention 64
5.4.5 Engineering Designs 64
5.5 POTENTIALLY SIGNIFICANT ADVERSE ENVIRONMENTAL AND SOCIAL IMPACTS OF THE PROPOSED PROJECT 66

CHAPTER SIX: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN 76

6.1 INTRODUCTION 76
6.2 PROPOSED MITIGATION MEASURES 76
6.3 INSTITUTIONAL RESPONSIBILITIES AND ACCOUNTABILITIES 96
6.3.1 Implementation and Monitoring Strategy 98
6.3.2 COVID-19 Protocols and Management Plan for the ESMP of the GGC Doma Erosion and Flood Control 99
6.4 CAPACITY BUILDING PLAN FOR THE ESMP OF THE GGC DOMA EROSION AND FLOOD CONTROL 101
6.5. GRIEVANCE MECHANISM 103
6.5.1 The Need for Grievance Mechanism (GM) 103
6.5.2 Grievance Mechanism Process 104
6.6. PUBLIC CONSULTATION PLAN 105
6.7. MONITORING, SURVEILLANCE, AND EVALUATION PLAN 105
6.7.1 Monitoring, Evaluation and Reporting 105
6.7.2 Monitoring 106
6.7.3 Evaluation/Audits 107
6.7.4 Reporting 108
6.8. COSTS OF IMPLEMENTING THE ESMP 108

CHAPTER SEVEN: SUMMARY, RECOMMENDATIONS AND CONCLUSION 109

REFERENCES..... 111

ANNEX 112

ANNEX 1: LIST OF PERSONS.....112
ANNEX 2: SAMPLE OF DATA GATHERING INSTRUMENT.....116
ANNEX 3 STAKEHOLDER CONSULTATION CHECKLIST 125
ANNEX 4: GENERAL ENVIRONMENTAL MANAGEMENT CONDITIONS FOR CONSTRUCTION CONTRACTS/CIVIL WORKS. 128
ANNEX 5: WASTE MANAGEMENT PLAN 134
ANNEX 6: CONTRACTOR - ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (C-ESMP).....135
ANNEX 7: TRAFFIC MANAGEMENT PLAN 137
ANNEX 8: CULTURAL AND PHYSICAL RESOURCES MANAGEMENT PLAN 138
ANNEX 9: INDICATIVE ENVIRONMENTAL AND SOCIAL CODE OF CONDUCT AND CLAUSES FOR CONTRACTORS.....140
ANNEX 10: COMPANY CODE OF CONDUCT FOR IMPLEMENTING ESHS AND OHS STANDARDS, PREVENTING GENDER-BASED VIOLENCE AND VIOLENCE AGAINST CHILDREN.....148
ANNEX 11: OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT (OHS) PLAN 151
ANNEX 12: SUMMARY OF THE DATABASE OF INFORMATION COLLECTED FOR ESMP. 178

Lists of Tables

Table 1-1: Sub-project phases covered by the ESMP 10
Table 2-1: World Bank Environmental Social Standard triggers by the Doma/Bama Erosion and Flood Control project. 2
Table 3-1: Summary of hydrological simulation 24
Table 3-2: Sediment fluxes and erosion processes 2
Table 3-3. Ambient Air Quality Parameters 3
Table 3-4: Ambient Noise Level within the Doma Project Communities. 6
Table 3-5: Mean Variation of Soil Properties along the gully slope at Pantami (upper), Barunde (middle) and Doma (lower) 11
Table 3-6: Landuse and Landcover Classes 13
Table 3-7: List of Flora and Fauna along the GGC Doma/Bama Gully stretch 16
Table 4-1: ESMP Consultation Activities 40
Table 5-1: Impact Magnitude Grid 47
Table 5-2: Significance Matrix Negative Impacts 49
Table 5-3: Significance Matrix Positive Impacts 50
Table 5-4: Project-Related Sources of Impacts. 51
Table 5-5 Valued Environmental and Social Components 53
Table 5-6: Interactions between Impact Sources and VESC 55
Table 5-7: potential significant adverse environmental and social impacts of the proposed Project 67
Table 6-1 E&S Mitigation and Management Plan for the GGC-Doma Erosion and Flood Control during the Pre-construction Phase 77
Table 6-2: E&S Mitigation and Management Plan for the GGC-Doma Erosion and Flood Control during the Construction Phase 88
Table 6-3: E&S Mitigation and Management Plan for the GGC-Doma Erosion and Flood Control during the Post-Construction phase 93
Table 6-4: Institutional responsibilities and accountabilities 96
Table 6-5: Training Programs and Workshops 101
Table 6-6: Grievance Procedures Steps 104
Table 6-7: Monitoring Arrangement 106
Table 6-8: Cost of ESMP 108

Lists of Figures

Figure 1- 1: Nigeria showing the location of Gombe state..... 3
Figure 1- 2: Engineering design layout of the proposed GGC Doma-Bogo intervention site in the Gombe Metropolis 4
Figure 2-1: Implementation Organogram of ACReSAL 16
Figure 3-1: Average monthly precipitation at the project site from 1990-2023 19
Figure 3-2: Average annual precipitation at the project site from 1990-2023..... 19
Figure 3-3: Average monthly relative humidity at the project site from 1990-2023..... 20
Figure 3-4: Average annual relative humidity at the project site from 1990-2023 21
Figure 3-5: Average monthly maximum and minimum temperature at the project site from 1990-2023..... 21
Figure 3-6: Average annual maximum and minimum temperature at the project site from 1990-2023..... 22
Figure 3-7: Wind direction and speed at the proposed project site..... 23
Figure 3-8: Wind class frequency distribution in the project intervention site..... 24
Figure 3-9: Delineated micro watershed..... 25
Figure 3-10: Runoff outfluxes in the project area..... 26
Figure 3-11: Sediment outflux in the project area 27
Figure 3-12: Sampling points for air quality measurement in the project area 4
Figure 3-13: Sampling points for noise level measurement in the project area..... 7
Figure 3-14: Relief Ranges in the Study Area Source: Author's GIS Analysis 9
Figure 3-15: Geology of Study Area. Source: Author's GIS Analysis..... 9
Figure 3-16: Current land use/ landcover classification, 2024 13
Figure 4-1: Shows the sex (a) and age distribution (b) in the project communities 19
Figure 4-2: Religion (a) and Ethnicity (b) in the project area..... 20
Figure 4-3: Marital (a) and Educational (b) status in the project area 20
Figure 4-4: Employment (a) and unemployment rate (b) in the project area 21
Figure 4-5: Livelihood (a) and annual income (b) in the project area 22
Figure 4-6: Major expenditure in the project area 23
Figure 4-7: Building type (a) and number of rooms per household (b)..... 24
Figure 4-8: Average number of persons sleeping per room 24
Figure 4-9: Vulnerability (a) and psychological trauma (b) in the project communities 25
Figure 4-10: Main natural disaster (a) rating of prominent disaster (b) 25
Figure 4-11: Factors making vulnerable to gully erosion and main reasons for gully erosion 26
Figure 4-12: Distance from house to gully site (a) and distance from school to erosion site (b) . 27
Figure 4-13 Reductions in attendance of pupils to the school (a) and increase in crimes due to gully (b)..... 27
Figure 4-14: Gully site as a hideout (a) and Gully effect on religious activities (b) 28
Figure 4-15: Erosion control measures 29
Figure 4-16: Community-based groups working on erosion issues (a) and gully erosion mitigation measures (b)..... 29
Figure 4-17: Active community involvement in addressing gully erosion issues (a) and afforestation membership (b)..... 30
Figure 4-18: Advisory services (a) and support services (b) 31
Figure 4-19 satisfaction with the enforcement of regulations on erosion..... 31

Figure 4-20: Common health problem (a) and clinic visit (b) 32
Figure 4-21: Water-borne ailment (a) and main water-borne ailment (b) 33
Figure 4-22: Gully is a challenge for women in terms of access to healthcare (a) and the type of health facility (b). 34
Figure 4-23: Proximity to health facility (a) and health problem management (b) 34
Figure 4-24: Main source of domestic water (b) and time taken to get water (b) 35
Figure 4-25: Toilet availability and type in the project communities 35
Figure 4-26: Source of noise pollution (a) and sources (b) 36
Figure 4-27: Presence of stagnant water 36
Figure 4-28: Type of insect and vector control 37
Figure 4-29: Solid waste management and domestic fuel 38
Figure 5-1: ESMP Process 45
Figure 6-1: Flowchart for Grievance Mechanism Adapted from NEWMAP, 2011 105

Lists of Plates

Plate 1: 1: Channel bank erosion showing properties (houses) at risk. 6
Plate 1: 2: Properties at risk of destruction. 7
Plate 3-1: Measurement of noise level (a) and air quality (b) at one of the sampling locations (Pantami) 8

Acronyms

ACReSAL	Agro-Climatic Resilience in Semi-Arid Landscapes
ARAP	Abbreviated Resettlement Action Plan
AU	Environmental Audit
BAT	Best Available Technology
BOQ	Bill of Quantities
CAs	Community Associations
CBOs	Community-Based Organization
CCAC	Climate and Clean Air Coalition
CEC	Cation Exchangeable Capacity
CEDAW	Convention on the Elimination of All Forms of Discrimination against Women
CEMPs	Construction Environmental Management Plans
C-ESMP	Contractors Environmental and Social Management Plan
CIGs	Community Interest Groups
CITES	Convention on International Trade and Traffic in Endangered Species
CPP	Community Participation Plans
CRC	Convention on the Rights of the Child
CRPD	Convention on the Rights of Persons with Disabilities
CSOs	Civil Society Organisations
CSS	Climate Safeguard Standard
Db	Decibel
DEM	Digital Elevation Model
E&S	Environmental and Social
EA	Environmental Assessment
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EMP	Environmental Management Plans
ESA	Environmental and Social Assessment
ESAP	Environmental and Social Assessment Procedures
ESDD	Environmental and Social Due Diligence
ESEU	Environmental Sanitation and Enforcement Unit
ESF	Environmental and Social Framework
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMMP	Environmental and Social Management and Monitoring Plan
ESMP	Environmental and Social Management Plan
ESO	Environmental Safeguard Officer
ESP	Exchangeable Sodium Percentage
ESS	Environmental and Social Safeguards
FAO	Food and Agricultural Organization

FEPA	Federal Environmental Protection Agency
FGD	Focus Group Discussions
FGN	Federal Government of Nigeria
FMEnv	Federal Ministry of Environment
FMWASD	Federal Ministry of Women Affairs and Social Development
FPMU	Federal Project Management Unit
FRSC	Federal Road Safety Corps
GBV	Gender-Based Violence
GDP	Gross Domestic Product
GHGs	Green House Gases
GIS	Geographical Information System
GON	Government of Nigeria
GOSEPA	Gombe State Environmental Protection Agency
GPS	Global Positioning System
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
HIV/AIDS	Human Immune Deficiency/ Acquired Immune Deficiency Syndrome
HSE	Health Safety and Environment
ICESCR -	International Covenant on Economic, Social and Cultural Rights
IDA	International Development Association
IEE	Initial Environmental Evaluation
IESIA	Integrated Environmental and Social Impact Assessment
IPF	Investment Project Financing
IPP	Indigenous Peoples Plan
IPPF	Indigenous Peoples Planning Framework
IRM	Independent Review Mechanism
ISO	International Organization for Standardization
ISS	International Safeguard System
ITCZ	Inter-Tropical Convergence Zone
ITD	Inter-Tropical Discontinuity
IUCN	International Union for Conservation of Nature
KIIs	Key informant interviews
LEL	Lower Explosive Limit
LFN	Laws of the Federation of Nigeria
LGAs	Local Government Area
LRP	Livelihood Restoration Plan
LTM	Line Transect Method
LULC	Land Use Land Cover
MDAs	Ministries, Departments and Agencies
MoU	Memorandum of Understanding
NAP	National Action Plan

NCDC	Nigeria Centre for Disease Control
NDVI	Normalized Difference Vegetation Index
NEPAD	New Partnership for Africa's Development
NESREA	National Environmental Standards and Regulations Enforcement Agency
NGOs	Non-Governmental Organizations
NiMET	Nigerian Meteorological Agency
ODK	Open Data Kit
OHSP	Occupational Health and Safety Plan
OSH	Occupational Safety and Health
OSs	Operational Safeguards
PACs	Project Affected Communities
PAP	Project Affected Persons
PAP	Project-Affected People
PDO	Project Development Objective
PHC	Primary Health Care
PiA	Project influence Area
PIM	Project Implementation Manual
PM	Particulate matter
PPE	Personal Protective Equipment
PPM	Parts per Million
RAF	Resettlement Action Framework
RAM	Risk Assessment Matrix
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
SAR	Sodium Adsorption Ratio
SEA	Sexual Exploitation and Abuse
SH	Sexual Harassment
SME	Small and Medium Scale Enterprise
SMEnv	State Ministry of Environment
SPMU	State Project Management Unit
STDs/STIs	Sexually Transmitted Diseases/Sexually Transmitted Infections
ToR	Terms of Reference
UES	Uniform Effluent Standards
UN SDG	United Nations Sustainable Development Goal
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
VDP	Vulnerability Development Plan
VOCs	Volatile Organic Compounds
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization

Executive Summary

ES1 Introduction

The Agroclimatic Resilience in Semi-Arid Landscapes (ACReSAL) project, initiated by the Federal Government of Nigeria (FGN) in collaboration with the World Bank, addresses desertification and landscape management challenges in Nigeria's semi-arid regions, particularly in the north. With $700 million in initial financing, the project focuses on land degradation, climate resilience, and sustainable natural resources management through tree planting, oasis rehabilitation, and sand-dune stabilisation. ACReSAL promotes an integrated, multi-sectoral approach involving federal, state, and local stakeholders to enhance community resilience, livelihoods, and institutional capacities. Building on the Nigeria Erosion and Watershed Management Project (NEWMAP), ACReSAL aims to increase the adoption of climate-resilient practices and sustainable natural resource productivity in arid and semi-arid watersheds.

ES2 Project Location

The project intervention site is located within the Gombe metropolis between latitudes 10°14' and 10°20'N and longitudes 11°07'and 11°13'E, designated as the Government Girls College (GGC) Doma/Bogo Erosion and Flood Control site, is situated within the urban area of the Gombe metropolis, serving as a critical focal point for addressing erosion and flood-related challenges. Gombe State, nestled in the northeastern geopolitical zone of Nigeria, exhibits distinct climatic patterns characterised by wet and dry seasons. The state encompasses an area of 18,768 km^2 and sustains a population of approximately 3,585,131 individuals, with Gombe metropolis accommodating around 573,000 residents. The proposed intervention site commences from Wuro Shayi to Barunde, Kanuel, and Liji. The total stretch of the Gully to be remediated is 19.185 km.

ES3 Project Proponent

The ACReSAL project has the following components, as summarised below:

- **Component A: Dryland Watershed Management** This component focuses on integrated watershed management planning to combat large-scale degradation in northern Nigeria.
- **Component B: Community Climate Resilience** This component seeks to enhance agro-climatic resilience at the community and household levels through locally adapted Sustainable Land and Water Management (SLWM) strategies.
- **Component C: Institutional Strengthening and Project Management** This component aims to improve Nigeria's institutional and policy framework for integrated landscape management while enhancing project monitoring and management.
- **Component D: Contingency Emergency Response Component (CERC)** This component provides rapid financial support in response to eligible crises or emergencies, including disasters and health emergencies, ensuring timely intervention and mitigation efforts.

The GGC Doma erosion and flood control ESMP fall within component A of the ACReSAL project.

ES 4 Legislative and Institutional Framework

The project will be guided by applicable Federal and State policies and regulatory frameworks, particularly the Environmental Impact Assessment Act No. 86, 1992 (as amended by EIA Act CAP E12

LFN 2004) and the World Bank ESF. Other relevant national legal and policies applicable to the project include the following:

- National Policy on the Environment (Revised 1999)
- National Environmental Protection (Management of Solid and Hazardous Wastes) Regulations, 1991
- National Environmental (Sanitation and Wastes Control) Regulations, 2009
- National Environmental (Noise Standards and Control) Regulations, 2009
- National Environmental (Surface/Groundwater Quality Control) Regulations 2011
- Harmful Wastes (Special Criminal Provisions etc.) Act CAP HI LFN 2004.
- National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulations, 1991
- National Environmental Protection (Effluent Limitation) Regulations, 1991
- Land Use Act CAP L5 LFN 2004

The Federal Ministry of Environment (FMEnv) is the statutory government institution mandated to coordinate environmental protection and natural resource conservation for sustainable development in Nigeria. It is also the lead implementing Ministry for the ACReSAL project in the country.

ES 5 Project Description

The erosion and flood control intervention will involve constructing concrete drainage structures to channel runoff away from the metropolis into the main tributaries of the River Gongola. The main structures include channel bed and bank stabilisation using concrete and gabion drainage.

The drainage bed construction structures include:

a) A drain inlet structure,
b) A central lined canal with four fingers making the total length,
c) A chute structure with stilling basins,
d) Drop structures, and
e) An exit system/outlet structure.

The drainage bank stabilisation measures include:

a) Gabion retaining wall,
b) Concrete retaining wall with weeping holes,
c) Slope cutting with geo-textile and grass and
d) Bio-remediation grass and tree planting on the 5m x 5m buffer of both sides of the drain channel.

Other subproject activities include:

a) Clearing of vegetation to create access and expansion work where relevant.
b) Demolition of existing structures, such as houses, within the project right of way (ROW) or (15m x 15m) setback and failed hydraulic infrastructure.
c) Rehabilitation of access routes for heavy-duty equipment conveyance.
d) Reclamation of degraded land area by sand filling or stabilisation of dormant gully fingers.

e) Bioremediation and creating 5m x 5m buffer zones along the gully channel.

The project will also include creating staging areas, setting up campsites, and sourcing materials like borrow pits. Heavy equipment such as bulldozers, excavators, and compactors will be used for site preparation and material transportation. According to engineering design specifications, the construction components will be made with concrete, steel, and other materials.

Channelisation is an engineering method that involves widening, deepening, or realigning existing waterways to increase their capacity to carry anticipated volumes of water. This helps water move freely with less damage to the banks. The process involves a thorough study and investigation, including determining land use and runoff coefficients, developing intensity and duration curves, computing discharge, assessing geological and geotechnical characteristics of sub-surface materials, analysing the stability of side slopes and existing gully slopes, considering soil fertility, bioremediation, and hydraulic flux. The GGC Doma-Bogo gully profile has a serpentine or curvilinear (meander) shape, which allows runoff to hit the gully's walls. This can lead to the collapse and flooding of nearby land and homes, resulting in loss of lives and property. To address this, gully realignments were incorporated into the design to reduce the curved sections along the length of the gully, as recommended in the series of World Bank Design Clinics/Training for Bankable Designs (Loraj Consult 2018).

Realignment requires excavating uneroded and stable ground to place hydraulic structures like culverts, stilling basins, chute channels, check dams, etc., to ensure proper connectivity in straight alignment with the flow direction. In this case, realignments were carried out where necessary in the design. However, most places where the realignments were proposed are either open spaces or temporal shanties built on natural waterways, which the RAP document has effectively captured. The material excavated will be used to reclaim the original adjacent gully areas.

The proposed structural and non-structural control measures project and the components of the construction work are as follows:

a. Earthworks and excavation are needed for storage embankment, gabion, and retaining walls.
b. Concrete work for the construction of retaining walls.
c. Sand traps/check dams for energy dissipation,
d. Provision of gabion and reno mattress as channel bank protection, and
e. Bio-engineering work; planting of tree seedlings and grasses for erosion control.

ES 6 Environmental and Social Baseline

In studying the proposed project site's existing environmental conditions, baseline information (physical, biological, and socio-economic conditions) on the area was obtained through field sampling and measurements, observations, and physical, chemical, and biological laboratory analysis of water

and soil samples collected from the project area, including a literature search. The socio-economic and health conditions in the host communities were also surveyed and documented.

The baseline conditions are summarised below:

Physical Environment

- The project area has good air quality, as the ambient concentrations were within the safe limits recommended by FMEnv.
- Ambient noise level ranged from 15dB to 19.8dB at night and 69.3dB to 72.4dB during the daytime. Regarding spatial variability, the value ranges between 50.3dB to 69.3dB around Nayi Nawa quarters and 60.6dB to 89.3dB as one approaches Borinde Junction. The noise levels are primarily within the urban background status of WHO (70dB) and FMEnv (90 dB) limit for industrial areas.
- All physicochemical parameters were within the FAO threshold for agricultural soils. Even though the soil fertility is low owing to leaching.
- Surface water quality is within safe limits, as recommended by both FMEnv and WHO.

Biological Environment

- The vegetation is typical of the Guinea savanna with woodland forest cover. The primary forest has been severely affected by human activities such as road construction, sand mining, farming, bush burning, cutting of firewood and timber exploitation.

Socio-economic environment

The demographic characteristic of the area shows that 78% of the respondents are male, while 22% are female. The age ranges from 46-55 (33%), 36-45 (32%), and 18-35 (20%), while 56 and above constitute 15% of the respondents. The Educational level indicates two schooling systems, i.e., western and Islamiyya, where 33% quranic; primary, 13%; secondary, 27%; tertiary, 26% and 1% attend non-formal. The income revealed that most respondents (35%) earn between 50,000 to 100,000 annually, a significant portion (28%) earn between 100,000 to 300,000 annually, while a smaller proportion (3%) earn above 2,000,000. On livelihood, about 28% are involved in crop production and livestock farming, while 25% are engaged in petty trading. Others derived income from off-farm temporary employment (5%) and agro-processing (6%). Civil servants comprised 16% of the respondents.

E7 Environmental and Social Impacts and Mitigation Measures

The planned activities for the project and the associated potential impacts and mitigation measures are summarized in Table A:

Table A: Project and the associated potential impacts and mitigation measure

Planned Activity	Associated & Potential Impact	Mitigation Measures
Pre-Construction		
Land acquisition	Loss of property (agitation)	Fair and timely compensation; stakeholder engagement and grievance redress mechanism
	Compensation	Ensure compensation aligns with market rates and is inclusive of all affected parties. Prepare a Resettlement Action Plan (RAP)
Site Preparation and land clearance	Conflicts over livelihood sources	Engagement with local communities; provision of alternative livelihood options
	Air quality deterioration from dust and emissions	Dust suppression methods (e.g., water spraying); vehicle emission controls; regular maintenance of machinery
	Noise and vibration	Use of noise barriers; scheduling noisy activities during less sensitive times; maintaining equipment
	Loss of vegetation cover	Minimise clearing, replanting, or compensatory planting.
	Loss of vulnerable threatened, and endangered tree species	Pre-clearance surveys; relocation of species if possible; compensatory planting
Population resettlement	Relocation of houses, buildings, or economic activities	Development and implementation of a Resettlement Action Plan (RAP); stakeholder engagement
Exploitation of borrow pits	Vegetation cover loss at the source	Sustainable extraction practices; site rehabilitation plans
Implementation of construction sites	Noise pollution and emissions from construction machinery	Use of quieter machinery; regular maintenance; emissions control; adherence to work hours
	Disruption to daily lives, increased traffic	Traffic management plans; community engagement
	Safety hazards	Implement safety management plans; regular site inspections; safety training for workers, Occupational/Community Health and Safety (O/CHS).
	Job opportunities for local communities	Employment of local labour; fair recruitment processes
Construction of infrastructures	Air quality deterioration	Dust suppression methods; vehicle emission controls; regular maintenance of machinery

Planned Activity	Associated & Potential Impact	Mitigation Measures
	Disruption to livelihood activities	Engagement with local communities; provision of alternative livelihood options
	Noise pollution and emissions from construction machinery	Use of quieter machinery; regular maintenance; scheduling noisy activities during less sensitive times
	Predisposition of soil to erosion	Erosion control measures (e.g., silt fences, vegetation cover); proper drainage systems
	Increased traffic and road accidents	Traffic management plans; clear signage; community engagement
	Hazardous waste generation and contamination	Proper hazardous waste management practices; training for workers on waste handling
	Soil contamination from fuel/oil leakage	Spill prevention and control plans; regular maintenance of equipment
	Occupational accidents and injuries	Implementation of safety management plans; regular site inspections; safety training for workers
Creation of borrow pits	Land degradation and increased susceptibility to erosion and flooding	Sustainable excavation practices, site rehabilitation plans, and development of a flood management plan.
	Risk of accident and drowning	Fencing and signage around borrow pits; community awareness programs
Capacity to implement ESMP	Inadequate safeguard officers	Hiring of qualified safeguard officers; capacity-building programs for existing staff
	Inability to implement ESMP	Regular reviews and audits of ESMP implementation; stakeholder engagement and preparation of a C-ESMP
Construction Phase		
Construction activities	Increase ambient noise from the operation of machinery	Use of noise barriers, scheduling noisy activities during daylight hours
	Discharge of sediment-laden runoff	Install silt fences, sediment traps, and check dams.
	Temporary road closures or diversions	Provide alternative routes, adequate signage, and public information.
	Emissions from operating heavy-duty engines	Regular maintenance of equipment, use of low-emission engines
	Dust generation from construction activities	Water sprinkling, covering materials during transport

Planned Activity	Associated & Potential Impact	Mitigation Measures
	Pollution of existing Rivers from open defecation of workers	Provision of adequate sanitation facilities
	Threat to community culture, safety and security	Sensitisation programs, security patrols
	Labour Influx, which could lead to an increase in sexual activities and the potential spread of STDs/STIs, including HIV/AIDS	Awareness campaigns, health screenings
	Increased risk of Sexual Exploitation and Abuse (SEA)/ Gender Based Violence (GBV)	SEA/GBV awareness training, establishing reporting mechanisms, and signing of the Code of Conduct
	Child labour and school dropout in the project communities	Enforcement of labour laws, community awareness programs
	Traffic congestion and increased road traffic accidents	Traffic management plan, hire traffic controllers
	Increase demand on community health and sanitation infrastructure	Strengthening local health facilities, provision of mobile health units
	Open defecation of construction workers	Provision of portable toilets, sanitation education
	Loss of employment for temporary construction workers	Skills training programs, job placement services
Decommission Phase		
Landscape	Aesthetics due to beautification	Implement landscaping plan
Dismantling and Removal of Equipment and Vehicles	Dust, noise, and oil spill during the activity	- Dust suppression (water spraying)
		- Use of noise barriers
		- Proper disposal and recycling of oil and fuel
Labour	Loss of Employment following Project Closure	- Offer alternative employment opportunities
		- Provide vocational training

ES 8 Institutional responsibilities and accountabilities

The practical implementation of the Environmental and Social Management Plan (ESMP) for the Gombe State ACReSAL project depends on the commitment and capacity of various institutions and stakeholders including the Federal Ministry of Environment, Gombe State Ministry of Environment, Gombe ACReSAL State Project Management Unit (SPMU), Contractor, Supervising Consultant, Gombe State Environmental Protection Agency (GOSEPA), Gombe LGA, Affected Community and Public, Community Development Associations (CDA), NGOs/CSOs and World Bank.

ES 9 Covid 19 Protocol

Gombe State is actively implementing measures to prevent the spread of COVID-19, emphasising the safety and health of workers and the surrounding community through the SPMU and the Contractor. This involves collaboration with health authorities like the NCDC and the state COVID-19 task force, regular awareness campaigns, and training programs. Preventive measures include providing PPE, ensuring hygiene and sanitation, and enforcing social distancing. Health monitoring includes daily screenings, a protocol for managing suspected cases, and contact tracing. For COVID-19 cases, isolation facilities, medical support, and transparent communication are established. Additionally, community engagement involves outreach programs and a feedback mechanism to address concerns and suggestions.

ES 10 Capacity Building Plan

A robust capacity-building plan is essential for effectively implementing the Environmental and Social Management Plan (ESMP) for the GGC Doma erosion and flood control project. This plan aims to enhance the skills and knowledge of the State Project Management Unit (SPMU), contractors, the local community, and other stakeholders. The objectives are to equip stakeholders with the necessary skills to implement and monitor the ESMP, ensure environmental and social safeguards compliance, and promote sustainable practices and community engagement. The target audience includes SPMU staff, contractors, local community members, government officials, and NGOs. A training needs assessment will identify specific knowledge gaps and requirements for each group, leading to developing a detailed training program. The program will cover environmental laws, community engagement, health and safety protocols, sustainable construction practices, and various training methods.

ES11 Grievance Mechanism

The Grievance Mechanism (GM) is essential for addressing grievances from people affected by the project, ensuring culturally appropriate and effective resolution to avoid prolonged judicial proceedings and potential resistance. It aims to resolve disputes promptly, involving local stakeholders and the project office, emphasising affordable and accessible third-party dispute settlement. The process involves several steps: receiving and registering complaints, assessing them, formulating responses, selecting and implementing resolution approaches, announcing results, tracking outcomes, and learning from experiences. The GM is tailored to specific cultural and project contexts and includes clear procedures for filing and resolving grievances, with a structured process for appeals and ongoing monitoring during and after project implementation.

ES12 Monitoring

Effective monitoring, evaluation, and reporting are essential for the success of the Environmental and Social Management Plan (ESMP). The plan ensures that mitigation measures are implemented effectively, addresses emerging issues, and provides feedback for remedial actions. Monitoring includes compliance with legal and regulatory requirements during all project phases, focusing on air quality, noise, socio-economic factors, biodiversity, and safety. Internal and external monitoring will be conducted through regular site visits and inspections, with responsibilities divided among various stakeholders. Internal monitoring ensures correct ESMP implementation and involves capacity building and participatory approaches. Independent experts will handle external monitoring to review compliance documentation. Annual audits will evaluate the ESMP's effectiveness and identify improvement areas, while regular quarterly reports will summarise performance and document monitoring results across all project phases.

ES 13 Estimated Cost of Implementing and Monitoring ESMP

The total cost for Implementing the ESMP and Monitoring Plan for the GGC Doma Erosion and Flood Control Rehabilitation Works is estimated at Three Hundred and Twenty-Five Million, Eight Hundred and Nine Thousand Naira, only (N325,809,000); corresponding to Two Hundred and Twenty Thousand, Eight Hundred and Fifty-Nine US Dollars [USD220,859] only.

Table C: Estimated Cost of ESMP

Item	**Responsibility for implementation and Monitoring**	**Cost Breakdown**	**Cost Estimate (NGN)**	**[1]Cost Estimate in US Dollars (USD)**
Cost of Enhancing +ve impacts and Mitigation of –ve impacts	*SPMU, State Min. of Envr, GOSEPA, FRSC*	*the sum of direct monitoring amount*	*203,625,000.00*	*138,033*
Cost of Capacity Building	*SPMU, State Min. of Enver, GOSEPA, State Min. of Health*		*9,213,750.00*	*6,246*
Monitoring, Evaluation & Audit	*SPMU, State Min. of Envr, GOSEPA*		*73,170,000.00*	*49,600*
Management cost of Implementing ESMP	*SPMU, State Min. of Envr, GOSEPA*	*5% of Mitigation Cost*	*10,181,250.00*	*6,902*
SUBTOTAL			*296,190,000.00*	*200,781*

[1] Note that the exchange rate stud at 1475.19 on 30/05/2024 (https://www.cbn.gov.ng/rates/exchratebycurrency.asp)

Item	Responsibility for implementation and Monitoring	Cost Breakdown	Cost Estimate (NGN)	[1]Cost Estimate in US Dollars (USD)
Contingency		***10% of Sub-Total***	*29,619,000.00*	*20,078*
TOTAL			***325,809,000.00***	***220,859***

CHAPTER ONE: GENERAL INTRODUCTION

1.1 Background

The Agroclimatic Resilience in Semi-Arid Landscapes (ACReSAL) project, initiated by the Federal Government of Nigeria (FGN) in collaboration with the World Bank, aims to address critical challenges related to regional desertification control and landscape management in the semi-arid landscapes of Nigeria. With an initial financing of $700 million from the World Bank, the project is committed to tackling issues such as land degradation and enhancing climate resilience in arid and semi-arid watersheds, particularly in Northern Nigeria.

In response to the pressing need for sustainable natural resources management, the FGN expressed its commitment to combating desertification through initiatives such as tree planting, oasis rehabilitation, rangeland establishment, and sand-dune stabilisation. These efforts underscore the urgency of implementing cost-effective land restoration practices to ensure future food and water security in a changing climate.

Recognising the importance of an integrated approach to address the complex challenges of dryland ecosystems, the ACReSAL project seeks to fill existing gaps by promoting an integrated, spatial, and multi-sectoral approach to building community resilience and improving the sustainable productivity of natural resources. Specifically, the ACReSAL project operates within a collaborative framework involving multiple federal, state, and local stakeholders and civil society organisations. At the federal level, the Federal Ministry of Environment (FMEnv) serves as the lead agency, with coordination and support from various Ministries, Departments, and Agencies (MDAs) responsible for planning, agriculture, forest, water resources, finance, infrastructure, and emergency response, among others.

These partnerships will facilitate the development of multi-sectoral approaches for desertification control and landscape management, improve community livelihoods and resilience, and strengthen institutions involved in natural resources management and human development. By leveraging lessons learned from international development partners like the World Bank Group, the project aims to enhance the adoption of climate-resilient landscape management practices while enhancing livelihoods in targeted arid and semi-arid watersheds in Northern Nigeria.

1.2 ACReSAL Project Development Objective and Components

1.2.1 The Project Development Objective

The primary objective of the ACReSAL project, as outlined in its Project Development Objective (PDO), is to increase the adoption of climate-resilient landscape management practices and enhance livelihoods in targeted arid/semi-arid watersheds. By leveraging lessons from various international development partners, including the World Bank Group, the project aims to adopt a more integrated, spatial, and multi-

sectoral approach to building community resilience and improving the sustainable productivity of natural resources.

1.2.2 The ACReSAL Project Components

The ACReSAL project has the following components and sub-components, as summarised below:

Component A: Dryland Watershed Management focuses on integrated watershed management planning to combat large-scale degradation in northern Nigeria. The sub-components include:

- **A1 (Strategic Watershed Management)** aims to support comprehensive, integrated watershed planning and implementation.
- **A2 (Watershed Infrastructure)** targets landscape-level investments, emphasising water resource management, environmental stabilisation, and large-scale agricultural endeavours.
- **A3 (Special Ecosystems)** aims to enhance the management of unique ecosystems such as wetlands, desert oases, and protected areas through strategic investments in ecosystem restoration, biodiversity conservation, and water resource enhancement.

Component B: Community Climate Resilience seeks to enhance agro-climatic resilience at the community and household levels through locally adapted Sustainable Land and Water Management (SLWM) strategies. The sub-components include:

- **B1 (Community Strengthening)** focuses on building community capacity for sustainable natural resource management, prioritising vulnerable and marginalised groups, and fostering peace-building initiatives.
- **B2 (Community Investments)** aims to finance physical infrastructure projects at the community level, facilitate landscape restoration efforts, and support farmers adopting climate-smart agricultural practices.

Component C: Institutional Strengthening and Project Management aims to improve Nigeria's institutional and policy framework for integrated landscape management while enhancing project monitoring and management. The sub-components include:

- **C1 (Institutional and Policy Strengthening)** focuses on enhancing institutional infrastructure and establishing robust data analytics and decision support systems, accompanied by capacity-building initiatives.
- **C2 (Project Management)** supports overall project monitoring and management, ensuring effective coordination and implementation.

Component D: Contingency Emergency Response Component (CERC) provides rapid financial support in response to eligible crises or emergencies, including disasters and health emergencies, ensuring timely intervention and mitigation efforts.

1.3 Description of Sub-project/ Intervention Site

The project intervention site is located within the Gombe metropolis between

latitudes 10°14' and 10°20'N and longitudes 11°07'and 11°13'E (Figure 1-1), designated as the Government Girls College (GGC) Doma/Bogo Erosion and Flood Control site, is situated within the urban area of the Gombe metropolis (Figure 1-2), serving as a critical focal point for addressing erosion and flood-related challenges. Gombe State, nestled in the northeastern geopolitical zone of Nigeria, exhibits distinct climatic patterns characterised by wet and dry seasons. The state encompasses an area of 18,768 km^2 and sustains a population of approximately 3,585,131 individuals, with the Gombe metropolis accommodating around 573,000 residents.

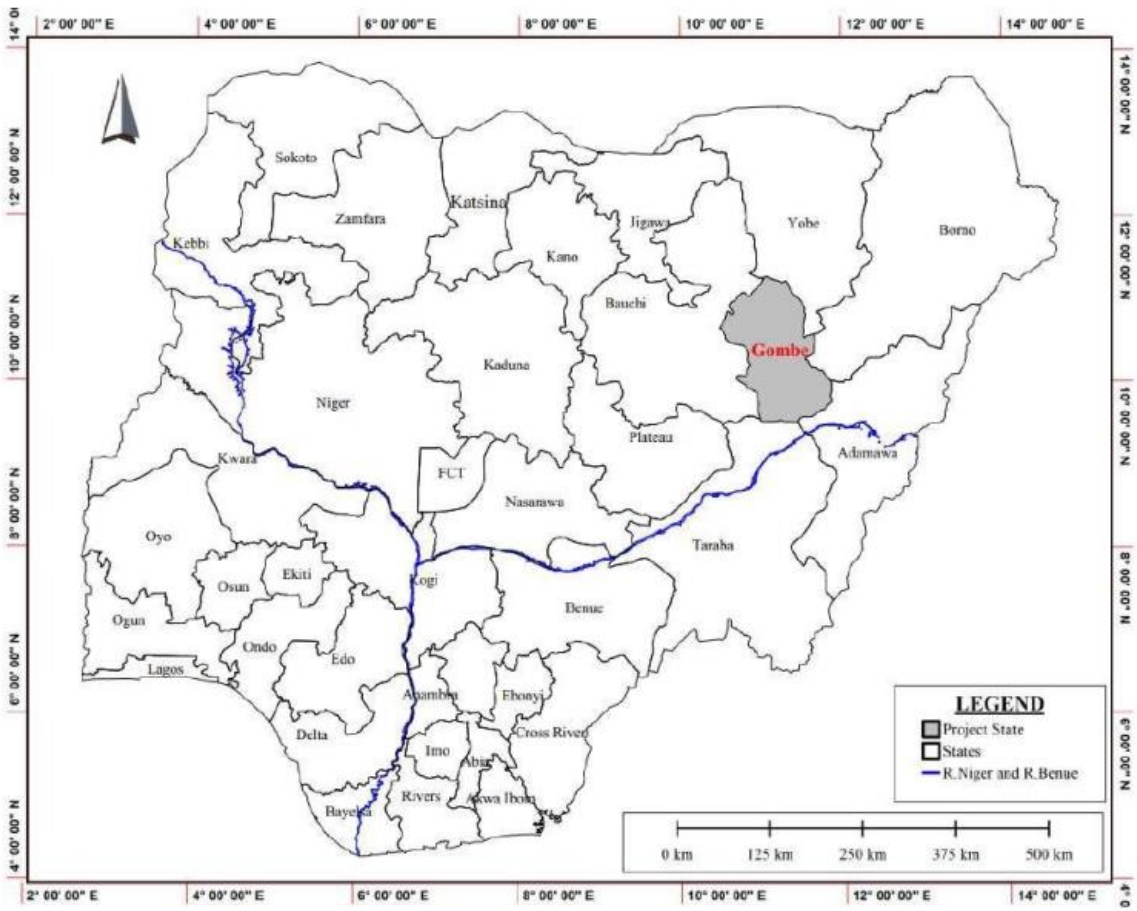


Figure 1- 1: Nigeria showing the location of Gombe state.

Topographically, the Gombe metropolis features a low-lying, undulating landscape, ranging from the Akko escarpment in the west to the foothills of Liji Hill in the east, ultimately draining into the plains. The site's drainage network comprises ephemeral streams and ravines originating from the Akko escarpment and flowing eastward, forming a complex network of channels. Notably, the site encompasses an ephemeral river/stream, serving as a major tributary to the Kanoyel Stream that feeds the Gongola River. The proposed intervention site commences from Wuro Shayi through Barunde and Kanuel and ends at Liji. The total stretch of the Gully to be remediated is 19.185 km (Figure 1-2).

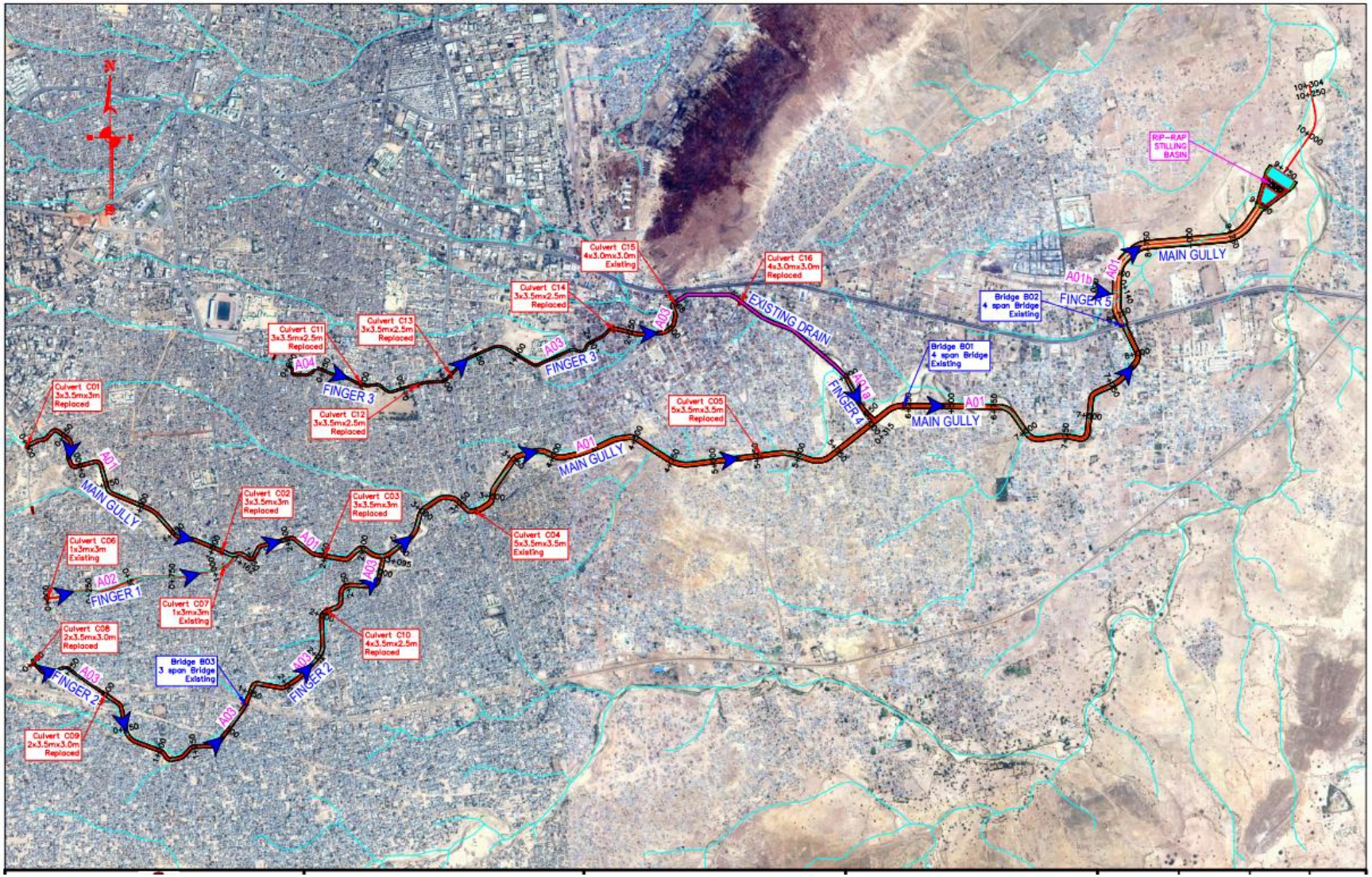


Figure 1- 2: Engineering design layout of the proposed GGC Doma-Bogo intervention site in the Gombe Metropolis

The terrain exhibits rugged characteristics, marked by undulating outcrops and exposed rock formations, with some elevations reaching up to 240m above sea level. Drainage patterns within the site consist of numerous smaller streams flowing from north to south, contributing to the main channel's meandering course through the metropolis. Geologically, the area is underlain by Bima, Yolde, and Pindiga formations, with soil compositions primarily consisting of silty/clayey sand, silty/lateritic clay, laterite, and sandstone.

Regrettably, the site is grappling with severe gully erosion and a crisis further intensified by relentless rainfall and a shortage of vegetation cover. This erosion has resulted in deep incisions and widening, manifesting as dissected gullies that have given rise to marginal lands. The high demand for land in Gombe has compelled low-income earners to settle in these marginal lands, thereby exacerbating erosion due to increased rooftop runoff.

The project will implement a comprehensive range of structural and non-structural measures to reduce erosion and flooding risks significantly. These measures will involve earthworks and excavation for storage embankments, gabion and retaining walls, concrete works for constructing retaining walls, sand traps and check dams for energy dissipation, provision of gabion and reno mattresses for channel bank protection, and bio-engineering works such as planting erosion-control grasses. In addition, cross-drainage structures will be strategically placed along the Doma stream/channel to manage water flow effectively.

The project intervention is deeply mindful of the site's ecological sensitivity and includes measures to mitigate environmental impacts such as erosion and flood hazards. Its primary aim is to enhance the ecosystem's health, safeguard infrastructure, and improve the livelihoods of the Gombe community through integrated watershed management and sustainable land and water management strategies.

1.4 Sub-project Activities and Related Specific Works

The sub-project activities and specific works related to the GGC Doma/Bogo erosion and flood control intervention will involve the construction of concrete drainage structures to channel runoff away from the metropolis and the main tributaries of River Gongola (illustrated in Figure 1-2). The main structures include channel bed and bank stabilisation using concrete and gabion drainage structures to channel runoff away from the area. The drainage bed construction structures include i) a drain Inlet Structure, ii) a central lined canal with four fingers making the total length, iii) a chute structure with stilling basins, iv) drop structures, and v) an exit system/outlet structure. The designed bank stabilisation measures include i) gabion retaining wall, ii) concrete retaining wall with weeping holes, iii) slope cutting with geo-textile and grass, and iv) bio-remediation grass and tree planting on the 5mx5m buffer of both sides of the drain channel. Other subproject activities are i.e.

a) Clearing of vegetation to create access and expansion work where relevant.
b) Demolition of existing structures, such as houses, within the project right of way (ROW) or (15m X 15 m) setback and failed hydraulic infrastructure.
c) Rehabilitation of access routes for heavy-duty equipment conveyance.
d) Reclamation of degraded land area by sand filing or stabilisation of dormant gully fingers.
e) Bioremediation and creating 5m x 5m buffer zones along the gully channel.

The project involves creating staging areas, setting up campsites, and sourcing materials like burrow pits. Heavy equipment such as bulldozers, excavators, and compactors will be used for site preparation and material transportation. According to engineering design specifications, the construction components will be made with concrete, steel, and other materials.

1.4.1 Structural and Construction Requirements.

Channelisation is an engineering method that involves widening, deepening, or realigning existing waterways to increase their capacity to carry anticipated volumes of water. This helps water move freely with less damage to the banks. The process involves a thorough study and investigation, including determining land use and runoff coefficients, developing intensity and duration curves, computing discharge, assessing geological and geotechnical characteristics of sub-surface materials, analysing the stability of side slopes and existing gully slopes, considering soil fertility and bioremediation, and considering hydraulic design.

Plate 1: 1: Channel bank erosion showing properties (houses) at risk.

Plate 1: 2: Properties at risk of destruction.

The GG Doma-Bogo gully alignments have a serpentine or curvilinear (meander) shape, which allows water runoff to hit the gully's walls. This can lead to the collapse and flooding of nearby land and homes, resulting in loss of lives and property (Plate 1-1 and Plate 1-2). To address this, gully realignments were incorporated into the design to reduce the curved sections along the length of the gully, as recommended in the series of World Bank Design Clinics/Training for Bankable Designs (Loraj Consult 2018).

Realignment requires excavating uneroded and stable ground to place hydraulic structures like culverts, stilling basins, chute channels, check dams, etc., to ensure proper connectivity in straight alignment with the flow direction. In this case, realignments were carried out where necessary in the design. However, most places where the realignments were proposed are either open spaces or temporal shanties built on natural waterways (Plate 1-3), which the RAP document has effectively captured. The material excavated will be used to reclaim the original adjacent gully areas.

The proposed structural and non-structural control measures project and the components of the construction work are as follows:

f. Earthworks and excavation are needed for storage embankment, gabion, and retaining walls.

g. Concrete work for the construction of retaining walls.
h. Sand traps/check dams for energy dissipation,
i. Provision of gabion and reno mattress as channel bank protection, and
j. Bio-engineering work; planting of tree seedlings and grasses for erosion control.

Plate 1: 3: Cross section of proposed channelisation and realignments along the gully stretch (Source: GGC Doma Gully Erosion Control Engineering Design Drawing, 2024).

1.5 ESMP Rationale, Objective and Preparation Approach

1.5.1 ESMP Rationale and Objectives

The proposed ACReSAL mandate plans to rehabilitate, control accelerated gully erosion, and regulate flood flow, involving construction activities that can cause negative environmental and social impacts. Some of the potential negative impacts that would arise during the construction works will include slope stabilisation,

excavation, re-channelization and other civil works that would generate wastes, noise/air pollution, accidents from the movement of equipment and materials to sites, occupational/community health & safety risks, risks associated with labour influx (security threat, gender-based violence (GBV) in particular Sexual Exploitation and Abuse due to labour influx, increase in STIs/STDs), grievance, among others.

These trigger eight Environmental and Social Standards (ESS) of the World Bank's Environmental and Social Framework (ESF). The Nigeria EIA Act requires any construction capable of causing a significant environmental impact to be subjected to an environmental assessment before the commencement of the civil works.

This Environmental and Social Management Plan (ESMP) is being developed to identify the environmental and social impacts associated with this construction project and to proffer mitigation measures that would address the potential negative consequences, taking cognisance of the World Bank's Environmental and Social Framework relevant to this project's activities.

The ESMP will achieve the following objectives:

i. Provide a detailed description of the main phases of the work (preparation, execution/construction, operation) and the critical activities of the work to be executed.
ii. Conduct public consultations with the Project's stakeholders to collect suggestions that will be integrated into the ESMP.
iii. Carry out an analysis of the initial environmental status of the sites concerned and describe the biophysical, socio-economic and cultural characteristics of the environment in which the sub-project activities will take place,
iv. Highlight the significant constraints to be considered during site preparation, construction, installation, and operation phases.
v. Identify the environmental and social components that may be impacted by the implementation of the works
vi. Check to ensure that the design and construction methods and the various components of the works are consistent with the project areas' ecological, social, economic and cultural realities and, if necessary, propose any necessary readjustments.
vii. Analyse the legal and regulatory framework for environmental management in line with the national legislation and World Bank safeguard policies.
viii. Identify and analyse, by implementation phase, the potential social and environmental impacts, both positive and negative (including impacts on physical cultural resources), that may result from the realisation of the rehabilitation, renovation or construction works of the infrastructures
ix. Assess the significance of these impacts during the project phases, compared to the no-project scenario.
x. Propose measures to optimise the positive impacts during the different phases of the works and technically viable and economically feasible mitigation measures to avoid, minimise, mitigate or compensate for the negative

environmental and social impacts to bring them to acceptable levels.

xi. Present the proposed mitigation measures' costs and assign responsibilities.
xii. Assess the need for solid and liquid waste collection, disposal and infrastructure management, and make recommendations.
xiii. Propose a mechanism for managing complaints that may arise during the work.
xiv. Potentially screen out environmentally unsound activities
xv. Propose modified designs to reduce environmental and social impacts
xvi. Identify feasible alternatives
xvii. Predict significant adverse impacts
xviii. Engage and interact with project-affected persons and communities.

1.5.2 Approach and Methodology for ESMP

The approach and methodology adopted for this ESMP include:

- Bibliographic research and literature review
- Site inspection
- Field data collection
- Stakeholder Consultation.
- Reporting.

1.6 Sub-project Phases Covered by the ESMP

Table 1-1 presents activities consistent with the sub-project phases (Pre-construction, Construction, and Post-Construction/ Operations and maintenance).

Table 1-1: Sub-project phases covered by the ESMP

Potential Impact Source		Activities
Pre-Construction		
	Soil Disturbance	• Surveying and mapping of the project area • Site clearance and vegetation removal • Earthworks and excavation for embankments • Transportation and storage of construction materials
	Water Pollution	• Handling and storage of construction chemicals and materials • Potential runoff from construction sites into nearby water bodies
	Air Pollution	• Dust generation from earth-moving activities • Exhaust emissions from construction vehicles and equipment
	Noise Pollution	• Operation of heavy machinery and equipment • Construction vehicle movement and traffic • Use of power tools and construction activities
	Habitat Disturbance	• Clearing of vegetation and alteration of natural habitats

Potential Impact Source		Activities
		• Potential displacement of wildlife species • Disruption of nesting sites and breeding grounds
	Traffic Congestion	• Increased traffic due to transportation of construction materials and equipment • Temporary road closures or detours for construction activities • Potential disruption to local traffic flow
	Land Acquisition	• Identification and negotiation of land parcels for project implementation • Potential displacement of residents or businesses
	Grievances and Negative Community Perception	• Stakeholder consultations and community engagement activities • Handling and resolution of grievances and complaints • Addressing concerns and misinformation about the project • Implementing community awareness and education programs
	Vegetation and Biodiversity	• Removal of vegetation for construction activities • Potential loss of biodiversity due to habitat destruction • Impact on local flora and fauna populations
	Influx of Labour	• Recruitment and mobilisation of construction workers • Increased demand for temporary housing and amenities for labourers • Potential strain on local resources and infrastructure due to increased population
Construction		
	Soil Erosion	• Excavation for storage embankments • Construction of gabion and retaining walls • Earthworks for channel bank protection • Installation of cross-drainage structures • Bio-engineering works (e.g., planting vetiver grass)
	Air Pollution	• Operation of construction machinery and equipment • Dust generation from construction activities • Emissions from operating heavy-duty engines
	Noise Pollution	• Operation of construction machinery and equipment • Construction vehicle movements • Pile driving for retaining wall construction
	Water Pollution	• Discharge of sediment-laden runoff

Potential Impact Source		Activities
		• Spillage of construction materials • Sediment build-up in stream channels • Discharge of effluent from workers • Routine servicing of equipment
	Traffic Congestion	• Movement of construction vehicles and machinery • Temporary road closures or diversions • Blockage of the road to enable construction work
	Safety Hazards	• Potential accidents involving construction workers • Operating equipment and likely collision with structures • Digging of ditches and trench excavation • Excavation of trenches and drainages • Blockage of the road causing traffic problems • Movement of heavy-duty equipment causing trampling on vegetation • Mobilization of workforce • Movement of staff to and from work site • Conveyance of materials and personnel to and from the work site • Operation and use of worker's camp • Civil and earthworks • Moving and deployment of equipment for bioremediation
	Grievances and Negative Community Perception	• Interaction with local communities during construction activities • Addressing community concerns and grievances
	Movement of Labor	• Ensuring a safe working environment and preventing harassment or abuse • Implementing policies and protocols to address sexual misconduct
Decommissioning Activities		
	Noise Pollution	• Remove heavy machinery and construction vehicles from the site. • Removal of labour camps/makeshift structures may create noise disturbance to nearby residents.
	Water Pollution (Environment)	• Proper disposal of construction debris, ensuring compliance with waste management regulations.
	Safety Hazards	• Dismantling and removal of temporary structures and facilities used by construction workers. • Collection and proper disposal of waste materials

Potential Impact Source		Activities
		generated during construction activities. • Ensuring proper safety measures are in place to prevent accidents and injuries to workers and the public during decommissioning.
	Urban infrastructure	• Minimizing disruption to urban utilities such as roads, water supply, and electricity during decommissioning activities.
	Air Pollution	• Dust emissions can create disturbance to nearby residents.
	Soil erosion	• Implementing erosion control measures during site restoration to prevent soil erosion post-construction.
	Local traffic	• Coordinating decommissioning activities to minimise traffic congestion and disruptions to local communities.
	Local biodiversity	• Assessing and mitigating any potential impact on local flora and fauna during decommissioning.

1.7 Structure of the Report

Cover page
Table of contents
List of acronyms, tables, figures
Executive Summary

Chapter 1: General Introduction
1. Background (evolvement of ACReSAL Project)
2. ACReSAL Project Development Objective and Components
3. Description of Sub-project/ Intervention Site
4. Sub-project Activities and Related Specific Works
5. ESMP Rationale, Objective and Preparation Approach
6. Sub-project Phases Covered by the ESMP

Chapter 2: Institutional and Legal Framework for Environmental Management
1. Discussion of the World Bank Environmental and Social Standards triggered by ACRESAL and the proposed activity.
2. Summary of relevant local and federal policy, legal, regulatory, and administrative frameworks

Chapter 3: Biophysical Environment
1. Description of the area of influence and environmental baseline conditions

Chapter 4: Socio-Economic Characteristics and Consultation with Stakeholders

1. Analysis of existing livelihood opportunities, income, gender characteristics, age profile, health, transport access, and existing community structures – at the watershed, community, household, and individual levels
2. Analysis of existing formal and informal grievance redress mechanisms in and around the intervention area
3. Presentation of consultations with relevant stakeholders and affected persons.
4. Other topics as relevant (e.g., Gender Based Violence, Sexual Exploitation and Abuse, Child Labour, Gender Discrimination, Security issues, etc.)

Chapter 5: Assessment of Potential Adverse Impacts and Analysis of Alternatives
1. Methods and techniques used in assessing and analysing the environmental and social impacts of the proposed project.
2. Discuss alternatives to the current project and reasons for their rejection, including a short description of likely future scenarios without intervention.
3. Discussion on engineering designs (civil engineering only vs. a combination of civil engineering and biological settings) and the best
4. Discussion of the potentially significant adverse environmental and social impacts of the proposed project

Chapter 6: Environmental and Social Management Plan (ESMP), including:
1. Discussion of the proposed mitigation measures – To include COVID-19 protocols and Management Plan
2. Institutional responsibilities and accountabilities
3. Capacity building plan
4. Description of grievance redress mechanism (in alignment with the ESMF, RPF, RAP, and Project Implementation Manual) to address conflicts or disagreements about some project activities.
5. Public consultation plan
6. Monitoring, surveillance, and evaluation plan, including suitable indicators for the proposed project.
7. Costs of implementing the ESMP

Chapter 7: Summary, Recommendations and Conclusion

References
Annexe

CHAPTER TWO: INSTITUTIONAL AND LEGAL FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT

2.1 Introduction

This chapter highlighted the relevant regulatory instrument, consisting of the policy, legal, and administrative framework within which the ESMP was carried out. It included the Bank's relevant environmental and social requirements as they relate to the Federal, State, and Local governments. It also points to the applicable international protocols, treaties, and conventions and the World Bank Safeguard Policies.

2.2 World Bank Environmental and Social Standards

World Bank projects are guided by Environmental and Social Standards (ESS). These standards are designed to enable the integration of environmental and social considerations into the development, planning and execution of projects. The proposed intervention project triggers eight of the ten standards except for ESS7 and 9. The ten standards are:

i. ESS1: Assessment and Management of Environmental and Social Risks and Impacts
ii. ESS2: Labor and Working Conditions
iii. ESS3: Resource Efficiency and Pollution Prevention and Management
iv. ESS4: Community Health and Safety
v. ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement
vi. ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
vii. ESS7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities
viii. ESS8: Cultural Heritage
ix. ESS9: Financial Intermediaries
x. ESS10: Stakeholder Engagement and Information Disclosure

These Environmental and Social Standards are integral to the World Bank's commitment to sustainable development and responsible lending practices. They help ensure that projects funded by the bank contribute to positive social and environmental outcomes while minimising harm to people and the planet.

2.2.1 World Bank Environmental and Social Standards triggered by the ACRESAL Project

The Doma/Bama erosion and flood control project is classified under “category A” because of its potential adverse impact on the population or areas of environmental importance. It is site-specific and likely reversible, and mitigation measures can be

more easily designed/ implemented. Table 2-1 provides a summary of the World Bank ESS triggers by the Doma/Bama project.

Table 2-1: World Bank Environmental Social Standard triggers by the Doma/Bama Erosion and Flood Control project.

WORLD BANK ESS	Core requirement	Potential Trigger under the proposed project	Recommendation
ESS1: Assessment and Management of Environmental and Social Risks and Impacts	Develop and implement an Environmental and Social Management Plan (ESMP) that outlines mitigation measures, monitoring, and reporting mechanisms for all identified environmental and social impacts assessed in the projects.	The Civil work has a site-specific impact, including site clearing and excavation for storage embarkment and retaining walls, which will impact the air, water, and land. Concrete works for the construction of retaining walls and check dams will dissipate the energy of flood flow.	1. Assessing, managing, and monitoring the environmental and social risks and impacts of the project throughout the project lifecycle to meet the policy's requirements. 2. The ESMF was prepared for the ACReSAL project to ensure that site-specific ESMPs are developed for projects and to implement all measures set out, with good monitoring and reporting.
ESS2: Labor and Working Conditions	Promote fair treatment, non-discrimination, and equal opportunity for workers. Ensure safe and healthy working conditions, protect workers' rights, and prevent child and forced labour. Implement	These activities will likely employ many workers in construction, maintenance, and other services. This includes direct and indirect workers with grievances about employment conditions and	To ensure compliance with ESS2 and promote safe and fair working conditions, the project will develop a Labor Management Plan (LMP), Occupational Health and Safety (OHS), and issues

WORLD BANK ESS	Core requirement	Potential Trigger under the proposed project	Recommendation
	grievance mechanisms for workers.	labour agreements.	that address ESS2's concerns.
ESS3: Resource Efficiency and Pollution Prevention and Management	Enhance resource efficiency and reduce pollution. Manage hazardous materials and waste and minimise project-related greenhouse gas emissions. Implement measures for sustainable water and energy use.	Construction and maintenance activities will require significant materials (e.g., concrete, steel, sand). ESS3 ensures that these materials are used efficiently to minimise waste.	The ESMP outlined specific measures prioritising using sustainable and locally sourced materials to promote energy-efficient machinery. A Waste Management plan has been developed.
ESS4: Community Health and Safety	Safeguard communities from project-related risks and impacts. Address community exposure to disease, ensure the structural safety of infrastructure (dam) and develop emergency preparedness and response measures.	Physical Safety Risks such as structural failures and construction accidents may occur during construction. Others may include health risks (dust) and disruption of services (access to school, healthcare and market) may occur.	The mitigation measures addressing community health and safety risks are captured in this ESMP.
ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	Avoid or minimise involuntary resettlement by providing compensation, livelihood restoration, and support to affected persons. Ensure	**Triggered** because of some restrictions on access to sources of livelihood. The demolition of structures may also cause people to lose their shelters	Project location and design cause Involuntary Resettlement. Assessment of PAP may Prepare a site-specific Resettlement Action

WORLD BANK ESS	Core requirement	Potential Trigger under the proposed project	Recommendation
	meaningful consultation and participation of affected communities in resettlement planning and implementation.	or farmlands.	Plan (RAP) that addresses how PAP will be compensated and the grievance redress process.
ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	Protect biodiversity and promote the sustainable management of living natural resources. Avoid impacts on critical habitats, implement conservation measures, and involve local communities in resource management.	The activities require significant conversion of areas of natural habitats along the gully stretch, especially the bioremediation for slope stabilisation.	The site-specific ESMP is developed for the project to implement all measures set out in the plan and conduct monitoring and reporting.
ESS7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	Respect the rights and cultures of indigenous peoples and historically underserved communities. Obtain their free, prior, and informed consent (FPIC) for projects affecting their lands, resources, or cultural heritage.	**Not triggered**	It is not applicable (No indigenous groups were identified).
ESS8: Cultural Heritage	Protect tangible and intangible cultural heritage from adverse project impacts.	**Triggered** because the project will involve significant excavations, earthworks, and	Assess, manage, and monitor cultural heritage throughout the project lifecycle, with stakeholder

WORLD BANK ESS	Core requirement	Potential Trigger under the proposed project	Recommendation
	Consult with affected communities to identify cultural heritage, assess potential consequences, and develop mitigation measures.	environmental modifications that would likely affect known and unknown cultural heritage sites.	consultation and participation embedded in a site-specific ESMP.
ESS9: Financial Intermediaries		**Not triggered**	Not applicable to the ACReSAL project.
ESS10: Stakeholder Engagement and Information Disclosure	Engage stakeholders through continuous and meaningful consultation. Disclose project information transparently. Develop and implement a Stakeholder Engagement Plan (SEP) to guide engagement activities throughout the project lifecycle.	**This is triggered** by the fact that building strong, collaborative relationships is key to project sustainability and success. Open communication fosters project buy-in for successful implementation through accurate information sharing, active engagement, clear accountability, and transparency.	To inform and involve stakeholders, a stakeholder engagement plan (SEP) and Grievance Mechanism (GM) have been developed to accommodate ESS10's requirements in the project.

2.3 International Conventions and Agreements

The international conventions, to which Nigeria is a signatory, relevant to this project are as follows:

- African Convention on the Conservation of Nature and Natural Resources
- Convention on Biological Diversity
- Endangered Species (Control of International Trade and Traffic)
- Conservation of Migratory Species of Wild Animals (1973)
- United Nations Framework Convention on Climate Change (1992)

- Convention to Combat Desertification (1994)
- Convention on the Elimination of All Forms of Discrimination against Women (CEDAW)
- Human and Peoples' Rights on the Rights of Women in Africa in 2005
- Civil and Political Rights Covenant
- Economic, Social and Cultural Rights Covenant
- Convention on the Elimination of All Forms of Violence Against Women
- Convention on the Rights of the Child

2.3 National Legislative Environmental Regulatory Instruments

The protection of the environment is a major priority for the Nigerian Government, which has led to the establishment of institutions and legal policies to regulate and monitor developments sustainably. The Doma/Bama erosion and flood control project shall comply with these policies.

2.3.1 National Policy on Environment (1988)

The National Policy on Environment 1989 was updated in 1999 to provide "a viable national mechanism for cooperation, coordination and regular consultation, as well as harmonies management of the policy formulation and implementation process which requires the establishment of effective institutions and linkages within and among the various tiers of government – federal, state and local government". The policy aims to foster sustainable management of natural resources in Nigeria by providing guidelines and strategies.

- ensure that the environment is of adequate quality to guarantee the health and well-being of citizens.
- manage natural resources for the benefit of present and future generations.
- maintain, enhance and restore ecosystems and ecological processes essential for preserving biological diversity.
- raise public awareness and promote the understanding of essential linkages between the environment and development; and
- cooperate with other countries, international organisations and agencies on transboundary environmental management.

2.3.2 Environmental Impact Assessment (EIA) Act No. 86 of 1992, CAP E12, LFN 2004

The most relevant environmental regulations for the Doma/Bima erosion and flood control works and the sustainable management of the natural resources in the project area is the EIA Act (No. 86 of 1992), which gives specific powers to the FMEnv to request and facilitate EIAs for all major public or private sector investments, i.e., any proposed physical work or activity that is likely to have significantly impacts on the environment. In effect, the decree deals with all EIA-related issues including:

i. timing and processing of EIA.
ii. content of an EIA report including the factors to be considered in the EIA.
iii. public involvement in the EIA process and public disclosure.

iv. transboundary impact (covering state and international boundaries).
v. definition and requirement of environmental management plans for polluting development projects.
vi. review of EIA and conflict resolution mechanisms.
vii. powers of the FEPA now defunct to further regulate the EIA process; and,
viii. lists of activities subject to mandatory EIA.

2.3.3 National Climate Change Policy (2021-2030)

The overall goal of the Policy is to:

Promote a low-carbon, climate-resilient and gender-responsive sustainable socio-economic development. Some of the expected outcomes of the policy's goal include:

i. Reduced vulnerability to climate change impacts across all sectors.
ii. Improved social, cultural, economic and ecological resilience.
iii. Reduced greenhouse gas emissions.
iv. Increased awareness of climate change impacts and adaptation and mitigation measures.
v. Enhanced and strengthened research, innovation and technology development and transfer and systematic observations.
vi. Enhanced capacity to implement climate change-related interventions at national, state and community levels.
vii. Climate change and its cross-cutting issues mainstreamed in development.

The goal of Nigeria's Climate Change Policy will be achieved through the attainment of the following objectives:

i. Implementing adaptation and mitigation measures that promote low-carbon development.
ii. Strengthening capacities and synergies at local, sub-national and national levels and at individual and institutional levels to implement climate change response.
iii. Promoting scientific research, technology and innovations to address the challenges of climate change.
iv. Developing and implementing appropriate strategies and actions to reduce Nigerians' vulnerability to the impacts of climate change across all sectors.
v. Mainstreaming gender, children and youth, and other vulnerable groups into all climate change interventions.
vi. Promoting sustainable land-use systems that enhance agricultural production, ensure food security and maintain ecosystem integrity.
vii. Promoting climate-proofing of construction and infrastructural development.
viii. Enhancing national capacity to mobilize international and national resources, both technical and financial, for investment in climate change.
ix. Developing an effective climate change communication and information management system that facilitates access by all stakeholders to climate information.
x. Strengthening national institutions and mechanisms (policy, legislative and economic) to establish a suitable and functional system for climate change

governance.

2.3.4 Land Use Act of 1978 (CAP L5 LFN2004)

The Land Use Act, modified in 1990, is now cited as the CAP L5 LFN2004. It remains the primary legal means to acquire land in the country, with urban and non-urban land management divided between state governors and local governments. The law governs land acquisition for purposes such as erosion control, following international best practices like the World Bank Operational Policy.

2.3.5 National Environmental Standards and Regulation Enforcement Agency (NESREA) ACT 2007

The Act gives the Agency the power to prevent the use of equipment or technology that harms the environment and to take legal action against violators. It also allows the Agency to enforce environmental laws related to sanitation and pollution control. Additionally, the Regulations Gazette contains rules that complement the NESREA Act and are relevant to the proposed project.

- **National Environmental (Sanitation and Wastes Control) Regulations, 2009. S. I. No. 28**: This regulation establishes the legal framework for sustainable and environmentally friendly practices in sanitation and waste management to minimize pollution. It will guide sanitation practices for erosion control civil works.
- **National Environmental (Ozone Layer Protection) Regulations, 2009. S. I. No. 32**: These provisions prohibit the import, manufacture, sale, and use of ozone-depleting substances. This law will guide the kind of chemicals used in the project area.
- **National Environmental (Noise Standards and Control) Regulations, 2009. S. I. No. 35:** The main objective of this Regulation is to ensure tranquillity and psychological well-being by regulating noise levels in mixed development projects. The law will guide noise levels at all phases of the project.
- **National Environmental (Construction Sector) Regulations, 2010. S. I. No. 19:** These Regulations aim to prevent and minimize pollution from Construction, Decommissioning, and Demolition Activities to the Nigerian Environment. This law will guide construction and related activities within the proposed erosion control construction works to ensure that such activities do not lead to pollution.
- **National Environmental (Control of Vehicular Emissions from Petrol and Diesel Engines) Regulations, 2010. S. I. No. 20:** The regulations aim to restore, preserve, and improve air quality by setting standards for vehicular and heavy machinery emissions at construction sites.
- **National Environmental (Surface and Groundwater Quality Control) Regulations, 2010. S. I. No. 22:** The purpose of this Regulation is to restore, enhance, and preserve the physical, chemical, and biological integrity of the nation's surface waters and maintain existing water uses. This law will guide the activities related

to the design of the erosion and flood control structures in a way that best protects the water resources availability and quality and the subsequent water supply to the proposed site.

Furthermore, the work of NESREA is guided by its corporate strategic plan that describes the scale of the environmental and social challenges and explains how NESREA, with the support of other key stakeholders, addresses these issues around the following policies:

- **Environmental Enforcement Policy**: This policy provides actions to enforce environmental legislation, standards, regulations, and guidelines fairly and appropriately in a manner that will protect environmental quality and safeguard public health. It is equally applicable to the ACReSAL projects.

- **National Environmental Sanitation Policy:** In this policy, it aim to improve government regulations related to housing, urban development, food security, water supply, sanitation, disease control, flood and erosion control, drought management, school health services, environmental education, and accommodation for contract workers.

- **National Policy Guidelines on Solid Waste Management:** This policy aims to improve and safeguard public health and welfare through efficient, sanitary solid waste management methods that are economical, sustainable, and guarantee sound environmental health.

- **National Policy Guidelines on Pest and Vector Control**: This policy establishes and strengthens pest and vector control units at the three tiers of government.

National Training Manual on Food Sanitation for Food Handlers: "Food policy aims to educate handlers for safe food practices to protect public health and align with national standards through NESREA's training and supervision."

2.3.6 The Harmful Waste (Special Criminal Provision Etc.) Act 1988

The Act was created to prohibit the carrying, depositing, and dumping of hazardous wastes on any land or territorial waters, and related matters. This Act is primarily focused on imposing penalties for specific actions or omissions mentioned in section 12. The Act has a broad jurisdiction and aims to remove any immunity provided by the Diplomatic Immunities and Privileges Act, making offenders subject to criminal prosecution. Section 6 of the Act imposes a severe penalty of life imprisonment and the forfeiture of any aircraft, vehicle, or land involved in the violation.

2.3.7 National Guidelines on Environmental Management Systems (1999)

The guidelines establish an Environmental Management System (EMS) requirement in 'all organisations/facilities in Nigeria'. They also state that this EMS should be audited annually or as necessary.

2.3.8 National Guidelines on Environmental Auditing (2001)

These are designed to serve as a reference for compliance with the Environmental Audit requirements of the FMEnv. It states that a company must conduct an audit every three years or at the discretion of the Hon. Minister of the FMEnv. The ACReSAL erosion control structure is expected to comply with this requirement as a key indicator to ensure environmental and social quality monitoring as enshrined in OS 1, 3, 4 and 5.

2.3.9 Natural Resources Conservation Council Act 286 of 1990

This Act aims to establish the Natural Resources Conservation Council to be responsible for conserving Nigeria's natural resources and formulating a national policy for conservation. This ensures that biological diversity is protected, as enshrined in the World Bank ESS operational safeguard on biodiversity and ecosystem services.

2.3.10 Forest Law

The National Forest Law governs the forestry sector, focusing on preserving forests and establishing reserves. Each state and the Federal Capital Territory have their own forest laws based on national regulations. Management of forests is mostly the responsibility of state governments due to decentralization. The National Forest Policy emphasizes community involvement in forest management and calls for innovative approaches to participation. It requires the government to establish a legal framework for tree tenure, access rights, and benefit sharing from forest products. While the National Forestry Act includes community-based arrangements and decentralization of responsibilities, local communities do not currently have forestland or management rights over state lands.

2.3.11 National Policy on Flood and Erosion Control 2006 (FMEnv.)

This policy addresses the need to combat erosion in the country utilizing the procedures outlined in the National Action Plan for Flood and Erosion Control and Technical Guidelines, developed by the WIC Environmental Committee, which was set up to plan an operational platform for these issues. This will ensure the safety of the landscape as triggered by the ESS1 on *Environmental and social risk and impact assessment*.

2.3.12 Nigeria's Local Agenda 21

Nigeria's Local Agenda 21 programme seeks to:

- **(a)** integrate environment into development planning at all government and private sector levels.
- **(b)** commence a transition to sustainable development.
- **(c)** address sectoral priorities, plans, policies and strategies for the major sectors of the economy and
- **(d)** Simultaneously foster regional and global partnerships.

The agenda is appropriately aligned with the basic requirements of the ESMP.

2.3.13 The Agricultural Promotion Policy 2016-2020

The National Agricultural Technology and Innovation Policy (NATIP) of Nigeria, under the National Development Plan (2021-2025), aims to modernise the agricultural sector for food security, employment, and wealth creation. Using previous policies like the Agricultural Promotion Policy (APP) 2016-2020, NATIP focuses on leveraging knowledge, technology, and global best practices to revitalise agricultural production and processing. Key strategies include research revitalisation, training, extension services improvement, access to inputs and markets enhancement, and promotion of agro-enterprises.

NATIP also addresses security challenges threatening agricultural investments and draws lessons from the COVID-19 pandemic to strengthen Nigeria's food security and global competitiveness. The policy emphasises stakeholder collaboration for effective implementation and monitoring, supported by specific strategies, action plans, and a robust monitoring and evaluation framework.

The NATIP aims to support women in agriculture by focusing on value chain development and reducing their workloads through appropriate technologies. It also promotes digital and climate-smart agriculture to build resilience to climate change.

2.3.14 Water Resource Act 101

The Water Resources Act 101 of 1993 is a significant provision that entrusts the Federal Government of Nigeria with the responsibility to manage and regulate all water and water resources in the country focusing on maintaining appropriate standards and techniques for the investigation, use, control, protection, management, and administration of water resources.

Furthermore, the National Water Supply and Sanitation Policy (NWSSP), established in January 2000, is designed to ensure the provision of adequate potable water and sanitation to all Nigerians in a sustainable and affordable manner. This policy emphasizes collaborative investment from the three tiers of government, the private sector, and the beneficiaries. Additionally, specific consumption standards for semi-urban (small towns) and urban water supply are outlined in accordance with the Nigerian Standard for Drinking Water Quality, 2007. This standard is based on general principles of the preventive, integrated and collaborative multi-agency approach.

The standard outlines the parameters and maximum allowable limits for drinking water in Nigeria. It covers normative references/laws, the definition of terminologies, institutional roles and responsibilities, monitoring, data management, and compliance criteria. In developing this standard, references were made to the Nigerian Industrial Standards for Potable Water and Natural Mineral Water, the National Guidelines and Standards for Water Quality in Nigeria, the World Health Organization (WHO) guidelines for drinking water quality (3rd Edition), and the International Standard Organization of Nigeria (ISO). The principles of this standard emphasize the need for an integrated management approach to effectively protect public health against water-related diseases.

2.3.15 Labour Act (1990)

Nigeria has ratified all eight core Labour Standard Conventions of the International Labour Organization. While the country has ratified these conventions and enacted laws to enforce their provisions, there are indications of restrictions on the trade union rights of workers, discrimination, child labour, and forced labour. The Labor Act is the primary law protecting the employment rights of individual workers. It covers the protection of wages, contracts, employment terms and conditions, and recruitment, and classifies workers and particular worker types. Union membership is governed by the Trade Union Amendment Act of 1995. The 1999 Constitution further includes the objective of equal pay for equal work without discrimination on account of sex, or any other ground whatsoever, but implementation is slow.

2.3.16 Criminal Code

The Nigerian Criminal Code makes it an offence punishable with up to 6-month imprisonment for any person who:

- Violates the atmosphere in any place to make it noxious to the health of persons in general dwelling or carrying on business in the neighbourhood or passing along a public way or
- Does any act which is, and which he knows or has reason to believe to be likely to spread the infection of any disease dangerous to life, whether human or animal.

The project may impact air quality; hence, the project activities shall be carried out to comply with relevant provisions.

2.3.17 Public Health Law (L.N 47 of 1955, Cap 103)

- Justifies the execution of developmental projects under guidelines that promote health by protecting the environment and safeguarding the health of humans.
- The Public Health laws empower Medical Officers of Health (operating at the Local Government Council, under the supervision of the State and Federal Ministries) to require, by implication, that individuals and groups ensure that their activities promote an environment that fosters good health (sub-sections 6 and 7(m).

2.3.18 The Endangered Species Act, CAP E9, LFN 2004

This Act focuses on protecting and managing Nigeria's wildlife and some species in danger of extinction because of overexploitation. These sections are noteworthy:

- Section 1 prohibits, except under a valid license, the hunting, capture or trade of animal species, either presently or likely in danger of extinction.
- Section 5 defines the liability of any offender under this Act.
- Section 7 provides for regulations for environmental prevention and control regarding this Act's purposes.

Given that most of the 21km stretch of the flood control channel of this project cut across the urban Gombe and is not prone to any impact on wildlife habitats or endangered species, the project activities did not trigger this Act and World Bank OP 4.04: Natural Habitats. However, the project shall be carried out to comply with relevant provisions.

2.3.19 Nigerian Gender-Related Policies

Gender-related policies are essential to this project as Women will be involved in PAPs during the subproject implementation. The project shall consider women's improvement activities.

The Gender Policy Framework in Nigeria

The 1999 constitution of Nigeria prohibits discrimination based on origin, sex, religion, status, ethnicity, or language. The government has committed to promoting gender equality and women's empowerment. Nigeria has signed and ratified various international instruments, emphasizing the need to eliminate gender discrimination and ensure equality. In 2000, a National Policy on Women was adopted, later upgraded to become the National Gender Policy in 2006.

National Gender Policy, 2006

The Nigerian National Gender Policy aims to promote the welfare and rights of women and children in Nigeria. It focuses on empowering women, involving men in ending sexism, increasing women's leadership roles, eliminating gender-based discrimination, and integrating a gender perspective into all sectors of development.

2.3.20 The National Urban Policy Framework and Action Plan (2012)

This plan aims to promote sustainable development and urban economic development, ensure effective urban growth management, and ensure urban infrastructure and service delivery.

2.4 State Legislation

2.4.1 Gombe State Ministry of Environment and Forest Resources

The Gombe State Ministry of Environment and Forest Resources is entrusted with safeguarding, conserving, and enhancing the environmental and forested areas within the state. It is mandated to conceive and execute initiatives to mitigate environmental catastrophes such as flooding, erosion, desertification, and the sustainable management of forest resources.

2.4.2 Gombe State Environmental Sanitation and Protection Agency (GOSEPA)

Operating under the purview of the Gombe State Ministry of Environment and Forest Resources, GOSEPA assumes jurisdiction over all matters of the environment within the state. Its obligations encompass the strategic planning and development of urban centres, provision of essential amenities, infrastructure, and other requisite functions essential for promoting sound and organised urban expansion.

2.4.3 Gombe State Ministry of Agriculture and Natural Resources

The Gombe State Ministry of Agriculture bears principal responsibility for the formulation and execution of agricultural policies within the state. Additionally, it undertakes the task of enlightening and coordinating the activities of farmers across the state.

2.5 Comparing National Procedures and World Bank Policies

Observing both policies, it can be identified that Nigeria's environmental and social management system and the World Bank **share similar views**. All laws, regulations and instruments governing investments and activities in the natural resources sector are generally consistent with the World Bank procedures.

A. **Similarities:**

- Both Nigeria's EIA safeguard tools and the World Bank's safeguard instrument emphasise the importance of early consideration of environmental and social issues, starting at the screening stage of project development.
- They advocate for the identification and early consultation with stakeholders to ensure their concerns are addressed and incorporated into the project planning.
- Preventing adverse impacts through considering feasible alternatives is a shared principle in Nigeria's EIA requirements and the World Bank's operational procedures.
- Both frameworks highlight the importance of incorporating mitigation measures into planning, particularly in the engineering design phase, to minimise negative environmental and social impacts.

Regarding gaps and differences, recent WB assessments have pointed out the quality of the interactions between EIA and WB regulations. The EIA has demonstrated its willingness and abilities to undertake in-depth, technically sound reviews, provide authoritative guidance, and use conditionality effectively in administering the environmental permitting process.

Differences and Gaps:

- While both frameworks categorise projects based on their potential environmental and social impacts, the specific categories differ. Nigeria's EIA categorises projects into Category I, II, and III based on the scale and nature of impacts. In contrast, the World Bank categorises projects into Category A, B, C, and FI.
- There are differences in the thresholds and criteria used for categorisation. For example, Nigeria's Category I projects include large-scale activities like agriculture development on 500 or more hectares. In contrast, the World Bank's Category A projects have sensitive, diverse, and potentially irreversible impacts over the long term.
- In the event of policy discrepancies, *the World Bank Policies will override national policies and regulations, indicating a hierarchy where the World Bank's safeguard instrument takes precedence over Nigeria's EIA safeguard tools*.

B. **Project-Specific Application:**

- In cases involving a proposed intervention, such as the Doma/Bama Gully Erosion and Flood Control Site intervention by ACReSAL in Gombe State, Nigeria's EIA requirements and World Bank operational procedures apply.
- *The more stringent safeguard policy shall take precedence in the event of divergence*

between the two frameworks, ensuring that the highest level of environmental and social protection is maintained.

It is important to note that while Nigeria's EIA safeguard tools and the World Bank's safeguard instrument share similar principles regarding environmental and social management, there are differences in categorisation criteria and hierarchy in case of policy discrepancies. However, both frameworks ensure early consideration of environmental and social issues, stakeholder consultation, impact prevention, and mitigation measures are incorporated into planning processes. The World Bank Policies will override national policies and regulations in case of policy discrepancies.

2.5 Institutional/Administrative Framework[2]

ACReSAL is a large and complex project with many actors who must be critical of its implementation. The Federal Ministry of Environment (FMEnv) will lead the implementing organisation. It will collaborate with the Federal Ministry of Water Resources (FMWR), the Federal Ministry of Agriculture and Food Security (FMAFS) and other relevant MDAs. **The involvement of different ministries and states and the multisectoral nature of the project require innovative approaches to implementation** - Figure 2-1 presents the implementation organogram for the ACReSAL project:

- ***The Federal Project Management Unit (FPMU) will oversee the project's overall supervisory activities. The FPMU will be hosted by the Federal Ministry of Environment and headed by the National Project Coordinator,*** with support from other MDAs.
- **The Federal *Steering Committee (FSC)*** and ***Federal Technical Committee (FTC)*** will provide overall policy and technical guidance respectively. The FSC will be chaired by the Minister of Environment, co-chaired by the Ministers of Agriculture and Rural Development and Water Resources, and will include the Federal Ministry of Finance, Budget and National Planning (FMFBNP), Commissioners of the Environment of the Participating States, and other state- and federal-level MDAs as appropriate.
- ***The State Project Management Unit (SPMU)*** will be responsible for the overall supervisory activities of the Project at the State level. The SPMU will be hosted by the State Commissioner of Environment and headed by the State Project Coordinator.
- **A *State Steering Committee (SSC)*** and ***State Technical Committee (STC)*** will provide overall policy and technical guidance. The SSC will be chaired by State Commissioners for the Environment and include Permanent Secretaries of Finance, Agriculture, Water, and other sector representatives. The STC will be chaired by the Permanent Secretary of the Environment and include relevant Directors of

[2] ACReSAL Project Implementation Manual Vol. 1 (May 2022).

Agriculture, Water, and other sector representatives.

- At the community level, a ***Local Implementation Committee (LIC),*** headed by the relevant Local Government Chairperson, will support inclusive participation and promote local ownership of project activities. Whenever possible, the project will use existing community-led structures and planning processes, e.g., those developed under NEWMAP and FADAMA, to ensure strong community engagement based on transparency, participation, accountability, and enhanced local capacity principles. Finally, as needed at individual sites, site committees will coordinate implementation.

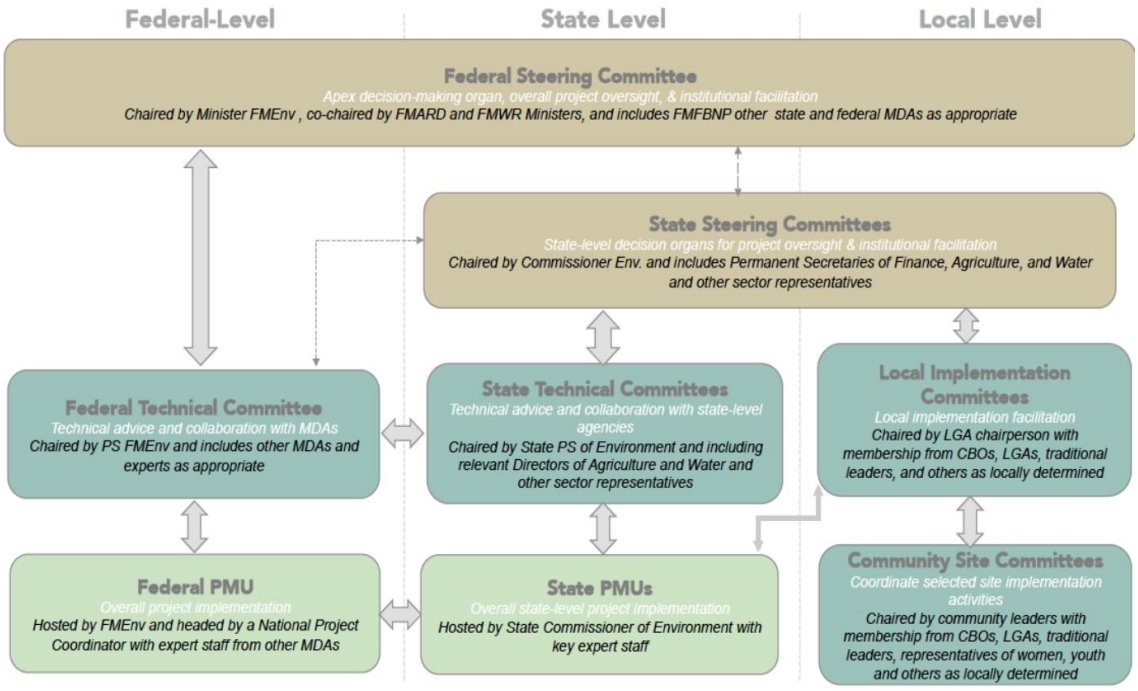


Figure 2-1: Implementation Organogram of ACReSAL

For this ESMP, the construction of works for the erosion site is overseen by the Ministry of Works and Housing in collaboration with municipal assemblies and other state agencies. These bodies regulate project activities to ensure environmental protection. The main regulating institutions are:

i. **ACReSAL:** The ACReSAL is represented by the Engineering & Environmental Safeguard unit, the main regulatory body in charge of project development within the SPMU with overall supervision of the World Bank Task Team.

ii. **Federal Ministry of Environmental Protection Agency (FMENV):** The Environmental Protection Agency (EPA) oversees Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) procedures. The agency's goal is to ensure adherence to best practices and to foster cooperation

from entities whose activities may pose a threat to the environment.

CHAPTER THREE: BIOPHYSICAL ENVIRONMENT

3.1 Introduction

The success of the GGC Doma erosion control project relies heavily on understanding the biophysical baseline conditions crucial for assessing the current state of the project environment and predicting potential impacts resulting from the erosion control intervention. This section presents a comprehensive analysis of the biophysical factors within the project area. The critical environmental and biophysical parameters encompass:

- Climate and meteorology
- Watershed and hydrological analysis
- Noise and air quality assessment
- Relief and Geology
- Soil assessments
- Water quality (ground and surface)
- Flora and fauna

3.2 Climate and Meteorology

The GGC Doma gully erosion control site is in a tropical wet and dry or savanna climate (Classification: *Aw*). With an average yearly temperature of approximately 30.54°C, it stands 1.08% higher than the averages across Nigeria. Annually, the site typically receives around 800-1000 mm of precipitation, spread across approximately 96.26 rainy days, constituting roughly 26.37% of the year.

The onset of rainfall is between April and May because the Inter Tropical Convergence Zone (ITCZ) movement from the southwest of Nigeria heralds increased rainfall at the site. However, as September approaches, the ITCZ gradually migrates southward, resulting in a decline in both the amount and frequency of rainfall experienced in the area.

3.2.1 Rainfall

The onset of rainfall between April and May marks the beginning of the wet season at the intervention site. As June progresses, precipitation steadily increases, reaching a notable level of around 145mm. However, rainfall peaks in August, hitting approximately 260mm. This surge in precipitation during August signifies the height of the rainy season and corresponds to a peak in runoff, significantly contributing to channel erosion in the area.

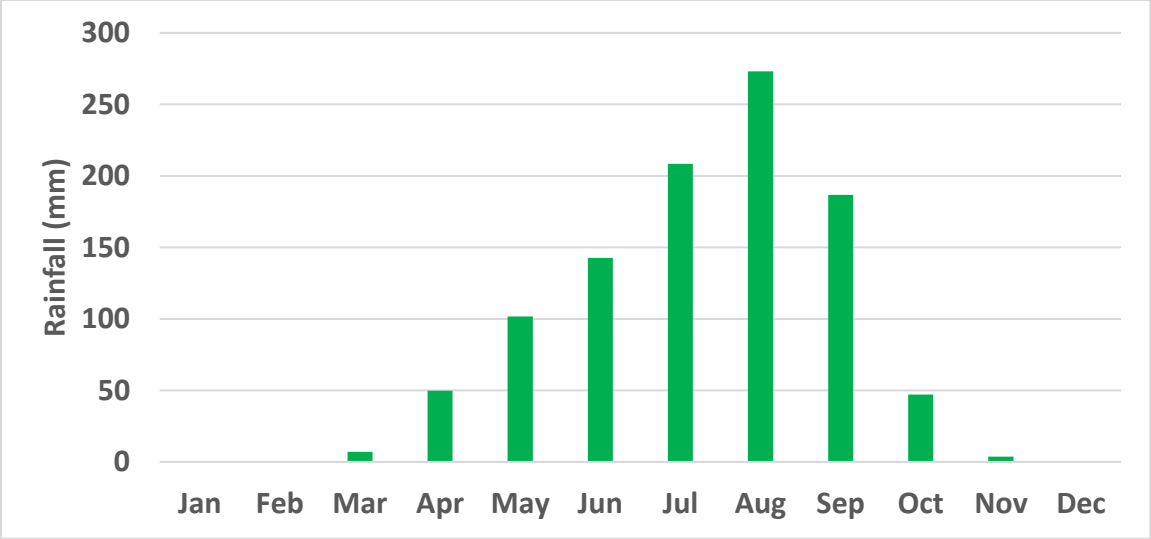


Figure 3-1: Average monthly precipitation at the project site from 1990-2023

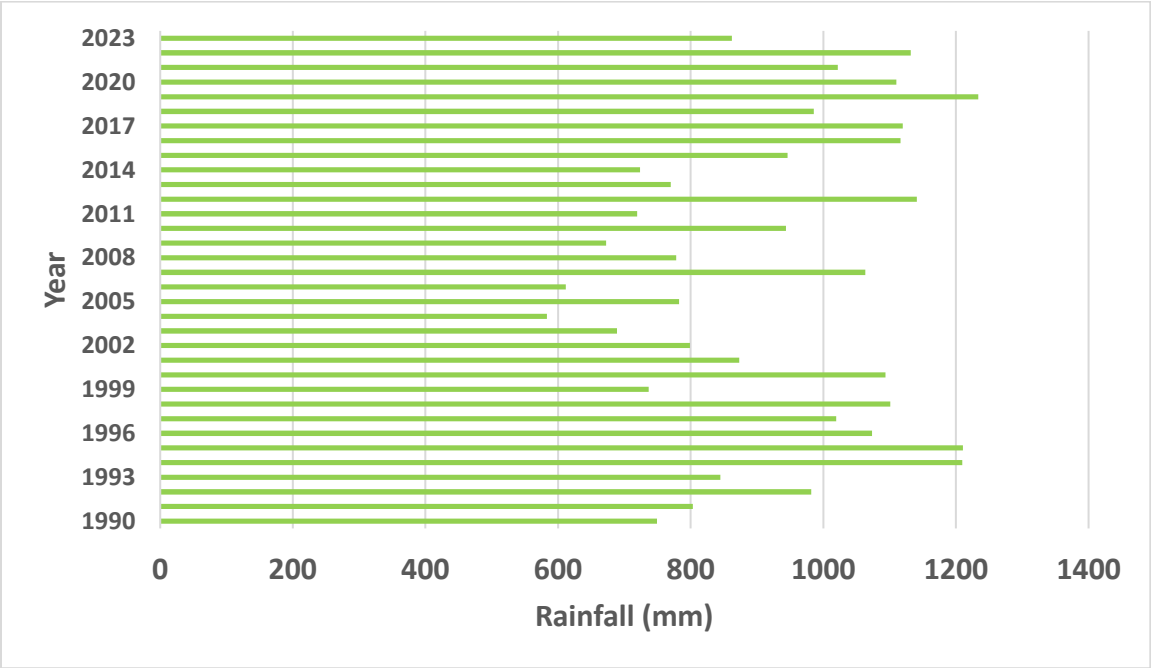


Figure 3-2: Average annual precipitation at the project site from 1990-2023

Following the peak in August, rainfall intensity gradually diminishes as September transitions into October. This gradual decline marks the onset of the dry season, characterised by reduced rainfall and a decrease in runoff. As depicted in Figure 3.1, the monthly rainfall pattern presents these yearly fluctuations.

Figure 3.2 illustrates the longitudinal average annual rainfall from 1990 to 2023. On average, the annual rainfall average is about 950mm. However, specific years, such as 2004, experienced significantly lower rainfall, dipping below 500mm. These

fluctuations underscore the variability of the annual rainfall pattern at the intervention site.

3.2.2 Relative Humidity

The GGCS Doma experiences low humidity during January, February and March, with about 21%, 19% and 20% humidity, respectively. However, as rainfall begins, the humidity starts to increase. The period from July to August corresponds to the highest humidity levels, reaching above 80% in August, which aligns with the peak rainfall periods. Figure 3.3 presents the average monthly relative humidity from 1990-2023. As the rainfall diminishes, the moisture also decreases.

Figure 3.4 depicts the annual relative humidity in the project site. The annual relative humidity average is about 55% in the project site. In addition, the relative humidity pattern exhibits minimal variations over time.

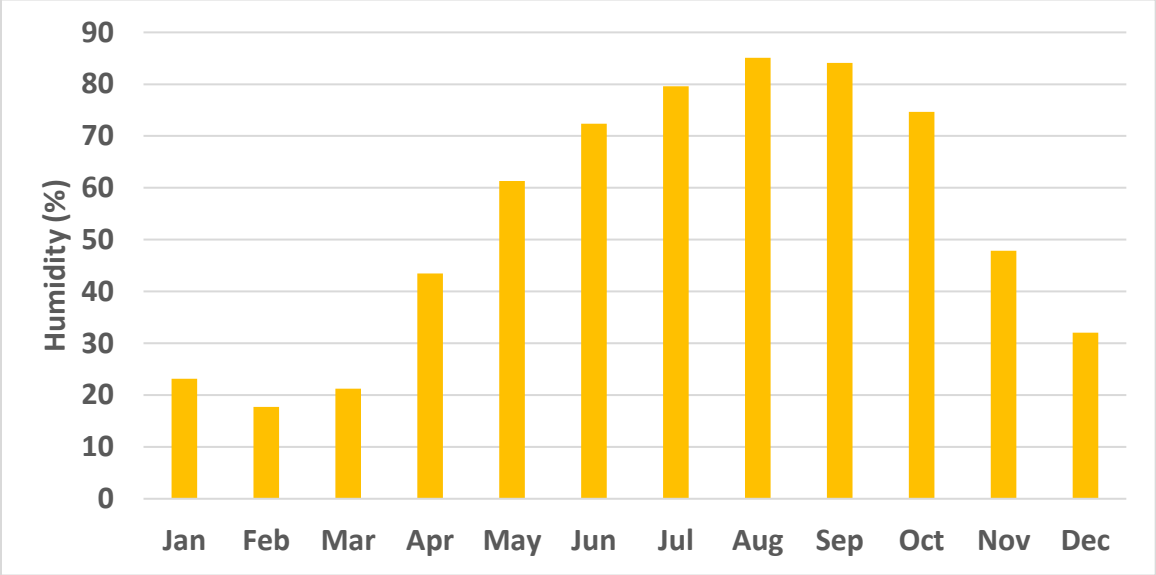


Figure 3-3: Average monthly relative humidity at the project site from 1990-2023

3.2.3 Temperature

The peak temperatures typically occur in March and April, averaging around 40°C, with a minimum of 24°C during the same months. As June and July approach, temperatures gradually decline alongside the onset of rainfall. December and January are the lowest temperatures, averaging around 15°C minimum and 32°C maximum. Figure 3.5 presents the proposed project area's monthly maximum and minimum temperatures.

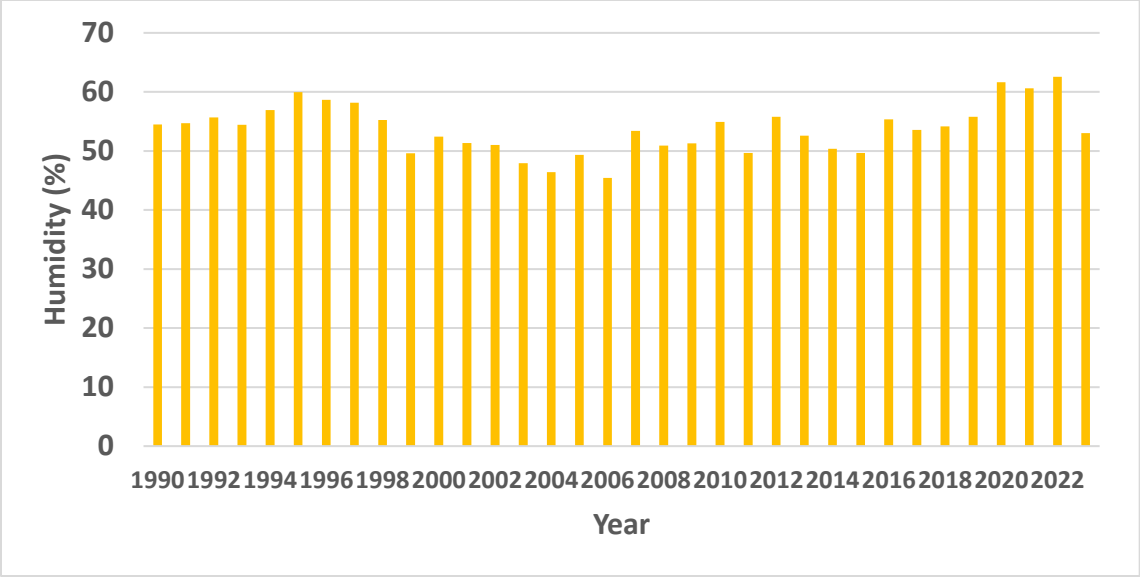


Figure 3-4: Average annual relative humidity at the project site from 1990-2023

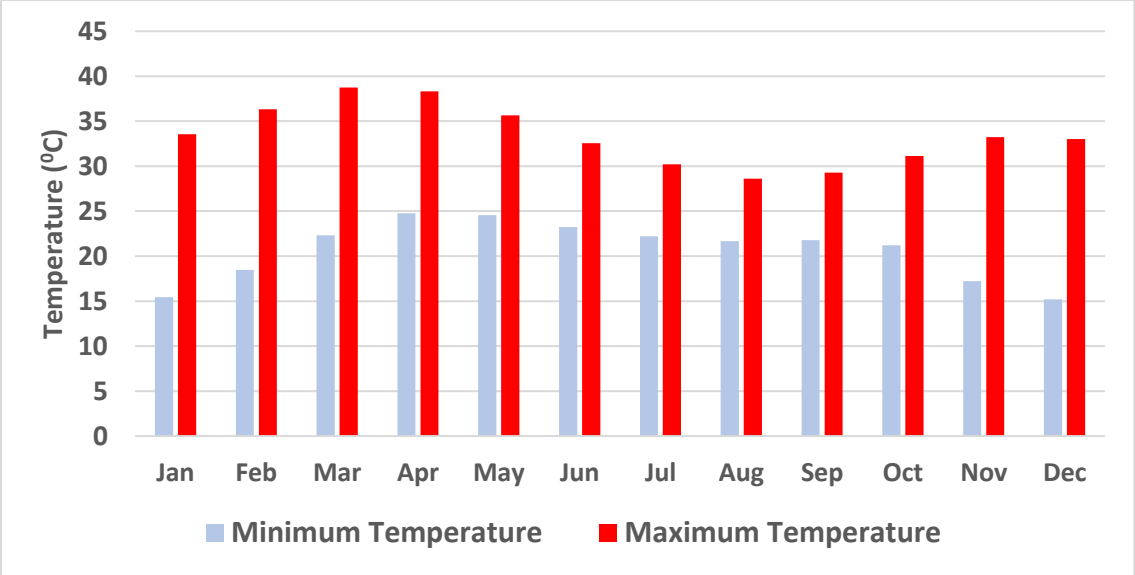


Figure 3-5: Average monthly maximum and minimum temperature at the project site from 1990-2023

At the GGC Doma gully intervention project site, annual average maximum and minimum temperatures are about 35°C and 21°C, respectively. Over time, there have been minor fluctuations in temperature within the area, as illustrated in Figure 3.6.

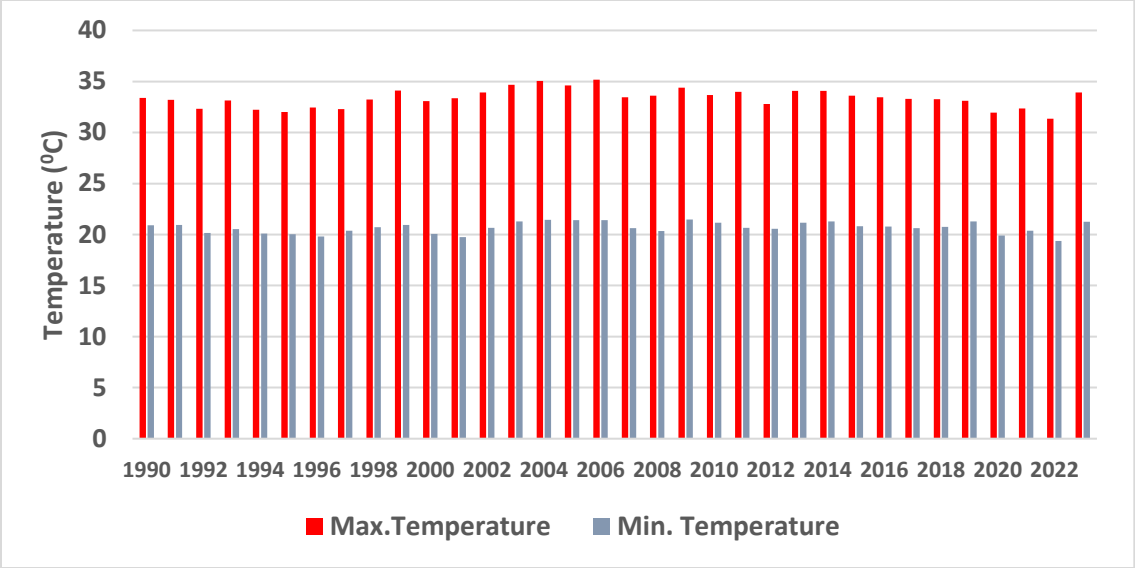


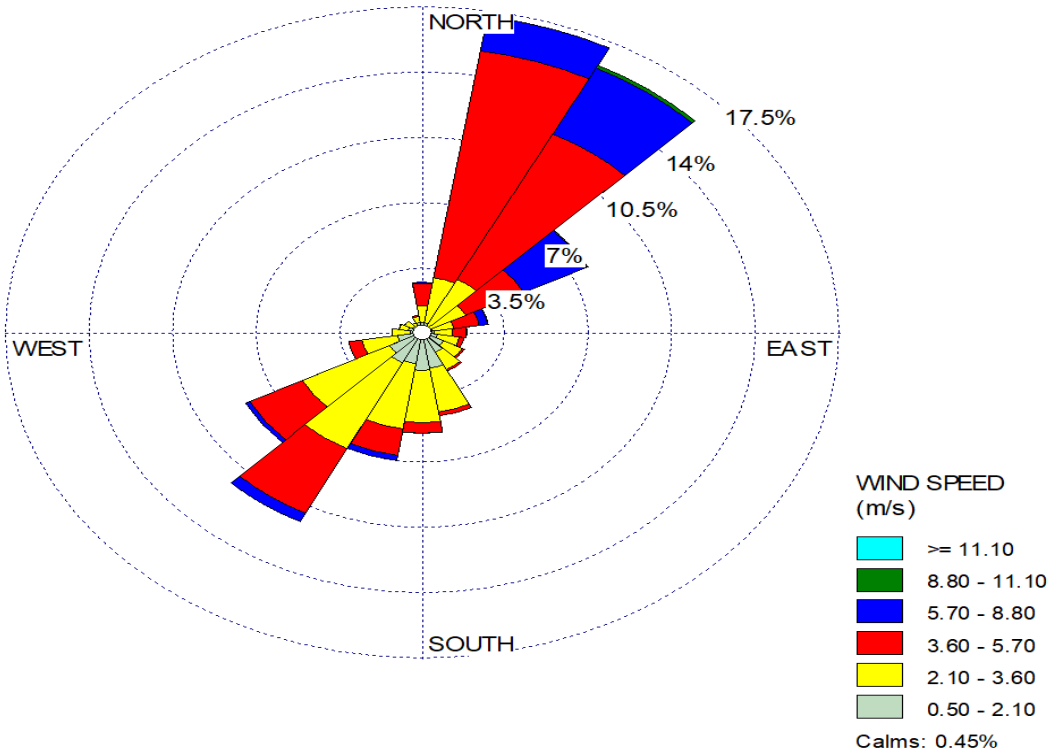
Figure 3-6: Average annual maximum and minimum temperature at the project site from 1990-2023

3.2.4 Wind Speed and Direction

The predominant wind direction at the project site is between 100 and 450 degrees, with wind speeds typically ranging from 3.60 to 5.70 m/s. The minimum wind speed recorded ranges from 0.50 to 2.10 m/s, while the maximum wind speed reaches 11.10 m/s or more. The wind rose diagrams illustrating these patterns can be found in Figure 3.7.

Wind speeds reach their peak between April and May, signalling the conclusion of the dry season. Conversely, during the height of the rainy season in July and August, wind speeds are at their lowest, averaging between 2.2 and 2.6 m/s. Starting from February, wind speeds gradually increase, reaching a peak in April, just before the onset of rainfall. Figure 3.8 depicts the distribution of wind classes, with 36.1% representing the highest frequency of winds ranging from 3.60 to 5.7 m/s, while calm conditions, with wind speeds of 0.5 m/s, account for approximately 2%.

Overall, wind speed can interact with other environmental factors, such as rainfall intensity and soil characteristics, to influence the rate and severity of gully erosion. However, the site experiences a mild wind speed, indicating runoff and other factors as the major cause of gully erosion in the area. The data for the wind speed and direction for the period 2010-2020 were downloaded from https://cds.climate.copernicus.eu//.



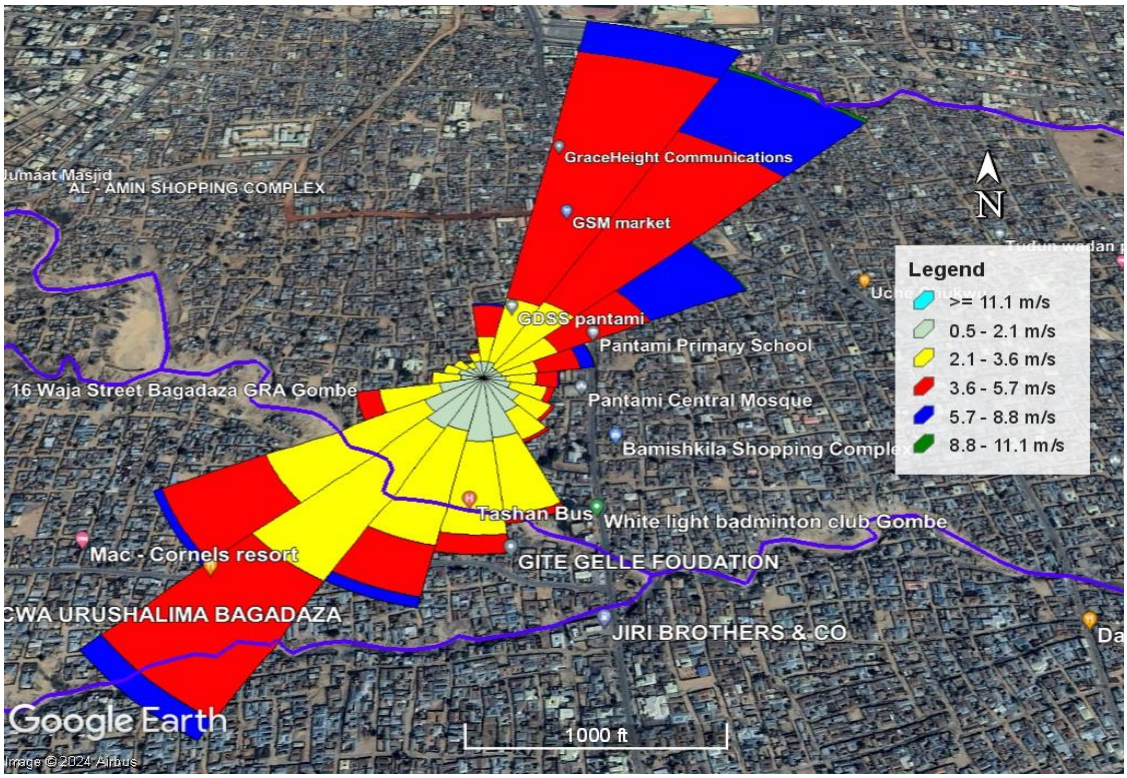


Figure 3-7: Wind direction and speed at the proposed project site

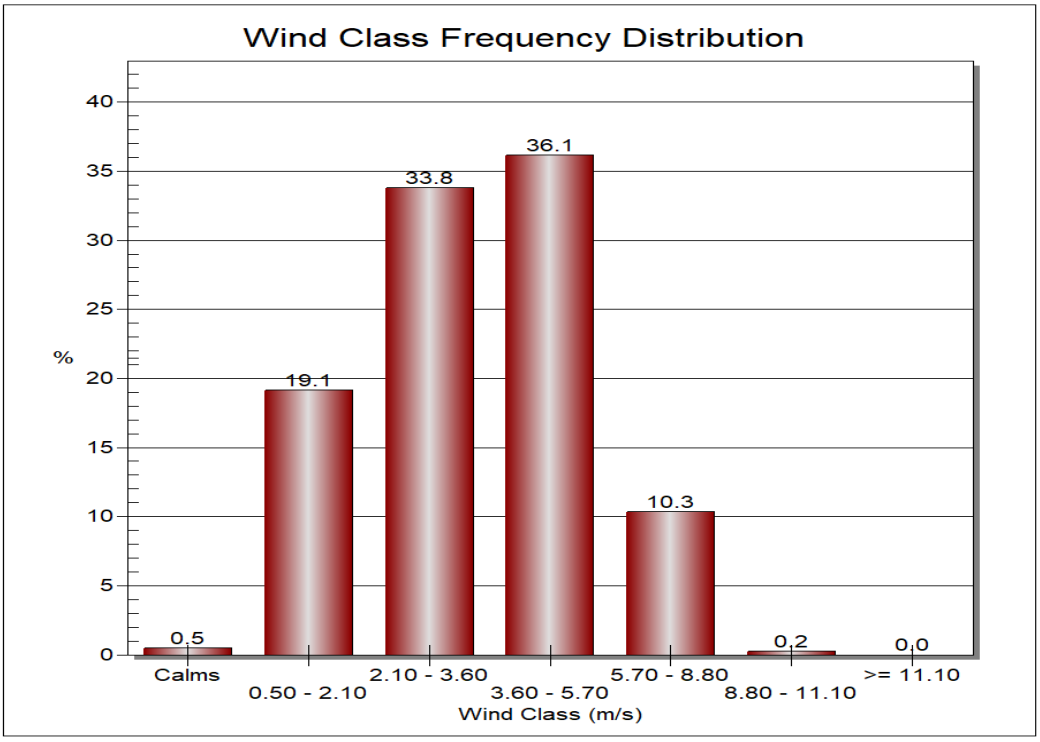


Figure 3-8: Wind class frequency distribution in the project intervention site

3.3 Micro watershed and Hydrological Analysis

The GGC Doma gully project area was delineated into 19 subbasins as depicted in Figure 3.9. Also, 19 Hydrological Response Units were delineated with 19 channels. The watershed area is about 4710.77 ha. The warm-up and simulation periods were 1 and 22 years respectively. The delineation of micro watersheds provides valuable insight into current conditions and drainage patterns, essential for effectively mitigating the impacts of interventions during project implementation. Table 3-1 shows the summary of the hydrological simulation.

Table 3-1: Summary of hydrological simulation

Subbasins	HRU	Channels	Watershed area (ha)	Warm-up period (year)	Simulation length (year)
19	192	192	4710.77	01	22

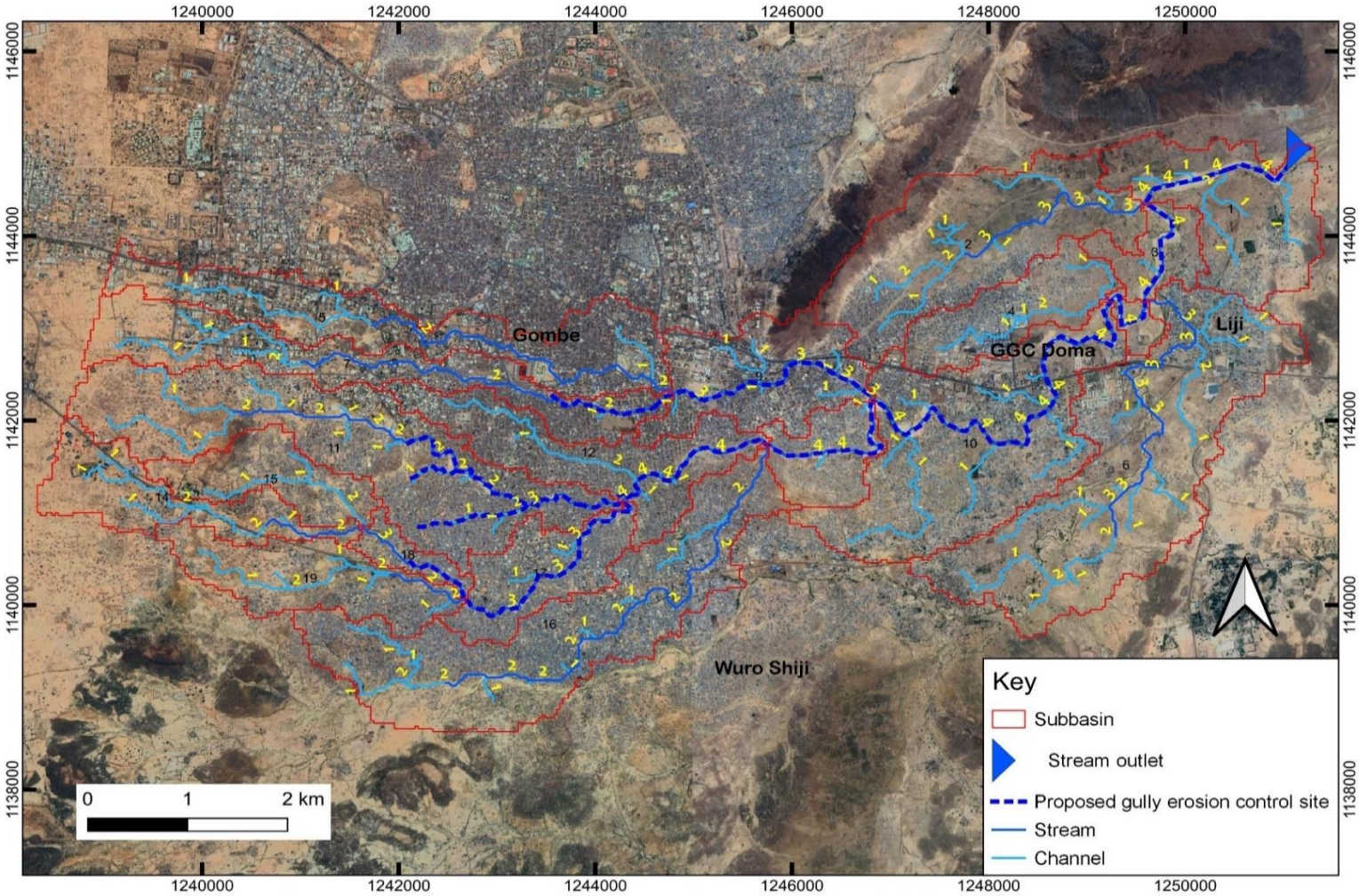


Figure 3-9: Delineated micro watershed.

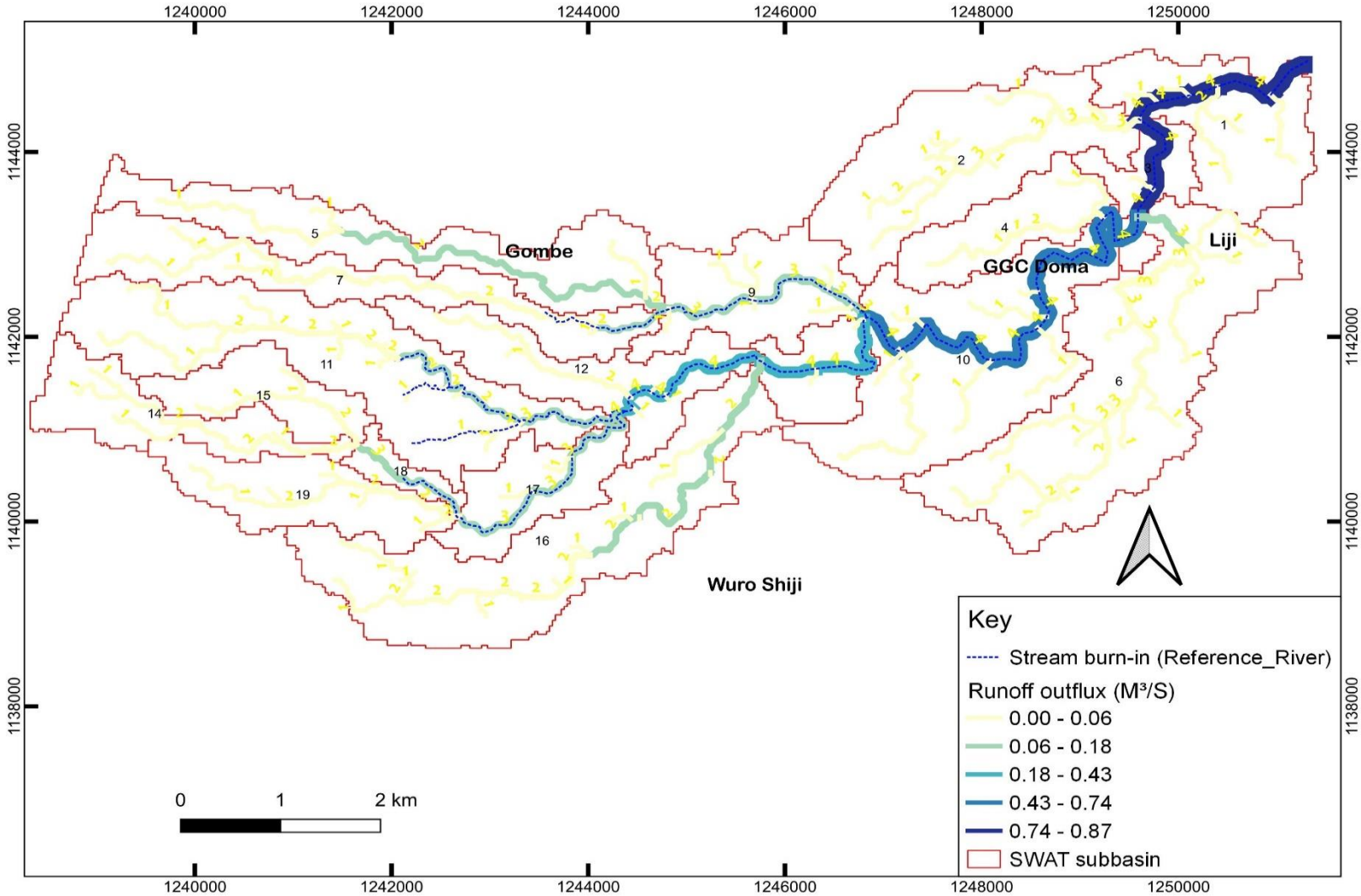


Figure 3-10: Runoff outfluxes in the project area

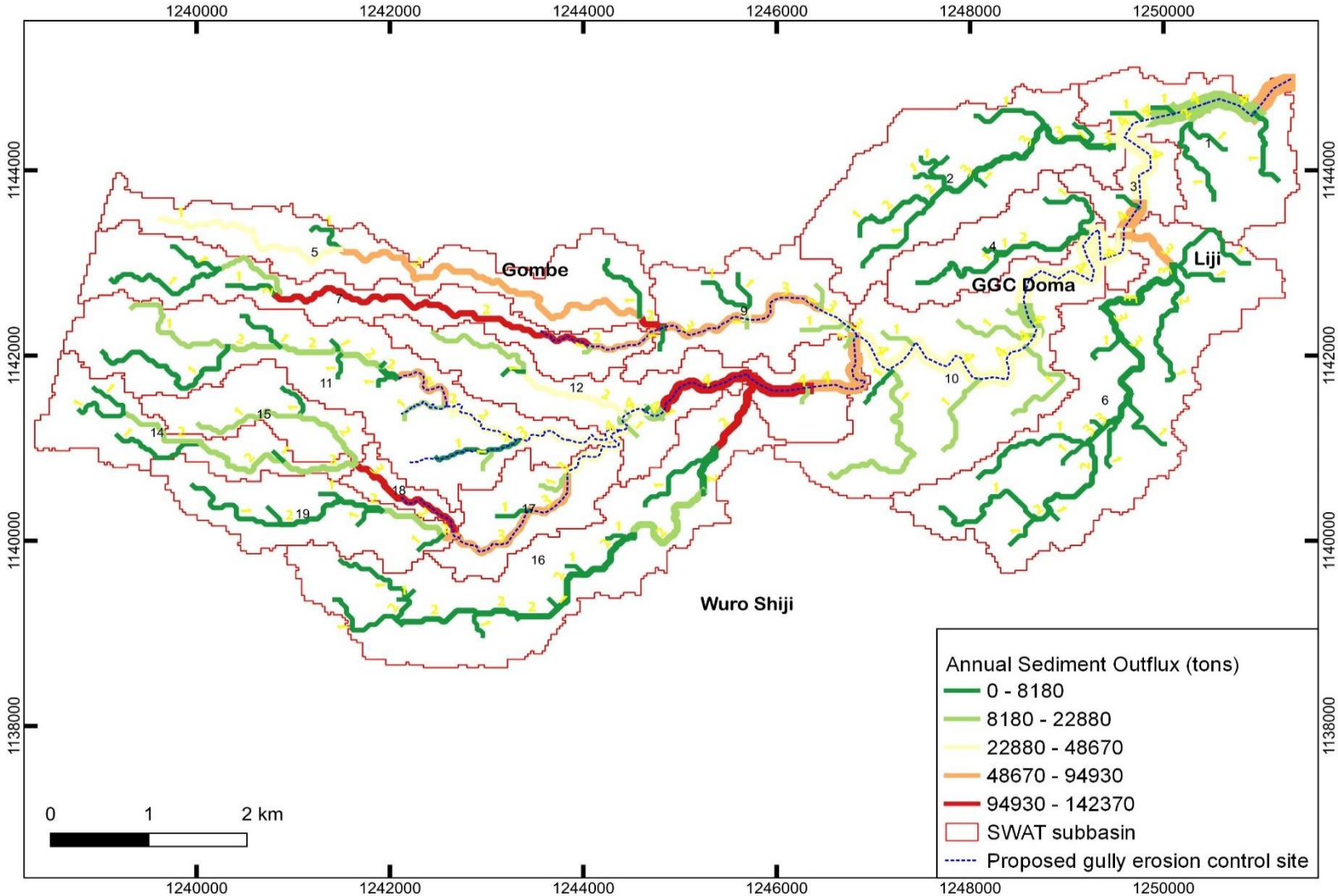


Figure 3-11: Sediment outflux in the project area

In Figure 3.9, the delineated watershed is depicted, highlighting the stream ordering pattern. Upstream areas are characterised by a stream in one order, indicating the convergence of smaller rivers. Moving along the mid-stream, the order increases to streams 2-3, and finally downstream, it reaches 3-4 order. These streams are essential conduits for transporting water and sediment within the river system.

The importance of stream ordering in gully erosion cannot be overstated. Stream ordering provides critical insights into the hierarchical structure of river networks, indicating the relative size and connectivity of streams within a watershed. Understanding stream ordering helps identify the pathways through which water and sediment flow, influencing the formation and progression of gullies. Stream order is a useful tool for evaluating landscapes' susceptibility to gully erosion and for guiding targeted intervention strategies to reduce its impacts.

3.3.1 Runoff fluxes

It is important to understand the patterns of runoff influxes to effectively address gully erosion, as runoff is the primary agent driving erosive processes. By analyzing longitudinal data over time, project stakeholders can gain valuable insights into the dynamics of runoff within the watershed. This enables them to implement targeted mitigation measures that align with the specific needs and challenges of each phase of the project.

Therefore, longitudinal data is essential for comprehending the dynamics and implementing effective mitigation measures during project cycles. The upstream section exhibits an average runoff ranging from 0.00 to 0.06 m^3/s, the midstream averages between 0.43 and 0.74 m^3/s, and the downstream section experiences the highest runoff, ranging from 0.74 to 0.87 m^3/s. Figure 3.10 presents the runoff in the proposed project site.

3.3.2 Sediment analysis

Understanding the sediment dynamics and erosion patterns in the micro watershed is pivotal for the gully control project. Through this baseline information, the potential impacts of gully erosion can be mitigated, preserving the integrity of the channels in the watershed and ensuring the long-term sustainability of the catchment. As depicted in Table 3.2, From 2002 to 2022, sediment influx generally increases over time, with occasional fluctuations. For instance, there's a notable spike in sediment influx from 2019 to 2020, nearly doubling from 17,630.18 to 23,073.77 tons. Sediment outflux follows a similar trend, increasing steadily over the years. Like sediment influx, there are occasional spikes and drops, but the overall trend is upward.

Erosion in the channel bottom and bank has also exhibited an increasing trend over the years. Both values generally rise from 2002 to 2022, indicating ongoing erosion processes within the watercourse. Notably, erosion in the channel bank tends to be higher than in the channel bottom. For instance, in 2022, erosion in the channel bank is substantially higher than erosion in the channel bottom (18,105.54 vs. 2,715.727 tons). Figure 3.11 shows the sediment outfluxes in the project area.

The increasing trend in sediment influx and erosion rates suggests heightened vulnerability to gully erosion and sediment transport within the area. This could lead to adverse impacts such as habitat degradation, water quality deterioration, and infrastructure damage.

Table 3-2: Sediment fluxes and erosion processes

Year	Sediment influx (ton)	Sediment outflux (ton)	Erosion in channel bottom (ton)	Erosion in channel bank (ton)
2002	9282.508	9940.85	768.343	4142.831
2003	14636.58	15575.94	1135.83	6504.198
2004	13175.67	14202.69	988.1427	5985.835
2005	16670.56	17826.68	1218.901	7545.565
2006	13595.66	14653.43	990.8462	6420.422
2007	15515.89	16710.95	1133.507	7351.909
2008	14621.99	15818.9	1067.742	7071.413
2009	16074.41	17293.18	1152.611	7684.201
2010	16324.33	17537.46	1152.227	7790.837
2011	12913.9	14026.25	909.6427	6298.353
2012	17092.54	18297.22	1197.558	8167.528
2013	10969.38	11991.33	773.7435	5510.44
2014	11804.6	12835.62	828.6422	5863.355
2015	11938.27	12949.42	828.191	5881.977
2016	14994.36	16035.92	1034.116	7225.537
2017	11515.21	12481.78	803.5061	5709.761
2018	15002.85	16023.56	1028.565	7187.372
2019	17630.18	18647.42	1195.458	8263.171
2020	23073.77	24051.57	1520.602	10499.36
2021	42282.32	43671.88	2811.945	18840.33
2022	40554.93	41857.51	2715.727	18105.54

Source: Hydrological Simulation, 2024

3.4 Ambient Air Quality Assessment

It is important to note that atmospheric gases occur naturally to ensure ecological stability; however, anthropogenic activities may equally increase the gas concentration in the

atmospheric boundary above threshold limits, translating into air pollution. Table 3.3 presents the result of the air quality parameters as measured in the project area. Figure 3-12 shows the sampling points for the ambient air assessment.

Table 3-3. Ambient Air Quality Parameters

S/N	SAMPLING LOCATION	AIR QUALITY PARAMETERS						
		PM2.5 (µg/m³)	PM1.0 µg/m³)	PM10 µg/m³)	HCHO µg/m³	TVOC (mg/m³)	TEMP (°F)	HUMIDITY (%)
1	Nayi Nawa	49	68	32	2.009	0.104	84	23
2	HammaduKeffi/Bagadaza	54	61	30	0.019	0.104	91.4	31
3	Pantami	61	77	36	0.0024	0.001	93.5	35
4	Borinde Junction	61	73	31	0.011	0.007	93.4	23
5	Layin Dan Gusau	49	56	27	0.009	0.338	89.4	43
6	Yalan Guruza	34	47	22	0.009	0.039	93	83
7	Yalan Guruza	38	50	24	0.027	0.117	98.1	29
8	Ligi/Biu Road	34	42	19	0.009	0.052	89.9	31
9	Kwadan/Kurba/Ligi	37	40	18	0.009	0.507	87	93
10	Byepass Road/Kwadan	31	41	15	0.009	0.039	96.3	65

Source: Fieldwork, 2024

Site-specific air quality is determined by the ambient concentration of the various atmospheric gases (pollutants). Atmospheric air is a major sensitive environmental media that can be degraded through emissions of dust particles, aerosols, and toxic gases into the environment, with short-term and long-term effects on the environment and human health. Human interference with the physical environment during project development is the major pathway through which the stable state condition of the environment can be altered.

The effect of air pollution is directly proportional to the toxicity of the gases, level of exposure, and susceptibility of individuals exposed. Most of the air pollutants were not detected around the proposed project area during the field assessment; only PM (1.0, 2.5 & 10), TVOC, HCHO, Temperature, and Humidity were assessed. However, at each stage of the project development, there might likely be significant releases of pollutants into the environment, so it should be monitored to ensure environmental sustainability.

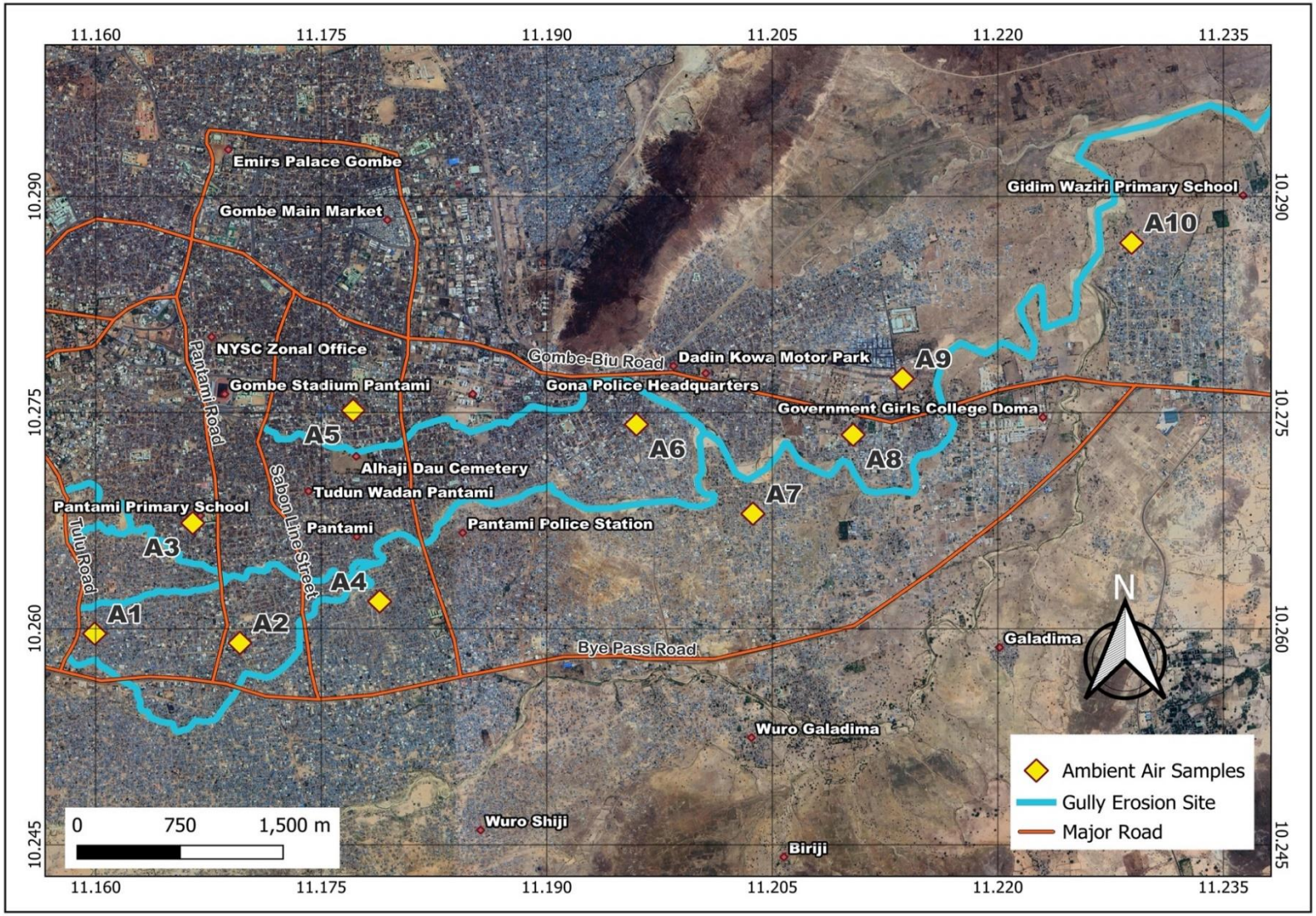


Figure 3-12: Sampling points for air quality measurement in the project area

3.4.1 Particulate Matter (PM1.0, PM2.5 & PM10)

Particulate Matter (PM), also called particle pollution, is the term referring to the mixture of dust, soot, fumes, smoke, and other aerosols in the form of liquid droplets or solid particles which are introduced into the environment from ground-blown dust and emissions vehicles and other combustion engines. In the context of construction activities, PM2.5 and PM10 are the pollutants of most concern. The existing baseline of PM2.5 is higher around the Pantami and Borinde Junction with an average value of 61µg/m^3, with the lowest values recorded at Bypass Road/Kwadan with a value of 31µg/m^3

The sampled air quality further shows that ambient air concentration of PM1.0 ranged from 40 – 77µg/m^3 and the PM2.5 ranged from 31–61.0µg/m^3 while the PM10 ranged from 15–36µg/m^3 across sampling locations (**Error! Reference source not found.** and Figure 3.12). The mean concentrations of PM1.0, PM2.5 and PM10 are 44.8µg/m^3, 55.5µg/m^3 and 25.4µg/m^3 respectively. The concentration of PM2.5 recorded in all the sampling locations was below the FMEnv (80µg/m3) threshold hourly average values for outdoor concentration, but above the WHO (25µg/m^3) standard annual average values. On the other hand, the concentrations of PM10 in the ambient air within the project locations were below the FMEnv (250µg/m3) and WHO (50µg/m^3) threshold daily (24-hour) average values for outdoor concentration. This indicates that the concentrations of PM2.5 and PM10 across the project location during baseline studies were within permissible limits, and generally, the Air Quality Index is very good for the whole sampled location.

The proposed project's activities will increase particulate matter in the air, potentially causing health issues for workers and the community. To minimize this impact, construction activities must be carefully managed to reduce particle emission.

3.4.2 Total Volatile Organic Compounds (TVOCs)

The measured TVOC data obtained from the field revealed that the TVOCs ranged from 0.001 to 0.507mg/m^3 with the mean values of 0.1308mg/m^3. The lowest value of 0.001mg/m^3 was found in the Pantami project community, while the highest value of 0507mg/m3 was measured in the Kwadan/Kurba project community. The high TVOC in the Kwadan/Kurba project community was anthropogenic activities like vehicle emissions, household smoke, and Suya spots. Exposure to VOCs can cause health problems ranging from minor symptoms felt by chemically sensitive individuals to more severe effects like illness and even death, depending on the degree of exposure.

3.4.3 Formaldehyde (HCHO)

Formaldehyde, popularly known as HCHO, is a common indoor air pollutant. It is a gas that can irritate a person's eyes, nose, throat, and lungs or trigger an asthma attack, even at low concentrations. Prolonged exposure to formaldehyde can cause cancer. The recorded values of the HCHO at the proposed project communities are presented in Table 3.3. The lowest value of 0.0024 µg/m^3 was recorded at the Pantami project community, while the highest value of 2.009 µg/m^3 was recorded at the Nayi Nawa project community. The mean value of 0.211 µg/m^3 was recorded in the entire project communities, signifying that the mean value is higher than the World Health Organization (WHO) established indoor air quality guideline for short- and

long-term exposures to formaldehyde (FA) of 0.1 μg/m³ (0.08 ppm) for all 30-min periods at lifelong exposure. This exposes some of the project communities, especially Nayi Nawa, to danger.

3.5 Noise Level Assessment

The recorded noise level data within Doma gully erosion project communities indicate that the noise level ranges from 45.5dB at the Pantami project community to 89.3dB at Borinde Junction, with a minimum mean value of 52.56dB and maximum mean value of 74.30, as presented in Table 3.4. Figures 3-13 show the sampling points for the noise level assessment.

Table 3-4: Ambient Noise Level within the Doma Project Communities.

S/N	Location	Minimum (dB)	Maximum (dB)
1	Nayi Nawa	50.3	69.3
2	HammaduKeffi/Bagadaza	54.3	73.2
3	Pantami	45.5	71.2
4	Borinde Junction	60.6	89.3
5	Layin Dan Gusau	61.7	72.3
6	Yalan Guruza	53	82.9
7	Yalan Guruza	49.3	61.5
8	Ligi/Biu Road	48.1	63.4
9	Kwadan/Kurba/Ligi	51.1	87.5
10	Byepass Road/Kwadan	51.7	72.4
Mean Values		**52.56**	**74.3**

Source: Fieldwork, 202

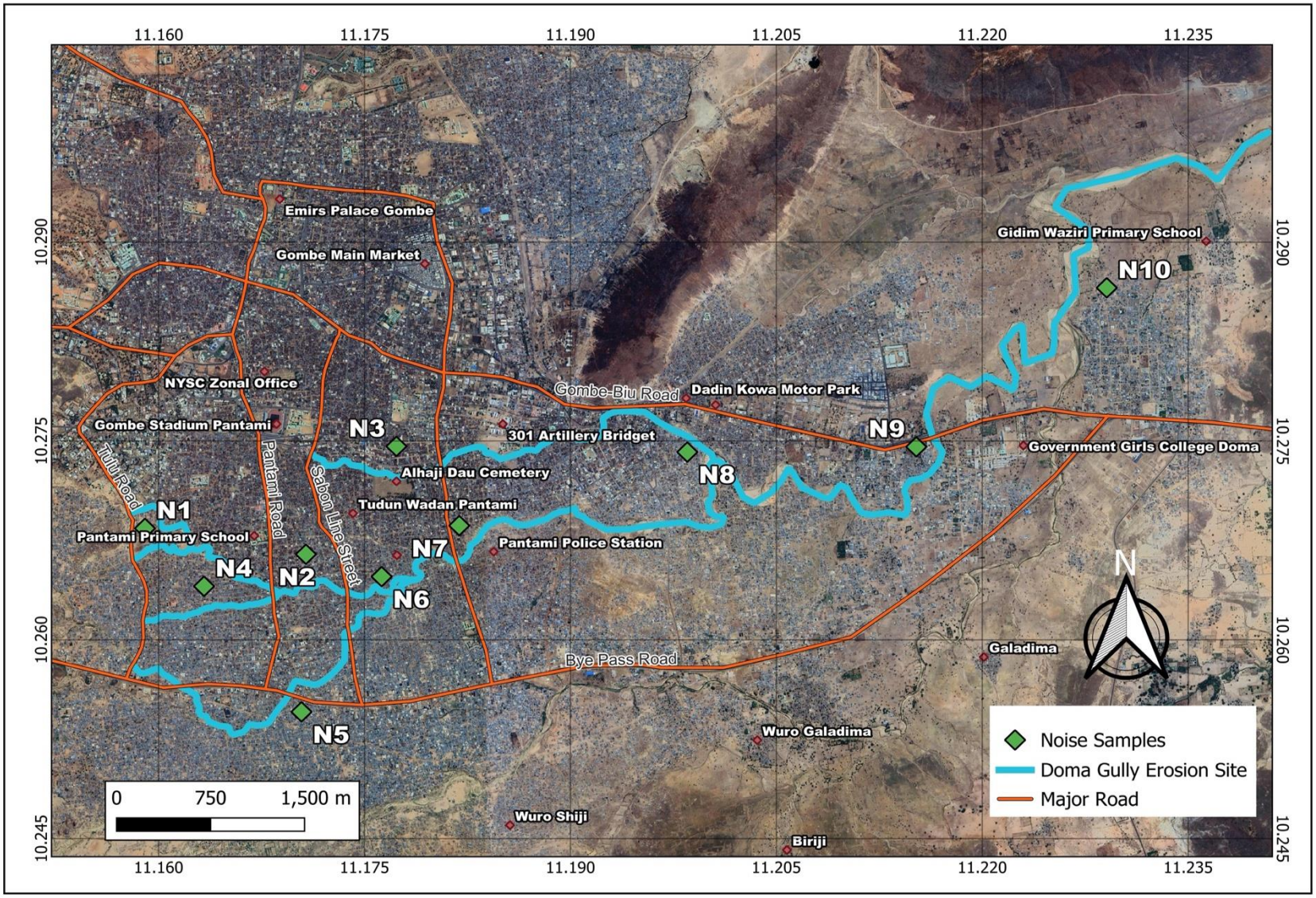


Figure 3-13: Sampling points for noise level measurement in the project area

a) b)

Plate 3-1: Measurement of noise level (a) and air quality (b) at one of the sampling locations (Pantami)

The maximum noise level of 89.3dB was recorded at Kwadan/Kurba and was attributable to the traffic movement during the data collection process. The lowest value of 45.5dB was recorded at the Pantami project community. The minimum noise level ranges from 45.5dB to 61.7dB, with a mean value of 52.56 dB. The recorded mean noise values within the proposed project communities were mostly within the natural background status of 20-60 dB. Still, the mean maximum level exceeded the natural status and WHO limit of (70dB), and the mean values of the noise level were below the threshold limit (55dB) for residential areas. However, the background noise level is expected to soar higher during the project construction activities and operational phases due to the presence of heavy-duty machines and vehicular movement. The project construction phase is expected to generate noise far above the average baseline noise level, so workers in the project area and its vicinity will be exposed to hourly noise levels. Prolonged exposure to the average noise level of about 85dB usually results in hearing loss (SKC, 2000). NIOSH (1996) attributed hearing impairment among workers to mechanical noise exposure. Loss of hearing due to noise exposure can lead to tinnitus, i.e., buzzing in the ear, while insomnia and tiredness can also be caused by exposure to noise. Plate 3-1 shows one of the researchers collecting noise level data at Nayi Nawa project community.

3.6 Geology and Relief

The study area is GGC Doma's main gully, and its finger extensions are at Pantami, Bagadaza, and Barundi. The lowest relief region of the study area lies between 384.31m-385m, while the highest relief range is between 560.01 and 595m (Figure 3.14). The geological characteristics of the study area include sequences of Cretaceous Sedimentary deposits of the Kerikeri Formation, the siltstone, sandstone and ironstone of the Gombe Formation, the shale and

limestone of the Pindiga and Yolde Formation, Bima Formation and the basement rocks (Figure 3.15).

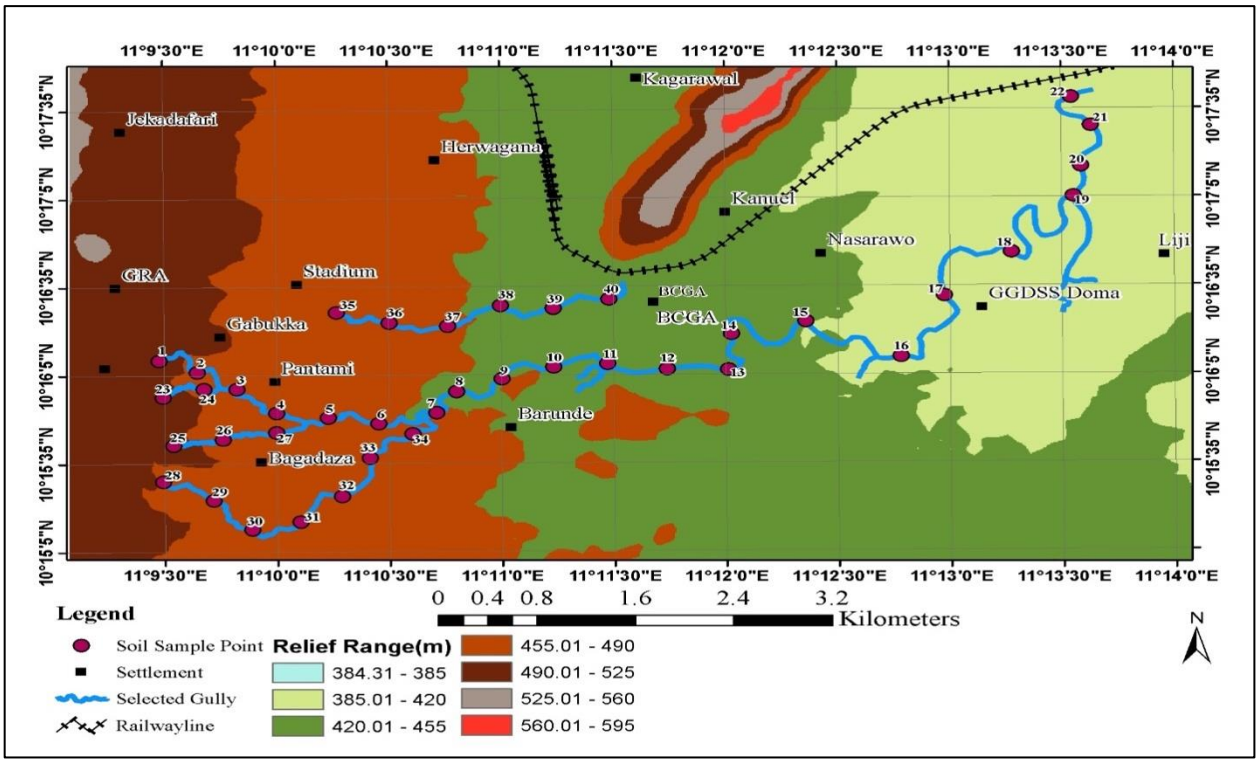


Figure 3-14: Relief Ranges in the Study Area Source: Author's GIS Analysis

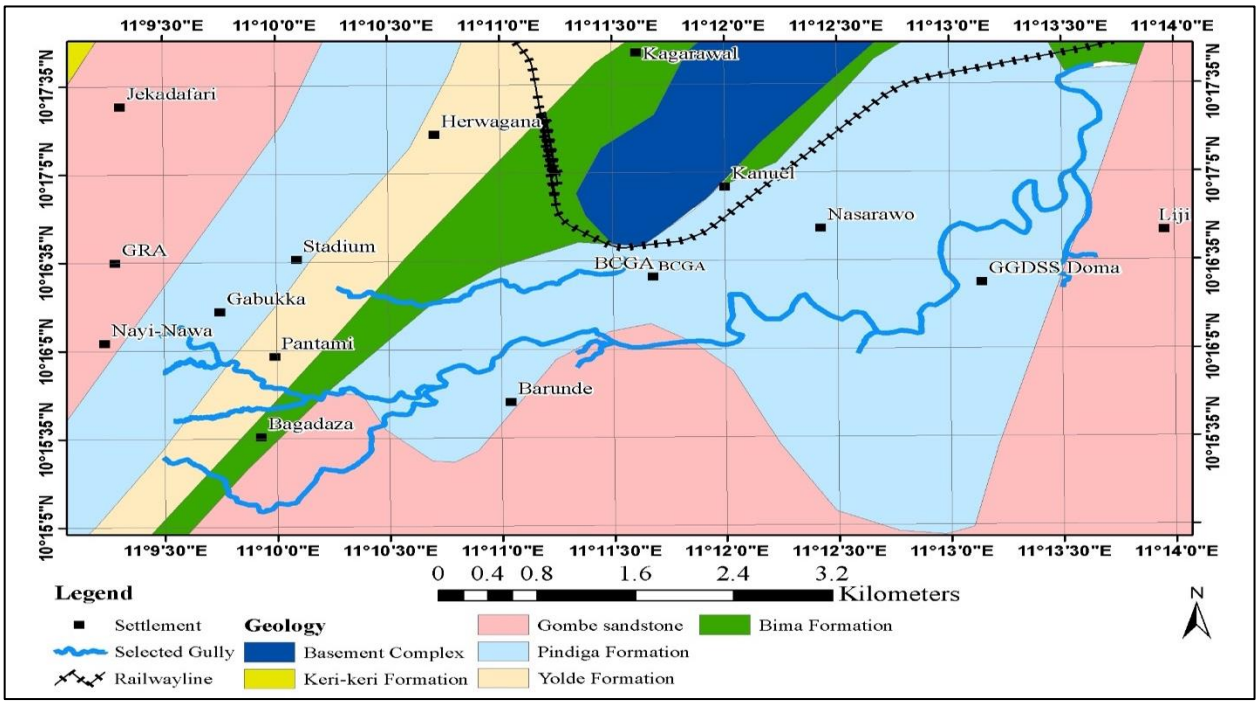


Figure 3-15: Geology of Study Area. Source: Author's GIS Analysis

3.7 Soil Assessment

The result of the variation of soil properties along the gully slope at Pantami (upper), Barunde (middle) and Doma (lower) is presented in Table 3.5 and Appendix 5a). The soil physical analysis results show that the soil particle size was dominated by sand fraction, and the soil texture was sandy loam. This could be responsible for the high degree of susceptibility of the area to gully erosion because of the loose nature of the soil. Soil pH was rated moderately acidic (5.8 – 5.9), and the middle slope was higher in soil pH than the upper and lower slopes. Soil organic carbon (O.C), total nitrogen (TN) and available phosphorus (AP) were all rated low, less than 1% (< 1%) for O.C and TN and (10 mg/kg) for AP. Figure 3-16 shows the soil sample location.

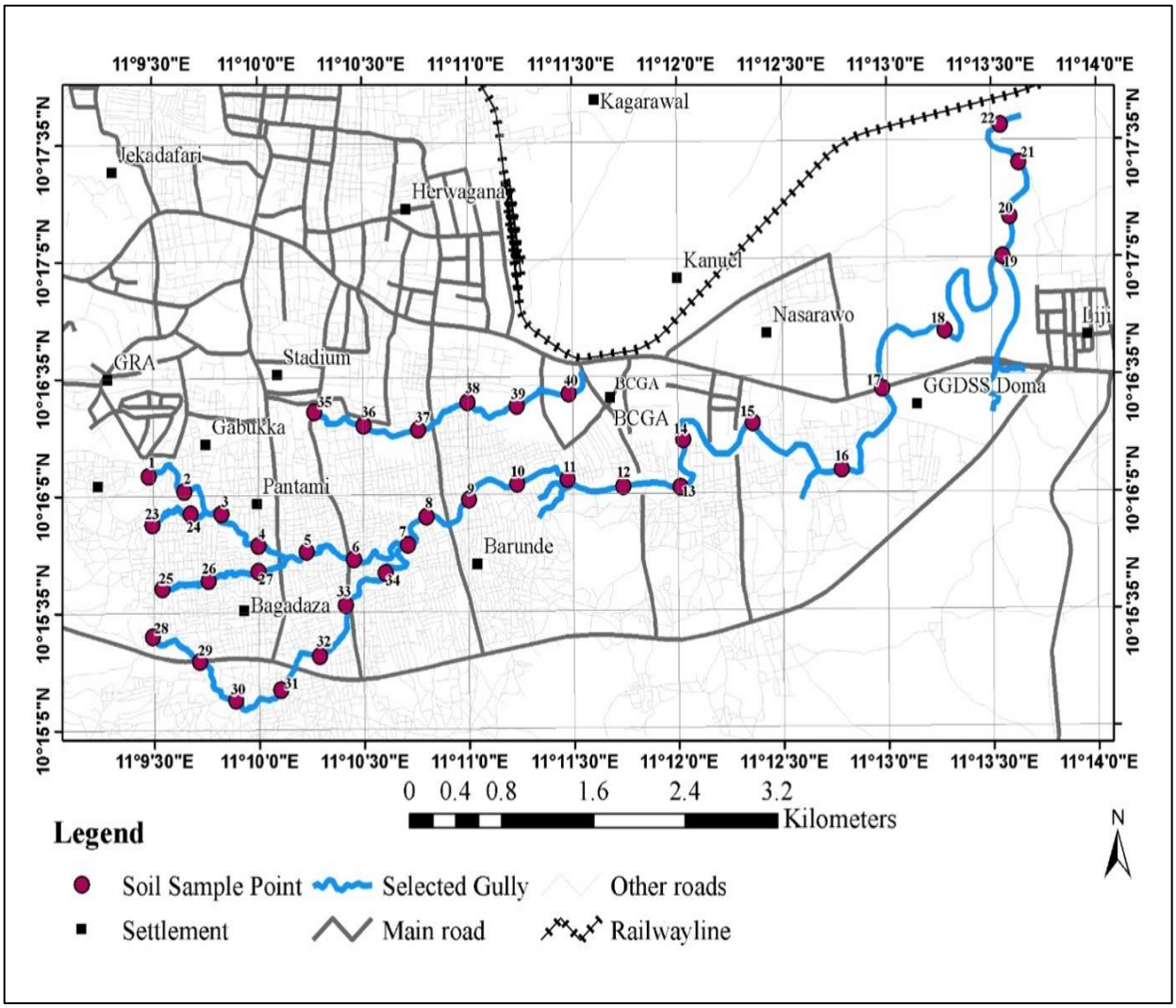


Figure 3.16: Soil Sample Location Source: Author's GIS Analysis

Table 3-5: Mean Variation of Soil Properties along the gully slope at Pantami (upper), Barunde (middle) and Doma (lower)

Location	Sand	Silt	Clay	pH (1:1)	O.C	T.N	A.P	Ca	Mg	K	Na	EA	ECEC	Zn	Cu	Mn	Fe
	(%)				(%)		(mg/kg)	(cmol(+)/kg)						(mg/kg)			
Upper Slope	61.27	20.37	18.36	5.83	0.55	0.05	5.03	1.91	0.64	0.21	0.08	0.11	2.95	5.85	2.54	25.26	167.15
Middle Slope	60.66	21.97	17.37	5.91	0.65	0.05	3.32	2.29	0.58	0.25	0.08	0.10	3.31	8.25	2.60	33.32	178.25
Lower Slope	60.67	20.76	18.57	5.79	0.60	0.05	4.72	2.03	0.63	0.20	0.08	0.12	3.06	6.83	2.94	30.36	168.73
P-Values	0.99	0.93	0.51	0.13	0.07	0.71	0.14	0.42	0.52	0.25	0.75	0.91	0.53	0.59	0.42	0.13	0.86
LS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Std Error	1.848	1.441	1.492	0.428	0.026	0.014	0.002	0.331	0.101	0.020	0.013	0.002	0.014	0.785	0.137	1.348	7.693

Source: Laboratory analysis, 2024

Soil O.C. in the middle were higher than the lower slope and upper slope, while AP on the upper slope were higher than the middle and lower slope. These nutrients determine the property and health of the soil in terms of supporting ecosystem services such as nutrient cycling, supporting biodiversity and protecting the soils from agents of degradation, i.e. water and wind erosion. There is a need to adopt management practices to build up the organic carbon content for sustainability. This will include planting leguminous cover crops and adopting agroforestry along the gully sites. Soil exchangeable calcium (Ca), magnesium (Mg), and potassium (K) were all rated moderate for all the slope classes. The middle slope was higher in Ca and K than the upper and lower slopes, while the upper slope was higher in Mg than the middle and lower slopes. All three slope classes were rated low in exchangeable sodium (Na) being less than (0.1 cmol(+)/kg). Exchangeable acidity (EA) was rated low, less than (1.0cmol(+)/kg) and suggests that the soils have little or no acidity problem. The lower slope class was higher in acidity than the upper and middle slopes, which could be attributed to the downward transportation of material from the upper and middle slopes.

Effective Cation Exchange Capacity (ECEC) was generally low for all three slopes class/locations less than (4 cmol(+)/kg). However, the middle slope was higher in ECEC than the lower and upper slopes. The low ECEC indicates the general low fertility of the soil along the gully. The soil's organic carbon content determines the amount of ECEC present in the soil. All three slope classes/locations were very high in all the micronutrients (Iron (Fe), Manganese (Mn), Copper (Cu) and Zinc (Zn)). The middle slope was higher in Fe, Mn, and Zn than the upper and lower slopes, although the difference was not statistically significant. The soil on the lower slope was higher in extractable Zn than the upper and lower slopes, though the difference was not statistically significant like that of the other micronutrients.

3.7.1 Implications of Changing Soil Properties on Gully Development

The soils in the three slope classes were loose and had a sandy loam texture. They were low in fertility because of low macronutrients (OC, TN and AP). Exchangeable bases were rated medium except Na, which was rated low. Effective Cation Exchange Capacity and Exchangeable acidity were low for all three slope classes/locations. All the micronutrients were adequately available with very little chance of deficiency. However, for sustainability, the manure application and management practices which will encourage the return of plants/crop residues into this soil to improve the soil quality should be applied. This will include agroforestry on marginal lands, i.e. areas along the gully, and the creation of awareness of the need to avoid building structures on the waterway and proper waste disposal instead of dumping waste in the gully site.

3.8 Land use/ Landcover Analysis

Land use/ land cover categories identified from satellite imagery using supervised/maximum likelihood classification in the study area in 2024 include built-up area, gully, rock outcrop, vegetation/grassland, and bare surface/open spaces. The categories are presented in Figure 3.17.

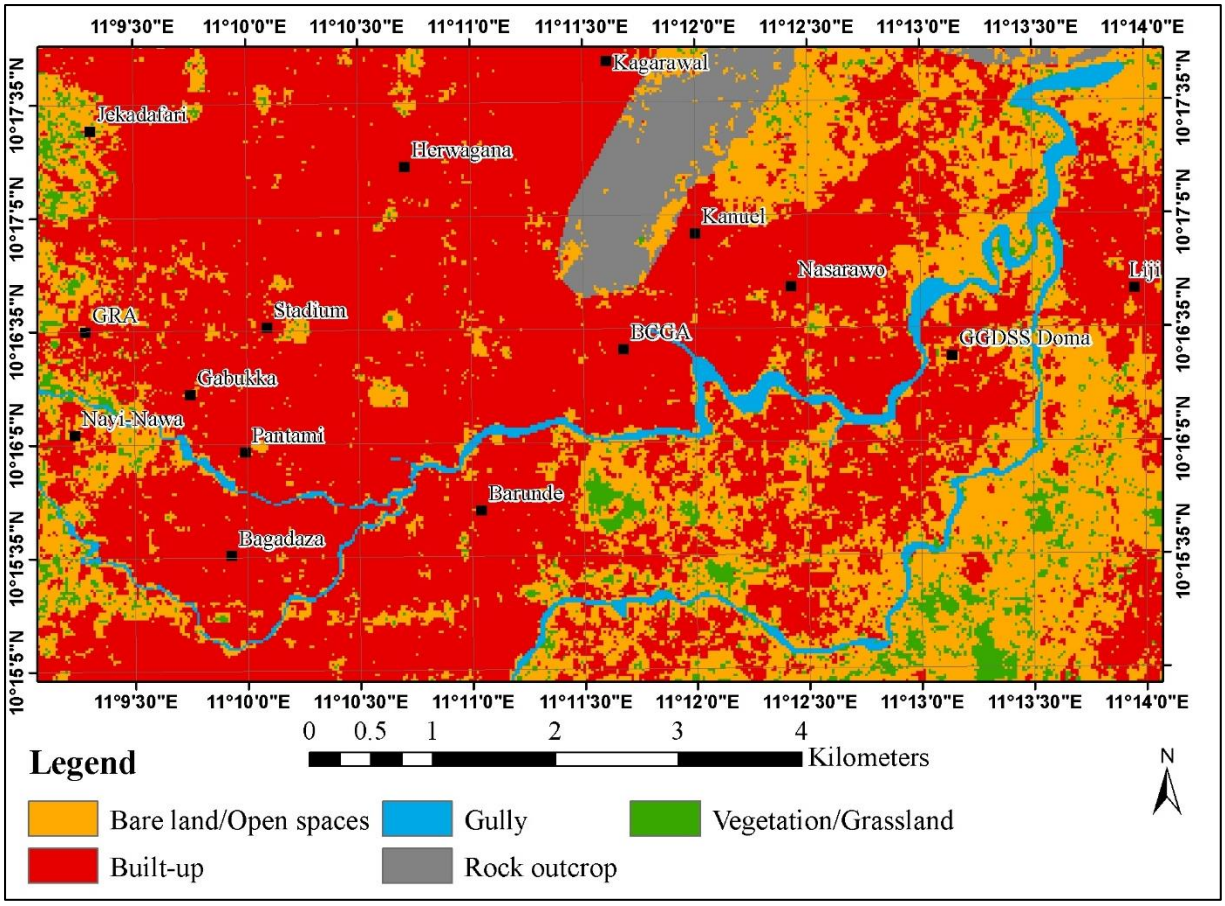


Figure 3-16: Current land use/ landcover classification, 2024
Source: Author's GIS Analysis

Table 3.6 presents the spatial extent of the classified land use and land cover types. The land use/land cover categories identified in the study area are built-up areas, bare land/open spaces, gully, vegetation/grassland, and rock outcrop.

Table 3-6: Landuse and Landcover Classes

LULC Class	Area extent 2024 (km²)	%T
Bare land/Open spaces	12.42	27.10
Built-up	28.66	62.53
Gully	1.49	3.25
Vegetation/Grassland	1.51	3.30
Rock outcrop	1.76	3.83
Total	45.84	100.00

During the past decade, changes in land use/land cover have altered the environment and the ecosystem services it provides. Extensive areas of grassland and wooded vegetation have been converted to build-up areas. Built-up areas have expanded, and the resultant use of earth materials and vegetal resources in constructing dwelling places created badlands, burrow pits, extended bare surfaces, and gullies that have devastated the land recourses. Presently, the built-up Area has the highest area extent, covering an area of

28.66 km^2. The vegetation and grassland provide arable land for farming and animal grazing. It is showing a decrease in area extent with a record of 1. 51km^2 because of the increasing density of dwellings and settled areas as well as the abandonment of farmland because of land degradation and inadequate land use practice of slash and burn subsistence agriculture on the fragile resource base of low soil fertility. Bare land/open space had an extent of 12.42 km^2.

This relatively large extent to other land uses could have resulted from deforestation, vegetal cover loss, poor land management and land degradation occasioned by overgrazing and the increasing dimensions of gullies as well as an increasing number of people seeking livelihoods from off-farm activities of logging, fuel wood marketing and charcoal production to meet the energy needs of the rural populace. The total area occupied by gullies is 1.49 km2, which is likely to increase if no effort is made to control gully erosion in the study area. The rock outcrop occupies an area extent of 1.49 km^2. The implications of extensive changes in land use and land cover are increases in surface temperature and contributions to greenhouse gas emission that accentuate climate change, increases around impervious surfaces which generate high runoff and impede infiltration during rainfall events, consequently accelerating gullies initiation and development.

3.9 Flora and Fauna Assessment

Among the vegetation explored during the course of this survey (Table 3.7), 90% of them are invasive trees, the remaining 10% are native, and are at risk of extinction in our dear state (Gombe) metropolis; they comprise the following; Baobab, Doum tree palm, Tamarind, Guiera senegalensis, Brossus aethiopum, Balsmina, Sacred fig, Desart date, and most common varieties in all the location are; bindweed, Neem Trees, Baobab, Pawpaw, bindweed, Moringa, Mango tree. While the slightest ones are Sacred Pig, Tamarin, Jatropha, Guava, and Guiera Senegalensis.

The common animals are laughing Dove, Senegal Coucal, Long tail Starling, Northern Grey-Headed Sparrow, Red-billed fire Flinchers, cut-throat finch, Yellow Wagtail, Piapiac, Purple Glossy Starling, Hen's Goat, Cattle Ergate, Village Indigo. The uncommon ones are Speckled Pigeon and Abyssinian Roller.

The populace of site 5 engaged in dry season farming of Rice, Onion, Tomatoes, etc. These activities attracted several Insectivores and Frugivorous Birds. One of the farmers, Mrs Abdullahi Ali, retired DSP Ligi, said they could be able to harvest more than 50 Baskets of onion and Tomatoes annually and is the only site where more than 20 Species of birds were identified, and I am expecting more than my count at this site. Hence, re-exploration of birds is needed. If the proposed dam is established around the site or close to it, the community income would increase, and it would attract more species of birds due to the availability of food and water and a conducive environment.

Some birds are threatened due to the anthropogenic activities of humanity around the globe; for instance, noise pollution from machinery, trains, and vehicles leads to the migration of speckled pigeons. Abdim's storks are threatened by the habitat destruction of the baobab trees and are affected by pesticides used by farmers to control insects on their farm's land.

Those Animals live longer on native trees than on invasive ones. Hence, the number of native trees is drastically reducing daily due to the illegal cutting of trees, urbanisation, and colonisation of invasive species. This leads to the migration of animals to somewhere they can find suitable habitats to survive, protect their infants, and continue existing.

It is therefore recommended that:

- The public, NGOs, and Government should engage in tree planting and other afforestation projects of native trees to create an environment that harmonises with nature for the benefit of present and future generations.
- The government, in collaboration with environmental experts, including NGOs and naturalists, should engage in awareness campaigns to highlight the effects and impacts of habitat destruction and its consequences.
- Households and industries should minimise the release of pollutants and greenhouse gases to create a safer habitat for plants and animals.

Table 3-7: List of Flora and Fauna along the GGC Doma/Bama Gully stretch

	SCIENTIFIC NAMES	VEGATATION ENGLISH NAME	HAUSA NAME	RARE/ SCANTY	ENDEMIC /ORIGIN	IMPACT	THREAT
FLORAL							
1	*Ficus polita*	Ficus citrifolia	Durmi	Abundant	Native	Locally treatment of ulcers, cancer	Illegal cutting
2	*Polythia longitata*	Masquerade	Dogon yaro	Abundant	Non-native tree	Control noise pollution, windbreakers	Urbanisation
3	*Adansonia digitata*	Baobab	Bishiyar kuka	Abundant	Native	Human consumption, habitat of migratory water birds, i.e. abdim's stork	Introduction of invasive species (Down *et al.*,.2020)
4	*Eucalaptus globalus*	Eucalyptus	Bishiyar turare/ zaiti	Abundant	Non- native	It is used to make local perfumes, treat Simonelli typhoid, and provide diet to some birds. i.e. flycatchers that feed on insects	Climate change alte migratory birds/ insectivorous birds feeding habit on this tree
5	*Azadracta indica*	Neem tree	Maina	abundant	Non-native	Neem oil is used to control tick and termite parasites and is also used for female hairdressing.	Illegal cutting for firewood
6	*Royal farm*	Royal farm		Rare	Non-native, are from Mexico	Use for decoration	Urbanisation
7	*Termiminalia mentalis*	Satellite tree	Bishiyar	Rare	Native to Africa		Illegal cutting
8	*Balanite egyptica*	Desert date	Bishiyar Aduwa	rare	Native	Transnationally used in the treatment of intestine worms'	Colonisation of invasive trees and

						infection, wounds, malaria, diarrhoea and stomach aches. Habitat of various birds, i.e. piapiac, indigo, and red-billed fire finches	intensive commercial farming (song *et al.*, 2018)
9	*Carica papaya*	Pawpaw tree	Gwanda	Abundant	Native US	Human consumption, local treatment of typhoid fever	Insect pest
11	*Jatropa curcas*	Jatropha curcas	Bita da zugo	Rare	Native to Mexico	Local treatment of child worms,	Urbanisation
12	*Terminalia catapa*	Umbrella tree	Bishiyar umbrella	Rare	Native to Australia	Shade provision, human consumption	Illegal cutting
13	*Moringer oleifera*	Moringa oleifera	Zogale	Abundant	Native to India	Human consumption improves human health, such as liver protection.	Urbanisation
14	*Phoenix dactylifera*	Date tree	Dibino	Rare	Native	Source of food, landscaping, income generation, its seed aid human digestion	Urbanisation
15	*Ficus thonningii*	Sacred fig	Chediya	Rare	native to African countries	Its bark is used for traditional medicines such as cold, sore throat	Urbanisation
16	*Siena siamea*	Cassord tree	Gadilam	Abundant	Native to Asia	Control of typhoid, staphylococcus aurues	Illegal cutting
FAUNA							
2	*Streptopelia senegalensis*	Laughing Dove	Kurchiya	Abundant	Resident and common	Control of insect pest	Excessive use of pesticides and herbicides used by farmers to control insects threatening this particular bird

3	*Capra hirus*	Goat	Akuya	Rare	Resident and common	Income generation and source of protein	Lack of foraging site
4	*Ovis aries*	Sheep	Tinkiya	Rare	Resident and common	Income generation and source of protein	Lack of foraging site
5	*Gallus gallus*	Hens	Kaza	Scanty	Resident and common	Income generation and source of protein	
6	*Coluba guinea*	Speckled pigeon	Hasbiya	Santy	Resident and common	Sources of Protein	Habitat destruction, Noise pollution, and herbicides are a major threat to their population, and that leads to migration (humbart et. al., 2009)
7	*Butterfly*	Red wing butterfly	Mallam bude littafi	Rare	Common	Agent of Plant pollination and dispersal of seeds Thomson.	Habitat loss due to urbanisation, climate change and invasive species

Source: Field Survey (2024).

CHAPTER FOUR: SOCIO-ECONOMIC CHARACTERISTICS AND CONSULTATION WITH STAKEHOLDERS

4.1 Introduction

The socioeconomic baseline study provides insights into the project communities' existing social and economic conditions. This section presents an overview of key socioeconomic factors that influence and are influenced by the erosion control intervention.

4.2 Demographic Profile

Understanding the demographic composition of the project area, including population size, age structure, and ethnic diversity, is essential for targeting interventions and addressing the needs of vulnerable groups.

4.2.1 Sex and Age

Figure 4.1 depicts the distribution of respondents by gender across the communities. Of all respondents, 78% were male, whereas 22% were female. This disparity is influenced by the prevailing religious and cultural norms within the sampled communities.

Regarding age distribution, most respondents fell within the 36-55 age range. Specifically, 33% were between 46 and 55 years old, while 32% belonged to the 36-45 age category. Similarly, 20% were within the 18-35 age bracket. The elderly population, aged 56-65 and those above 65, constituted 8% and 7% of the total respondents, respectively (Figure 4.1).

a) b)

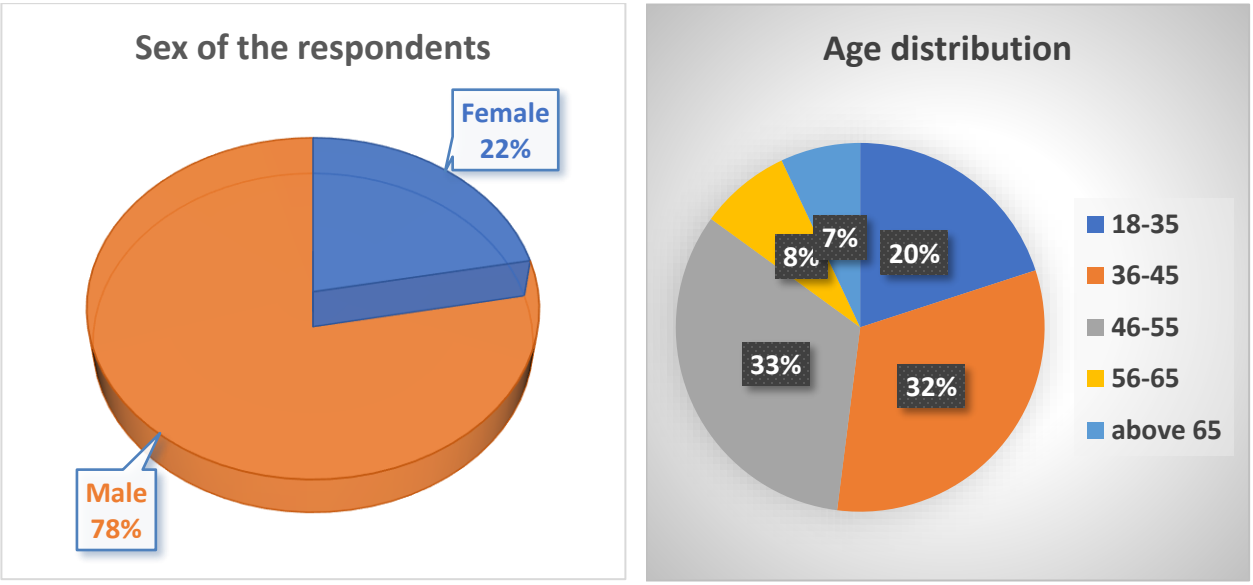


Figure 4-1: Shows the sex (a) and age distribution (b) in the project communities

4.2.2 Ethnicity

Similarly, the demographic composition of the communities is characterised mainly by the Fulani and Hausa ethnic groups Figure 4.2. Accordingly, 43% and 23% of respondents identify as Fulani and Hausa. Other ethnicities, such as Jukun, Tangale, Tera, Tula Waja, and others, constitute 44% of respondents.

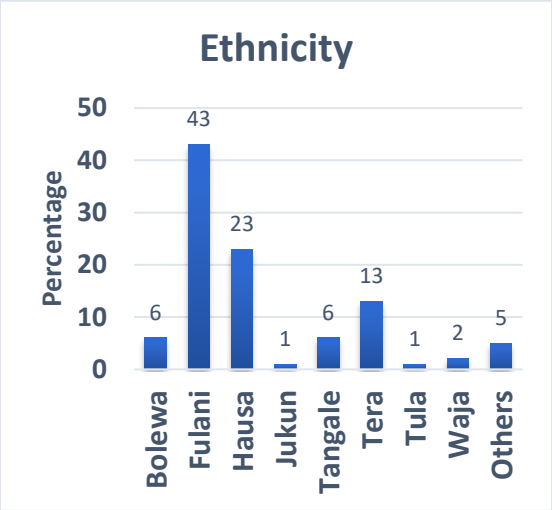


Figure 4-2: Religion (a) and Ethnicity (b) in the project area

4.2.3 Marital Status and Education

The marital status of the respondents exhibited notable diversity, as illustrated in Figure 4.3. A substantial majority, comprising 85% of the respondents, were married. Conversely, 11% were widows, while 4% identified as single.

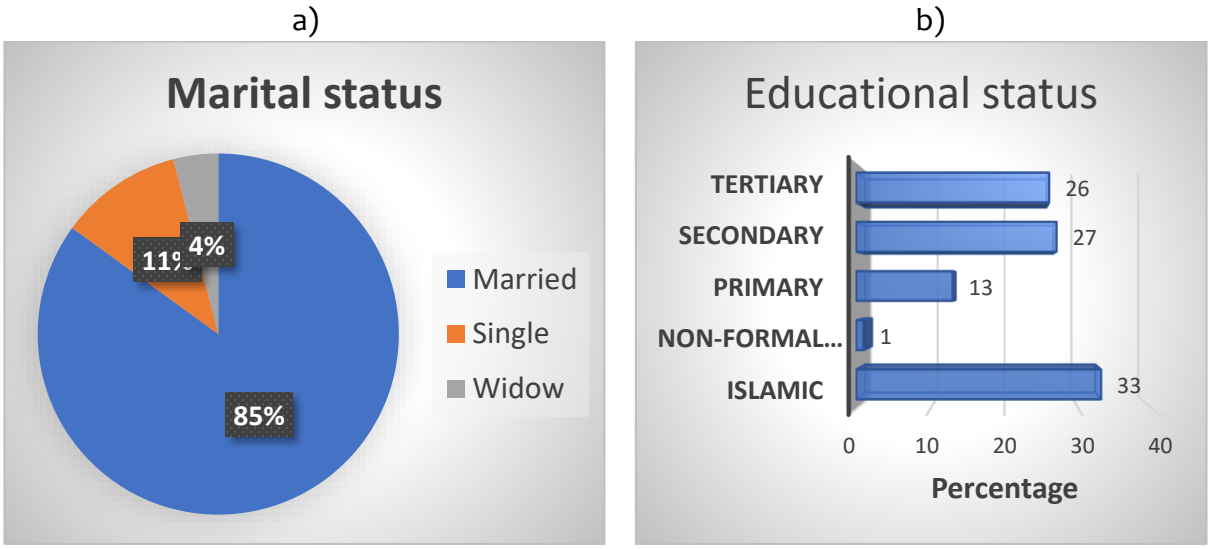


Figure 4-3: Marital (a) and Educational (b) status in the project area

Regarding educational attainment, respondents displayed a range of formal and non-formal educational backgrounds. Those with Islamic education represented 33% of the sample. Additionally, 13%, 27%, and 26% attended primary, secondary, and tertiary schools. Only a minimal proportion, constituting 1%, had received non-formal education (Figure 4.3b).

4.3 Livelihoods and Economic Activities

Livelihood strategies and economic activities vary across the project communities, ranging from agriculture and fishing to small-scale businesses and artisanal activities.

4.3.1 Employment

Figure 4.4 depicts the respondents' employment status, revealing that 22% were engaged in various forms of employment while 19% were unemployed. The predominant category among the respondents was self-employment.

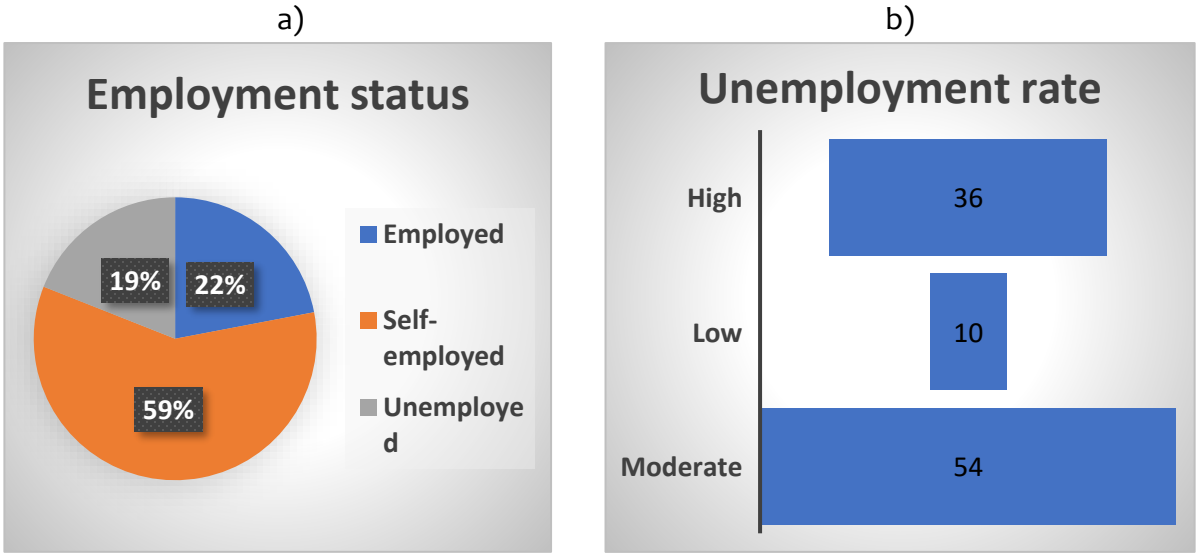


Figure 4-4: Employment (a) and unemployment rate (b) in the project area

Within the communities, the unemployment rate was reported to be moderate by 54% of respondents. Additionally, 36% and 10% of respondents indicated high and low unemployment, respectively. This moderate unemployment rate can be attributed to the prevalence of self-employment among most individuals in the area (Figure 4.4b).

4.3.2 Livelihood

Regarding livelihood options, respondents exhibited a diverse range of choices Figure 4.5. Approximately 28% were in crop and livestock farming, while 25% engaged in petty trading. Additionally, a small percentage derived their income from off-farm temporary employment (5%) and agro-processing (6%). Civil servants comprised 16% of the respondents

When considering annual income, most respondents (35%) reported earning between 50,000 and 100,000 annually, as shown in Figure 4.5b. A significant portion (28%) earned between

100,000 and 300,000 annually, while a smaller proportion (3%) reported earnings above 2,000,000. These income disparities can be attributed to variations in the profitability of different livelihood options among respondents.

a) b)

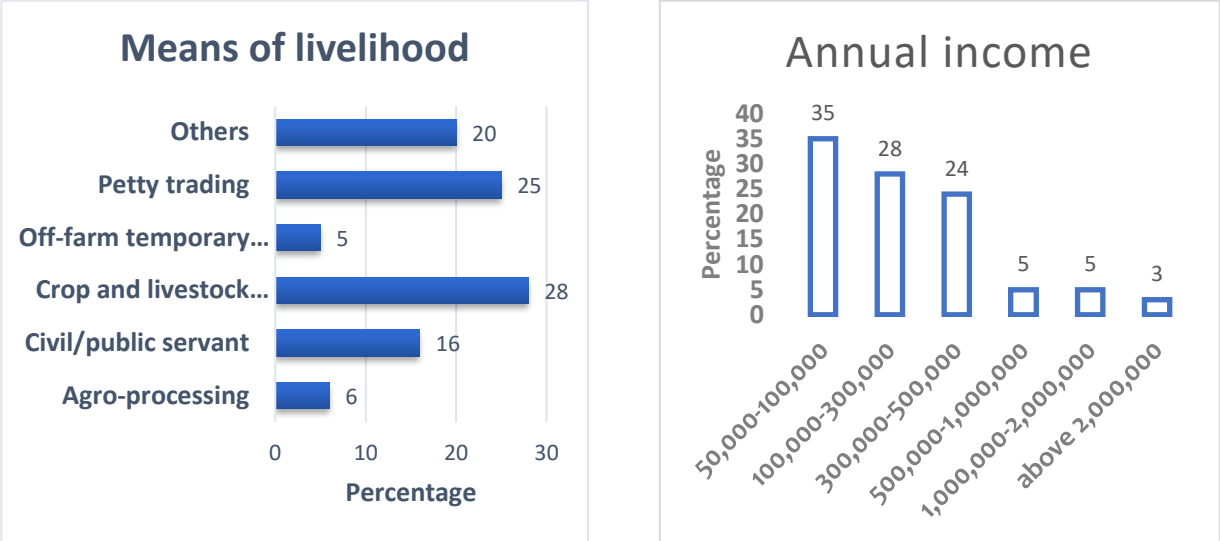


Figure 4-5: Livelihood (a) and annual income (b) in the project area

Figure 4.6 shows that the respondents primarily allocate their earnings towards feeding their families, constituting 46% of their expenditures. This allocation aligns with most respondents' cultural and religious practices, who predominantly belong to the Hausa/Fulani ethnic groups. Within these communities, providing for the family's nutritional needs is deemed a paramount obligation.

Surprisingly, 37% of their earnings are allocated to school fee payments. This underscores the importance placed on education within these communities, reflecting a significant investment in the future generation's development.

In contrast, only 12% is designated for rent payments. This allocation suggests that homeownership may be more prevalent within these communities, or alternative housing arrangements, such as extended family living situations, might mitigate the need for significant rental expenditures.

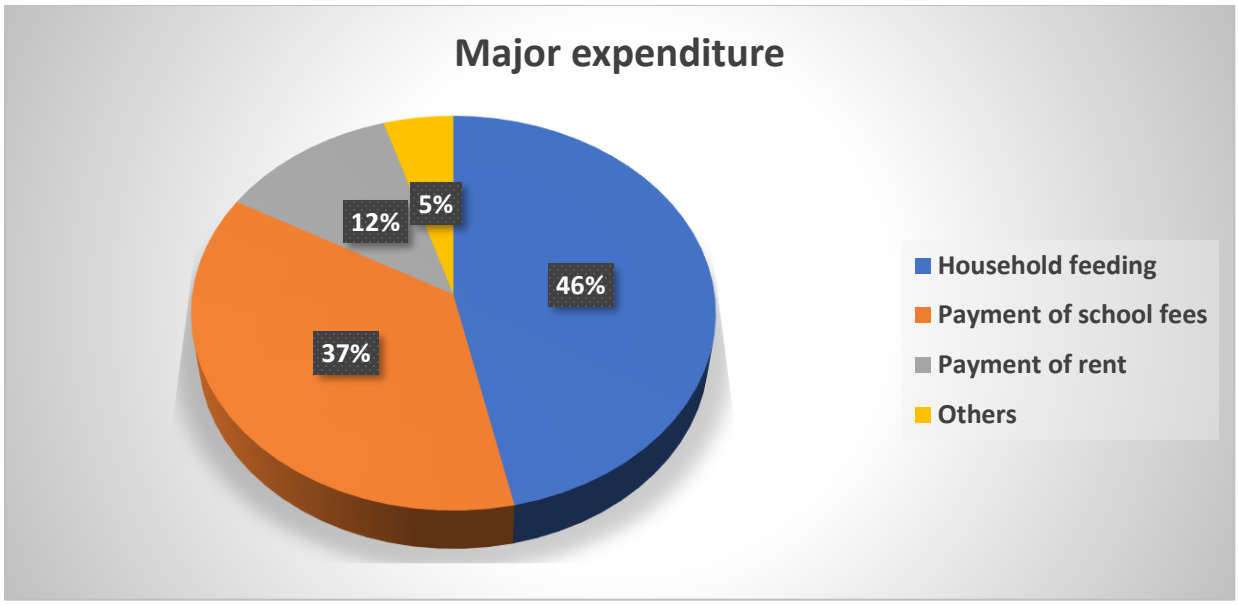


Figure 4-6: Major expenditure in the project area

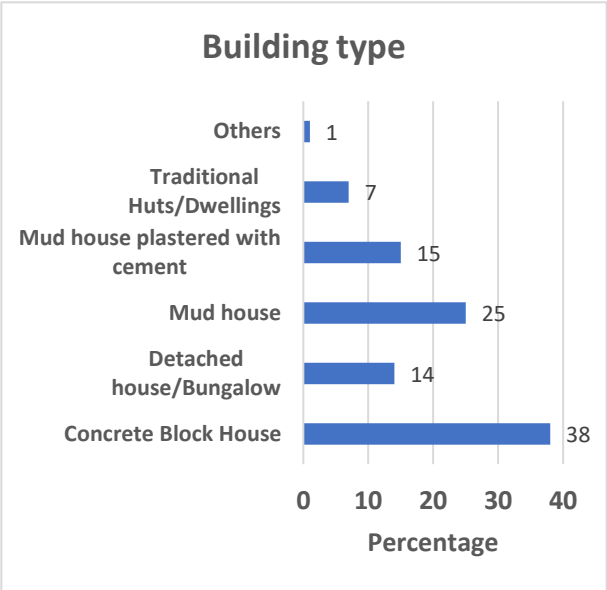
4.4 Social Infrastructure and Services

Access to basic social infrastructure and services, such as education, healthcare, water supply, and sanitation, influences community well-being and resilience to environmental hazards. Assessment of infrastructure gaps and service delivery constraints guides investments in social infrastructure and ensures equitable access to essential services for all community members.

4.4.1 Building Characteristics

The respondents reside in various types of dwellings, reflecting the diversity of housing structures within the community, as shown in Figure 4.7. The majority, comprising 38%, inhabit concrete block houses, while 25% dwell in mud houses. Additionally, 14% and 15% reside in detached bungalows and mud houses plastered with cement. A smaller proportion, 7%, inhabit traditional huts or dwellings.

a) b)



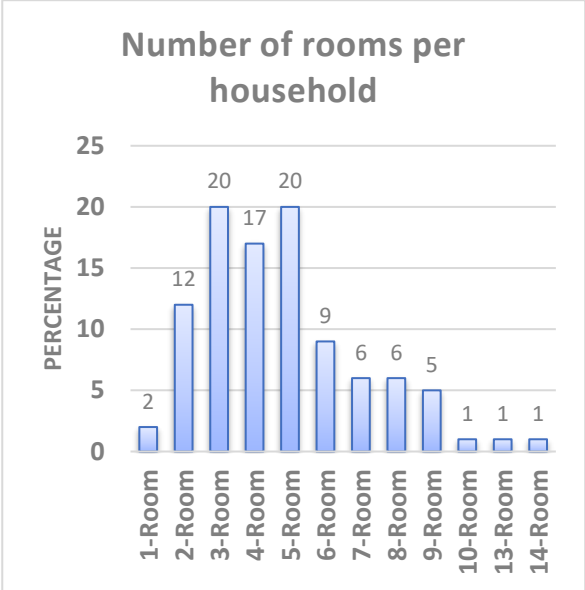


Figure 4-7: Building type (a) and number of rooms per household (b)

There is considerable variation in the number of rooms per household, ranging from 1 to 14 rooms. A significant percentage of respondents generally have between 1 and 9 rooms in their homes, while a smaller fraction (3%) has 10 to 14 rooms.

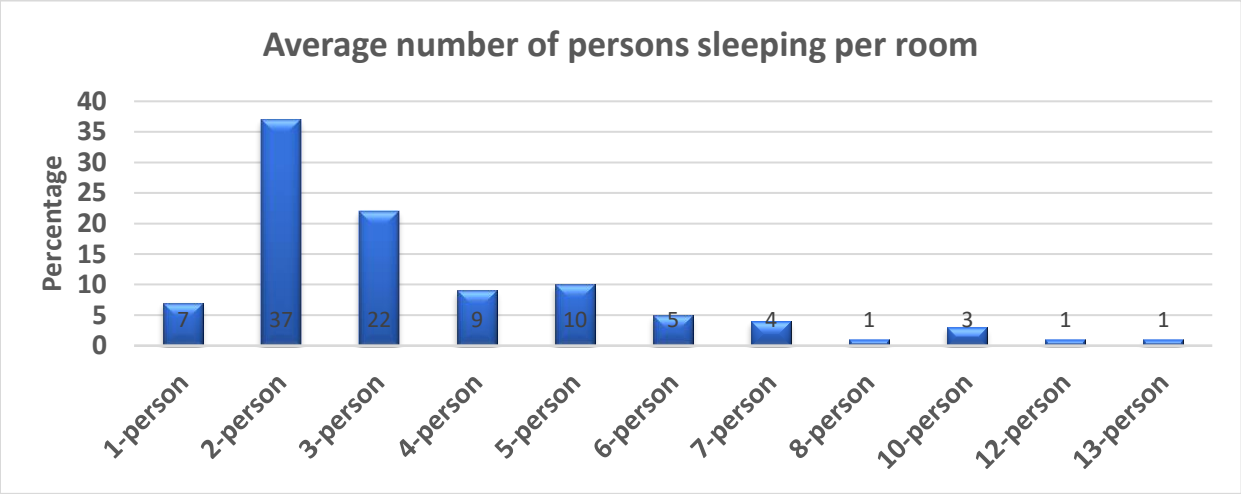


Figure 4-8: Average number of persons sleeping per room

Figure 4.8 depicts the distribution of the average number of individuals sleeping in a room. Notably, 37% of respondents reported that two people typically sleep in a room. Conversely, it was uncommon for 10 to 13 individuals to share a single room, as indicated by respondents.

4.4.2 Vulnerability Assessment from Gully Erosion

The findings revealed that 88% of the respondents felt vulnerable to the area's socioeconomic and environmental threats posed by gully erosion, whereas 12% felt secure, as shown in Figure 4.9.

a) b)

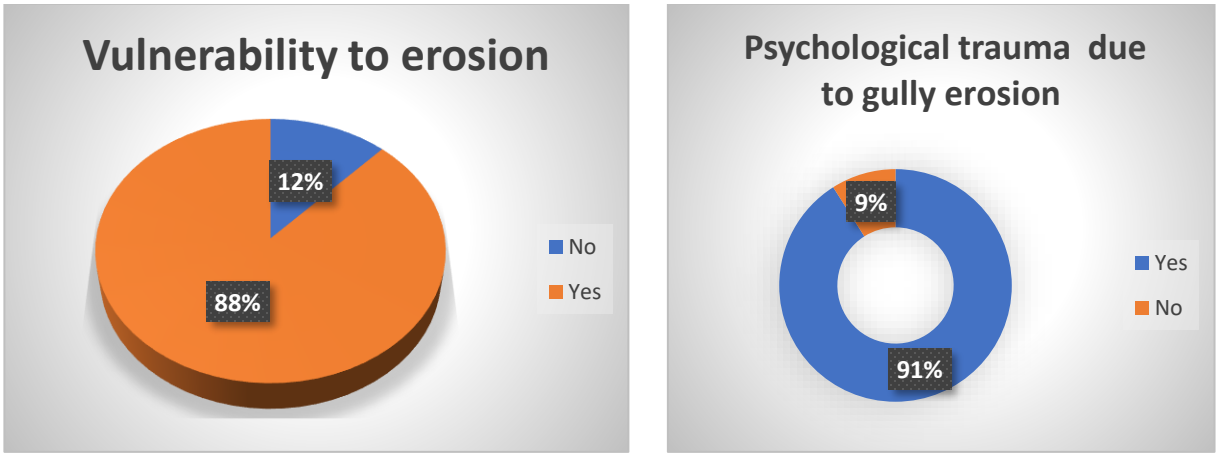


Figure 4-9: Vulnerability (a) and psychological trauma (b) in the project communities

Moreover, 91% of the respondents reported experiencing psychological distress due to the presence of gullies in the area, while 9% indicated feeling unworried about them.

a) b)

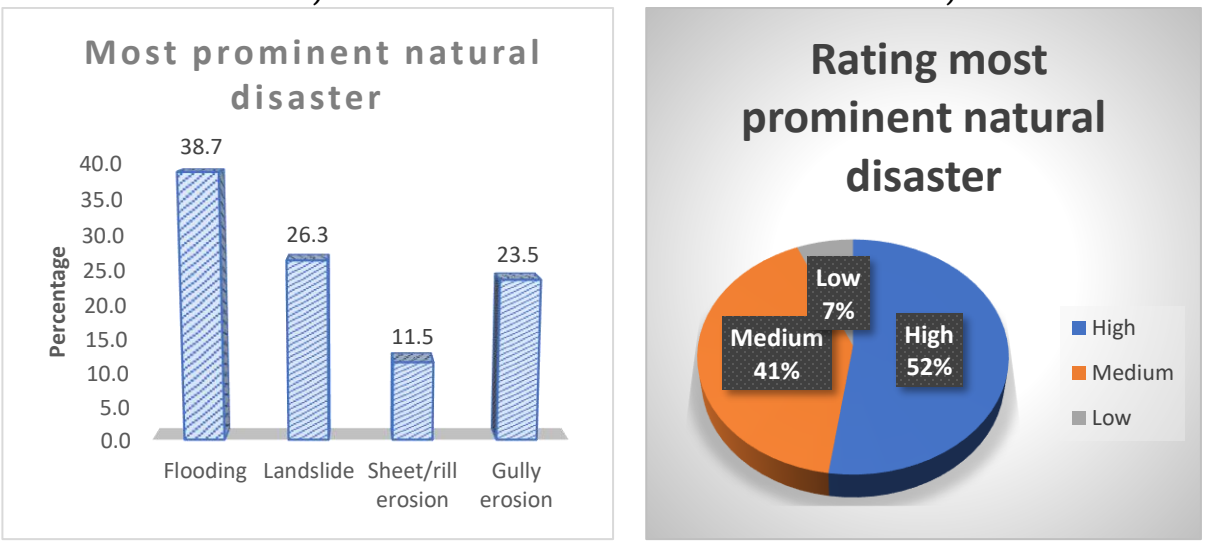
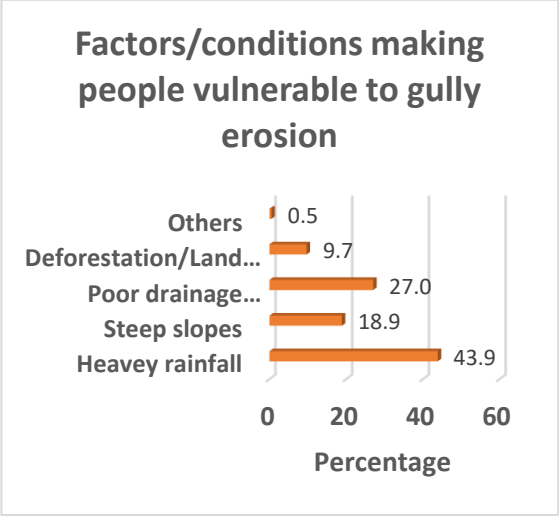


Figure 4-10: Main natural disaster (a) rating of prominent disaster (b)

According to 38.7% of respondents, the most prevalent natural disaster in the area is flooding, often triggered by heavy rainfall. Consequently, other natural disasters like landslides, sheet/rill, and gully erosion are also observed in Figure 4.10.

Regarding the severity of the most prominent natural disaster, 52% of respondents rated it as high, while 41% considered it medium. Only a small proportion, 7% of respondents, rated its severity as low (see Figure 4.10b).

a)



b)

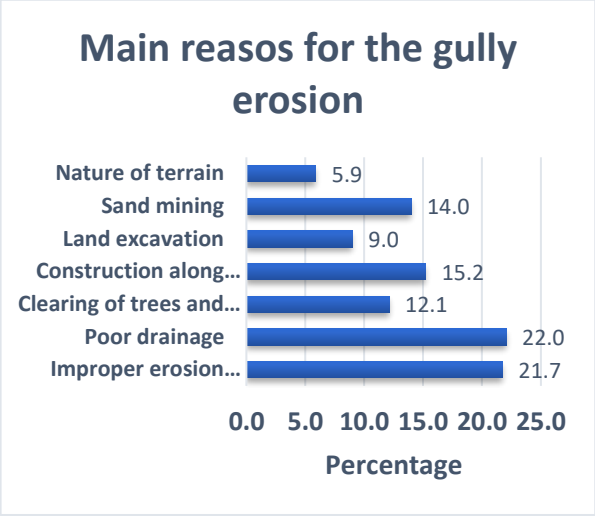


Figure 4-11: Factors making vulnerable to gully erosion and main reasons for gully erosion

The study identified various factors and conditions contributing to people's vulnerability to gully erosion. Heavy rainfall emerged as the primary factor, cited by 43.9% of respondents. Additionally, poor drainage systems and the steepness of the slope in the area accounted for 27% and 18%, respectively. Deforestation and land clearance were also recognised, contributing to 9.7% of the vulnerability, as depicted in Figure 4.11a.

Improper erosion control measures and inadequate drainage systems were identified as the main reasons for gully erosion in the area, accounting for 21.7% and 22%, respectively. Furthermore, construction along waterways (15.2%), indiscriminate clearing of trees and vegetation (12.1%), and sand mining (14%) were also significant contributors to the occurrence of gully erosion in the area, as illustrated in Figure 4.11b.

4.4.3 Impacts of Gully

Most respondents (34%) reside approximately 50-100 meters from the gully sites, with 20% living 100-200 meters from these locations. A mere 1% of respondents dwell up to 1000 meters from the gully sites. Figure 4.12 indicates that nearly 8% of respondents are highly susceptible to the threats posed by gully erosion.

Similarly, respondents highlighted the proximity of schools to gully erosion sites. Nearly 60% reported that schools are less than 50-100 meters from these sites. This proximity places pupils at risk of the hazards associated with gullies (Figure 4.12).

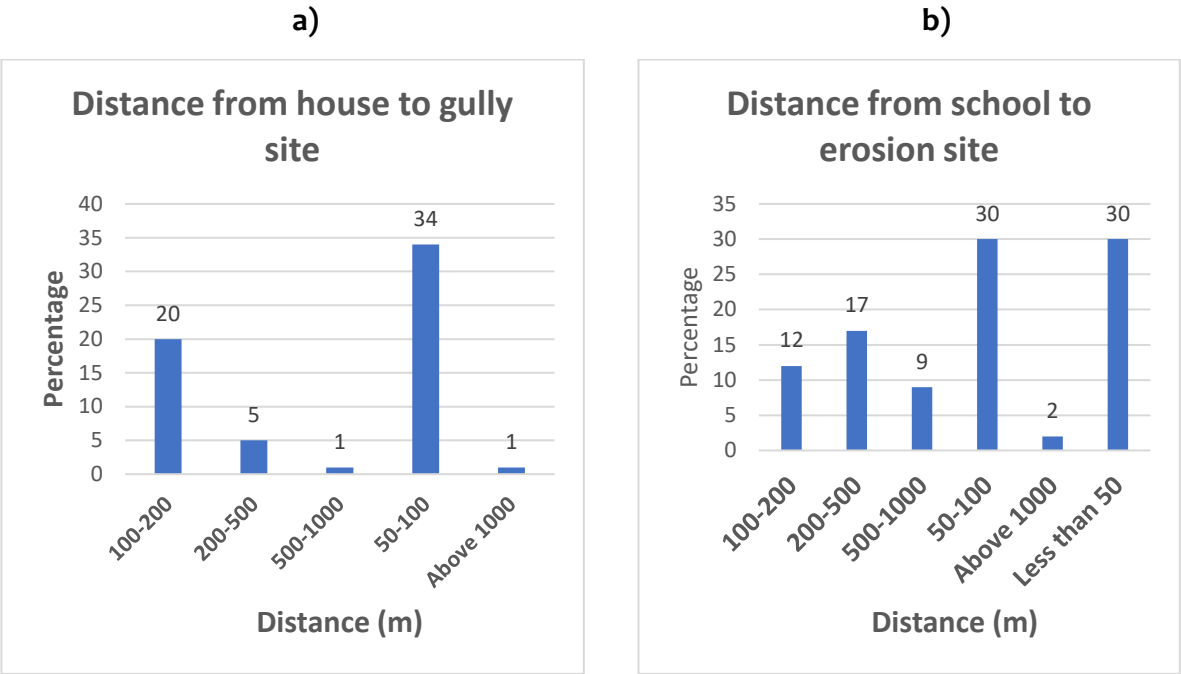


Figure 4-12: Distance from house to gully site (a) and distance from school to erosion site (b)

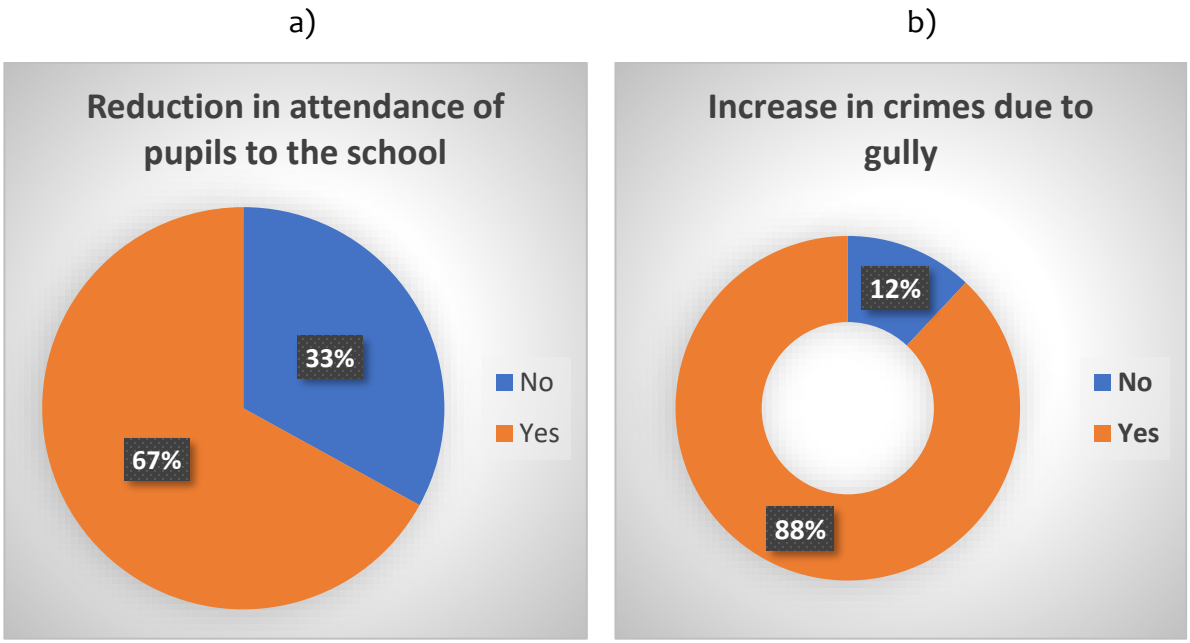


Figure 4-13 Reductions in attendance of pupils to the school (a) and increase in crimes due to gully (b)

67% of respondents reported a significant decrease in school attendance due to the looming threat of gully erosion. Conversely, 33% of respondents stated that there had been no decrease in school attendance because of gully erosion, as illustrated in Figure 4.13a.

a) b)

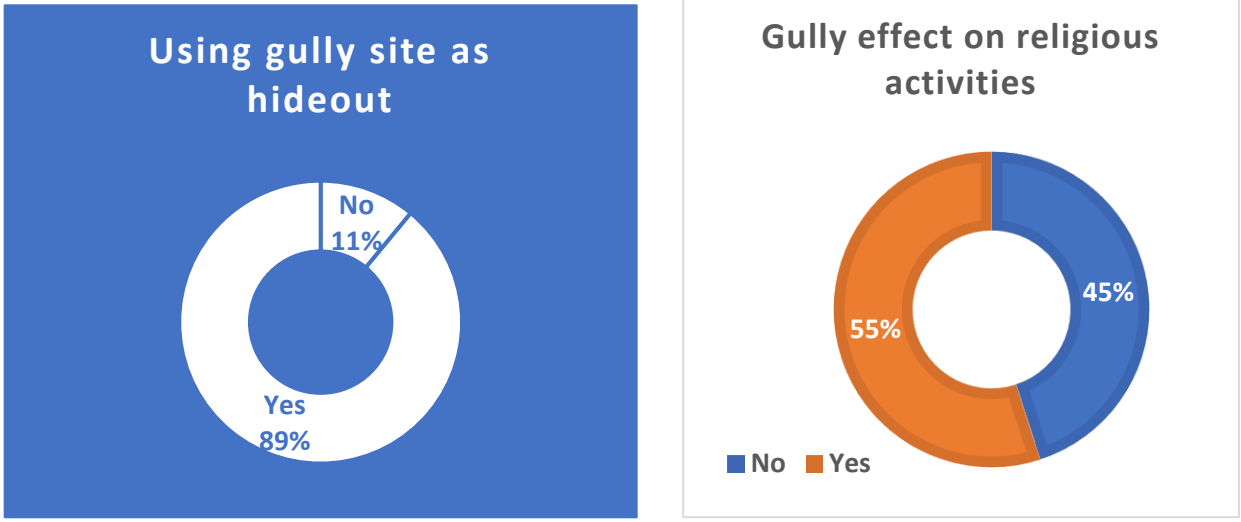


Figure 4-14: Gully site as a hideout (a) and Gully effect on religious activities (b)

Moreover, an overwhelming majority of respondents, accounting for 88%, observed a significant increase in crime rates due to gullies in the area. Only 12% of respondents reported no increase in crime attributable to gully erosion, as depicted in Figure 4.14.

In Figure 4.14a, 89% of respondents identified gully erosion sites as hideouts for criminals in the area, consequently increasing crime rates.

Additionally, as depicted in Figure 4.14b, 55% of respondents reported that gullies in the area affected religious activities, whereas 45% stated that they did not observe any impact on spiritual activities.

4.4.4 Mitigation Measures

Figure 4.15 indicates that 88% of respondents confirmed implementing erosion control measures in the area, while only 12% reported the absence of such measures.

Similarly, as depicted in Figure 4.16a, 76% of respondents acknowledged the involvement of community-based organisations in activities related to soil erosion, while 24% indicated no such involvement.

More than 60% of respondents reported that the predominant erosion mitigation measures/strategies they identified included constructing adequate drainage systems and

planting vegetation. Additionally, community awareness initiatives and government regulations were recognised as other measures to mitigate the impact of gully erosion in the area (Figure 4.16).

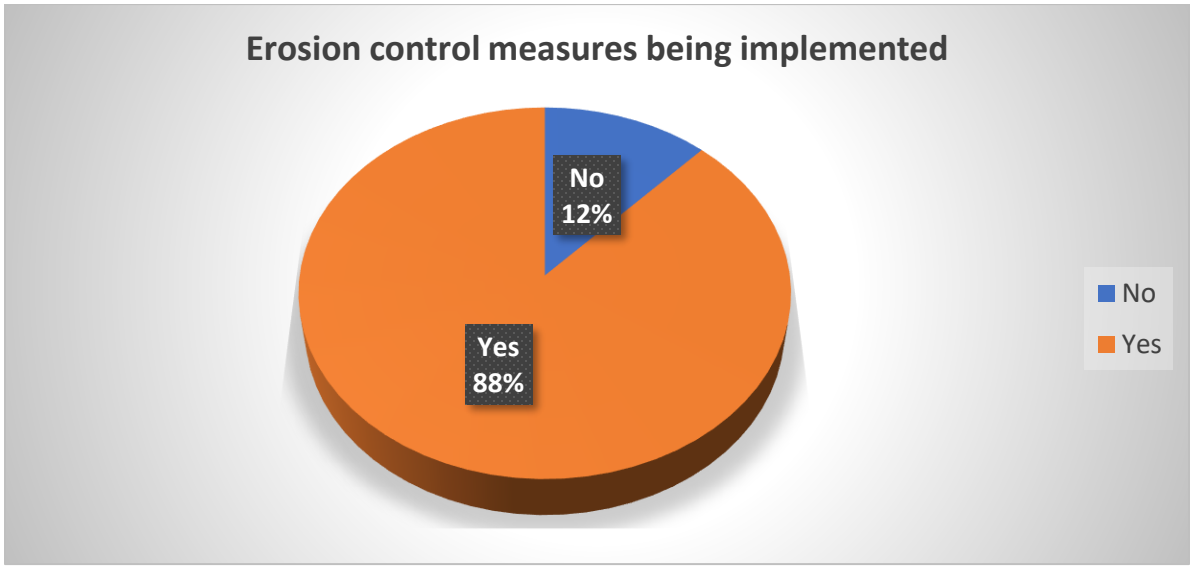


Figure 4-15: Erosion control measures

a) b)

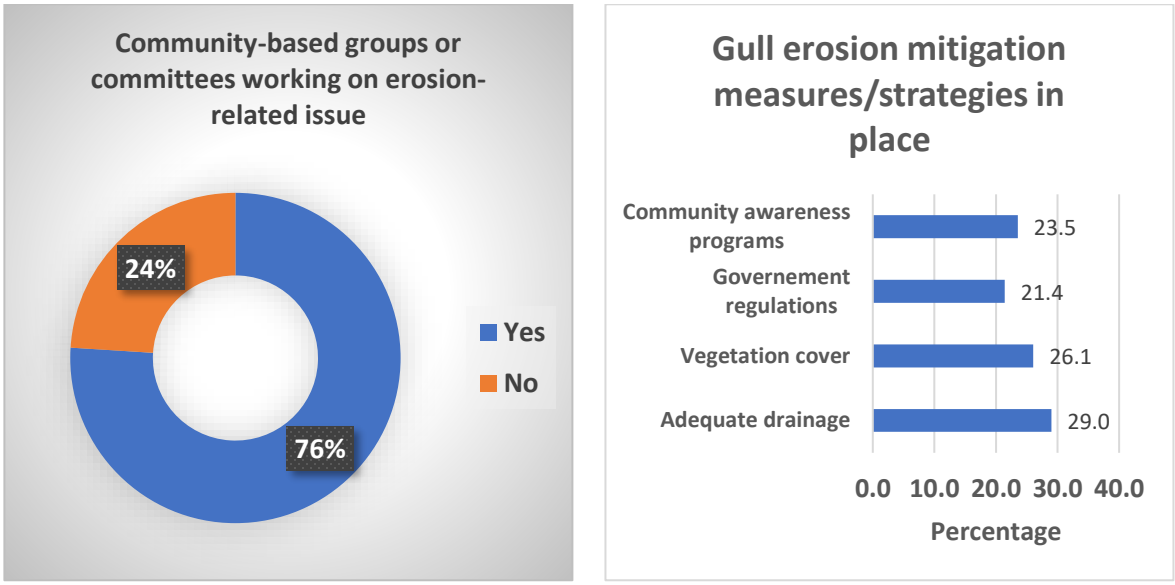
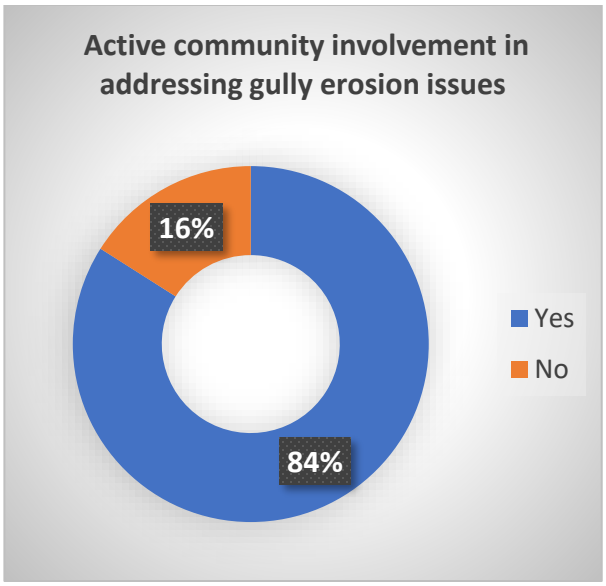


Figure 4-16: Community-based groups working on erosion issues (a) and gully erosion mitigation measures (b)

a) b)



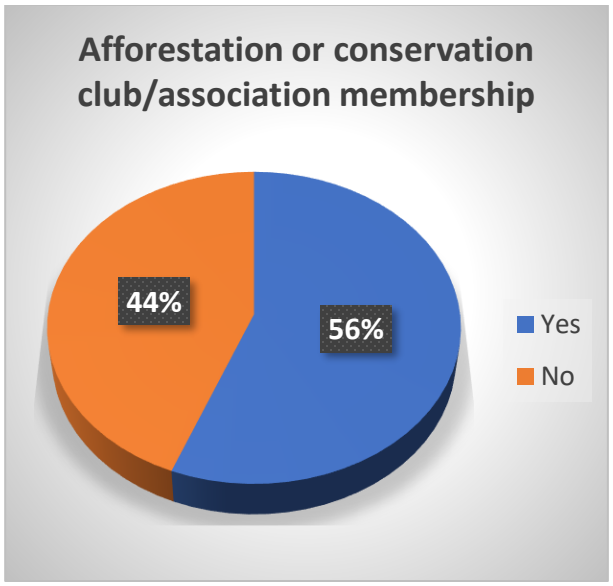


Figure 4-17: Active community involvement in addressing gully erosion issues (a) and afforestation membership (b)

In Figure 4.17a, 84% of respondents reported active community involvement in decision-making processes to address gully erosion in the areas, while 16% indicated a lack of community engagement.

Concerning membership in afforestation clubs or associations, a substantial proportion of respondents (56%) indicated that they had joined such groups to contribute to preserving the environment for future generations (Figure 4.17b). Conversely, 44% of respondents reported not belonging to any afforestation club or association.

4.4.5 Support Services

Figure 4.18a shows that 61% of respondents acknowledged receiving advisory support services in integrated land/water management practices from organisations supported by the project. Conversely, 39% indicated they had never received advisory support services from project-supported organisations.

According to 71.1% of respondents, the Agricultural and Community Resilience Support Agency for Livelihood (ACReSAL) emerged as a significant project-supported organisation offering advisory services in integrated land/water management, as shown in Figure 4.18b. Organisations such as Jewel Environmental Initiatives and other youth groups provide advisory support services in integrated land/water management.

a) b)

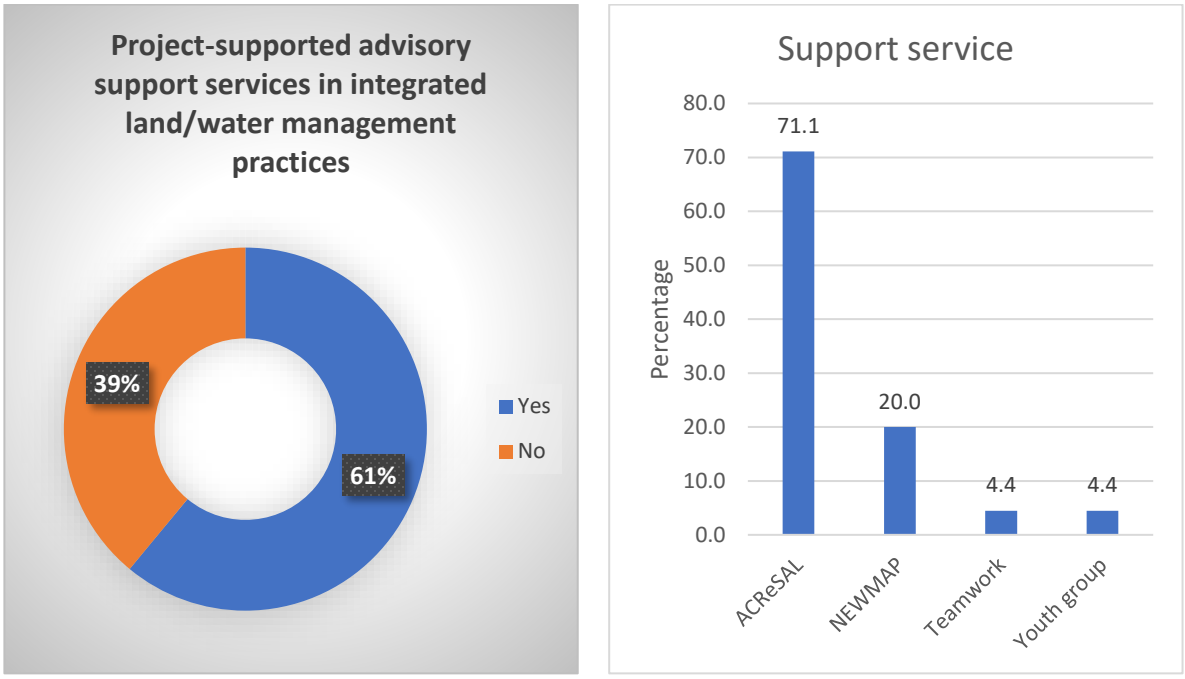


Figure 4-18: Advisory services (a) and support services (b)

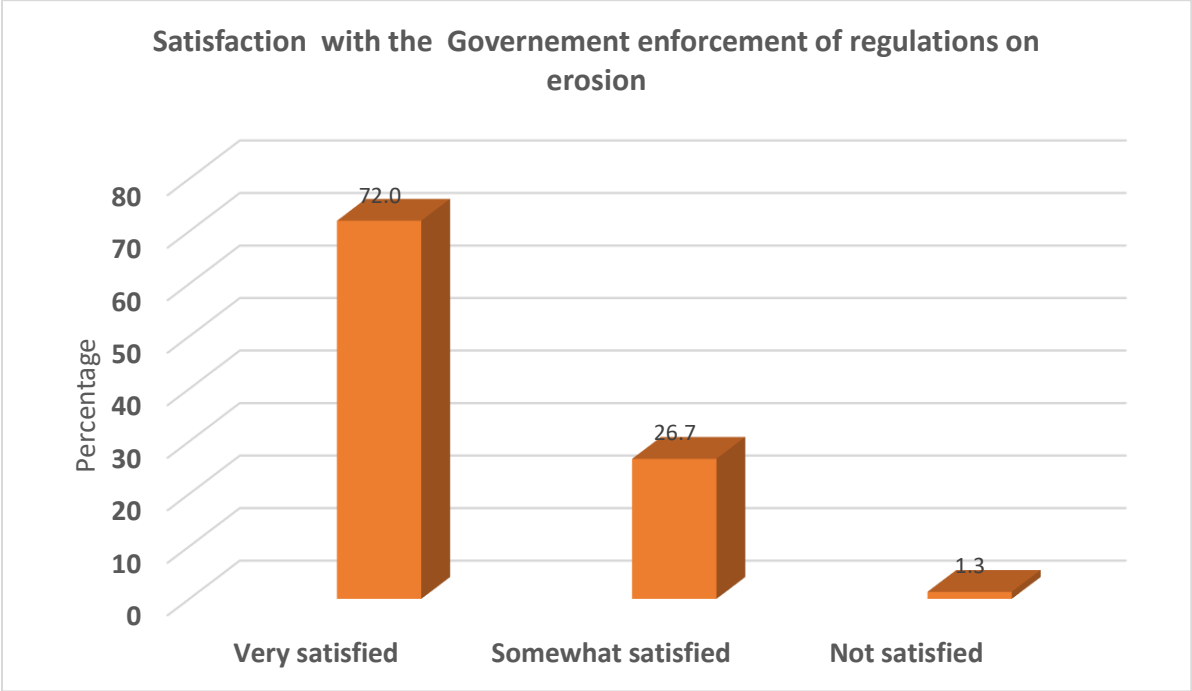


Figure 4-19 satisfaction with the enforcement of regulations on erosion

In Figure 4.19, it is evident that 72% of respondents expressed a high level of satisfaction with the government's enforcement of rules for controlling erosion in the areas, while 26.7%

indicated a moderate level of satisfaction. A minimal proportion (1.3%) of respondents reported dissatisfaction.

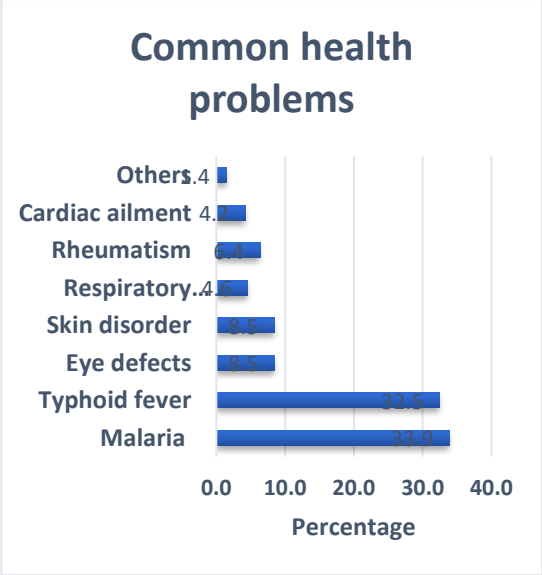
4.5 Health Assessment

4.5.1 Common Health Problems and Clinic Visit

The prevailing health issues in the area predominantly include malaria (33.9%) and typhoid (32.5%), which are attributed to mosquito bites and the consumption of contaminated water or unhealthy vegetables. Additionally, skin disorders, eye defects, and rheumatism are commonly reported, often stemming from ageing and underlying medical conditions. However, respiratory diseases and cardiac ailments are infrequent occurrences, as indicated in Figure 4.20a.

Figure 4.20b illustrates the frequency of clinic visits. Most respondents (21%) visited clinics within the last seven days, while 18% visited hospitals within the past two days. Another 13% visited clinics within the last 2-3 months from the interview date. Surprisingly, 11% of respondents could not recall their last clinic visit.

a)



b)

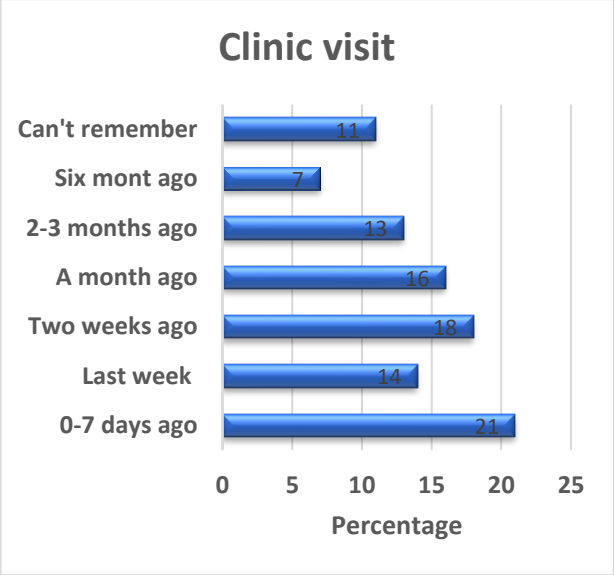


Figure 4-20: Common health problem (a) and clinic visit (b)

4.5.2. Water-Borne Ailment

Waterborne ailments are not prevalent in the communities, as indicated by Figure 4.21. A significant majority of interviewees, comprising 80%, confirmed the infrequent occurrence of waterborne diseases, while 20% acknowledged their frequent occurrence.

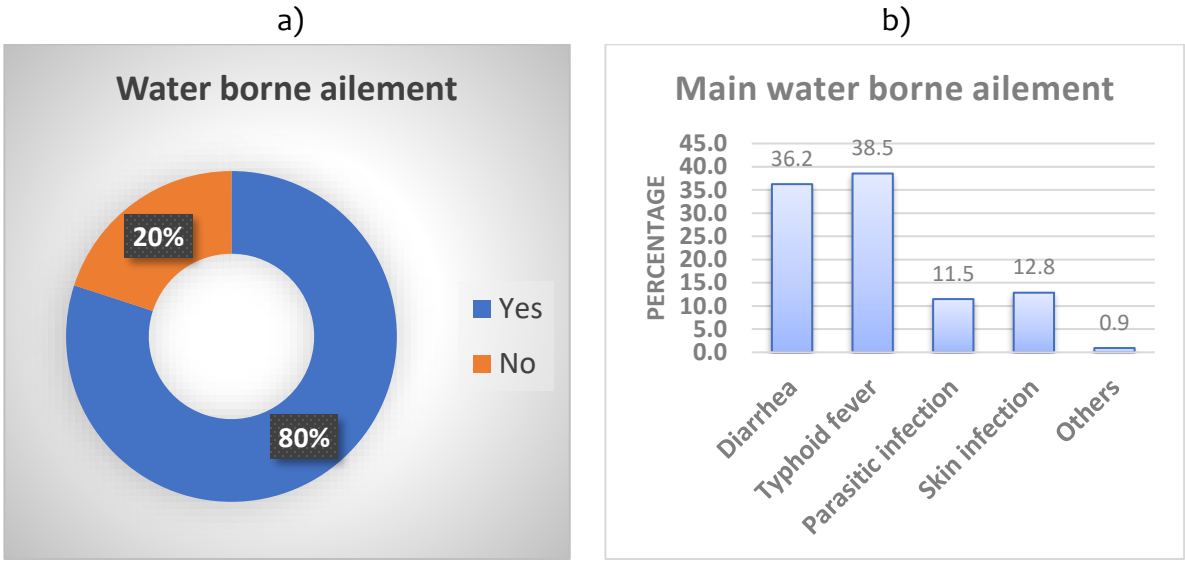


Figure 4-21: Water-borne ailment (a) and main water-borne ailment (b)

Furthermore, Figure 4.21 shows that diarrhoea and typhoid are the primary waterborne diseases prone to the community, with 36.2% and 38.5% of respondents identifying them, respectively. Additionally, the community is susceptible to other ailments, such as parasitic infections and skin disorders.

4.5.3 Access to Healthcare

Certainly, gullies within the communities have restricted women's access to healthcare facilities, as 85% of respondents confirmed (Figure 4.22a). Conversely, 15% of respondents reported that gullies did not impede women's access to healthcare facilities.

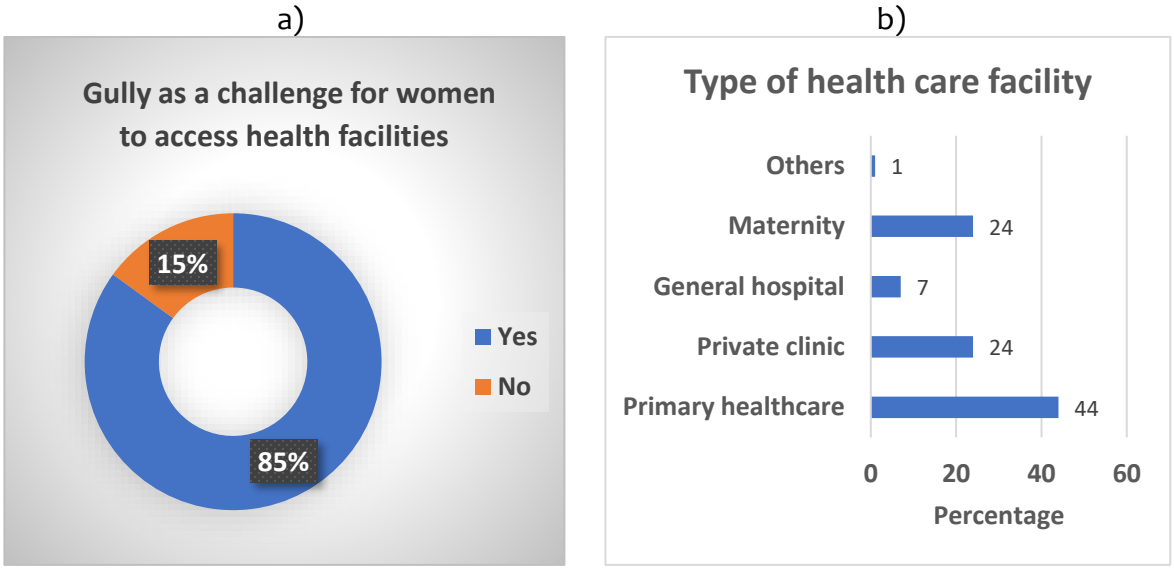


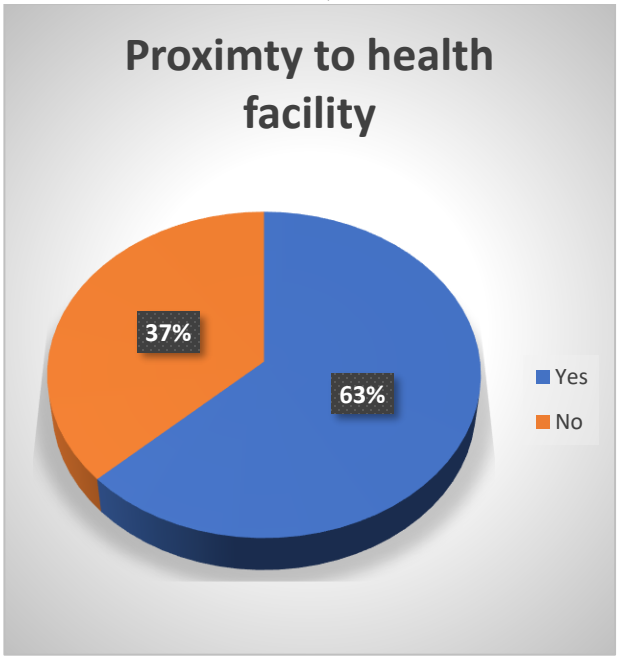
Figure 4-22: Gully is a challenge for women in terms of access to healthcare (a) and the type of health facility (b).

The primary type of healthcare facility available in the area is primary healthcare centres, comprising 44%. Maternity hospitals and private clinics are equally prevalent, accounting for 24% each. General hospitals represent 7% of healthcare facilities in the area (Figure 4.22b).

Regarding the distance between households and healthcare facilities, 63% of respondents reported that the facilities were near their residences, whereas 37% stated that the facilities were far away (Figure 4.23a).

Regarding obtaining medications, most respondents (26.1%) and (23.9%) acquire them from health practitioners at healthcare centres and general hospitals, respectively. Additionally, 26.6% resort to self-medication, while 15.2% use traditional medicines (Figure 4.23b).

a)



b)

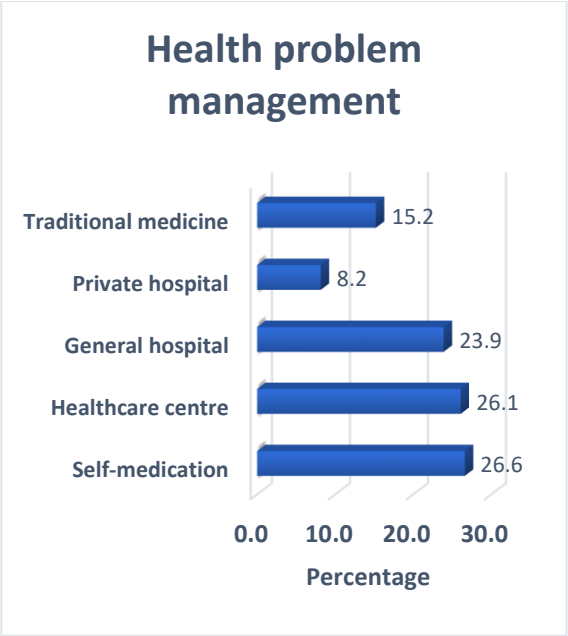


Figure 4-23: Proximity to health facility (a) and health problem management (b)

4.6 Sanitation and Hygiene

4.6.1 Domestic Water Sources

Five primary sources of domestic water have been identified in the area: tap water, boreholes, wells, streams, and rainwater. Boreholes and wells emerge as the main sources, constituting 48.8% and 16.3% of respondents, respectively (Figure 4.24). Rainwater and streams, dependent on seasonal rainfall, account for 14% and 1.7%, respectively, while tap water represents 15.7%.

Regarding the average time required to reach the water source from households, 33% of respondents reported taking 10-20 minutes to cover the distance. Another 20% require 1-10 minutes, while 19% walk more than 60 minutes to fetch water. On average, people spend 10-30 minutes fetching water in the area (Figure 4.24b).

a) b)

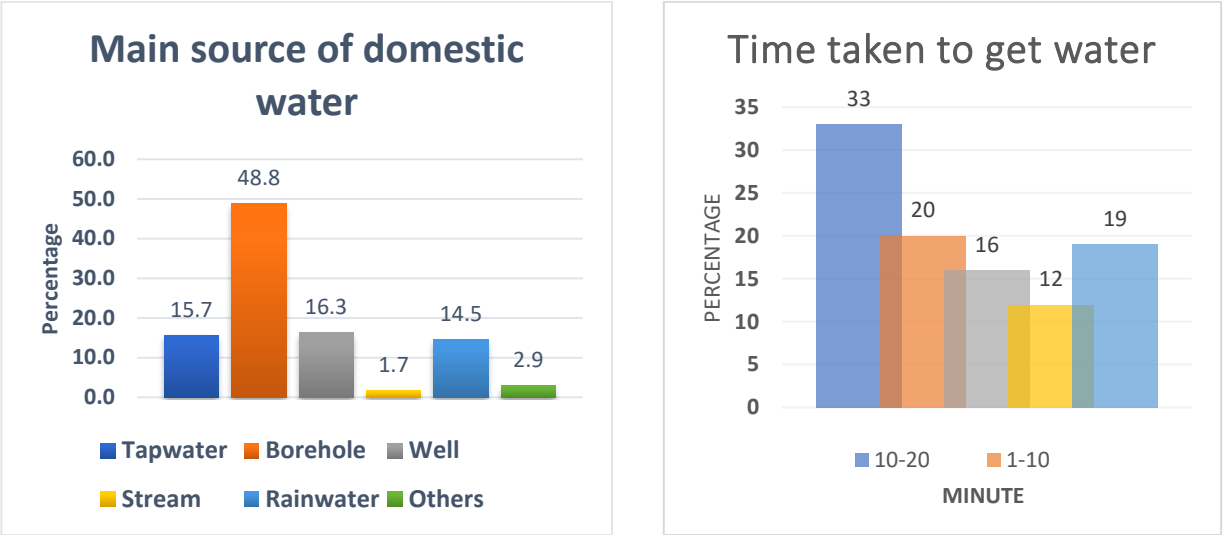


Figure 4-24: Main source of domestic water (b) and time taken to get water (b)

4.6.2 Toilet Characteristics

In Figure 4.25a, 89% of respondents have toilet facilities in their houses, while 11% do not. This indicates that open defecation is rare in the area. The pit latrine is the area's most prevalent type of toilet facility, accounting for 65%. Water closets and other toilet facilities represent 30% and 5%, respectively (Figure 4.25b).

a) b)

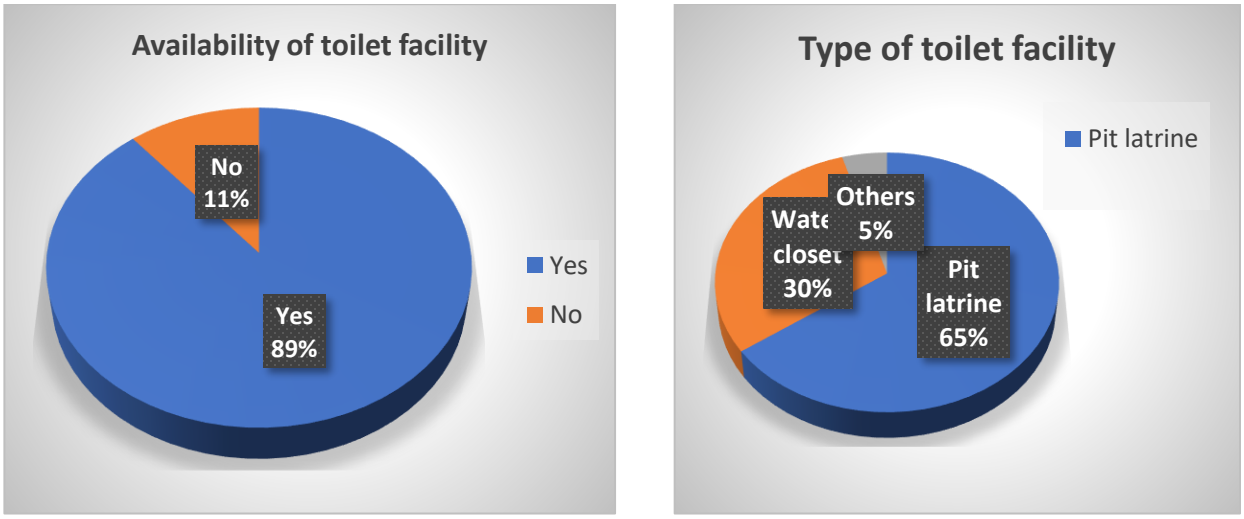


Figure 4-25: Toilet availability and type in the project communities

4.6.3 Noise and Air Pollution

Automobile engines constitute the primary source of noise pollution, comprising 64%, followed by agro-processing sites at 24% (Figure 4.26a). The principal sources of air pollution in the community stem from domestic fuels and emissions from automobile engines, accounting for 54.7% and 35.4%, respectively. Other contributing sources include emissions from agro-processing sites (Figure 4.26b).

a) b)

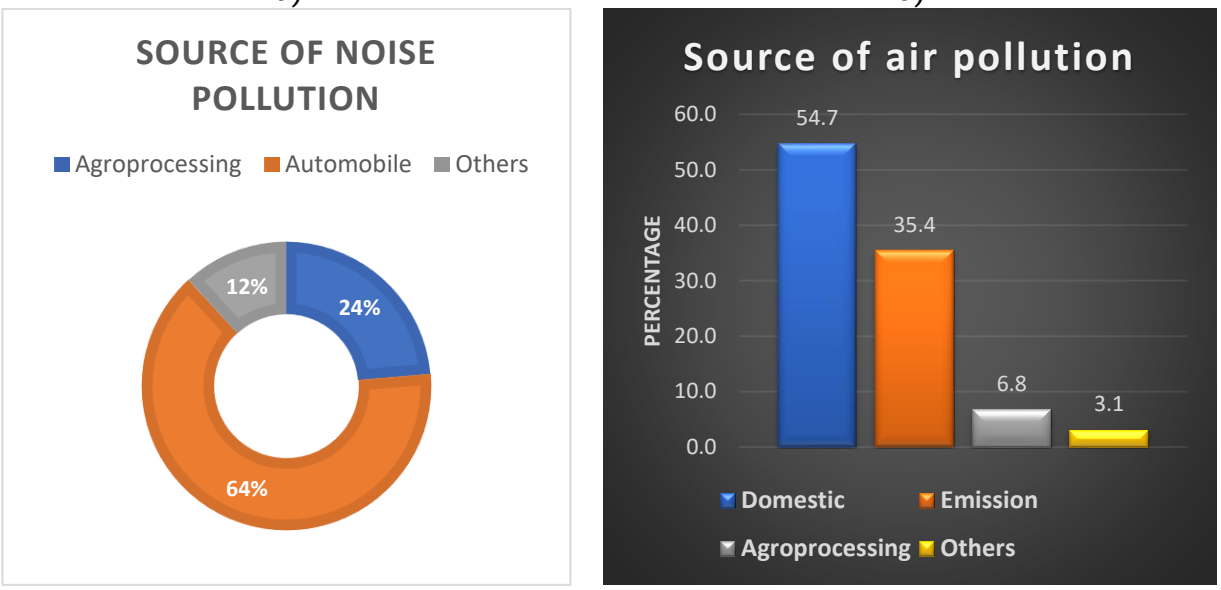


Figure 4-26: Source of noise pollution (a) and sources (b)

4.6.4 Vectors

In Figure 4.27, it is revealed that 63% of respondents acknowledged the presence of stagnant pools of water in their surroundings, while 37% reported their absence.

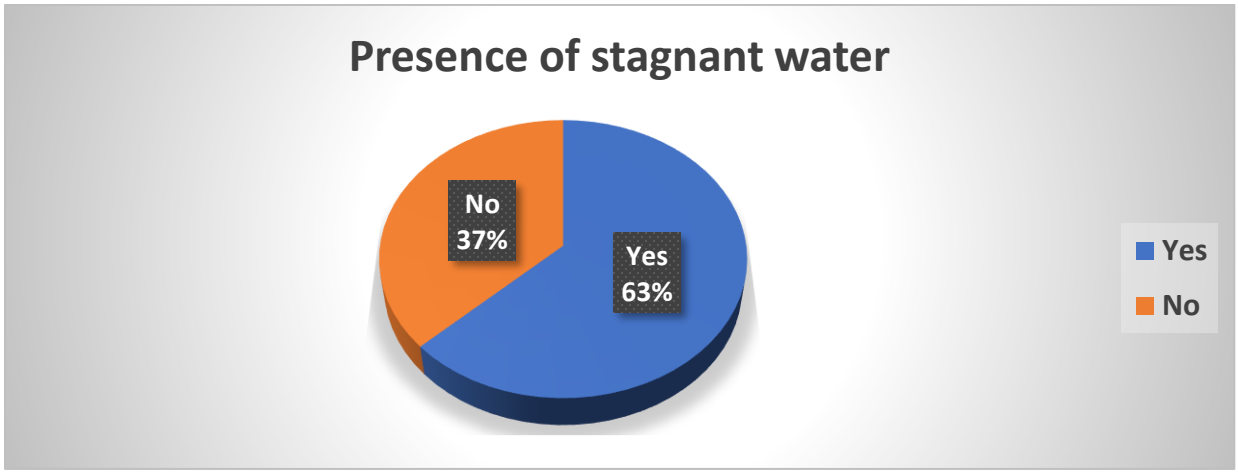


Figure 4-27: Presence of stagnant water

The predominant vectors in the area are mosquitoes, cockroaches, and flies, representing 40.9%, 27.8%, and 26.5%, respectively. Sandflies are less common, accounting for 4.8% (Figure 4.28a).

Most respondents (97.4%) utilise treated mosquito nets (insecticide-treated nets) and chemical sprays to protect themselves from mosquito bites and other vectors. Conversely, only a small percentage of respondents employ other methods to control vectors/insects (Figure 4.28b).

a) b)

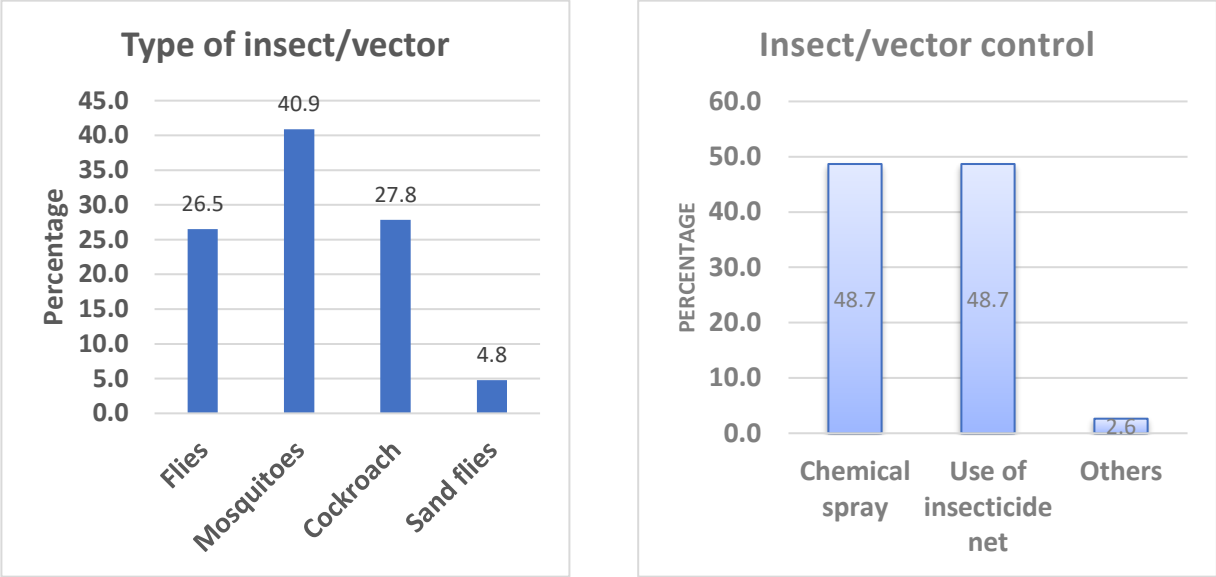


Figure 4-28: Type of insect and vector control

4.6.5 Waste Management and Domestic Fuel

The respondents use various solid waste management methods, including dumping into gullies, stream dumping, landfilling, open dumping, open-air incineration, and composting. The main methods for solid waste management are open dumping and dumping into gullies, accounting for 26.8% and 22.5% %, respectively (Figure 4.29a). Landfilling and stream dumping accounted for 17.7% and 11.3%, respectively.

People in the community use different types of domestic fuels. Most people use charcoal and wood for domestic fuel, which accounts for 34.9% and 33.9% of the respondents, respectively (Figure 4.29b). Other inhabitants use electricity, animal dung, crop residues, and kerosene.

a) b)

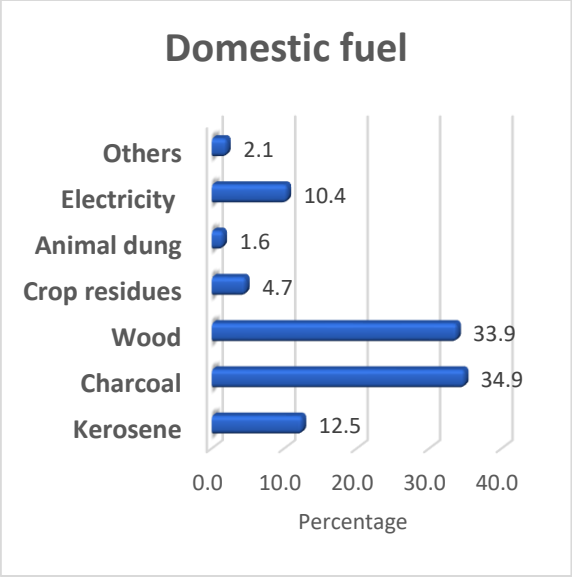


Figure 4-29: Solid waste management and domestic fuel

4.7 Stakeholder Engagement and Consultation

This section details consultation and participation undertaken as part of the ESMP process and assesses the potential socio-economic impacts of the Project and associated works. The assessment considers the changes that may occur during the project's construction, operation, and decommissioning in terms of demographics and economics, social infrastructure, land use, community aspects, and occupational and public health and safety.

4.7.1 Principles of Consultation and Consultation Requirements

The consultation principles align with the relevant Equator Principles and World Bank ESS10 to ensure that all reasonable public opinions are adequately considered.

World Bank ESS10 requires the implementation of community engagement, project information disclosure, consultation and grievance mechanisms. The ESS requires the Project to undertake a process of consultation with affected communities in a manner that provides them with opportunities to express their views on Project risks, impacts, and mitigation measures and allows the Sponsor to consider and respond to them. The consultation process should be undertaken in a manner that is inclusive, culturally appropriate, free from intimidation, timely and informed

4.7.2 Key Stakeholders and Consultees

As a part of the development of the public consultation program for the ESMP, stakeholder identification was performed to determine all individuals, local communities, organisations, educational, research, and design organisations, and governmental authorities who might be potentially affected by or might affect the outcome of the proposed Erosion Control Project. The criteria used in the stakeholder identification process included:

- the proximity of residents' households to the Project site,
- the level of potential interest in the Project among federal and local governmental authorities, scientists and local/international NGOs with interest or expertise.

Different stakeholder groups were first identified in a stakeholder matrix that determined the level of potential interests and locations of the specific stakeholder group. The following stakeholder[3] Groups were defined during the identification process:

i. Federal Ministry of Environment (FMEnv)
ii. Community members
iii. Akko and Gombe LGA
iv. Traditional Rulers/Community leaders
v. Gombe State Ministry of Environment and Forest Resources
vi. Gombe State Ministry of Agriculture and Natural Resources
vii. Gombe State Ministry of Water Resources
viii. Gombe State Environmental Sanitation and Protection Agency (GOSEPA)
ix. Ministry of Land and Survey, Gombe State
x. Community-Based Association
xi. Community Women group

4.7.3 ESMP Consultation Activities to Date

4.8.3.1 Initial Consultations

A multi-method approach was used during the initial consultation phase to gather socio-economic data and information regarding the GGC Doma/Bama Erosion and Flood Control (the Project Host/Affected communities), including focus group discussions, in-depth interviews, and field observation.

Focus group discussion—This involved consultation and engagement with community heads, district chiefs, community youth groups, other interest groups, and individuals. Public consultation/forum with the project-affected/neighbouring communities represented by all social strata/groups was conducted.

In-depth interviews - Personal interviews were conducted to gather information and opinions of residents of the project-affected/neighbouring communities. Households were sampled for interview using the systematic random sampling method. A comprehensive questionnaire for data collection was developed, whereby certain information was requested, such as household biodata, livelihoods, and infrastructure inventories, including land, typical properties, houses, commercial properties, and social services infrastructure.

Field observation - The socio-economic study team also physically inspected significant facilities and landmarks, such as water supply points, school buildings, health care facilities,

[3] Additional Stakeholders will continue to be identified as the Project progresses.

markets, town halls, occupational activities, informal sector activities and conditions of roads and houses. Other areas of interest studied were cultural heritage features of the project affected/neighbouring communities. The demographic pattern, land size/use, economic activities (emphasising low-income groups highly dependent on primary activities), community structure, employment, markets, labour supply, income distribution, consumption, and the migration pattern of the host/affected and neighbouring communities were also studied.

4.7.3.2 Updated Consultations

Given the awareness/sensitisation campaigns made by the Gombe ACReSAL office through radio jingles and community interaction, the ESMP team leveraged this existing knowledge base to hold three additional meetings with local communities and other stakeholders. The primary goals of these meetings and interviews were to:

- Describe the Project and the ESMP process.
- Discuss and identify potential Project impacts associated with the construction and operation of the solar park, including the electric transmission line, roads and other on-site facilities.
- Understand local land use, activities and populations living and working within or near the Project site.
- Identify the most effective ways of information dissemination in the future.
- Develop a list of stakeholders' groups and local people most likely affected by the Project.

Details are set out in Table 4.1. The consultation and disclosure carried out to date will be developed further as the Project progresses into construction and operation.

Table 4-1: ESMP Consultation Activities

No.	Stakeholder	No. of Stakeholders at the meeting	Observation
1	Interaction with Community leaders	Three persons, Director,	There are concerns about the need for an effective compensation mechanism and resettlement action plan that incorporates all stakeholders. It should be transparent and completed within a specific time frame to avoid a communication gap or vacuum.

2	Women	18 persons spread across the major affected neighbourhoods	They all support the project and noted that this aligns with their needs. Emphasised the need for regulation on land development in marginal areas to avoid the development of gully heads. There is a need for access roads, especially in the Nayi Nawa community.
3	Project Affected Communities	89	Very supportive of the project and stressed the need for transparency in the implementation process.

Responses from the stakeholder meetings and discussions provided relevant background information and helped identify major environmental and social concerns/issues within the project area. The section that follows highlights the issues and concerns raised by different stakeholders. The key observations made during consultation activities are outlined below:

The meeting recognised key stakeholders, including leaders and representatives from various communities affected by gully erosion. The consultant then introduced the purpose of the meeting, emphasising the importance of community engagement in addressing gully erosion issues. He also provided a brief overview of the project benefits and the likelihood of other associated impacts. This forms the basis on which he recalls the need for an ESMP that considers the environmental and social concerns emerging from the project. Participants were happy to be involved in the consultation process and shared the following.:

a) **Impact of Gully Erosion:** Participants shared their understanding of erosion and highlighted its detrimental effects, including loss of lives, property, farmlands and mental stress. Participants recall the fear and anxiety among community members, especially during heavy rainfall. They also note the disruption of peaceful sleep and daily activities due to erosion-related risks.

b) **Causes of Gully Erosion and solutions:** Stakeholders discussed the causes of erosion, such as agricultural activities and deforestation leading to soil erosion. They also note that poor construction on waterways and natural drains exacerbates erosion, and the soft nature of the soil contributes to accelerated gully formation. Participants all proposed solutions, including drainage construction of culverts/drainages to control water flow, tree planting and halting the expansion of gully fingers and enforcing regulations (land-use regulation) to prevent development in vulnerable areas.

c) **Community Cooperation and Participation:** The need for community cooperation and integrity in compensation processes and active involvement in project management and implementation was emphasised. Stakeholders also note the need for the participation of community leaders in sensitisation and education efforts—empowerment of local communities to take ownership of project outcomes. The latter would, therefore, have some level of capacity building.

d) **Compensation and Project Management: this includes**
   - Fair compensation for affected households and enterprises.
   - Capacity building and training on project management and maintenance.
   - Involvement of community leaders and security agencies in project execution.

e) **Project Execution Timing and Prioritization:** Participants believed that preference for project execution during the rainy season to understand water behaviour is important in ensuring the sustainability of the civil works. They also stress the need to identify priority areas for intervention based on the severity of erosion impacts. These include Riyal, Abacha Quarters, Gabadaza, Nayi Nawa, and areas behind the Commissioner's house.

f) **Government Role and Legislation: Calls were made for government intervention and law enforcement to ensure** project management and execution.

g) **Vulnerable Groups and Equity:** Concerns about the impact on vulnerable groups such as women, orphanages, and the physically challenged, urging their inclusion and compensation.

h) **Sustainability and Attitude Change:** Participants reminisced about traditional erosion management practices and noted changes in attitudes and environmental care over time. Stakeholders stressed the need for attitudinal change, sustainable practices, and responsible waste management to prevent future erosion.

i) **Appeal for Assistance**: Participants appealed for government intervention, particularly for improved transportation access in Nayi Nawa community.

j) **Community Pledges**: Community members and associations present at the workshop pledge to take responsibility for project management and support the project.

Key recommendations from the engagement include:

a) Conduct sensitisation campaigns on erosion management and community participation.
b) Implement land-use regulations and tree-planting initiatives to prevent erosion.
c) Ensure community involvement in project planning, implementation, and management.
d) Enforce laws and regulations governing waste management and land development.
e) Prioritize project execution during the rainy season to observe water behaviour.
f) Address transportation challenges in Nayi Nawa community through government intervention.

g) Compensation and assistance for vulnerable groups affected by erosion should be considered.
h) Emphasize sustainability, attitudinal change, and responsible environmental practices.

They highlighted the importance of proactive measures to mitigate erosion risks and ensure the long-term sustainability of the project outcomes. The consultation activities indicate broad community support for the intervention, largely due to the recognised positive impacts on the socio-economic environment in affected areas and the wider Gombe metropolis. Full details of consultation reports are available in Annex 12.

4.7.4 Future Consultation Activities

Additional consultation activities are proposed as the Project progresses. Gombe ACReSAL will seek to undertake the following:

- Disclosure of Draft ESMP at locations accessible to local communities and other stakeholders.
- Invite comment on Draft ESMP.
- Preparation and disclosure of a Stakeholder Engagement Plan (SEP).
- Implement a Grievance Mechanism that will be in place throughout the construction, operation, and decommissioning of the GGC Doma/Bama erosion and flood control project.
- Disclosure of monitoring reports.

A Project Community Health and Safety Plan will be created to describe potential hazards of the project during construction and commissioning to local communities, as well as the methods for controlling these hazards. The plan will also outline emergency preparedness and response and include a grievance mechanism to ensure that feedback is acknowledged and addressed appropriately. Additionally, a Grievance Mechanism will be developed to address worker grievances and raise reasonable workplace concerns.

4.8 Traditional Grievance Redress Mechanism

The grievance redress mechanism identified during the stakeholder consultation with community leaders, women, community members and vigilante groups involves several key components:

a) **Community Engagement:** They emphasise the importance of community engagement in the grievance redress mechanism. They suggest that community leaders and representatives should be involved in addressing grievances and ensuring that concerns are adequately communicated to project authorities.

b) **Transparent Communication:** Stakeholders should have access to clear and transparent communication channels to report grievances and seek resolution. This may involve establishing dedicated contact points or hotlines for receiving complaints and feedback.

c) **Documentation and Reporting:** Grievances should be documented systematically, including details of the issue, the parties involved, and the proposed resolution. A reporting mechanism should be established to track the status of grievances and ensure timely response and resolution.

d) **Responsive Action:** Project authorities should respond promptly to reported grievances and take appropriate action to address them. This may involve conducting investigations, consulting relevant stakeholders, and implementing corrective measures as necessary.

e) **Feedback and Follow-Up:** Stakeholders should receive feedback on resolving their grievances, including information on the actions taken and any changes implemented. Follow-up mechanisms should be in place to ensure that grievances are fully resolved and that stakeholders are satisfied with the outcomes.

From the foregoing, it was clear that the community members felt obliged to have representation in the committee to address any of their grievances. Hence, the ESMP has proposed their inclusion.

CHAPTER FIVE: ASSESSMENT OF POTENTIAL ADVERSE IMPACTS AND ANALYSIS OF ALTERNATIVES

5.1 Introduction

The chapter thoroughly examines the potential negative impacts of the proposed project and analyzes different alternatives. It carefully considers project options such as the no-project option, delayed implementation, and alternative engineering designs to identify the most feasible and effective solution. It also proposes mitigation measures to address adverse environmental and social impacts to enhance project sustainability.

5.2 Methods and Techniques Used in Assessing and Analyzing the Environmental and Social Impacts

The ESMP process aims to assess and investigate the identified potential impacts that are most likely to be significant. This chapter includes the proposed project's physical, biological and social impacts. The information below consolidates the impacts of the proposed Erosion and Flood control intervention at the GGC Doma/Bama gully site. These impacts have been sourced from the envisaged interaction of the different planned project activities with individual environmental receptors based on the international best practice for the ESMP framework (Figure 5.1).

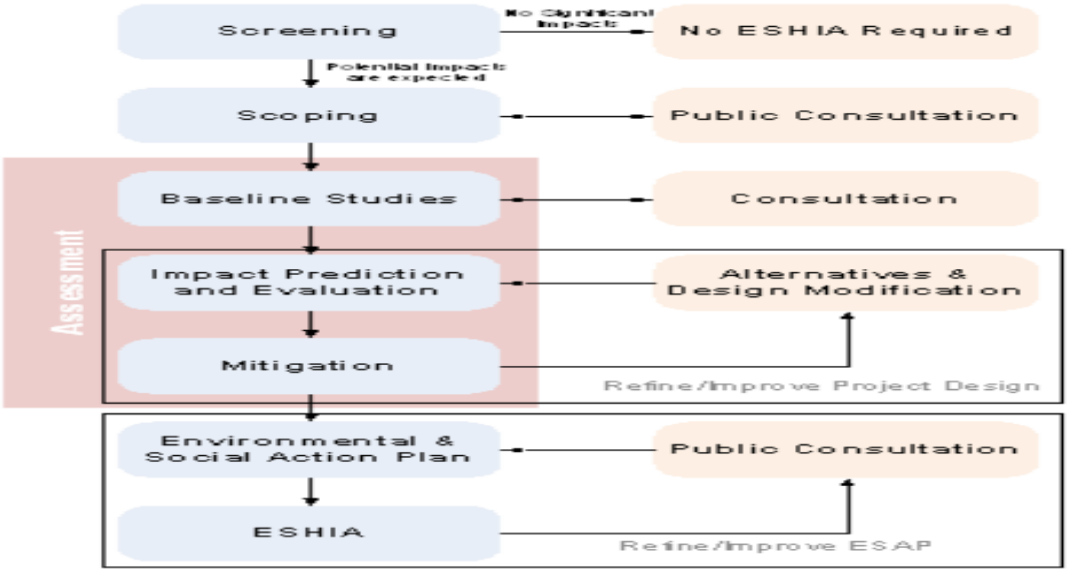


Figure 5-1: ESMP Process

Main environmental, social and climate change impacts anticipated the project's most significant negative effects that might be generated during construction and operation include:

a. loss of biodiversity.
b. ecological fragmentation.
c. disruption of fish habitats.
d. degradation of air quality.
e. greenhouse gas emissions.
f. water pollution.
g. soil pollution through the contamination of chemical inputs; and
h. production of solid waste, sediments and wastewater.

To mitigate negative impacts, various measures will be implemented during both construction and operation. The ESMP has established appropriate mitigation measures and a social and environmental management plan to identify, manage, and monitor the project's impacts while observing the Bank's safeguards measures.

5.2.1 Impact Definition and Approach

Environmental impacts from planned and non-planned activities during all phases of the Project are assessed based on detailed knowledge and industry experience of these activities. For this ESMP, an environmental or socio-economic impact is defined as:

"Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities or services." (ISO 14001)

The prediction of impacts is an objective exercise aimed at determining the potential effects of the Project and its associated activities on the environment. The impacts on various resources and receptors are detailed and evaluated based on the significant interactions identified during scoping. The impact assessment process considers a wide range of potential impacts, which leads to the use of various prediction methods including quantitative and semi-quantitative techniques (e.g., noise impacts on sensitive community receptors) and qualitative techniques for assessing certain socio-economic impacts on communities.

The assessment was based on a cause and effects matrix between project-related impact sources and valued environmental components. Impacts are defined by their intensity (low, medium, major), their extent (regional, local, limited) and duration (long, medium, short). The impact analysis takes account of the three major phases of any project development cycle, including the description of the expected impacts:

- Pre and Construction (site preparation and infrastructure construction) phase
- infrastructures operation and maintenance phase
- closure and rehabilitation phase

For each project phase, a recapitulative table, including impact sources, potentially affected elements, and impact descriptions, is presented. Cumulative impacts are also considered.

The method used to identify, analyse, and mitigate environmental and social impacts or improve positive impacts places the project in a sustainable development perspective. The mitigation of anticipated negative consequences and the enhancement of positive impacts allow its environmental and social acceptability by stakeholders. The methodology used for the project impact assessment is presented in the following sections.

5.2.2 Potential Impact Assessment

The project's eventual impacts were evaluated using a grid that relates impact sources to environmental and social components. This analysis identifies the elements likely to be affected by future activities or infrastructures. Then, the identified potential impacts are assessed.

Impact Assessment

Impact assessment involves identifying the magnitude, intensity, extent, duration, and probability of occurrence of any potential impact on the project during its life cycle.

5.2.2.1 Impact Magnitude

The impact of project activities on the physical, biological, and human environment was determined by an overall assessment of how one or several impact sources affect an environmental component. This evaluation considers the measures included in the project design and determines the magnitude of impact persistence after management measures have been applied. The magnitude of the impact reflects the intensity of the impact, its extent, and its duration. Impact magnitude is ranked as major, moderate, or minor based on the magnitude grid (Table 5.1). Those impacts are either positive or negative.

Table 5-1: Impact Magnitude Grid

Analysis Criteria			**Magnitude**
Intensity	**Extent**	**Duration**	
High	Regional	Long-term	Major
		Medium-term	Major
		Short-term	Major
	Local	Long-term	Major
		Medium-term	Major
		Short-term	Moderate
	Limited	Long-term	Major
		Medium-term	Moderate
		Short-term	Moderate
Moderate	Regional	Long-term	Major

		Medium-term	Moderate
		Short-term	Moderate
	Local	Long-term	Moderate
		Medium-term	Moderate
		Short-term	Moderate
	Limited	Long-term	Moderate
		Medium-term	Moderate
		Short-term	Minor
Low	Regional	Long-term	Moderate
		Medium-term	Moderate
		Short-term	Minor
	Local	Long-term	Moderate
		Medium-term	Minor
		Short-term	Minor
	Limited	Long-term	Minor
		Medium-term	Minor
		Short-term	Minor

5.2.2.2 Impact Intensity

The intensity of an impact on environmental and human components indicates the degree to which the assessed component is disturbed. The analysis will consider the component's properties, particularly its sensitivity, capacity to accommodate changes, and estimated value. Impact intensity is divided into three levels:

- High: the impact threatens or destroys significantly the concerned element's integrity or changes substantially or irreversibly its environmental distribution or role.
- Medium: the impact alters the component quality and its environmental distribution or role without damaging its integrity.
- Low: the impact slightly alters the concerned component without substantially changing its quality, environmental distribution, or role.

5.2.2.3 Impact Extent

The extent of an impact on natural and human environments refers to the area of the territory or the proportion of the population affected by the proposed project. It can be regional, local or limited to the study area:

- Regional: the impact affects the entire RSA (Regional Study Area), a greater area or most of the RSA's population.

- Local: The impact mainly affects the LSA (Local Study Area) or bordering population groups.
- Limited: the impact affects only a limited area or some individuals in the LSA.

5.2.2.4 Impact Duration

This refers to the period for which the project's effect will be felt in the environment during the project life cycle. This parameter reflects the intermittent nature of an impact. Duration can be long-term, medium-term, or short-term:

- Long-term: The impact is felt continuously or intermittently throughout the project's lifetime and is often permanent or irreversible.
- Medium-term: the impact is felt temporarily, continuously or intermittently during construction.
- Short term: impact is felt temporarily, continuously or intermittently for a limited period in the project's construction, closure or rehabilitation phases.

5.2.2.5 Probability of Impact Occurrence

Impact assessment also involves defining the probability of occurrence, the probability that an anticipated impact will affect a component. This factor is not used to evaluate the magnitude but to relativise impacts. The probability of occurrence can be high, moderate, or low:

- High probability of occurrence: the impact will certainly occur.
- Moderate probability of occurrence: the impact is likely to occur, but the occurrence cannot be ascertained.
- Low probability of occurrence: it is improbable that the impact will occur, or it might occur only by accident.

Based on the above methodology, the impacts resulting from the project are classified within this ESMP as either positive or negative, with a specific severity rating. All environmental and social effects have been identified based on the information summarised in this ESMP, and their significance is assessed and classified by combining the probability and severity scores as shown in Table 5-2, which relates to negative impacts, or Table 5-2 which relates to positive effects below:

In assessing whether an impact is significant, reference has been made, where appropriate, to the criteria on which the evaluation is based. These may include legislative requirements, policy guidance or accepted practice and experience.

Table 5-2: Significance Matrix Negative Impacts

Significance			Probability Rating			
			Very low	Low	Medium	High
			1	2	3	4
Severity Rating	Very low	1	**Negligible**	**Minor**	**Minor**	**Minor**
	Low	2	**Minor**	**Minor**	**Moderate**	**Moderate**
	Medium	3	**Minor**	**Moderate**	**Moderate**	**Major**
	High	4	**Minor**	**Moderate**	**Major**	**Major**

Table 5-3: Significance Matrix Positive Impacts

Significance			Probability Rating			
			Very low	Low	Medium	High
			1	2	3	4
Severity Rating	Very low	1	**Negligible**	**Minor**	**Minor**	**Minor**
	Low	2	**Minor**	**Minor**	**Moderate**	**Moderate**
	Medium	3	**Minor**	**Moderate**	**Moderate**	**Major**
	High	4	**Minor**	**Moderate**	**Major**	**Major**

5.3 Key Elements for Impact Analysis

The method used to assess the project's impacts relies primarily on extensive knowledge of the project and its environment and experience conducting environmental and social impact assessments for similar projects. It allows for analysing interactions between impact sources and identifying valuable environmental and social components (VESC).

The project description, comprising the location of proposed infrastructures and their technical properties, operation, maintenance, and closure processes, has allowed the identification of different sources of impacts likely to affect the environment for each of the project phases.

Valued environmental components have been identified based on the baseline characterisation study, which has allowed for the identification of the most sensitive components and the main issues raised by various stakeholders, who have been met. The

following sections present the different impact sources and VESC specific to the project and its receiving environment.

5.3.1 Sources of Impact

The sources of impacts are project components that can potentially affect the proposed GGC Doma/Bama erosion and flood control project environment and the social status of the people living in the project communities. They are divided according to the project phases: construction and operation (Table 5.4).

Table 5-4: Project-Related Sources of Impacts.

Pre-construction phase	
Land acquisition	Acquisition of the land needed for project implementation. This acquisition is achieved before the start of construction works.
Population resettlement	Relocation of houses, buildings or economic activities inside the project area that are part of the RAP.
Construction phase	
Site preparation	Site preparation for construction: Overburden removal, deforestation, excavation and earthworks for constructing the project's temporary and permanent infrastructures (e.g., access roads, buildings, workers camps, service and storage areas and maintenance areas for vehicles and equipment).
Exploitation of burrow of pits	Operation of various quarries to supply granular material.
Implementation of construction sites	Development of temporary infrastructures and working sites, including storage areas for materials.
Construction activities	General activities related to the construction of the channelisation, slope stabilisation and bio-engineering works.
Work in the aquatic environment	Works in streams or wetlands for the construction of the project's temporary and permanent infrastructures
Management of hazardous products and residual materials	Management, handling and transportation of dangerous products, contaminants, residual materials, waste, and any material for disposal.

Transport and traffic	Road transportation of workers, materials, and equipment required for on-site construction, machinery circulation, and road and access maintenance.
Purchase of materials, goods and services	Needed purchases to undertake construction works.
Labour	The hiring of labour dedicated to construction works and the presence of workers on-site.
Operation Phase	
Presence and operation of industrial facilities	Presence and operation of facilities
Facilities maintenance	Inspection and maintenance of machinery
Management of residual/hazardous material	Handling and storing residual and dangerous products used in the operations, including hydrocarbons used in electric transformers, waste and spent oils.
Transport/circulation	Transportation and circulation within the right-of-way, including refueling and maintenance of vehicles.
Purchase of material, goods and services	Necessary purchases to operate the construction site
Presence of workers	Employees working within the construction site.
Decommissioning Phase	
Landscape	Loss of Aesthetics due to Abandoned Project Facilities
Abandoned Infrastructure	Machinery and structures will need proper disposal.
Labour	Loss of Employment following Project Closure

5.3.2 Valued Environmental and Social Components

The characterisation of physical (terrestrial/marine), biological, and human environments, together with consultation activities with stakeholders, has allowed the identification of the

valued environmental and social components that may be affected by one or more impact sources (Table 5.5). Impact analysis, therefore, focuses solely on those components.

Table 5-5 Valued Environmental and Social Components

Physical environment VESC	Description
Air quality	Physicochemical properties of air, including dust content.
Soil	Soils' physicochemical characteristics and structure, particularly their agricultural potential and sensibility to erosion and chemical inputs.
Water resources	Hydrology and physicochemical properties of surface and groundwater.
Noise	Characteristics of noise levels.
Biological environment VESC	**Description**
Habitats, fauna and flora	Terrestrial and riparian vegetation associations form natural habitats and their associated fauna. Includes species with conservation status.
Avifauna	Birds inhabit the project area permanently or seasonally.
Aquatic and semi-aquatic habitats and fauna	Habitats and animals for which aquatic habitats are essential to their life cycles. Includes species with a particular conservation status.
Essential habitats	Natural or modified habitats of high biodiversity values.
Human environment VESC	**Description**
Land use planning	Residential, commercial, and industrial land uses; access to natural resources (timber and non-timber products, hunting, fishing); agriculture.
Existing infrastructures	Existing infrastructures and services (road and train networks, power supply, gas, drinking water, municipal infrastructures, telecommunications).
Economy, employment and livelihoods	Local and regional economic development, employment, workforce, employability, income and means of subsistence for affected communities.

Quality of life, health and safety	The well-being of the population related to their surrounding environment, their physical safety, and their perception of situations that may constitute a risk to the environment or health, considering the following elements: water and air quality, noise exposure, soil vibration, physical and economic security, risk perception, and services offered to the community.
Social cohesion	Nature and intensity of social relationships.
Vulnerable groups	People who, because of their gender, ethnicity, age, physical or mental. Disability, social status or economic situation could be prejudiced.
Cultural and archaeological heritage	Heritage sites, sacred sites and zones of archaeological potential.
Landscape	Landscape units and visual fields integrity.

5.3.3 Interactions between Impact Sources and VESC

The impact assessment was performed with a Leopold matrix relating the impact sources and the VESC. The potential impacts assessment is performed based on the different interactions thus identified (Table 5.6)

Table 5-6: Interactions between Impact Sources and VESC

Impact Sources		Physical environment VESC				Biological environment VESC			Human environment VESC							
		Air quality	Soil and agricultural intensification	Water resources	Noise and vibration	Terrestrial habitats, fauna and flora	Avifauna	Aquatic and semi-aquatic habitats and fauna	Land planning and use	Existing infrastructures	Economy, employment and livelihoods	Quality of life, health and safety	Social cohesion	Vulnerable groups	Cultural and archaeological heritage	Landscape
Pre-construction Phase	Land acquisition												x	x		
	Population resettlement								x	x	x	x	x	x		
Construction Phase	Site preparation	x	x	x	x	x	x	x	x	x					x	x
	Exploitation of borrow of pits					x	x								x	x
	Implementation of construction sites	x		x	x	x	x	x								
	Construction activities	x	x	x	x	x	x	x	x	x	x	x			x	x

Impact Sources		Physical environment VESC				Biological environment VESC			Human environment VESC							
		Air quality	Soil and agricultural intensification	Water resources	Noise and vibration	Terrestrial habitats, fauna and flora	Avifauna	Aquatic and semi-aquatic habitats and fauna	Land planning and use	Existing infrastructures	Economy, employment and livelihoods	Quality of life, health and safety	Social cohesion	Vulnerable groups	Cultural and archaeological heritage	Landscape
	Work in aquatic environment					x	x	x								
	Management of hazardous products and residual materials	x	x	x		x		x				x				
	Transport and traffic	X	x	x	x	x				x	x	x				
	Purchase of materials, goods and services															
	Labor					x	x	x				x	x			
Operation phase	Presence and operation of heavy machineries	X	x	x	x	x	x	x		x	x	x	x			x
	Facilities maintenance		x	x	x	x	x	x								

Impact Sources		Physical environment VESC				Biological environment VESC			Human environment VESC							
		Air quality	Soil and agricultural intensification	Water resources	Noise and vibration	Terrestrial habitats, fauna and flora	Avifauna	Aquatic and semi-aquatic habitats and fauna	Land planning and use	Existing infrastructures	Economy, employment and livelihoods	Quality of life, health and safety	Social cohesion	Vulnerable groups	Cultural and archaeological heritage	Landscape
	Management of residual/hazardous material		x	x		x		x				x				
	Transport / circulation	X	x	x	x	x		x		x	x	x				
	Purchase of material, goods and services															
	Presence of workers					x	x	x								
Decommissioning	Management of residual/hazardous material		x			x	x	x								x
	Revenue											x				

[4] These are just preliminary assumptions; as the project is a permanent facility, detailed decommissioning activities and impact are speculative. Details in the impact statement were therefore not included.

Impact Sources		Physical environment VESC				Biological environment VESC			Human environment VESC							
		Air quality	Soil and agricultural intensification	Water resources	Noise and vibration	Terrestrial habitats, fauna and flora	Avifauna	Aquatic and semi-aquatic habitats and fauna	Land planning and use	Existing infrastructures	Economy, employment and livelihoods	Quality of life, health and safety	Social cohesion	Vulnerable groups	Cultural and archaeological heritage	Landscape
	Abandoned Infrastructure															x
	Labour										x					

5.4 Project Options and Alternatives

The following options were appraised during this proposed project: No project options, Delayed project options, and Go-ahead options. The Project option chosen was the Go-ahead option because it admits and emphasises the critical need for the planned development identified during the project scoping phase.[5]Considering its enormous benefits, this option was significantly weighed positive. This option will contribute to improved environmental safety, social well-being, and economic livelihood of the host community. It will also enhance job creation, overcome the lingering threat to lives and properties, and provide many more direct and indirect socio-economic benefits.

5.4.1 Benefits of the Project

The specific benefits of the project include:

Technical Benefits:

1. Implementing gabion walls, retaining walls, and bio-engineering measures will effectively mitigate erosion and prevent further degradation of the landscape and infrastructure.
2. Construction of storage embankments and check dams will help regulate water flow, reducing the risk of flooding during heavy rainfall events.
3. Cross-drainage structures and channel bank protection measures will enhance drainage systems and minimise waterlogging and associated risks.
4. The project will stabilise roads, buildings, and other infrastructure by addressing soil erosion and sediment build-up, ensuring longevity and functionality.
5. Strategic watershed planning and ecosystem restoration efforts will contribute to improved water resource management and ecosystem health, benefiting both urban and rural communities.

Commercial and Economic Benefits:

1. The project's focus on erosion and flood control will enhance the desirability and value of properties in the area, benefiting homeowners and real estate developers.
2. By preventing erosion-induced damage to infrastructure and property, the project will lead to significant cost savings for local governments and private entities regarding repair and maintenance expenses.
3. The construction phase will generate employment opportunities for local labourers, contractors, and skilled professionals, stimulating economic activity in the region.

[5] See GGC Doma Erosion/Flood Control Site Engineering Design Report (2024)

4. Increased investment in construction materials, equipment rental, and related services will benefit local businesses and foster economic growth and development.
5. Preserving natural landscapes and improved infrastructure will attract tourists and outdoor enthusiasts, support local tourism businesses and generate revenue for the community.

Social Benefits:

1. The project will enhance the safety and well-being of residents, particularly those living in vulnerable areas, by reducing the risk of erosion-related hazards such as landslides and flooding.
2. Protection of agricultural land from erosion and flooding will safeguard farmers' livelihoods, ensuring food security and economic stability for rural communities.
3. Improved infrastructure and drainage systems will facilitate better access to essential services such as healthcare, education, and transportation, particularly during adverse weather conditions.
4. Engagement with local communities throughout the project lifecycle will empower residents to participate in decision-making processes, fostering a sense of ownership and pride in the project's outcomes.
5. Restoring degraded ecosystems and adopting sustainable land management practices will contribute to environmental conservation efforts and preserve biodiversity and natural resources for future generations.

5.4.2 Envisaged Sustainability

Economic Sustainability: The erosion and flood control project will benefit both locally and nationally economically. By investing in innovative engineering solutions, such as advanced technology and materials, the project can minimise long-term maintenance costs and maximise the effectiveness and lifespan of infrastructure. Although this approach requires a higher initial investment, it aligns better with long-term economic sustainability, fostering economic growth and supporting sustainable development goals. Additionally, the project will provide employment opportunities during the construction phase, contributing to poverty reduction and integrating rural and urban economies.

Box1: Economic sustainability
Alternative 1: Conventional Erosion Control Measures
Pros: Familiarity with traditional methods, minimal disruption to existing ecosystems.
Cons: Limited effectiveness in addressing severe erosion, the potential for habitat disturbance, and reliance on non-sustainable materials.
Alternative 2: Eco-friendly Erosion Control Techniques
Pros: Implementing bioengineering solutions, such as planting native vegetation and using natural materials like gabions and coir logs, promotes habitat restoration, reduces erosion, and enhances biodiversity.

Cons: It requires specialised knowledge and training, and the initial establishment phase may be time-consuming.
Recommended Approach: Prioritize Alternative 2 to ensure environmental sustainability. The project can mitigate negative impacts on ecosystems by adopting eco-friendly erosion control techniques, promoting habitat restoration, and contributing to long-term environmental health and resilience.

a) **Environmental Sustainability:** To ensure environmental sustainability, the erosion and flood control project will adhere to enabling regulations and standards set by relevant authorities. The project will prioritise eco-friendly erosion control techniques, such as bio-engineering solutions and natural materials, to mitigate negative impacts on ecosystems and enhance biodiversity. Adherence to waste management practices, continuous consultations with host communities, and strict implementation of Environmental and Social Management Plans (ESMP) will be ensured.

Box 2: Environmental Sustainability
Alternative 1: Conventional Erosion Control Measures
Pros: Familiarity with traditional methods, minimal disruption to existing ecosystems.
Cons: Limited effectiveness in addressing severe erosion, the potential for habitat disturbance, and reliance on non-sustainable materials.
Alternative 2: Eco-friendly Erosion Control Techniques
Pros: Implementing bioengineering solutions, such as planting native vegetation and using natural materials like gabions and coir logs, promotes habitat restoration, reduces erosion, and enhances biodiversity.
Cons: It requires specialised knowledge and training, and the initial establishment phase may be time-consuming.
Recommended Approach: Prioritize Alternative 2 to ensure environmental sustainability. The project can mitigate negative impacts on ecosystems by adopting eco-friendly erosion control techniques, promoting habitat restoration, and contributing to long-term environmental health and resilience.

b) **Social Sustainability**: The erosion and flood control project will prioritise comprehensive community engagement to enhance social sustainability. Through sustained stakeholder engagement, the project will foster trust, promote social cohesion, and ensure project outcomes align with community needs and aspirations. Robust community engagement, tailored to the risks and impacts of the project, will be instituted, incorporating the language preferences and decision-making processes of affected communities. Additionally, a grievance mechanism will address concerns and grievances, promoting transparency and accountability in environmental and social performance. This means embracing comprehensive community engagement will build positive relationships with stakeholders

and ensure the project's long-term success by integrating local knowledge and perspectives into decision-making processes.

Box 3: Social Sustainability
Alternative 1: Limited Community Engagement
Pros: Streamlined decision-making process, the potential for faster project implementation.
Cons: Limited community involvement may lead to grievances, lack of local buy-in, and resistance to project activities.
Alternative 2: Comprehensive Community Engagement
Pros: Local communities' active involvement in project planning, implementation, and monitoring fosters trust, promotes social cohesion and ensures project outcomes align with community needs and aspirations.
Cons: Requires additional time and resources for community consultation and participation.
Recommended Approach: Embrace Alternative 2 to enhance social sustainability. By prioritizing comprehensive community engagement, the project can build positive relationships with stakeholders, address concerns, and ensure its long-term success by integrating local knowledge and perspectives into decision-making processes.

In conclusion, ***prioritising innovative engineering solutions, eco-friendly erosion control techniques, and comprehensive community engagement*** will enhance the overall sustainability of the erosion and flood control project across economic, environmental, and social dimensions. By investing in sustainable practices and fostering collaboration with local communities, the project can achieve its objectives while promoting long-term resilience and well-being for people and the environment.

5.4.3 Project Options and Alternatives Selection

Established ESMP processes, including the requirements of Nigerian regulations and the World Bank ESS principles, call for an analysis of reasonable alternatives to various elements of the proposed project. To align with the Federal Ministry of Environment's (FMEnv) National Environmental Protection Regulation of 1991, which mandates early selection of best engineering and operational options for new point sources, a range of alternatives and options were evaluated to facilitate the identification of the most appropriate means of meeting the project's environmental objective.

Project Options

a) ***Option 1: No Project***

The no-project option involves taking no action to address the erosion and flood control issues identified at the site. It consists in maintaining the status quo without implementing any interventions.

Analysis:

- **Environmental Impact:** Without intervention, the site remains vulnerable to ongoing erosion and flooding, leading to continued environmental degradation. This degradation includes soil erosion, sedimentation of water bodies, loss of vegetation, and habitat destruction. The lack of mitigation measures exacerbates these ecological impacts over time.
- **Social Impact:** Communities in the area continue to face risks to their safety, livelihoods, and infrastructure from recurrent flooding and erosion events. The absence of intervention prolongs residents' exposure to these hazards, increasing vulnerability and potential displacement.

Recommendation: The No Project Option is not recommended due to its significant environmental and social risks. Failing to address the erosion and flood control issues would lead to continued environmental degradation and heightened vulnerability for the affected communities. Implementing proactive measures is necessary to mitigate these risks and promote sustainable development.

b) Option 2: Delayed Project

Description: The Delayed Project Option involves postponing the implementation of the erosion and flood control project for various reasons, such as funding constraints, bureaucratic hurdles, or logistical issues. While the project is still planned, its execution is delayed beyond the initially intended timeframe.

Analysis:

- **Environmental Impact:** Delaying the project prolongs the site's exposure to erosion and flooding, exacerbating environmental degradation. Without timely intervention, erosion continues to erode soil, increase sedimentation in water bodies, and degrade habitats. The prolonged delay further amplifies these ecological impacts.
- **Social Impact:** Communities remain vulnerable to flooding and erosion-related hazards during the delay period. The ongoing risks to lives, property, and livelihoods persist, with residents experiencing heightened uncertainty and insecurity about their future.

Recommendation: While delays in project implementation may be unavoidable due to various challenges, efforts should be made to expedite the process. The Delayed Project Option prolongs environmental degradation and exacerbates social vulnerabilities, underscoring the importance of prioritising timely action to address the identified issues.

c) Option 3: **Go-ahead**

Description: The Go-ahead Option involves proceeding with the planned erosion and flood control project and implementing the identified measures to address the site issues. This option signifies the commitment to proactive intervention to mitigate environmental degradation and enhance community resilience.

Analysis:

- **Environmental Impact:** Implementing erosion and flood control measures mitigates environmental degradation, reducing erosion, sedimentation, and habitat loss. These proactive measures restore and preserve natural ecosystems, promoting biodiversity and ecosystem services.
- **Social Impact:** Communities benefit from improved safety, reduced risks to livelihoods and infrastructure, and enhanced resilience to flooding and erosion events. The project's implementation enhances community well-being, fosters social cohesion, and promotes sustainable development outcomes.

Recommendation: The Go-ahead Option is highly recommended as it addresses the identified environmental and social risks. Proceeding with the erosion and flood control project demonstrates a commitment to environmental stewardship and community welfare, promoting resilience and sustainability in the area. Effective implementation of the project, coupled with comprehensive environmental and social management measures, ensures that the benefits are maximised while minimising adverse impacts.

5.4.4 Future Scenarios Without Intervention

Without intervention, the erosion and flood control issues will likely worsen. Continued erosion will degrade soil quality, decrease agricultural productivity, and cause the loss of fertile land. Flooding events will become more frequent and severe, posing risks to lives, property, and infrastructure. Communities will struggle to cope with the impacts, facing increased displacement, economic losses, and social disruption. Environmental degradation will exacerbate, affecting water quality, biodiversity, and ecosystem services. This indicates that without intervention, the future scenario is one of heightened environmental degradation, increased social vulnerability, and diminished resilience for affected communities.

5.4.5 Engineering Designs[6]

Identifying and investigating alternatives is a key aspect of the ESMP process. Therefore, all reasonable and feasible options were identified and assessed during the scoping phase to determine the most suitable options to consider and evaluate during the ESMP phase based on the available structural and non-structural design interventions. These include:

[6] Based on the GGC Doma Erosion/Flood Control Site Engineering Design Report (2024)

i. **Protection of Slopes**

The reliance on natural vegetation to safeguard steep and rain-prone slopes is generally inadequate. In such instances, employing bio-engineering solutions is recommended. Bioengineering involves utilising vegetation, engineering structures, and non-living plant material to mitigate slope erosion and shallow-seated instability. Bioengineering offers several advantages, including soil protection against erosion and rain splash, increased soil infiltration capacity, enhanced resistance to failure through root binding, and reduced soil moisture through transpiration. Typical bio-engineering solutions include using Vetiver grass to stabilise terraces and gullies, trees, shrubs, and other grasses to stabilise slopes, embankments, and drains.

ii. **Retaining Walls**

Retaining walls are vertical or near-vertical structures that retain earth, soil, or water. They serve various purposes, including preventing earth walls from collapsing, retaining water to form water channels, protecting bridge abutments from soil erosion, and serving as water storage structures. These walls are constructed with backfill support and can withhold lateral earth pressures. They prevent soil from sliding or eroding and are typically used in areas with undesirable slopes or where the landscape requires shaping for specific purposes.

iii. **Reinforced Concrete Walls**

The frequent occurrence of flooding, attributed to factors such as population growth, deforestation, poor drainage systems, and inadequate governance, necessitates using reinforced concrete walls. These walls are employed in selected riverbank locations threatened by floods and erosion to safeguard houses, buildings, and infrastructure. Reinforced concrete walls can withstand surcharge loads and backfill movement, making them suitable for high-risk areas.

iv. **Excavations**

In response to the meandering nature of the Doma River, which widens channels on one side while eroding the other, selective excavation is proposed to redirect its course. This measure aims to stabilise the riverbank and mitigate erosion in specific locations.

v. **Earth Fills and Dyke**

Enhancing and stabilising riverbanks involves backfilling behind retaining walls and constructing dykes on shallow banks and detention storage stilling basins. These measures contribute to erosion control and flood mitigation, ensuring the stability of riverbanks and surrounding areas.

Implementing Bio-engineering Solutions for Slope Protection is the best and recommended option. This approach aligns with sustainable practices by utilising natural vegetation to mitigate slope erosion and instability, offering long-term benefits for environmental

preservation and community resilience. Hence, a combination of structural and non-structural technology was selected to include the following:

a) Construction of retaining walls
b) Reinforced concrete retaining walls
c) Construction of Box Culverts
d) Bioengineering
e) Excavation and fill
f) Detention storage (Stilling Basin) on the river
g) Earth Dam

5.5 Potentially Significant Adverse Environmental and Social Impacts of The Proposed Project

Table 5.7 below presents the potential significant adverse environmental and social impacts of the proposed project:

Table 5-7: potential significant adverse environmental and social impacts of the proposed project

Planned Activities within the Project Phase	Associated and Potential Impacts	Impact Qualification													Risk		Impact Category
		Direct	Indirect	Reversible	Irreversible	Cumulative	Long term	Short term	Beneficial	Adverse	Residual	Regional	Local	Micro area	Probability	Magnitude	
Pre-Construction Phase																	
Land acquisition	Loss of property (agitation)	X		X				X		X			X		CERTAIN	MARGINAL	HIGH
	Compensation	X		X				X	X					X	CERTAIN	CRITICAL	
Site Preparation and land clearance	Conflicts and crises over the source of livelihood	X		X				X		X			X		CERTAIN	MARGINAL	HIGH
	Air quality deterioration from the release of dust and gaseous emissions from exposed soil surfaces and vehicles	X		X				X		X			X		LIKELY	MARGINAL	HIGH
	Noise and vibration from the use of machinery and motorised equipment	X		X				X			X		X		CERTAIN	NEGLIGIBLE	MEDIUM
	Loss of vegetation cover due to clearing of project site	X		X				X			X		X		POSSIBLE	MARGINAL	MEDIUM

Planned Activities within the Project Phase	Associated and Potential Impacts	Impact Qualification													Risk		Impact Category
		Direct	Indirect	Reversible	Irreversible	Cumulative	Long term	Short term	Beneficial	Adverse	Residual	Regional	Local	Micro area	Probability	Magnitude	
	Loss of vulnerable threatened and endangered tree species due to site clearing.	X		X				X		X			X		POSSIBLE	MARGINAL	MEDIUM
Population resettlement	Relocation of houses, buildings or economic activities inside the project area that are part of the RAP.																
Exploitation of borrow of pits	Operation of various quarries to supply granular material that may affect vegetation cover at the source	X			X	X	X			X	X				POSSIBLE	MARGINAL	MEDIUM
Implementation of construction sites	Noise pollution and emissions from construction machinery.	X		X				X		X			X		POSSIBLE	MARGINAL	MEDIUM
	Disrupt the daily lives of nearby communities, leading to issues such as increased traffic	X		X				X		X			X		POSSIBLE	MARGINAL	MEDIUM

Planned Activities within the Project Phase	Associated and Potential Impacts	Impact Qualification													Risk		Impact Category
		Direct	Indirect	Reversible	Irreversible	Cumulative	Long term	Short term	Beneficial	Adverse	Residual	Regional	Local	Micro area	Probability	Magnitude	
	Poor site management can pose safety hazards such as tripping hazards, falling objects, and exposure to hazardous materials, leading to accidents and injuries.	X		X				X		X			X		POSSIBLE	MARGINAL	MEDIUM
	Providing temporary infrastructures and working sites can create job opportunities for local communities.	X						X	X					X	POSSIBLE	MARGINAL	LOW
Construction of infrastructures such as access roads, demolition of affected properties, truck parking, etc.	Air Quality deterioration from dust and fumes generated during excavation, filling, backfilling, Stockpiling and compaction activities.	X		X				X		X			X		POSSIBLE	MARGINAL	MEDIUM
	Disruption to livelihood	X		X				X		X			X		POSSIBLE	MARGINAL	MEDIUM

Planned Activities within the Project Phase	Associated and Potential Impacts	Impact Qualification													Risk		Impact Category
		Direct	Indirect	Reversible	Irreversible	Cumulative	Long term	Short term	Beneficial	Adverse	Residual	Regional	Local	Micro area	Probability	Magnitude	
	activities due to interruptions of construction activities																
	Noise pollution and emissions from construction machinery.	X		X				X		X			X		POSSIBLE	MARGINAL	MEDIUM
	Predisposition of soil to erosion during excavation and earth movement	X		X				X		X					POSSIBLE	CRITICAL	HIGH
	Increased traffic and road accidents along affected segments due to disruption of flow by heavy-duty vehicles.	X		X				X		X					POSSIBLE	CRITICAL	HIGH
	Generation of hazardous waste and contamination of nearby rivers from indiscriminate handling of wastes.	X		X				X		X					LIKELY	CRITICAL	HIGH

Planned Activities within the Project Phase	Associated and Potential Impacts	Impact Qualification													Risk		Impact Category
		Direct	Indirect	Reversible	Irreversible	Cumulative	Long term	Short term	Beneficial	Adverse	Residual	Regional	Local	Micro area	Probability	Magnitude	
	Soil contamination from leakage/spillage of fuel or oil from equipment and vehicles.	X		X				X		X			X		POSSIBLE	MARGINAL	MEDIUM
	Risk of occupational accidents and injuries from working in excavations and the use of machinery and equipment	X		X				X		X					LIKELY	MARGINAL	MEDIUM
Creation of borrow pits.	Unsustainable excavation and non-rehabilitation of burrow pits may lead to land degradation and increased susceptibility to erosion and flooding.	X		X				X		X					POSSIBLE	MARGINAL	MEDIUM
	Borrow pits may become inundated with water, which can	X		X		X	X			X					CERTAIN	MARGINAL	HIGH

Planned Activities within the Project Phase	Associated and Potential Impacts	Impact Qualification													Risk		Impact Category
		Direct	Indirect	Reversible	Irreversible	Cumulative	Long term	Short term	Beneficial	Adverse	Residual	Regional	Local	Micro area	Probability	Magnitude	
	lead to accidents and drowning for humans and animals.																
Capacity to implement ESMP	The project has no safeguard officers and is likely unable to implement the ESMP prepared for the project.	X		X			X			X		X			UNLIKELY	CRITICAL	HIGH
Construction/Operation Phase																	
Construction activities	Increase ambient noise from the operation of machinery	X		X				X			X		X		POSSIBLE	MARGINAL	MEDIUM
	Discharge of sediment-laden runoff		X	X				X			X		X		LIKELY	MARGINAL	HIGH
	Temporary road closures or diversions	X		X			X			X			X		LIKELY	MARGINAL	HIGH
	Emissions from operating heavy-duty engines		X	X			X			X			X		LIKELY	MARGINAL	MEDIUM
	Dust generation from construction activities		X	X			X			X			X		LIKELY	MARGINAL	HIGH

Planned Activities within the Project Phase	Associated and Potential Impacts	Impact Qualification													Risk		Impact Category
		Direct	Indirect	Reversible	Irreversible	Cumulative	Long term	Short term	Beneficial	Adverse	Residual	Regional	Local	Micro area	Probability	Magnitude	
	Pollution of existing Rivers from workers' open defecation may lead to an increased risk of water-borne diseases in nearby communities.	X		X			X			X			X		POSSIBLE	MARGINAL	MEDIUM
	Threat to community culture, safety and security due to the presence of workers and business opportunists.	X		X		X				X		X	X		POSSIBLE	MARGINAL	MEDIUM
	Labour Influx, which could lead to an increase in sexual activities and the potential spread of STDs/STIs, including HIV/AIDS, in the project location		X	X		X				X			X		POSSIBLE	CRITICAL	HIGH
	Increased risk of Sexual		X	X			X			X			X		POSSIBLE	MARGINAL	MEDIUM

Planned Activities within the Project Phase	Associated and Potential Impacts	Impact Qualification													Risk		Impact Category
		Direct	Indirect	Reversible	Irreversible	Cumulative	Long term	Short term	Beneficial	Adverse	Residual	Regional	Local	Micro area	Probability	Magnitude	
	Exploitation and Abuse (SEA)/ Gender Based Violence (GBV) due to the Influx of workers.																
	Child labour and school dropouts in the project communities due to the availability of work during project operation.		X	X		X				X			X		POSSIBLE	CRITICAL	HIGH
	Traffic congestion and increased road traffic accidents along the affected segment due to the movement of vehicles conveying construction materials		X	X				X			X		X		POSSIBLE	MARGINAL	HIGH
	Increase demand on community health and sanitation infrastructure due	X		X				X			X		X		POSSIBLE	MARGINAL	MEDIUM

Planned Activities within the Project Phase	Associated and Potential Impacts	Impact Qualification													Risk		Impact Category
		Direct	Indirect	Reversible	Irreversible	Cumulative	Long term	Short term	Beneficial	Adverse	Residual	Regional	Local	Micro area	Probability	Magnitude	
	to the influx of workers and camp followers.																
	Construction workers' open defecation may increase the risk of waterborne diseases in nearby communities.		X	X							X	X			POSSIBLE	MARGINAL	MEDIUM
	Loss of employment for temporary construction workers		X	X				X					X		LIKELY	MARGINAL	MEDIUM
Decommissioning Phase																	
Landscape	Aesthetics due to beautification		X	X			X		X				X		LIKELY	CRITICAL	MEDIUM
Dismantling and Removal of Equipment and Vehicles	Dust, noise, and oil spill during the activity	X		X				X			X		X		POSSIBLE	MARGINAL	MEDIUM
Labour	Loss of Employment following Project Closure		X	X				X					X		LIKELY	MARGINAL	MEDIUM

CHAPTER SIX:ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

6.1 Introduction

This chapter presents the Environmental and Social Management Plan (ESMP) for the GGC Doma Erosion and Flood Control Project in Gombe State, Nigeria. The ESMP is designed to ensure that all environmental and social risks associated with the project are effectively managed and mitigated, aligning with both national regulations and international best practices. The ESMP outlines the specific mitigation strategies, cost estimates for implementation, COVID-19 protocols, institutional arrangements for execution, and the monitoring and evaluation (M&E) framework.

The primary goal of the ESMP is to mitigate the adverse environmental and social impacts identified during the project's scoping. By implementing this plan, we aim to enhance positive outcomes while minimising potential adverse effects on the environment and local communities.

6.2 Proposed mitigation measures

The GGC Doma erosion and flood control project aims to address the severe erosion and flooding challenges affecting the region. In highly urbanised areas like the Gombe metropolis, mitigating the environmental and social impacts that may arise during the project's pre-construction, construction, and operational phases is crucial.

Mitigation measures are designed to minimise, manage, or eliminate adverse effects on the environment and local communities. These measures are a key component of the Environmental and Social Management Plan (ESMP), ensuring the project is implemented sustainably and responsibly.

The proposed mitigation measures for the GGC Doma erosion and flood control project are presented in Table 6.1 – 6.3:

Each mitigation measure is tailored to the specific activities and potential impacts identified in the project. They include detailed actions, monitoring indicators, and responsibilities to ensure effective implementation and compliance with national and international environmental and social standards.

Table 6-1 E&S Mitigation and Management Plan for the GGC-Doma Erosion and Flood Control during the Pre-construction phase

Planned Activity	Associated & Potential Impact	Mitigation Measures	Implementing Institution	Estimated Mitigation Cost (NGN)	Monitoring Indicators	Frequency of Monitoring	Where to Monitor	How to Monitor	Responsibility for Monitoring	Estimated Monitoring Cost (NGN)
Land acquisition	Loss of property (agitation)	Fair and timely compensation; stakeholder engagement and grievance redress mechanism	SPMU/Contractor	2,000,000.00	Number of grievances reported and resolved; status of compensation disbursement	Monthly	Project-affected areas	Surveys, interviews, grievance records	Gombe State Min. of Env., SPMU ACReSAL E&S Team.	500,000.00
	Compensation	Ensure compensation aligns with market rates and is inclusive of all affected parties. Prepare a Resettlement Action	SPMU ACReSAL E&S Team/RAP Consultant		Percentage of affected individuals compensated.	Before construction/ operation	Project-affected areas	Financial records, surveys, interviews	Gombe State Min. of Env., GOSEPA, SPMU ACReSAL E&S Team.	-

Planned Activity	Associated & Potential Impact	Mitigation Measures	Implementing Institution	Estimated Mitigation Cost (NGN)	Monitoring Indicators	Frequency of Monitoring	Where to Monitor	How to Monitor	Responsibility for Monitoring	Estimated Monitoring Cost (NGN)
		Plan (RAP)								
Site Preparation and land clearance	Conflicts over livelihood sources	Engagement with local communities; provision of alternative livelihood options	SPMU	7,500,000.00	Number of conflicts reported; number of alternative livelihoods provided	Monthly	Local communities	Surveys, community meetings, grievance records	Gombe State Min. of Env., GOSEPA, SPMU ACReSAL E&S Team.	1,125,00.00
	Air quality deterioration from dust and emissions	Dust suppression methods (e.g., water spraying); vehicle emission controls; regular maintenance of machinery	Contractor	2,100,000.00	Air quality measurements (PM10, PM2.5 levels); number of dust suppression activities	Weekly	Construction site, surrounding areas	Air quality monitoring stations, visual inspections	Gombe State Min. of Env., GOSEPA, SPMU ACReSAL E&S Team.	420,000.00

Planned Activity	Associated & Potential Impact	Mitigation Measures	Implementing Institution	Estimated Mitigation Cost (NGN)	Monitoring Indicators	Frequency of Monitoring	Where to Monitor	How to Monitor	Responsibility for Monitoring	Estimated Monitoring Cost (NGN)
	Noise and vibration	Use of noise barriers; scheduling noisy activities during less sensitive times; maintaining equipment	Contractor	200,000.00	Noise level measurements; the number of complaints from local communities	Weekly	Construction site, surrounding areas	Noise monitoring equipment, community surveys	Gombe State Min. of Env., SPMU ACReSAL E&S Team, Contractors E&S Team, NESREA	50,000.00
	Loss of vegetation cover	Minimise clearing; replanting or compensatory planting	Contractor	1,500,000.00	Area of vegetation cleared vs. replanted	Monthly	The project site, replanting areas	Satellite images, drone surveys, field inspections	Gombe State Min. of Env., SPMU ACReSAL E&S Team.	750,000.00
	Loss of vulnerable threatened, and endange	Pre-clearance surveys; relocation of species if possible;	Contractor	1,250,000.00	Number of species relocated or replanted; survival rate of	Monthly	The project site, replanting areas	Field inspections, biodiversity surveys	Gombe State Min. of Env., SPMU ACReSA	437,500.00

Planned Activity	Associated & Potential Impact	Mitigation Measures	Implementing Institution	Estimated Mitigation Cost (NGN)	Monitoring Indicators	Frequency of Monitoring	Where to Monitor	How to Monitor	Responsibility for Monitoring	Estimated Monitoring Cost (NGN)
	red tree species	compensatory planting			relocated species				L E&S Team.	
Population resettlement	Relocation of houses, buildings, or economic activities	Development and implementation of a Resettlement Action Plan (RAP); stakeholder engagement	SPMU ACReSAL E&S Team/RAP Consultant		Number of households or businesses relocated; satisfaction level of relocated individuals.	Monthly	Resettlement areas, original locations	Surveys, interviews, RAP reports	Gombe State Min. of Env., GOSEPA, SPMU ACReSAL E&S Team.	-
Exploitation of borrow pits	Vegetation cover loss at the source	Sustainable extraction practices; site rehabilitation plans	Contractor	1,000,000.00	Area of land rehabilitated; vegetation covers post-extraction	Monthly	Borrow pit sites	Field inspections, satellite images, drone surveys	Gombe State Min. of Env., SPMU ACReSAL E&S Team, Contractors E&S Team, NESREA	750,000.00

Planned Activity	Associated & Potential Impact	Mitigation Measures	Implementing Institution	Estimated Mitigation Cost (NGN)	Monitoring Indicators	Frequency of Monitoring	Where to Monitor	How to Monitor	Responsibility for Monitoring	Estimated Monitoring Cost (NGN)
Implementation of construction sites	Noise pollution and emissions from construction machinery	Use of quieter machinery; regular maintenance; emissions control; adherence to work hours	Contractor	1,250,000.00	Noise and emission level measurements; number of maintenance activities	Weekly	Construction site, surrounding areas	Noise monitoring equipment, emission testing, maintenance records	Gombe State Min. of Env., SPMU ACReSAL E&S Team, Contractors E&S Team, NESREA	875,000.00
	Disruption to daily lives, increased traffic	Traffic management plans; community engagement	Contractor /SPMU	4,500,000.00	Traffic flow measurements; number of complaints from local communities	Weekly	Nearby roads, community areas	Traffic cameras, community surveys, traffic flow analysis	Gombe State Min. of Env., SPMU ACReSAL E&S Team, FRSC, Gombe State Min of Transport	3,375,000.00

Planned Activity	Associated & Potential Impact	Mitigation Measures	Implementing Institution	Estimated Mitigation Cost (NGN)	Monitoring Indicators	Frequency of Monitoring	Where to Monitor	How to Monitor	Responsibility for Monitoring	Estimated Monitoring Cost (NGN)
	Safety hazards	Implementation of safety management plans; regular site inspections; safety training for workers	Contractor /SPMU	1,000,000.00	Number of safety incidents; number of safety training sessions conducted	Weekly	Construction site	Safety inspection reports, training attendance records	Gombe State Min. of Env., SPMU ACReSAL E&S Team, Contractors E&S Team, NESREA	250,000.00
	Job opportunities for local communities	Employment of local labour; fair recruitment processes	Contractor /SPMU	500,000.00	Number of local workers employed; satisfaction level of employed workers	Monthly	Construction site, local community areas	Employment records, surveys	Gombe State Min. of Env., SPMU ACReSAL E&S Team.	175,000.00
Construction of infrastructures	Air quality deterioration	Dust suppression methods; vehicle emission controls;	Contractor /SPMU	2,000,000.00	Air quality measurements (PM10, PM2.5 levels);	Weekly	Construction site, surrounding areas	Air quality monitoring stations, visual	Gombe State Min. of Env., SPMU ACReSAL E&S	400,000.00

Planned Activity	Associated & Potential Impact	Mitigation Measures	Implementing Institution	Estimated Mitigation Cost (NGN)	Monitoring Indicators	Frequency of Monitoring	Where to Monitor	How to Monitor	Responsibility for Monitoring	Estimated Monitoring Cost (NGN)
		regular maintenance of machinery			number of dust suppression activities			inspections	Team. NESREA	
	Disruption to livelihood activities	Engagement with local communities; provision of alternative livelihood options	SPMU	1,000,000.00	Number of disruptions reported; number of alternative livelihoods provided	Monthly	Local community areas	Surveys, interviews, community meetings	Gombe State Min. of Env., SPMU ACReSAL E&S Team.	200,000.00
	Noise pollution and emissions from construction machinery	Use of quieter machinery; regular maintenance; scheduling noisy activities during less	Contractor /SPMU	750,000.00	Noise and emission level measurements; number of complaints from local communities	Weekly	Construction site, surrounding areas	Noise monitoring equipment, community surveys	Gombe State Min. of Env., SPMU ACReSAL E&S Team. NESREA	187,500.00

Planned Activity	Associated & Potential Impact	Mitigation Measures	Implementing Institution	Estimated Mitigation Cost (NGN)	Monitoring Indicators	Frequency of Monitoring	Where to Monitor	How to Monitor	Responsibility for Monitoring	Estimated Monitoring Cost (NGN)
		sensitive times.								
	Predisposition of soil to erosion	Erosion control measures (e.g., silt fences, vegetation cover); proper drainage systems	Contractor /SPMU	1,150,000.00	Presence and condition of erosion control measures	Monthly	Construction site	Field inspections, erosion control measure assessments		862,500.00
	Increased traffic and road accidents	Traffic management plans; clear signage; community engagement	Contractor /SPMU	7,500,000.00	Number of traffic incidents; traffic flow measurements	Weekly	Nearby roads, community areas	Traffic cameras, community surveys, traffic flow analysis		1,500,000.00
	Hazardous waste generation and contamination	Proper hazardous waste management practices; training for	Contractor /SPMU	1,250,000.00	Number of waste disposal incidents; number of workers trained	Monthly	Construction site, waste disposal areas	Waste management records, training attendance records	Gombe State Min. of Env., SPMU ACReSAL E&S Team,	312,500.00

Planned Activity	Associated & Potential Impact	Mitigation Measures	Implementing Institution	Estimated Mitigation Cost (NGN)	Monitoring Indicators	Frequency of Monitoring	Where to Monitor	How to Monitor	Responsibility for Monitoring	Estimated Monitoring Cost (NGN)
		workers on waste handling.							Contractors E&S Team, NESREA	
	Soil contamination from fuel/oil leakage	Spill prevention and control plans; regular maintenance of equipment	Contractor /SPMU	750,000.00	Number of spill incidents; condition of spill containment measures	Monthly	Construction site	Spill incident reports, field inspections	Gombe State Min. of Env., SPMU ACReSAL E&S Team, Contractors E&S Team, NESREA	112,500.00
	Occupational accidents and injuries	Implementation of safety management plans; regular site inspections; safety training for workers	Contractor /SPMU	2,000,000.00	Number of safety incidents; number of safety training sessions conducted	Weekly	Construction site	Safety inspection reports, training attendance records	Gombe State Min. of Env., SPMU ACReSAL E&S Team, Contractors E&S Team, NESREA	1,000,000.00

Planned Activity	Associated & Potential Impact	Mitigation Measures	Implementing Institution	Estimated Mitigation Cost (NGN)	Monitoring Indicators	Frequency of Monitoring	Where to Monitor	How to Monitor	Responsibility for Monitoring	Estimated Monitoring Cost (NGN)
Creation of borrow pits	Land degradation and increased susceptibility to erosion and flooding	Sustainable excavation practices; site rehabilitation plans	Contractor	1,000,000.00	Area of land rehabilitated; vegetation covers post-extraction	Monthly	Borrow pit sites	Field inspections, satellite images, drone surveys	Gombe State Min. of Env., SPMU ACReSAL E&S Team,	150,000.00
	Risk of accident and drowning	Fencing and signage around borrow pits; community awareness programs	Contractor	Included in the contract cost	Number of accidents reported; condition of fencing and signage	Monthly	Borrow pit sites	Field inspections, Incident records, & community reports	Gombe State Min. of Env., SPMU ACReSAL E&S Team, FRSC, Gombe State Fire Services	

Planned Activity	Associated & Potential Impact	Mitigation Measures	Implementing Institution	Estimated Mitigation Cost (NGN)	Monitoring Indicators	Frequency of Monitoring	Where to Monitor	How to Monitor	Responsibility for Monitoring	Estimated Monitoring Cost (NGN)
Capacity to implement ESMP	Inadequate safeguard officers	Hiring of qualified safeguard officers; capacity-building programs for existing staff	SPMU	2,500,000.00	Number of safeguard officers hired; number of capacity-building programs conducted	Monthly	Project management office	Employment records, training attendance records	Gombe State Min. of Env., SPMU ACReSAL E&S Team, Contractors E&S Team, NESREA	
	Inability to implement ESMP	Regular reviews and audits of ESMP implementation; stakeholder engagement	SPMU	9,000,000.00	ESMP implementation status; stakeholder feedback	Monthly	Project management office, project site	ESMP audit reports, stakeholder surveys	Gombe State Min. of Env., SPMU ACReSAL	
Sub Total				**51,700,000.00**						**13,432,500.00**

Table 6-2: E&S Mitigation and Management Plan for the GGC-Doma Erosion and Flood Control during the Construction phase

Activity	Potential Impact	Mitigation Measures	Implementing Institution	Estimated Cost of Mitigation (NGN)	Monitoring Indicators	Frequency of Monitoring	Where to Monitor	How to Monitor	Responsibility for Monitoring	Estimated Cost of Monitoring (NGN)
Construction activities	Increase ambient noise from the operation of machinery	Use of noise barriers, scheduling noisy activities during daylight hours	Contractor	7,375,000.00	Noise levels (dB)	Weekly	Construction site perimeter	Noise meters	Gombe State Min. of Env., SPMU ACReSAL E&S Team, Contractors E&S Team, NESREA	2,950,000.00
	Discharge of sediment-laden runoff	Install silt fences, sediment traps, and check dams	Contractor	14,750,000.00	Turbidity levels in runoff	Weekly, after-rain events	Downstream water bodies	Turbidity meters, visual inspection	Gombe State Min. of Env., SPMU ACReSAL E&S Team, Contractors E&S Team, NESREA	4,425,000.00
	Temporary road closures or diversions	Provide alternative routes, adequate signage, and public	Gombe State Government, SPMU, Contractor	4,425,000.00	Traffic flow, signage presence	Daily	Nearby roads	Visual inspection, traffic counters		1,475,000.00

Activity	Potential Impact	Mitigation Measures	Implementing Institution	Estimated Cost of Mitigation (NGN)	Monitoring Indicators	Frequency of Monitoring	Where to Monitor	How to Monitor	Responsibility for Monitoring	Estimated Cost of Monitoring (NGN)
		information								
	Emissions from operating heavy-duty engines	Regular maintenance of equipment, use of low-emission engines	Contractor	5,900,000.00	Air quality indices (PM2.5, PM10, NOx)	Weekly	Construction site	Air quality monitors	Gombe State Min. of Env., SPMU ACReSAL E&S Team, Contractors E&S Team, NESREA	3,687,500.00
	Dust generation from construction activities	Water sprinkling, covering materials during transport	Contractor	4,425,000.00	Dust levels (PM10)	Daily	Construction site and nearby areas	Air quality monitors	Gombe State Min. of Env., SPMU ACReSAL E&S Team, Contractors E&S Team, NESREA	2,950,000.00
	Pollution of existing Rivers from open	Provision of adequate sanitation facilities	Contractor/ Gombe State Min. of Environment	2,950,000.00	Water quality parameters (E. coli,	Weekly	Nearby rivers	Water sampling and lab analysis	Gombe State Min. of Env., SPMU ACReSAL	2,212,500.00

Activity	Potential Impact	Mitigation Measures	Implementing Institution	Estimated Cost of Mitigation (NGN)	Monitoring Indicators	Frequency of Monitoring	Where to Monitor	How to Monitor	Responsibility for Monitoring	Estimated Cost of Monitoring (NGN)
	defecation of workers				faecal coliform)				E&S Team, Contractors E&S Team, NESREA	
	Threat to community culture, safety and security	Sensitisation programs, security patrols	SPMU	7,375,000.00	Number of incidents reported	Monthly	Project area and community	Community surveys, incident reports	Gombe State Min. of Env., SPMU ACReSAL E&S Team	4,425,000.00
	Labour Influx, which could lead to an increase in sexual activities and the potential spread of STDs/STIs, including HIV/AIDS	Awareness campaigns, health screenings	SPMU/Contractor	5,900,000.00	Number of awareness sessions, health screening results	Monthly	Worker camps, community health centres	Health records, surveys	Gombe State Min. of Env., SPMU ACReSAL E&S Team, Gombe State Ministry of Health	3,687,500.00
	Increased risk of Sexual Exploitati	SEA/GBV awareness training, establish	SPMU/Contractor	4,425,000.00	Number of training sessions	Monthly	Worker camps, community	Training records, incident reports	Gombe State Min. of Env., SPMU	2,950,000.00

Activity	Potential Impact	Mitigation Measures	Implementing Institution	Estimated Cost of Mitigation (NGN)	Monitoring Indicators	Frequency of Monitoring	Where to Monitor	How to Monitor	Responsibility for Monitoring	Estimated Cost of Monitoring (NGN)
	on and Abuse (SEA)/ Gender Based Violence (GBV)	reporting mechanisms			reported cases				ACReSAL E&S Team, Gombe State Ministry of Health	
	Child labour and school dropout in the project communities	Enforcement of labour laws, community awareness programs	SPMU/Contractor	2,950,000.00	School attendance records, child labour incidents	Monthly	Schools, project area	School records, community reports	Gombe State Min. of Env., SPMU ACReSAL E&S Team, Gombe State Ministry of Education	2,212,500.00
	Traffic congestion and increased road traffic accidents	Traffic management plan, hire traffic controllers	SPMU/Contractor	5,900,000.00	Number of accidents, traffic flow	Weekly	Affected roads	Traffic surveys, police reports	Gombe State Min. of Env., SPMU ACReSAL E&S Team	2,950,000.00
	Increase demand on communit	Strengthening local health facilities,	SPMU	8,850,000.00	Health facility usage, availabili	Monthly	Health centres, worker camps	Health records, facility	Gombe State Min. of Env., SPMU	4,425,000.00

Activity	Potential Impact	Mitigation Measures	Implementing Institution	Estimated Cost of Mitigation (NGN)	Monitoring Indicators	Frequency of Monitoring	Where to Monitor	How to Monitor	Responsibility for Monitoring	Estimated Cost of Monitoring (NGN)
	y health and sanitation infrastructure	provision of mobile health units			ty of sanitation facilities			inspections	ACReSAL E&S Team	
	Open defecation of construction workers	Provision of portable toilets, sanitation education	Gombe State Government, SPMU, Contractor	2,950,000.00	Sanitation facility usage, water quality tests	Weekly	Worker camps, nearby water bodies	Visual inspection, water testing	Gombe State Min. of Env., SPMU ACReSAL E&S Team, GOSEPA, Contractors E&S Team, NESREA	2,212,500.00
	Loss of employment for temporary construction workers	Skills training programs, job placement services	SPMU	7,375,000.00	Number of workers trained job placement rate	End of the construction phase	Project area	Training records, employment data	Gombe State Min. of Env., SPMU ACReSAL E&S Team	2,950,000.00
Sub Total				**85,550,000.00**						**43,512,500.00**

Table 6-3: E&S Mitigation and Management Plan for the GGC-Doma Erosion and Flood Control during the Post Construction phase

Activities	Potential Impacts	Mitigation Measures	Implementing Institution	Estimated Cost of Mitigation (NGN)	Monitoring Indicators	Frequency of Monitoring	Where to Monitor	How to Monitor	Responsibility for Monitoring	Estimated Cost of Monitoring (NGN)
Landscape	Aesthetics due to beautification	Implement landscaping plan	Contractor	14,750,000.00	Completion of landscaping	Monthly	Through out the gully	Visual inspection, photo documentation	Gombe State Min. of Env., SPMU ACReSAL E&S Team, GOSEPA, Contractors E&S Team, Ministry of Land & Physical Planning	2,950,000.00
Dismantling and Removal of Equipment and Vehicles	Dust, noise, and oil spill during the activity	- Dust suppression (water spraying)	Contractor	7,375,000.00	Dust levels (PM10, PM2.5)	Weekly	Equipment removal sites	Air quality monitoring equipment	Gombe State Min. of Env., SPMU ACReSAL E&S Team, GOSEPA, Contractors E&S	1,475,000.00

Activities	Potential Impacts	Mitigation Measures	Implementing Institution	Estimated Cost of Mitigation (NGN)	Monitoring Indicators	Frequency of Monitoring	Where to Monitor	How to Monitor	Responsibility for Monitoring	Estimated Cost of Monitoring (NGN)
									Team, NESREA	
		- Use of noise barriers	Contractor	4,425,000.00	Noise levels (dB)	Weekly	Surrounding areas	Noise meters	Gombe State Min. of Env., SPMU ACRESAL E&S Team, GOSEPA, Contractors E&S Team, NESREA	1,475,000.00
		- Proper disposal and recycling of oil and fuel	Contractor	2,950,000.00	Absence of oil spills	Bi-weekly	Equipment maintenance areas	Visual inspection, soil testing	Gombe State Min. of Env., SPMU ACRESAL E&S Team, GOSEPA, Contractors E&S Team, NESREA	2,212,500.00

Activities	Potential Impacts	Mitigation Measures	Implementing Institution	Estimated Cost of Mitigation (NGN)	Monitoring Indicators	Frequency of Monitoring	Where to Monitor	How to Monitor	Responsibility for Monitoring	Estimated Cost of Monitoring (NGN)
Labour	Loss of Employment following Project Closure	- Offer alternative employment opportunities	SPMU/Contractor	22,125,000.00	Number of re-employed workers	Monthly	Human Resources Department	Employment records, surveys	Gombe State Min. of Env., SPMU ACReSAL E&S Team	4,425,000.00
		- Provide vocational training		14,750,000.00	Number of workers trained	Monthly	Training facilities	Training attendance records, feedback forms	Gombe State Min. of Env., SPMU ACReSAL E&S Team	3,687,500.00
Sub Total				**66,375,000.00**						**16,225,000.00**
Total				**203,625,000.00**						**73,170,000.00**

Summary

Phase	Cost of Mitigation	Cost of Monitoring
Pre-Construction	51,700,000.00	13,432,500.00
Construction	85,550,000.00	43,512,500.00
Post-Construction	66,375,000.00	16,225,000.00
Total	**203,625,000.00**	**73,170,000.00**

6.3 Institutional responsibilities and accountabilities

The successful implementation of the Environmental and Social Management Plan (ESMP) for the Gombe State ACReSAL project hinges on various institutions' and stakeholders' dedication and capacity. The roles and responsibilities for each category involved are outlined in Table 6.4.

Table 6-4: Institutional responsibilities and accountabilities

S/N	Category	Roles & Responsibilities
1	Federal Ministry of Environment	- Approve disclosure of the ESMP in-country. - Conduct environmental monitoring to ensure compliance with national standards.
2	Gombe State Ministry of Environment	- Oversee environmental monitoring and compliance at the state level - Conduct site assessments and monitor ESMP implementation.
3	Gombe ACReSAL SPMU	- Ensure funding for the Environmental and Social safeguards unit and M&E function - Disclose the ESMP to the public - Coordinate and ensure timely implementation of responsibilities by all parties. - Supervise and fund mitigation measures and monitor Contractors' ESMP adherence. - Ensure project design conforms to ESMP recommendations. - Process and obtain requisite clearances for the project. - Develop and deliver training programs for SPMU staff, Contractors, and others. - Review and approve Contractors' ESMP (C-ESMP). - Liaise with Contractors on ESMP/RAP implementation. - Engage with various federal and state agencies on regulatory matters. - Interact with NGOs and CBOs involved in the project.
4	Environmental & Social Safeguard Units	**Environmental Safeguards Officer** - Supervise construction to ensure adherence to ESMP mitigation measures. - Collect baseline environmental data. - Ensure project activities follow ESMP guidelines. - Liaise with stakeholders on environmental issues. - Monitor mitigation measures and project impacts. **Social Safeguards Officer** - Coordinate implementation of social aspects of ESMP. - Liaise with stakeholders on social issues. - Conduct impact evaluations and beneficiary assessments.

S/N	Category	Roles & Responsibilities
		- Establish partnerships with CBOs and CSOs.
5	Contractor	- Procure materials and construct according to BOQ specifications. - Implement ESMP during project execution. - Ensure staff adherence to good practices, including PPE use and zero tolerance for gender violence. - Hire Safeguards personnel for ESMP implementation. - Mitigate environmental and social impacts. - Implement a Code of Conduct (CoC) for staff. - Develop and follow C-ESMP. - Prepare work plans for environmental and social management. - Communicate significant impact changes during construction to ESO. - Maintain records of environmental incidents and actions taken. - Supervise ESMP measures and prepare monitoring reports. - Conduct Job Hazard Analysis (JHA) before work commencement. - Ensure CoC training for all contractors and workers. - Provide amenities and PPEs to workers. - Prepare and submit required reporting data to the Supervising Consultant.
6	Supervising Consultant	- Supervise ESMP implementation by Contractors. - Review Contractors' C-ESMP for compliance. - Develop good practice construction guidelines. - Prepare and submit regular environmental monitoring reports. - Maintain interaction with Engineer/ESSU for ESMP provisions. - Provide oversight and frequent reports on compliance. - Implement Environmental and Social Monitoring Plan. - Supervise mitigation of environmental and social impacts. - Report incidents or non-compliance to SPMU. - Train staff involved in environmental supervision. - Make recommendations to SPMU for ESMP improvement. - Supervise construction and work camp management. - Prepare monthly safeguards reports.
7	Gombe State Environmental Protection Agency (GOSEPA)	- Inspect project premises for compliance with sanitation and waste management standards. - Collaborate with other MDAs, NGOs, and donors on environmental protection and waste recycling.
8	Gombe LGA	- Provide oversight across projects for ESMP compliance. - Monitor public health, sanitation, and waste management activities.

S/N	Category	Roles & Responsibilities
9	Affected Community and Public	- Promote environmental awareness. - Review environmental and social performance reports. - Provide feedback on nonconformity issues. - Attend public meetings for information dissemination and feedback. - Support mitigation measures and awareness campaigns.
10	Community Development Associations (CDA)	- Mobilize and sensitise community members to participate in the project.
11	NGOs/CSOs	- Assist in effective response actions and conduct research for sustainable environmental strategies. - Collaborate with government and other stakeholders on environmental initiatives.
12	World Bank	- Provide overall supervision and technical support. - Disclose ESMP on the World Bank external site. - Monitor SPMU's ESMP implementation and performance. - Ensure compliance with World Bank Safeguard Policies. - Recommend measures for strengthening ESMP implementation.

6.3.1 Implementation and Monitoring Strategy

Federal Ministry of Environment: This body is responsible for approving the ESMP disclosure and ensuring environmental standards are adhered to through regular monitoring. Their role is crucial in maintaining national compliance and providing overarching environmental oversight.

Gombe State Ministry of Environment: This ministry ensures that the project complies with environmental standards at the state level. They conduct site assessments and monitor the implementation of the ESMP to ensure compliance.

Gombe ACReSAL SPMU: The State Project Management Unit (SPMU) is pivotal in ensuring the ESMP is properly funded and implemented. Its responsibilities include public disclosure, coordination of involved parties, supervision of mitigation measures, compliance with World Bank standards, and training for staff and contractors. The SPMU also handles regulatory clearances and interacts with various agencies and NGOs.

Environmental & Social Safeguard Units: These units consist of Environmental and Social Safeguards Officers responsible for supervising adherence to ESMP mitigation measures, collecting baseline data, and liaising with stakeholders on environmental and social issues. They ensure project activities align with good practices and guidelines set in the ESMP.

Contractor: The contractor's role includes implementing the ESMP during project execution, ensuring staff adherence to good practices and PPE use, developing a Contractor's ESMP (C-ESMP), and maintaining records of environmental incidents. They also conduct Job Hazard Analysis (JHA) and ensure all contractors and workers sign and follow the Code of Conduct (CoC).

Supervising Consultant: This consultant oversees the contractor's ESMP implementation, reviews C-ESMP compliance, develops construction guidelines, and prepares regular monitoring reports. They also train staff, recommend ESMP improvement, and supervise construction and work camp management.

Gombe State Environmental Protection Agency (GOSEPA): GOSEPA inspects project premises to ensure compliance with sanitation and waste management standards and collaborates with other MDAs, NGOs, and donors on environmental protection and management.

Gombe LGA: The Local Government Authority oversees ESMP compliance within its jurisdiction and monitors public health, sanitation, and waste management activities.

Affected Community and Public: The community and public promote environmental awareness, review performance reports, provide feedback, attend public meetings, and support project mitigation measures and awareness campaigns.

Community Development Associations (CDA): These associations ensure community participation by mobilising and sensitising members.

NGOs/CSOs: Non-governmental and Civil Society Organizations assist in response actions, conduct research for sustainable environmental strategies, and collaborate with government and other stakeholders.

World Bank: The World Bank provides overall supervision and technical support, ensures ESMP disclosure, monitors SPMU's performance, ensures compliance with safeguard policies, and recommends measures for strengthening ESMP implementation.

6.3.2 COVID-19 Protocols and Management Plan for the ESMP of the GGC Doma Erosion and Flood Control

Like other regions in Nigeria, Gombe State is actively working to prevent the spread of COVID-19. Therefore, the SPMU (State Project Management Unit) and the Contractor must implement robust measures to ensure the safety and health of all workers and the surrounding community. This involves heightened awareness and strict adherence to COVID-19 protocols developed in collaboration with the NCDC (Nigeria Centre for Disease Control) and the relevant state COVID-19 task force.

a. Awareness and Training

i. **Collaboration with Health Authorities**: Work closely with the NCDC and the state COVID-19 task force to stay updated on the latest guidelines and best practices for COVID-19 prevention and management.

ii. **Intensive Campaigns and Enlightenment**: Conduct regular awareness campaigns to educate workers and the local community about COVID-19, its transmission, and prevention methods. Use posters, flyers, and digital platforms to disseminate information.

iii. **Training Programs**: Organize training sessions for workers on COVID-19 protocols, including proper use of PPE, hygiene practices, and social distancing measures.

b. Preventive Measures

i. **Provision of PPE**: Provide all workers with necessary preventive gadgets such as face masks, hand sanitisers, and surface disinfectants free of charge.

ii. **Hygiene and Sanitation**: Ensure regular cleaning and disinfection of workspaces, tools, and equipment. Install handwashing stations with soap and water at strategic locations on site.

iii. **Social Distancing**: Implement social distancing measures in all areas, including workspaces, rest areas, and vehicles. Limit the number of workers on-site at any given time to avoid crowding.

c. Health Monitoring and Reporting

i. **Health Screening**: Before allowing entry to the worksite, conduct daily health screenings for all workers, including temperature checks and symptom questionnaires.

ii. **Spotting and Reporting**: Establish a clear protocol for identifying, reporting, and managing suspected COVID-19 cases. This includes immediately isolating symptomatic individuals and notifying health authorities.

iii. **Contact Tracing**: In collaboration with health authorities, develop a system for tracking and notifying individuals who may have been in contact with a suspected COVID-19 case.

d. Management of COVID-19 Cases

i. **Isolation Facilities**: Establish designated isolation areas for workers who exhibit symptoms of COVID-19 or test positive and arrange for their transfer to medical facilities.

ii. **Medical Support**: Ensure arrangements with local health facilities for testing, treatment, and management of COVID-19 cases among workers.

iii. **Communication and Support:** Maintain transparent communication with workers regarding the status of COVID-19 on site and the measures being taken. Provide psychological support to affected workers to prevent discrimination and stigmatisation.

e. Community Engagement

i. **Outreach Programs:** Engage with the local community to share information about COVID-19 prevention and control measures being implemented on the project site. Ensure community members are aware of the steps being taken to protect their health.

ii. **Feedback Mechanism:** Establish a feedback mechanism for the community to express concerns and suggestions about COVID-19 measures, ensuring their voices are heard and addressed.

6.4 Capacity Building Plan for the ESMP of the GGC Doma Erosion and Flood Control

A robust capacity-building plan is essential to effectively implement the Environmental and Social Management Plan (ESMP) for the GGC Doma erosion and flood control project. This plan will focus on enhancing the skills and knowledge of the SPMU, contractors, the local community, and other stakeholders involved in the project.

Objectives

i. Equip stakeholders with the knowledge and skills to implement and monitor the ESMP effectively.
ii. Ensure compliance with environmental and social safeguards.
iii. Promote sustainable practices and community engagement.

Target Audience

i. SPMU staff
ii. Contractors and subcontractors
iii. Local community members
iv. Government officials
v. NGOs and CSOs involved in the project

Training Needs Assessment

A training needs assessment among the stakeholders identified each target group's specific knowledge gaps and training requirements (Table 6.5).

Table 6-5: Training Programs and Workshops

Training Topic	Target Audience	Training Method	Duration	Frequency	Responsible Entity	Estimated Cost (NGN)
Introduction to ESMP	SPMU Staff, Contractors	Workshop, Seminars	Two days	Once	Environmental Consultants	1,012,500.00
Environmental Laws and Regulations	SPMU Staff, Government Officials	Workshop, Seminars	Two days	Once	Legal Experts	810,000.00
Community Engagement and Participation	SPMU Staff, Community Leaders	Workshop, Interactive Sessions	Two days	Bi-annual	Community Engagement Specialists	607,500.00
Environmental Monitoring and Reporting	SPMU Staff, Contractors	Hands-on Training, Workshops	Three days	Quarterly	Environmental Consultants	1,215,000.00
Health and Safety Protocols	Contractors, Subcontractors	Workshops, Drills	Two days	Quarterly	Health and Safety Experts	810,000.00
COVID-19 Protocols and Management	All Stakeholders	Workshops, Seminars	One day	Quarterly	Health Professionals	405,000.00
Waste Management and Pollution Control	Contractors, SPMU Staff	Workshops, Hands-on Training	Two days	Bi-annual	Environmental Experts	911,250.00
Sustainable Construction Practices	Contractors, Subcontractors	Workshops, Field Visits	Two days	Bi-annual	Sustainable Development Experts	1,012,500.00
Grievance Redress Mechanism	SPMU Staff, Community Leaders	Workshops, Role-playing	One day	Bi-annual	Social Safeguard Experts	708,750.00
Biodiversity Conservation and Management	SPMU Staff, Contractors	Workshops, Field Visits	Two days	Annually	Environmental Experts	810,000.00

Training Topic	Target Audience	Training Method	Duration	Frequency	Responsible Entity	Estimated Cost (NGN)
Emergency Response and Preparedness	Contractors, SPMU Staff	Drills, Workshops	Two days	Annually	Emergency Response Experts	911,250.00
					Total	**9,213,750.00**

The total estimated cost for the capacity-building plan is approximately **NGN9,213,750.00**. This budget includes costs for trainers, training materials, venue hire, and other logistical expenses.

6.5. Grievance Mechanism

6.5.1 The Need for Grievance Mechanism (GM)

The Grievance Mechanism (GM) describes how people affected by the project can bring their grievances to the project management in a culturally appropriate manner for consideration and redress.

Effective organisational design and coordination substantially decrease the probability of implementation problems. Nevertheless, some affected persons are still likely to believe they have been treated inadequately or unfairly. Providing an accessible and credible means for PAPs to pursue grievances may decrease the likelihood of overt resistance to the project or protracted judicial proceedings that can halt implementation.

Therefore, if grievances arise, this redress mechanism has been prepared to address them. The Grievance mechanisms designed herewith aim to solve disputes as soon as possible in the interest of all parties concerned. This mechanism explicitly discourages referring such matters to the law courts for resolution, which would take considerably longer. Clear procedures for filing and resolving grievances from the affected population have been designed as much as possible.

During the consultations, the affected persons were helped to appreciate that there are provisions for addressing complaints or grievances. Project implementation will make the grievance procedure available to the affected persons.

The mechanism provides an affordable and accessible procedure for third-party settlement of disputes arising from resettlement. This mechanism is localised as much as possible with the active involvement of the CDA project office and other concerned stakeholders within the environment.

6.5.2 Grievance Mechanism Process

There is no ideal model or one-size-fits-all approach to grievance resolution. However, for simplicity, accessibility, affordability, and accountability, the following components make for a suitable grievance mechanism:

- Receiving and registering a complaint.
- Screening and assessing the complaint.
- Formulating a response.
- Selecting a resolution approach.
- Implementing the approach.
- Announcing the result.
- Tracking and evaluating the results.
- Learning from the experience and communicating back to all parties involved.
- Preparing a timely report to management on the nature and resolution of grievances.

Localised mechanisms that consider the specific issues, cultural context, local customs, and project conditions and scale have been adopted as much as possible. The Grievance procedures highlighted in this Chapter fall into four steps, as outlined in Table 6.6.

Table 6-6: Grievance Procedures Steps

Step	Category	Activities
1	***Reception and registration***	PAP files complaints or grievances regarding any aspect of the resettlement project verbally, in writing, or through a representative in English or the local language. The PAP's first instance where to complain is the "Project Implementation Committee".
2	***Resolution***	All grievances referred to the appropriate party for resolution A resolution must be reached within 15 days after receipt of the grievance. If additional information is needed, project management can authorise a further 15 days for resolution. The results of the grievances should be disclosed to the griever in writing, along with an explanation of the basis of the decision.
3	***Appeals***	Grievers dissatisfied with the response to their grievance may file an appeal. In such cases, the responsible authority assembles "The PMU (Project Coordinator" to hear cases, including at least one

		disinterested party from outside the agency responsible for the resettlement project. There will be no further redress available outside the resettlement project. In such cases, grievances would need to be pursued through the legal system.
4	**Monitoring**	During project implementation and at least three months following the project's conclusion, the scheme safeguards officer will prepare monthly reports regarding the number and nature of grievances filed and make them available to project management.

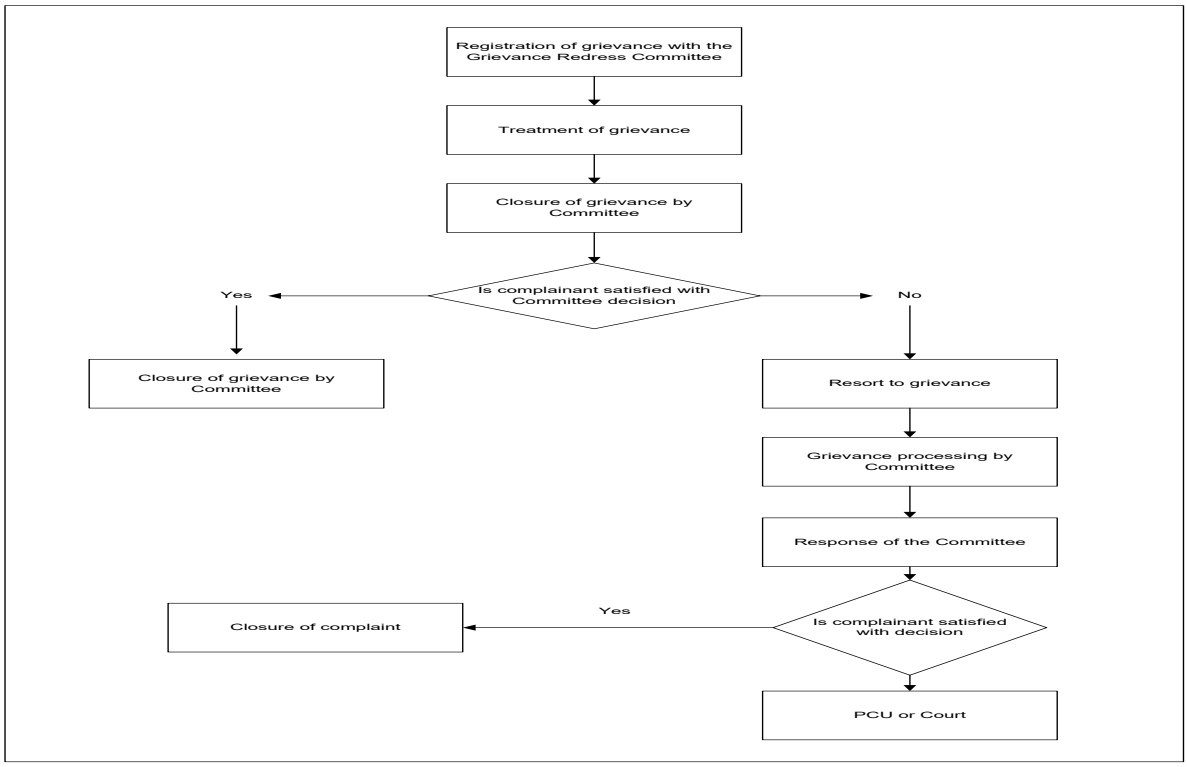


Figure 6-1: Flowchart for Grievance Mechanism Adapted from NEWMAP, 2011

6.6. Public Consultation Plan

6.7. Monitoring, Surveillance, and Evaluation Plan

6.7.1 Monitoring, Evaluation and Reporting

Monitoring, evaluation and reporting are vital for any plan. Consequently, the success of the ESMP will depend on effective monitoring, evaluation and reporting systems. The system will

ensure that mitigation measures or strategies are implemented effectively, allow for timely response to new and developing issues of concern, and provide feedback on significant environmental changes for remedial actions. This section presents the monitoring, evaluation and reporting arrangements for the ESMP and the monitoring plan summarised in Chapter 6 of this Report.

6.7.2 Monitoring

The overall objective of environmental and social monitoring is to ensure that all construction, operation and decommissioning activities comply with the legal and regulatory requirements to implement all mitigation measures effectively. The items to be monitored for this ESMP will include but are not limited to Air quality, Noise Quality, Socio-economic aspects, Vegetation and Biodiversity, Wastes, Archaeological and Cultural Heritage, Occupational Health and Safety, and Visual and Landscape. The critical measurement indicators for these aspects are contained in the monitoring plan (Table 6-7). The Proponent will employ monitoring techniques, including supervision and regular site inspections. As discussed below, monitoring activities will be undertaken at two levels (Table 6.7). It is important to note that other various.

Table 6-7: Monitoring Arrangement

Monitoring	Action	Responsibility	When	Deliverables
Internal Monitoring	Regular site visits ensure the mitigation measures and actions specified in the monitoring plan and, as bound by the contract, are satisfactorily implemented.	E&S Safeguard Unit – ACReSAL Gombe)	During Preconstruction, Construction Phases	Monitoring Reports and documentation
	Site visit for monitoring and inspection to ensure contractor adheres strictly to the engineering designs and specifications for the project	E&S Supervision Consultants	During Construction Phase	Observations and Monitoring Reports will be compiled and presented to the ACReSAL Gombe.
External Monitoring	Regular site visits to ensure the project is implemented in an environmentally & socially sustainable manner using the monitoring indicators specified in the monitoring plan and other	FMEnv/GMENR	During Preconstruction, Construction Phases	Inspect monitoring reports from Safeguard units and provide feedback on observations.

Monitoring	Action	Responsibility	When	Deliverables
	national and international environmental & social requirements			Enforce corrective actions where necessary.

Internal Monitoring

Internal monitoring's objective is to ensure that the ESMP is implemented correctly to meet the requirements set out in the World Bank ESSs. The Proponent will be responsible for conducting regular internal monitoring and audits on the implementation of the ESMP. To do this, the Proponent will have to develop the capacity of its staff to carry out internal monitoring activities (section 6.5). Capacity building would ensure that the project staff has adequate staffing in all aspects of ESMP for effective monitoring.

Monitoring should be participatory. This may be achieved by establishing an Environmental Monitoring Committee (EMC) that would foresee an effective mechanism for monitoring the implementation of ESMP and improving communications amongst the stakeholders. The EMC would also work with the external monitoring expert.

Independent Monitoring

The Proponent will hire an independent expert to carry out external monitoring. Their role will be to review environmental monitoring and environmental compliance documentation submitted by the Proponent.

Monitoring Indicators

These are the measurements, statistics or values that provide a proximate gauge or evidence of the effects of environmental management programs or the state or condition of the environment that could result from implementing the proposed project. The critical environmental indicators that must be monitored have been factored into the project's ESMP in Table 6.1 – 6.3.

6.7.3 Evaluation/Audits

Evaluation (Audits) will enable the Proponent to take stock of what has been achieved regarding ESMP implementation and provide information for corrective action. In this regard, the Proponent will undertake an Annual Audit of the ESMP and submit the report to the relevant authority. The main objectives of the Annual Audit will be to:

- Find out any significant environmental hazards and their existing control systems.
- Determine environmental and safety problems which are not adequately controlled and suggest how the control system in place can be improved.

- Provide information that would be used to improve an environmental health and safety management system.

6.7.4 Reporting

Regular reporting on the progress of implementing the ESMP will be critical in adjusting strategic directions and measuring performance. Progress reports will be made quarterly. The reports will outline, in summary, the performance of crucial measurement indicators. The internal and external monitoring results will be documented for all project phases.

6.8. Costs of implementing the ESMP

Table 6.8 summarises the cost of implementing the ESMP.

Table 6-8: Cost of ESMP

Item	Responsibility for implementation and Monitoring	Cost Breakdown	Cost Estimate (NGN)	[7]Cost Estimate in US Dollars (USD)
Cost of Enhancing +ve impacts and Mitigation of –ve impacts	*SPMU, State Min. of Envr, GOSEPA, FRSC*	*the sum of direct monitoring amount*	*203,625,000.00*	*138,033*
Cost of Capacity Building	*SPMU, State Min. of Envr, GOSEPA, State Min. of Health*		*9,213,750.00*	*6,246*
Monitoring, Evaluation & Audit	*SPMU, State Min. of Envr, GOSEPA*		*73,170,000.00*	*49,600*
Management cost of Implementing ESMP	*SPMU, State Min. of Envr, GOSEPA*	*5% of Mitigation Cost*	*10,181,250.00*	*6,902*
SUBTOTAL			*296,190,000.00*	*200,781*
Contingency	***10% of Sub-Total***		*29,619,000.00*	*20,078*
TOTAL			***325,809,000.00***	***220,859***

The total cost for Implementing the ESMP and Monitoring Plan for the GGC Doma Erosion and Flood Control Rehabilitation Works is estimated at **Three Hundred and Twenty-Five Million, Eight Hundred and Nine Thousand Naira, only** (N325,809,000); corresponding to **Two Hundred and Twenty Thousand, Eight Hundred and Fifty-Nine US Dollars** [USD220,859] only.

[7] Note that the exchange rate stud at 1475.19 on 30/05/2024 (https://www.cbn.gov.ng/rates/exchratebycurrency.asp)

CHAPTER SEVEN:SUMMARY, RECOMMENDATIONS AND CONCLUSION

The study indicates that the proposed project will not severely impact the local people's existing environmental, social, health, and safety conditions.

- There was no identification of cultural and heritage sites that may be affected by the proposed development.
- Potential environmental and social impacts of sufficient magnitude that could interrupt the execution of the project were not detected.
- The possible impacts of the proposed project on land use, vegetation, wildlife, air, socio-economic and health can be controlled and alleviated if the recommended measures are followed. Fire and spill prevention should be adequate, as specified in the report, and the requirements of International Health and Safety Standards should follow general Health and Safety regulations.
- Although a few negative environmental and social impacts may potentially occur due to the activities associated with the proposed works during the operational phase, adequate mitigation measures have been provided to address them.
- The proposed intervention work is most desirable because of the obvious environmental, health and socio-economic benefits. These far outweigh the negative environmental and social impacts that could arise during implementation.
- An appropriate institutional framework has been drawn up to implement the mitigation measures and environmental management plan, including the proposed monitoring programmes.

The preceding recommendations include the following:

- Community members should be sensitised and duly informed on the time and duration of work through consultations.
- Construction works should be carried out in an environmentally sustainable, socially responsible, and inclusive manner.
- Environmental auditing should be regularly undertaken to determine compliance with the proposed ESMP, and parties responsible for the implementation of the ESMP should be held accountable for any inadequacy during the implementation process. Any polluted soil, groundwater, and surface water or terrestrial or aquatic ecology

encountered during the baseline survey and the construction process must be reported to the relevant authorities and disposed of in an applicable manner.

The proposed project is considered to offer substantial net potential and associated benefits and to be environmentally sustainable. This environmental and social management plan report supports this opinion.

REFERENCES

National Institute for Occupational Safety and Health (NIOSH). (1996). *National Occupational Research Agenda*. NIOSH. Cincinnati, OH.

SKC (2000). Aircheck Use Manual. Applies to all Aircheck 2000 Models. INC 863 Valley View Road Eighty-Four. PA.

ANNEX

Annex 1: List of Persons

Agro-Climatic Resilience in Semi-Arid Landscapes (ACReSAL) Project

Ministry of Water, Environment and Forest Resources, Gombe State Project Management Unit

Stakeholder Consultation Meeting on the Environmental and Social Management Pland (ESMP)

for the GGC Doma Gully Erosion Contrl and River Stabilization Work with Affected Communities

ATTENDANCE LIST

SN	NAME	GENDER	COMMUNITY	PHONE NUMBER	SIGNATURE
1	DAUDA ADAMU	M	BARUNDE (DAKACI)	08023220220	[illegible]
	DAUDA TAFIDA	M	BOMALA DAKACI	09121729066	[illegible]
	HARUNA ABDULLAHI	M	GABUKKA DAKACI	08025569114	[illegible]
	HABA YARIMA	M	KURI BURIJI (DAKACI)	07069661766	[illegible]
	MAIGARI BUBA	M	MALAM KURI (DAKACI)	08064300559	[illegible]
	Usman Mohammad Maggi	M	Hammedu KAFI (DAKACI)	08052157839	[illegible]
	Ibrahim Jain MAINA	M	Pantami (DAKACI)	08077116186	[illegible]
	AHMED SABO MARAFA	M	MANAWACI (DAKACI)	08165602398	[illegible]
	Richard James	M	CO-GMACRESAL	08039256995	[illegible]

SN	NAME	GENDER	COMMUNITY	PHONE NUMBER	SIGNATURE
1	Isah Muhammad Malam Sidi	M	Nayinawa, Lidya, Kuwait	07081420062	[illegible]
2	NURA YMAR	B	BAGADAZA	08062807211	[illegible]
3	ALHASSAN BABAYO	M	Reser ABACH QTRS	09012120500	[illegible]
4	MALAM MAHMOODA MOH'D	M	Real	07034640289	[illegible]
5	MOHAMMED ABUBAKAR	M	WURO LIMAN QTS	08064147845	[illegible]
6	ADAMU MOH'D	M	PANTAMI MALAMKURI	09063994338	[illegible]
7	ISAH MUHAMMAD	M	BARUNDE QTS	08140239199	[illegible]
8	ALI DANJUMA	M	BAIPAS SIRANKEWO	07015106652	[illegible]
9	Aminu Saleh	M	Pantami	08167667362	[illegible]
10	GIDADO ABUBAKAR	M	BARUNDE	08080826416	[illegible]
11	MAMMAN AUDULAHI	M	BAGADAZA	08106784678	[illegible]
12	ABDULLAHI A. MOHAMMED	M	WURO SHI'E QTRS	08037368846	[illegible]
13	Adam Auwal Ahmad	M	Wuro Shi'e Qtrs	08038008301	[illegible]
14	AUWALU HASSAN	M	BAIPAS	07034359880	[illegible]
15	Inisa SILEMAN	M	Barunde	08024471713	[illegible]

SN	NAME	GENDER	COMMUNITY	PHONE NUMBER	SIGNATURE
1	SALLI IBRAHIM	MALE	Bomala	07065637667	
2	ALH. DANLAMI MUHID	"	Bomala	08062[illegible]56496	
3	Muhammad Aminu Muhid	MALE	T/Pantami	08036580460	
4	ABUBAKAR ABBA UMAR	"	T/pantami	08164813583	
5	NURA UMAR	"	T. PANTAMI	08132257410	
6	ABUBAKAR Muhammed	"	BOMALA	07066157589	
7	Hon. A.A. DANLAMARI	"	Wuro Bangale	08033653363	
8	Muhammad YAU	"	S/KEYO	07038084797	
9	AHMED ADAMU Jaimma	"	MUSINA	08060590494	
10	HUSSAINI MUHAMMAD	"	BARUNDE	08136855755	
11	MUSA IBN KHALID	MALE	BARUNDE	08038039622	
12	Abdulahi Muhammad Adamu	"	Abacha	07068610283	
13	ALH Yaya Abubakar	"	Abacha	07068260816	
14	Dr. Anwal Abdullahi	Male	W/Shiu	07038415852	
15	Ubandoma Adamu	"	Libaya	09164152731	

SN	NAME	GENDER	COMMUNITY	PHONE NUMBER	SIGNATURE
1	Aishatu Buba	F	pantami M.Kuri	08027999573	
2	Lydia Bawa	F	Tiwadan pantami Maya	07085187831	
3	Mishatu Mohammadu	F	Tiwadan pantami Maya	[illegible]	
4	JAZIBU M. MAGAJI	M	BARUNDI GABAS	07032134638	
5	ADAMU WAZIRI GOLAR	M	Barunde east	09066097467	
6	JIBRIN MAIRANA	M	KA GABAZA	08039006036	
7	Mohammed Lawan	M	Hammadu Kafi	07031866612	
8	Sani Garba (Andi)	M	Bagadaza	07037375858	
9	Abbassan Adamu	M	NAYINAWA	09165351578	
10	MUHAMMA LAWAN	M	malan Kuri	09162987920	
11	Salaimu Alhaji	M	Alu/Wonobiri	08105[illegible]	
12	Adamu danladi	M	WUROBIRIJI	09129736381	
13	HIROMA ZAKARI MKUBU	M	GABUKKA PANTAMI	07068487167	
14	Adamu Bello	M	Nayinawa	08124712[illegible]	
15	USMAN SHUAIBU	M	Sivankawa/Bomala	08038568120	

SN	NAME	GENDER	COMMUNITY	PHONE NUMBER	SIGNATURE
1	GANA AISHATU	F	GABUKKA / MAI KURI	09032343630	[signature]
2	Jummai Musa	F	Barunde	08038379887	Jummai
3	Alfine Peter Malik	F	Bagadaza	08064796008	[signature]
4	GRACE MICAH	F	Nyajinawa, Kupayed, Ta	08150574030	[signature]
5	Hassana Mohammed	F	Kuwait Liberya	07065171478	[signature]
6	Adaline Appolos	F	Wuro Juli	09032896393	[signature]
7	FATIMA Abubakar	F	WURO JULI	09065088111	[signature]
8	SALIHA MUHAMMAD	F	RIYAL & ABACA	08021301249	[signature]
9	AISHATU GARBA	F	RIYAL & ABACA	09068386481	[signature]
10	ZAINAB ALI	F	Bumala Saraikiyu	09138819457	[signature]
11	MARYAM IBRAHIM	F	FATAMA MALA KURI	09025887391	[signature]
12	Comfort D Kure	F	Bagadaza Gomba	08086572194	[signature]
13	Rufas Madina Sobok	F	Bagadaza "	07081701271	[signature]
14	Hussaina Hassan	F	Barunde	09032098000	[signature]
15	Maryam Saadu	F	Barunde	08164677254	[signature]

SN	NAME	GENDER	COMMUNITY	PHONE NUMBER	SIGNATURE
1.	MUKHTAR UMAR ABUBAKAR	M	RIYAL / ABACHA	08162132284	[signature]
2.	HARUNA AI IDRIS	M	GABUKKA / MALAM KURI	08131520480	[signature]
3	Abdullahi Jabbo	M	M/Kuri	08161558730	[signature]
4.	ALIYU MUHAMMAD UMAR	M	BARUNDE	08067947313	[signature]
5	Jafaru Dahiru Z		Yotlede	08081909287	[signature]
6-	ABDURRAHMAN SANI	M	WURO SHIE	08039317555	
7	Mohammed Magaji	M	Bagadaza	08036038731	[signature]
8.	Mohammed Usman	M	Riyal / Abacha	08024691678	[signature]
9.	Ahmed Madugu	M	Wuro Shie	08039307743	[signature]
10	Umar Abubakar	M	" "	08143508949	[signature]
11.	Abubakar Babayo	M	" "	08140434619	[signature]
12	Abubakar Imam	M	" "	08060950437	[signature]
13	Mohd Ibrahim	M	" "	07032101023	[signature]
14	ABUBAKAR MOHD		WURO BAJOGA	07038906601	[signature]
15	Ibrahim Muhammad	M	WURO JULI	08147996205	[signature]

SN	NAME	GENDER	COMMUNITY	PHONE NUMBER	SIGNATURE
1	HAMADU IBRAHIM	m	W/BAPPA SIRA	08026652167	
2	ALI DANJUMA	M	BAFFA SIRANKIMJO	09064251978	
3	Tukur USMAN	M	BARUNDE	07067338778	
4	Barnabas D. Buba	M	Bagardaya	08137903720	
5	Adamu Abubakar	M	NAYILA/KUMA	08036447339	
6	M. BUPPU Shango	M	N/A/K	08034625282	
7	Mammon Felix Bako	M	Nayinawa	08083148722	
8	ALI JAURO	M	BOMALA/SIRANKEYO	08028136031	
9	BABAYO BAPPALE	M	W/BAJOGA	09020213654	
10	ADAMU TUNJUBA	M	SEC-W/BAJOGA	07069593322	
11	HARUNA MOHAMMED	M	Chairman W/Bogga	08067123598	
12	Auwal Isaac	M	Sec Manawashi	09063339808	
13	ALIYU ABUBAKAR	M	WURO LIMAN	07035942785	
14	ADAMU ABDULLAHI	M	BARUDEY	08167249647	
15	Mohammed Abubakar	M	NAYI MAWA	08085338872	

SN	NAME	GENDER	COMMUNITY	PHONE NUMBER	SIGNATURE
	UMAR Muhammad ADAM	m	ABACHER Gombe	09135966952	
	AUWAL SHAVIBU	m	ABACHER Gombe	08148739479	
	ADAMU SHAVIBU	m	ABACHER Gombe	08077605261	
	ABUBAKAR Muhammad	m	WURO Liman	08068452283	
	ABUBAKAR Muhammad	m	Hammadukali	09094254949	
	ABUBAKAR Umaru	m	BAPPA SIRA Gwani	08127278807	
	MUHAMMAD ADAMU	m	WURO Julli	08124849110	
	USMAN ADAMU	m	WURO BAJOGA	09060966789	
	ABUBAKAR HAMMA	m	BAPPA SIRA	09122539777	
	MUHAMMAD YAQ	M	Serankiya 08028034747	07038089987	
	ABUBAKAR ABDULLAHI	M	Tudiadampontani	07089109491	
	MUHAMMAD WAWA SALEEH	M	Bomala	08105060694	
	IBRAHIM MUHAMMAD	M	WURO Juli/WURO LIMAN	07019867843	
	ABUBAKAR ADAMU MUHAMMAD	M	" " "	08021610655 07085778887	
	BAPPA BABAYO	M	" " "	08023505833	

Annex 2: Sample of Data Gathering Instrument

3a. Socioeconomic Survey Questionaire: For the ESMP of G.G.C DOMA GULLY EROSION CONTROL SITE, GOMBE, GOMBE STATE

(To be filled by enumerators)

Introductory and consent statement by enumerator

Do you accept to participate in the interview?.....Codes: 1=Yes; 0=No If Yes, continue with the interview. Otherwise, end the interview.

Name of enumerator _____ Date of interview (dd/mm/yyyy)

Enumerator's Phone Number: …….

Location information

Location Information	Name
Lat/Lon	
L.G.A.	
Ward	
Name of community	

SOCIODEMOGRAPHIC DATA OF THE RESPONDENT

S.N.	Item	Answer
1	Name of the respondent	
2	Phone No.	
3	Sex of the respondent 1. Male 0. Female	
4	Age of the household head in years	
5	Religion: (1) Islam (2) Christianity (3) Others (specify).....	
6	Ethnicity: (1) Hausa (2) Fulani (3) Yoruba (4) Igbo (5) Others (specify).....	
7	Marital status: (1) Single (2) Married (3) Widow (4) Separated (5) Others (specify)....	
8	Household size……	

9	Education status: 1) non-formal education; 2 Primary; 3 Secondary; 4; Tertiary; 5 Islamic	
10	Employment status 1) Employed, 2) Unemployed, 3) Self-employed	
11	How will you rate youth unemployment in this community 1) High, 2) Moderate, 3) Low	
12	Main livelihood source of the household head 1. crop and livestock farming, 2. petty trading, 3. Civil/public servant, 4. off-farm temporary employment, 5. Agro-processing 6. Others (specify)	
13	What is your annual income from this source? a) 1000-50000 (b) 50000-100000 (c) 100000-150000 (d) 150000-200000 (e) above 200000	
14	How do you spend majority of your income? a) Household feeding (b) Payment of school fees (c) payment of rent (d) others (specify)	
BUILDING CHARACTERISTICS		
15	Building type: (1) Traditional Huts/Dwellings (2) Detached house/bungalow 4) Mud house, 5) Concrete Block house, (5) Mud house plastered with cement, 4) Others (specify)	
16	How many rooms does your household have? …….	
17	What is the average number of persons that sleeps per room? ……	
VULNERABILITY ASSESSMENT ON GULLY EROSION		
18	Do you consider yourself vulnerable to the gullies in your community? i. Yes, ii. No	
19	What specific factors or conditions make you feel vulnerable to gully erosion? i. Heavy rainfall ii. Steep slopes in the area iii. Poor drainage systems iv. Deforestation or land clearing v. Other (please specify): _____	

20	What do you think is/are the main reason(s) for the gully erosion in your area? a) Improper erosion control b) Poor drainage c) Construction along waterways d) Clearing of trees and vegetation e) Land excavation f) Steep slope g) Others (Specify)	
21	Is there any psychological trauma you are experiencing staying in your house, shop or school due to the gully in your community? i. Yes ii No	
22	What is the most prominent natural disaster in your community/area(s)? a) Flooding b) Landslide c) Sheet/rill erosion d) No natural disaster, e) Other Specify	
23	How will you assess the rate of flooding and landslide in this community? I) High, ii) medium, iii) low –	
24	What is the estimated distance from your house to the gully in your community? a) Less than50m b) 50m -100m c) 101m – 200m d) 201m – 500m e) Above 1000m	
25	What is the average distance from school to the gully in your community? (a) Less than 50m (b) 50m-100m (c) 101m –200m (d) 201m –300m (e) Above300m	
26	Has there been a decrease in the number of students attending schools due to the gully in this community? a) Yes (b) No	
27	Have you personally experienced any negative impacts or damage from gully erosion? i. Yes ii. No	
28	If Yes, what is the negative impact?	
29	Has the gully led to the increase in crimes like theft, rape, assault? I) Yes ii) No	
30	Are the gully erosion sites being used as hideout for criminals?	

	Yes(b) No	
31	Has the gully affected any of your religious activities? i) Yes ii) No	
32	What number of humans are at risk as a result of gully erosion exposure in your household?	
33	What number of animals are at risk as a of gully erosion exposure in your household?	
34	What is the number of human lives lost because of gully erosion/flood in your community?	
35	What is the number of animal lives lost because of gully erosion/flood in your community?	
Land Use and Practices		
36	Are there any land use activities or practices in your immediate vicinity that might contribute to gully erosion? i. Yes ii. No	
37	If Yes, what is the main activity that contribute to gully erosion	
38	Do you think changes in land use or construction activities have increased the risk of gully erosion? i. Yes ii. No	
Mitigation Measure		
39	Have you observed any erosion control measures being implemented in your community? i. Yes ii. No	
40	What protective measures or strategies do you believe are in place to mitigate gully erosion in your community? i. Adequate drainage systems ii. Vegetation cover iii. Government regulations iv. Community awareness programs v. Other (please specify): _____	

41	What are the measures taken by the community/individuals to prevent/control erosion? I) Sand Bag ii) Tree planting iii) Stone Embankment iv) Others (Specify)	
42	What suggestions do you have for additional measures that could be taken to reduce vulnerability? i. Improved drainage systems ii. Afforestation projects iii. Government regulations enforcement iv. Community education programs v. Other (please specify): _____	
Community Collaboration/Government Intervention		
43	Have there been community meetings or initiatives to discuss gully erosion and its potential impact? i. Yes ii. No	
44	How well do you think the community collaborates with local authorities or environmental agencies to address gully erosion? i. Very well ii. Somewhat well iii. Not well at all	
45	Are there community-based groups or committees working on erosion-related issues? i. Yes ii. No	
46	Do you believe the community is actively involved in addressing gully erosion issues? i. Yes ii. No	

47	28. Do you belong to afforestation or conservation club/association? (a) Yes (b) No	
48	If yes, what is the main function of the club	
49	Are you currently receiving any project-supported advisory support services in integrated land/water management practices, planning, and/or monitoring along this gully site? i) Yes, ii) No	
50	If yes, what is the name of support service/s	
51	Are you aware of any government regulations or policies aimed at preventing gully erosion in your area? i. Yes ii. No	
52	How satisfied are you with the enforcement of such regulations? i. Very satisfied ii. Somewhat satisfied iii. Not satisfied	
Emergency Preparedness		
53	Do you know the emergency evacuation procedures in case of severe gully erosion events? i. Yes ii. No	
54	If Yes, what is the emergency evacuation procedures?	
55	Are there designated safe zones or shelters in your community during erosion incidents? i. Yes ii. No	

Future Concern		
56	Are you concerned about the potential escalation of gully erosion in the future? i. Very concerned ii. Somewhat concerned iii. Not concerned	
57	What measures do you think should be prioritized to address future erosion risks? i. Improved infrastructure ii. Strict land use regulations iii. Community awareness programs iv. Early warning systems v. Other (please specify):	

ENVIRONMENTAL CHARACTERISTICS /SANITATION AND HYGIENE

58	Main source of water for domestic use by members of your household? (1) Tap water (2) Borehole (3) Well (4) Spring (5) Stream (6) Bottled water (7) Sachet water (8) Rain water (9) Others (specify).....	
59	How long does it take to get water from source? (minutes) (1) 1-10 (2) 10-20 (3) 20-30 (4) 30-60 (5) above 60 minutes……	
60	What is the quality of the water? (1) Good (2) Fair (3) Poor	
61	Are there stagnant pools of water within your neighborhood? (1) Yes (2) No	
62	Do you have toilet facility in your household? 1. Yes 2. No	
63	If yes, what type of toilet facility is present in your household (1) Pit Latrine (2) (4) Water closet (5) Others (specify) ……	
64	If no, where do your household utilize? (1) Bush (2) near stream (3) Others, specify	
65	Do you share toilet with other households? (1) Yes (2) No	
66	If yes, what is the number of households sharing the toilet facility ……	
67	What types of vector (insects) do you experience in your community? (1) Flies (2) Mosquitoes (3) Cockroaches (4) Sandflies (5) Others (specify)……	

68	How do you control the pests in your household? (1) Chemical Spray (2) Use of Insecticide Treated Net (ITN) (3) Others (Specify)……	
69	What are the major activities that contaminate the air in your environment? (1) Domestic (2) Agro-prosessing (3) others (specify)…….	
70	How is the quality of air you breathe in this area? (1) Good (2) Fair (3) Poor	
71	Do you have access to services such as waste management along the gully in your community? (a)Yes [ ] (b)No [ ]	
72	How is solid waste managed in this area? (1) Composting (2) Open air incineration (3) Open dumping (4) Landfill (5) Burning (6) Stream dumping (7) Gullies as dump site (8) Others (specify)……	
73	Is noise a major issue in your area? (1) Yes (2) No	
74	If yes, what are the noise sources? (1) Agro-processing activities (2) Automobiles (3) Others (specify)……	
75	What type of fuel does your household mainly use for cooking? (1) Kerosene (2) Charcoal (3) Wood (4) Agricultural crop residue (5) Animal dung (7) Electricity (8) Others (specify	

HEALTH ASSESSMENT

76	What are your common health problems? (1) Malaria (2) Typhoid fever (3) Eye defects (4) Skin disorder (5) Rheumatism (6) Respiratory disorder (7) Cardiac ailment (8) Others (specify) ……	
77	When was the last time you visited a clinic? ……	
78	Are you prone to waterborne ailments? (1) Yes (2) No	
79	What type of waterborne ailments are you prone to? (1) Diarrhea (2) Typhoid fever (3) Parasitic infection (4) Skin infection (5) others (specify)……..	
80	Which of the diseases is/are associated with the existence of the gully erosion in this community?	

81	Does the gully serve as a challenge for women from accessing Health facilities? (a) Yes [ ] (b) No [ ]	
82	Is there any health facility close to your residential area? (1) Yes (2) No	
83	If yes, what type of health facility? (1) Primary health centre (2) Private clinic (3) General hospital (4) Maternity center (5) Others (specify)……..	
84	How do you manage your health problems? (1) Self-medication (2) Health Centre (3) General Hospital (4) Private Clinic (6) Traditional homes (7) Use herbal medicine (8) Spiritual homes (9) None	
85	How did you pay for the treatment? (1) Cash payment from personal funds (2) NHIS (3) Employer (4) Group/Voluntary association health insurance (5) Private health insurance (6) Sale of possessions (7) Loan/Gifts from friends/neighbors/relatives (8) Others (specify)……	

Annex 3 Stakeholder Consultation Checklist

ESMP (Environmental and Social Management Plan) workshop focused on gully erosion:

Understanding Stakeholder Concerns

1. What are the primary concerns or impacts that gully erosion is causing in your community?
2. How has gully erosion affected your livelihoods, properties, or the environment in this area?
3. Are there any specific areas or sites where gully erosion is particularly severe or problematic?

Identifying Stakeholder Needs

4. What do you believe are the most urgent needs for addressing gully erosion in this area?
5. What support or resources do you feel are lacking in mitigating gully erosion effectively?
6. How do you envision the ideal outcome of gully erosion management efforts?

Exploring Local Knowledge and Solutions

7. Are there any traditional or indigenous practices that have been effective in mitigating gully erosion?
8. Have there been any past initiatives or interventions to address gully erosion? If so, what were the outcomes, and what lessons can be learned?
9. How can local knowledge and community involvement be integrated into gully erosion management plans?

Assessing Potential Risks and Trade-offs

10. What potential risks or unintended consequences do you foresee with proposed gully erosion management measures?
11. Are there any trade-offs between addressing gully erosion and other community priorities or interests?
12. How can we ensure that gully erosion management efforts are sustainable and do not create additional environmental or social issues?

Exploring Collaboration and Partnerships

13. Which stakeholders or organizations do you believe should be involved in collaborative efforts to address gully erosion?
14. How can different stakeholders work together to pool resources and expertise in tackling gully erosion effectively?

15. What role do you see for government agencies, NGOs, private sector, and community groups in addressing gully erosion?

Addressing Long-term Planning and Resilience

16. How can gully erosion management efforts be integrated into long-term planning and development strategies for the area?
17. What measures can be taken to build resilience against future gully erosion risks, considering potential climate change impacts?
18. How can we ensure that gully erosion management plans are adaptive and responsive to changing environmental conditions?

Ensuring Equity and Inclusivity

19. How can we ensure that gully erosion management efforts are inclusive and equitable, particularly for marginalized or vulnerable groups?
20. Are there any specific considerations or needs of certain community members that should be prioritized in gully erosion management plans?
21. How can we promote participation and representation of all stakeholders, including women, youth, and indigenous communities, in decision-making processes related to gully erosion?

Evaluating Capacity and Resources

22. What existing resources, expertise, or infrastructure do you believe can be leveraged to address gully erosion in the community?
23. Are there any capacity-building needs or training opportunities that would enhance the community's ability to participate in gully erosion management activities?

Assessing Prioritization and Timing

24. How do you propose prioritizing areas for gully erosion management interventions within the community?
25. What factors should be considered when determining the timing and sequencing of gully erosion management actions?

Monitoring and Evaluation

26. What indicators or metrics should be used to assess the effectiveness of gully erosion management efforts?
27. How can we establish a monitoring and evaluation framework to track progress and adapt strategies based on feedback and outcomes?

Funding and Financial Mechanisms

28. What funding sources or financial mechanisms do you believe could support gully erosion management initiatives in the community?

29. How can we ensure equitable access to funding opportunities for gully erosion projects, particularly for communities with limited resources?

Community Engagement and Awareness

30. How can we enhance community awareness and understanding of gully erosion causes, impacts, and management options?
31. What communication strategies or outreach activities would be most effective in engaging community members in gully erosion mitigation efforts?

Legal and Regulatory Considerations

32. Are there any existing laws, regulations, or policies related to land use, water management, or environmental protection that should inform gully erosion management plans?
33. How can compliance with legal requirements be ensured while implementing gully erosion management measures?

Knowledge Sharing and Learning Exchange

34. Are there opportunities for knowledge sharing or learning exchange with other communities or organizations that have experience in gully erosion management?
35. How can lessons learned from past experiences or successful interventions in other regions be applied to gully erosion management in our community?

Conflict Resolution and Collaboration

36. How can potential conflicts or disagreements among stakeholders regarding gully erosion management be addressed and resolved?
37. What strategies can be employed to foster collaboration and build consensus among diverse stakeholders with varying interests and perspectives?

Annex 4: General Environmental Management Conditions for Construction Contracts/Civil Works.

1. In addition to these general conditions, the Contractor shall comply with any specific Environmental Management Plan (EMP) or Environmental and Social Management Plan (ESMP) for the works he is responsible for. The Contractor shall inform himself about such an ESMP, and prepare his work strategy and plan to fully take into account relevant provisions of that EMP. If the Contractor fails to implement the approved ESMP after written instruction by the Project Implementation Unit (PIU) to fulfill his obligation within the requested time, the Client (ACReSAL Gombe) reserves the right to arrange through the PIU for execution of the missing action by a third party on account of the Contractor.

2. Notwithstanding the Contractor's obligation under the above clause, the Contractor shall implement all measures necessary to avoid undesirable adverse environmental and social impacts wherever possible, restore work sites to acceptable standards, and abide by any environmental performance requirements specified in an ESMP. In general, these measures shall include but not be limited to:

(a) Minimize the effect of dust on the surrounding environment resulting from earth mixing sites, asphalt mixing sites, dispersing coal ashes, vibrating equipment, temporary access roads, etc. to ensure safety, health and the protection of workers and communities living in the vicinity of dust producing activities.

(b) Ensure that noise levels emanating from machinery, vehicles and noisy construction activities (e.g. excavation, blasting) are kept at a minimum for the safety, health and protection of workers within the vicinity of high noise levels and nearby communities.

(c) Ensure that existing water flow regimes in rivers, streams and other natural or irrigation channels is maintained and/or re-established where they are disrupted due to works being carried out.

(d) Prevent bitumen, oils, lubricants and waste water used or produced during the execution of works from entering into rivers, streams, irrigation channels and other natural water bodies/reservoirs, and also ensure that stagnant water in uncovered borrow pits is treated in the best way to avoid creating possible breeding grounds for mosquitoes.

(e) Prevent and minimize the impacts of quarrying, earth borrowing, piling and building of temporary construction camps and access roads on the biophysical environment including protected areas and arable lands; local communities and their settlements. In as much as possible restore/rehabilitate all sites to acceptable standards.

(f) Upon discovery of ancient heritage, relics or anything that might or believed to be of archaeological or historical importance during the execution of works, immediately report

such findings to the SE so that the appropriate authorities may be expeditiously contacted for fulfillment of the measures aimed at protecting such historical or archaeological resources.

(g) Discourage construction workers from engaging in the exploitation of natural resources such as hunting, fishing, and collection of forest products or any other activity that might have a negative impact on the social and economic welfare of the local communities.

(h) Implement soil erosion control measures in order to avoid surface run off and prevents siltation, etc.

(i) Ensure that garbage, sanitation and drinking water facilities are managed properly in construction areas.

(j) Ensure that, in as much as possible, local materials are used to avoid importation of foreign material and long-distance transportation.

(k) Ensure public safety and meet traffic safety requirements for the operation of work to avoid accidents.

3. The Contractor shall indicate the period within which he/she shall maintain status on site after completing civil works to ensure that significant adverse impacts arising from such works have been appropriately addressed.

4. The Contractor shall adhere to the proposed activity implementation schedule and the monitoring plan / strategy to ensure effective feedback of monitoring information to project management so that impact management can be implemented properly, and if necessary, adapt to changing and unforeseen conditions.

5. Besides the regular inspection of the sites by the PIU for adherence to the contract conditions and specifications, the on a need basis the PIU shall appoint an Inspector to oversee the compliance with these environmental conditions and any proposed mitigation measures. State environmental authorities may carry out similar inspection duties. In all cases, as directed by the PIU, the Contractor shall comply with directives from such inspectors to implement measures required to ensure the adequacy of rehabilitation measures carried out on the bio-physical environment and compensation for socio-economic disruption resulting from implementation of any works.

Material Excavation and Deposit

6. The Contractor shall obtain appropriate licenses/permits from relevant authorities to operate quarries or borrow areas.

7. The location of quarries and borrow areas shall be subject to approval by relevant local and national authorities, including traditional authorities if the land on which the quarry or borrow areas fall in traditional land.

8. New extraction sites:

a) Shall not be located in the vicinity of settlement areas, cultural sites, wetlands or any other valued ecosystem component, or on high or steep ground or in areas of high scenic value, and shall not be located less than 1km from such areas.

b) Shall not be located adjacent to stream channels wherever possible to avoid siltation of river channels. Where they are located near water sources, borrow pits and perimeter drains shall surround quarry sites.

c) Shall not be located in archaeological areas. Excavations in the vicinity of such areas shall proceed with great care and shall be done in the presence of government authorities having a mandate for their protection.

d) Shall not be located in forest reserves. However, where there are no other alternatives, permission shall be obtained from the appropriate authorities and an environmental impact study shall be conducted.

e) Shall be easily rehabilitated. Areas with minimal vegetation cover such as flat and bare ground, or areas covered with grass only or covered with shrubs less than 1.5m in height, are preferred.

f) Shall have clearly demarcated and marked boundaries to minimize vegetation clearing.

9. Vegetation clearing shall be restricted to the area required for safe operation of construction work. Vegetation clearing shall not be done more than two months in advance of operations.

10. Stockpile areas shall be located in areas where trees can act as buffers to prevent dust pollution. Perimeter drains shall be built around stockpile areas. Sediment and other pollutant traps shall be located at drainage exits from workings.

11. The Contractor shall deposit any excess material in accordance with the principles of these general conditions, and any applicable EMP, in areas approved by local authorities and/or the PIU.

12. Areas for depositing hazardous materials such as contaminated liquid and solid materials shall be approved by the PIU and appropriate local and/or national authorities before the commencement of work. Use of existing, approved sites shall be preferred over the establishment of new sites.

Rehabilitation and Soil Erosion Prevention

13. To the extent practicable, the Contractor shall rehabilitate the site progressively so that the rate of rehabilitation is similar to the rate of construction.

14. Always remove and retain topsoil for subsequent rehabilitation. Soils shall not be stripped when they are wet as this can lead to soil compaction and loss of structure.

15. Topsoil shall not be stored in large heaps. Low mounds of no more than 1 to 2m high are recommended.

16. Re-vegetate stockpiles to protect the soil from erosion, discourage weeds and maintain an active population of beneficial soil micro-organisms.

17. Locate stockpiles where they will not be disturbed by future construction activities.

18. To the extent practicable, reinstate natural drainage patterns where they have been altered or impaired.

19. Remove toxic materials and dispose of them in designated sites. Backfill excavated areas with soils or overburden that is free of foreign material that could pollute groundwater and soil.

20. Identify potentially toxic overburden and screen with suitable material to prevent mobilization of toxins.

21. Ensure reshaped land is formed so as to be inherently stable, adequately drained and suitable for the desired long-term land use, and allow natural regeneration of vegetation.

22. Minimize the long-term visual impact by creating landforms that are compatible with the adjacent landscape.

23. Minimize erosion by wind and water both during and after the process of reinstatement.

24. Compacted surfaces shall be deep ripped to relieve compaction unless subsurface conditions dictate otherwise.

25. Revegetate with plant species that will control erosion, provide vegetative diversity and, through succession, contribute to a resilient ecosystem. The choice of plant species for rehabilitation shall be done in consultation with local research institutions, forest department and the local people.

Water Resources Management

26. The Contractor shall at all costs avoid conflicting with water demands of local communities.

27. Abstraction of both surface and underground water shall only be done with the consultation of the local community and after obtaining a permit from the relevant Water Authority.

28. Abstraction of water from wetlands shall be avoided. Where necessary, authority has to be obtained from relevant authorities.

29. Temporary damming of streams and rivers shall be done in such a way avoids disrupting water supplies to communities downstream, and maintains the ecological balance of the river system.

30. No construction water containing spoils or site effluent, especially cement and oil, shall be allowed to flow into natural water drainage courses.

31. Wash water from washing out of equipment shall not be discharged into water courses or road drains.

32. Site spoils and temporary stockpiles shall be located away from the drainage system, and surface run off shall be directed away from stockpiles to prevent erosion.

Traffic Management

33. Location of access roads/detours shall be done in consultation with the local community especially in important or sensitive environments. Access roads shall not traverse wetland areas.

34. Upon the completion of civil works, all access roads shall be ripped and rehabilitated.

35. Access roads shall be sprinkled with sufficient water at least five times a day in settled areas, and three times in unsettled areas, to suppress dust emissions.

Blasting

36. Blasting activities shall not take place less than 2km from settlement areas, cultural sites, or wetlands without the permission of the PIU.

37. Blasting activities shall be done during working hours, and local communities shall be consulted on the proposed blasting times.

38. Noise levels reaching the communities from blasting activities shall not exceed 90 decibels.

Health and Safety

39. In advance of the construction work, the Contractor shall embark upon an awareness and hygiene campaign. Workers and local residents shall be sensitized on health risks particularly of AIDS.

40. Adequate road signs to warn pedestrians and motorists of construction activities, diversions, etc. shall be provided at appropriate points.

41. Construction vehicles shall not exceed maximum speed limit of 40km per hour.

Repair of Private Property

42. Should the Contractor, deliberately or accidentally, damage private property, he shall repair the property to the owner's satisfaction and at his own cost. For each repair, the Contractor shall obtain from the PIU, a certificate that the damage has been made good satisfactorily in order to indemnify the Client from subsequent claims.

43. In cases where compensation for inconveniences, damage of crops etc. are claimed by the owner, the ACE has to be informed by the Contractor through the PIU.

Annex 5: Waste Management Plan

1. All vessels (drums, containers, bags, etc.) containing oil/fuel/surfacing materials and other hazardous chemicals shall be enclosed in a bund wall in order to contain spillage. All waste containers, litter and any other waste generated during the construction shall be collected and disposed of at designated disposal sites in line with applicable government waste management regulations.

2. All drainage and effluent from storage areas, workshops shall be captured and treated before being discharged into the drainage system in line with applicable government water pollution control regulations.

3. Used oil from maintenance shall be collected and disposed off appropriately at designated sites or be re-used or sold for re-use locally.

4. Entry of runoff to the site shall be restricted by constructing diversion channels or holding structures such as banks, drains, dams, etc. to reduce the potential of soil erosion and water pollution.

5. Construction waste shall not be left in stockpiles along the road, but removed and reused or disposed of on a daily basis.

6. If disposal sites for clean spoil are necessary, they shall be located in areas, approved by the ACReSAL PIU, of low land use value and where they will not result in material being easily washed into drainage channels. Whenever possible, spoil materials shall be placed in low-lying areas and shall be compacted and planted with species indigenous to the locality.

Disposal of Unusable Elements

7. Unusable materials and construction elements such as electro-mechanical equipment, pipes, accessories and demolished structures will be disposed of in a manner approved by the PIU. The Contractor has to agree with the PIU which elements are to be surrendered to the Client's premises, which will be recycled or reused, and which will be disposed of at approved landfill sites.

8. As far as possible, abandoned pipelines shall remain in place. Where for any reason no alternative alignment for the new pipeline is possible, the old pipes shall be safely removed and stored at a safe place to be agreed upon with the PIU and the local authorities concerned.

9. AC-pipes as well as broken parts thereof have to be treated as hazardous material and disposed of as specified above.

10. Unsuitable and demolished elements shall be dismantled to a size fitting on ordinary trucks for transport.

Annex 6: Contractor - Environmental and Social Management Plan (C-ESMP)

1. Within 6 weeks of signing the Contract, the Contractor shall prepare a construction ESMP to ensure the adequate management of the health, safety, environmental and social aspects of the works, including implementation of the requirements of these general conditions and any specific requirements of an ESMP for the works. The Contractor's ESMP will serve two main purposes:

- For the Contractor, for internal purposes, to ensure that all measures are in place for adequate ESMP management, and as an operational manual for his staff.
- For the Client (PIU) to ensure that the Contractor is fully prepared for the adequate management of the HSE aspects of the project, and as a basis for monitoring of the Contractor's ESMP performance.

2. The Contractor's ESMP shall provide at least:

- a description of procedures and methods for complying with these general environmental management conditions, and any specific conditions specified in an ESMP;
- a description of specific mitigation measures that will be implemented in order to minimize adverse impacts;
- a description of all planned monitoring activities (e.g. sediment discharges from borrow areas) and the reporting thereof; and
- the internal organizational, management and reporting mechanisms put in place for such.

3. The Contractor's ESMP will be reviewed and approved by the Client before start of the works. This review shall demonstrate if the Contractor's ESMP covers all of the identified impacts, and has defined appropriate measures to mitigate any potential impacts.

ESMP Reporting

4. The Contractor shall prepare bi-weekly progress reports on compliance with these general conditions, the project ESMP if any, and his own Construction ESMP. An example format for a Contractor ESMP Report is given below. It is expected that the Contractor's Reports will include information on:

- ESMP management actions/measures taken, including approvals sought from local or national authorities;
- Problems encountered in relation to ESMP aspects (incidents, including delays, cost consequences, etc. as a result thereof);

- Lack of compliance with contract requirements on the part of the Contractor;
- Changes of assumptions, conditions, measures, designs and actual works in relation to ESMP aspects; and
- Observations, concerns raised and/or decisions taken with regard to ESMP management during site meetings.

5. It is advisable that reporting of significant HSE incidents be done "as soon as practicable". Such incident reporting shall therefore be done individually. Also, it is advisable that the Contractor keeps his own records on health, safety and welfare of persons, and damage to property. It is advisable to include such records, as well as copies of incident reports, as appendixes to the bi-weekly reports.

Training of Contractor's Personnel

6. The Contractor shall provide sufficient training to his own personnel to ensure that they are all aware of the relevant aspects of these general conditions, any project ESMP, and his own C-ESMP, and are able to fulfil their expected roles and functions. Specific training should be provided to those employees that have particular responsibilities associated with the implementation of the C-ESMP. General topics should include:

- ESMP in general (working procedures);
- Emergency procedures; and
- Social and cultural aspects (awareness raising on social issues and GBV potentials).

Annex 7: Traffic Management Plan

- The contractor(s) shall install appropriate safety/traffic signages both at the construction corridor and borrow pit.
- Ensure that drivers and equipment operators are adequately satisfied.
- Specify and enforce speed limits (minimum 20km/k and 40km/h) particularly in built up areas and locations around sensitive infrastructures (schools, religious, recreational and health)
- Periodically revise traffic protocols and training staff on safety, speed limits. Also carry out traffic inspection and/or speed signs to encourage safe and responsible driving.
- Investigate and take necessary policy modification and punitive measures in the case of traffic incidents/complaints.
- The contractor(s) shall also notify the public through signages that will be install at different locations while access control must be provided.
- The contractor shall have trained and dedicated traffic officers at designated or at areas of important landmarks such as schools, religious and health centre.
- The contractor(s) shall develop and implement dust suppression or watering mechanism (particularly during the dry season)

Annex 8: Cultural and Physical Resources Management Plan

The contractor(s) shall implement the following cultural resources plan.

- Carry out sensitization and capacity building on identification, management and reporting of cultural and physical resources including chance find.
- Integrate the process of cultural and physical resources management plan with the HSE mechanism
- Build the capacity of both Field/HSE personnel for cultural and physical resource management, chance find and reporting protocols.
- Avoid activities around known cultural and physical resources such as shrines, grooves, burial sites/cemetery etc.
- Clearly mark the boundaries of identified site from project and create appropriate buffer for the protection and possibly design and erect signages for awareness.
- Keep record of such cultural and physical resources (including names, address, geographic location, maps)
- Keep equipment away from such resources
- Site office and general operational areas should not be located close to such resources.
- Ensure appropriate measures are taking to prevent or reduce soil disturbance around such cultural and physical resources area.

Chance Find Plan (for Cultural and Physical Resources)

- Avoid further work in such area
- Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be present until the responsible local authorities and Bureau of Art and Culture take over;
- Report chance find to the local community, PIU and authorities (LGA and Gombe State Ministry of Culture and Tourism)
- Mark and protect such areas for restrictions
- Implementation for the authority decision concerning the management of the finding shall be communicated in writing by Gombe State Ministry of Culture and Tourism
- These procedures must be referred to as standard provisions in construction contracts, when applicable, during project supervision, the Site Engineer shall monitor

the above regulations relating to the treatment of any chance find encountered are observed.

- Relevant findings will be recorded in World Bank Project Supervision Reports (PSRs), and Implementation Completion Reports (ICRs) will assess the overall effectiveness of the project's cultural property mitigation, management, and activities, as appropriate.
- Construction work could resume only after permission is given from the responsible Local Government, Gombe State Ministry of Culture and Tourism concerning safeguard of the heritage

Annex 9: Indicative Environmental and Social Code of Conduct and Clauses for Contractors

1. Environmental and Social Code of Conduct for Infrastructure Development

S/No.	Environmental and Social Issues	Potential Impact	Codes of Conduct
Pre-construction/Construction Phase			
1.	Land Use	• Construction works may affect cultivated and forested land resulting in a permanent loss of the resources. • While the landowner has to part away with his land ownership, the environmental effects can amplify if proper operation and maintenance schedules are overruled. There is however no land acquisition issue on this project.	minimize loss of resources. Demarcate RoW to avoid unnecessary encroachment.
2.	Material Use	Excess extraction of local resources, such as wood, sand, soil, boulders, etc. Degradation of forests, erosion and landslide at steep locales due to boulder, stone extraction. Change in river/stream ecosystem due to unchecked sand extraction.	Extract materials only on need basis. Avoid sensitive areas, such as steep slopes and water-ways.
3.	Slope Stability	Extraction of forest products and cutting of trees in the steep slopes increases soil erosion/landslide due to loss of soil binding materials. Wrong alignment can trigger slope failure Haphazard disposal of construction waste can disturb slopes	Extract carefully and secure the top soil within 25 cm from the surface. If down grading exceeds 70, construction of side drainage is necessary. Keep optimum balance in extraction and filling of soil works.

S/No.	Environmental and Social Issues	Potential Impact	Codes of Conduct
		Improper drainage facilities can result in erosion and landslides	geo-hazardous assessment and mapping Use designated disposal site and avoid side casting of spoil Provide proper drainage Use bio-engineering on exposed slopes
4.	Wildlife	Wildlife and human conflicts increase as wildlife might destroy the crops or attack the construction worker.	Avoid as much as possible areas with high biodiversity. Efficient movement of machinery and other traffic. Control poaching activities and regulate movement of labor force and their dependents into the forest area to minimize wildlife harassing, trapping and poaching.
5.	Drainage	Higher flow rate of surface water and water logging induce landslides and erosion. Quality of infrastructural works diminishes due to poor drainage such as water logging, immense flow rate of surface water.	It is strongly recommended that the cross drainage outlets must be channeled to the confirmed natural drains. If horizontal slope exceeds 5%, construction of flow control device necessary every 20m.

S/No.	Environmental and Social Issues	Potential Impact	Codes of Conduct
6.	Protection of Vegetation	Protected areas and highly forested areas. Degradation of forest areas. ▪ Degradation of agricultural land.	Use minimum and efficient use of wood products for construction. Initiate plantation at damaged and damage prone areas. Increase liability of local forest user groups. Avoid protected areas or densely forested areas
7.	Disposal of Construction Wastes	Dumping of wastes along the road or elsewhere.	Selected spoil dumping sites should be used. After disposal, the area should be leveled and compacted. It is recommended to conserve the soil by planting indigenous plants including grasses.
8.	Disposal of Sanitary Wastes	Unmanaged sanitary waste disposal creating health problems and public nuisance.	Proper sanitation area needs to be demarked. Check for hygiene of work force.
9.	Impacts on amenities along RoW	Road crossings at water supply, irrigation lines may be disturbed/damaged.	Avoid as much as possible the crossing over such amenities.
10.	Pollution	Dust generation from construction activities, construction vehicular movement increases air pollution.	minimize pollution during construction. Consider enclosure of construction areas from settlement.

S/No.	Environmental and Social Issues	Potential Impact	Codes of Conduct
		Noise pollution likely from construction machinery operation and vehicular movement. Sanitary problems likely at the construction and workforce quarters.	Enforce speed limit of vehicles
11.	Child abuse including sex and violence	Engaging in child exploitation Workforce engaging in sexual and physical abuse of minors Violence against minors	Ensure that contractors sign the code of conduct. Ensure zero tolerance to any form of child abuse. Monitor the adherence to the code of conduct. Issue stiff penalties to non-adherence.
12.	Violence against vulnerable groups	Sexual and/or physical violence against minors, women and other vulnerable groups	Ensure that contractors sign the code of conduct. Monitor the adherence to the code of conduct. Issue stiff penalties to non-adherence.
13.	Grievance Mechanism	Sub-project activities likely to result in grievances.	Use existing traditional methods to address grievances. Set time-frame for grievance redress and response.
14.	Communication	Information not properly disseminated. Likelihood of not using appropriate communication channel	• Ensure continuous informatio n disseminati on on environme

S/No.	Environmental and Social Issues	Potential Impact	Codes of Conduct
			ntal and social risks using appropriate local media (print and electronic). Disseminate information in local languages for wider coverage.
15.	Protection of vulnerable population	Exposure of vulnerable population including women and minors to forms of abuse including exploitation, sex and violence.	Adherence to code of conduct. Integrate CBOs/NGOs in monitoring activities.
17.	Exclusion of local people	Influx of diverse workforce may likely infringe on cultural values and resources. Sub-project activities may affect cultural resources such as trees, shrines, graves etc.	• Ensure compliance to native customs. • Ensure workers and contractors obey native customs. • Avoid impacts due to project. • Protection of boundaries from impacts due to construction. Relocation in case impacts are unavoidable.
		Non-consideration of local skills.	Considerations should be given (where possible) to local labour. Certain contracts viz; supply of construction

S/No.	Environmental and Social Issues	Potential Impact	Codes of Conduct
			materials e.g. granites, sand, planks etc should be considered for the local people.
18.	Road safety and traffic management	Likely closure and detour. Increase in road accident due to construction activities.	Develop and implement a sound traffic management plan. Liaise with project communities on alternative roads and timing of possible closures and detours. Install safety signage's in appropriate places including the interpretation in local languages. Deploy dedicated staff for road/traffic monitoring. Install ramp where necessary.
19.	Campaign on STIs including HIV/AIDS	Sexual interactions during project may lead to the transmission of STIs including HIV/AIDS in project communities.	Develop and implement a roboust STIs campaign. Embark on sensitization programme targeting youths and other vulnerable groups such as girls and sexually active women, the commercial sex workers– in collaboration with the National HIV/AIDS Coordination Agency

S/No.	Environmental and Social Issues	Potential Impact	Codes of Conduct
			(NACA) on protection and treatment.
20.	Overstretching of infrastructure	Workforce migration may exacerbate pressure on available social infrastructure (accommodation, transport etc). Likely upsurge in the prices of goods and services due to population avalanche.	Give adequate employment consideration to local population. Where possible contractors to provide means of transportation to workforce.
Operation Phase			
1.	Encroachment	Unmanaged settlement, construction along the RoW.	Establish RoW properly and enforce its limits.
2.	Interruption of Water Flow along RoW	Concentrated flow left unattended might have severe impact at the downhill alignment of the road.	Cross drain structures, namely pipe culverts, slab culverts, box culverts, need to be maintained. Outlet of these structures would be carrying the concentrated run off flow of the respective catchment, which will be quite high during rainy season, which in turn would require proper planning of drainage systems.
3.	Pollution/Vehicular emission	Dust generation from vehicular movement increases air pollution. Noise pollution likely from vehicular movement.	Enforce speed limit of vehicles. Maintain traffic size movement.

S/No.	Environmental and Social Issues	Potential Impact	Codes of Conduct
			Discourage use of horns.
4.	Aesthetics	Road construction is likely to increase landscape scars along the road alignment. In addition if the construction spoils are disposed off improperly, the ground vegetation would be destroyed which will be visible from a distance.	Such damage cannot be avoided but can be minimized through re-plantation of indigenous species and greenery development.
5.	Increased traffic and vehicular accident	Better road condition would increase vehicular traffic and the rate of accident due to over-speeding.	Install traffic signs and specify speed limits for appropriate places. Construct speed breakers. Where possible, traffic signs would be interpreted in local languages.

Annex 10: Company Code of Conduct for Implementing ESHS and OHS Standards, Preventing Gender Based Violence and Violence Against Children

Our company ---------- acknowledge that adhering to environmental, social health and safety (ESHS) standards, following the project's occupational health and safety (OHS) requirements, and preventing gender-based violence (GBV) and violence against children (VAC) is important.

The company considers that failure to follow ESHS and OHS standards, or to engage workers to partake in GBV or VAC activities- be it on the work site, the work site surroundings, at workers' camps, or the surrounding communities-constitute acts of gross misconduct and are therefore grounds for sanctions, penalties or potential termination of workers' employment. Prosecution by the Police of those who commit GBV or VAC may be pursued if appropriate.

We agree that while working on the project we will:

1. Attend and actively partake in training courses related to ESHS, OHS, HIV/AIDS, GBV and VAC as requested by our client and provide same to our workers.
2. Provide and ensure our workers wear their personal protective equipment (PPE) at all times when at the work site or engaged in project related activities.
3. Develop and take all practical steps to implement the contractor's environmental and social management plan (CESMP).
4. Implement the OHS Management Plan.
5. Ensure workers adhere to a zero-alcohol policy during work activities, and refrain from the use of narcotics or other substances which can impair faculties at all times.
6. Consent to Police background check.
7. Treat women, children (persons under the age of 18), and men with respect regardless of race, color, language, religion, political or other opinion, national, ethnic or social origin, property, disability, birth or other status.
8. Not use language or behavior towards women, children or men that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate.
9. Not engage in sexual harassment-for instance, making unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct, of a sexual nature, including subtle acts of such behavior (e.g. looking somebody up and down; kissing, howling or smacking sounds; hanging around somebody; whistling and catcalls; giving personal gifts; making comments about somebody's sex life; etc.).

10. Not engage in sexual favors-for instance, making promises or favorable treatment dependent on sexual acts-or other forms of humiliating, degrading or exploitative behavior.

11. Not participate in sexual contact or activity with children-including grooming, or contact through digital media. Mistaken belief regarding the age of a child is not a defense. Consent from the child is also not a defense or excuse.

12. Unless there is the full consent' by all parties involved, I will not have sexual interactions with members of the surrounding communities. This includes relationships involving the withholding or promise of actual provision of benefit (monetary or non-monetary) to community members in exchange for sex-such sexual activity is considered "non-consensual" within the scope of this Code.

13. Mandate our workers to consider reporting through the GRM or to their managers any suspected or actual GBV or VAC by a fellow worker, whether employed by our company or not, or any breaches of this Code of Conduct.

Regarding children under the age of 18:

14. Ensure wherever possible, ensure that another adult is present when working in the proximity of children.

15. Mandate our workers not to invite unaccompanied children unrelated to their family into their home, unless they are at immediate risk of injury or in physical danger.

16. Not use any computers, mobile phones, video and digital cameras or any other medium to exploit or harass children or to access child pornography ('Use of children's images for work related purposes" below).

17. Refrain from physical punishment or discipline of children.

18. Refrain from hiring children for domestic or other labor below the minimum age of 14 unless national law specifies a higher age, or which places them at significant risk of injury.

19. Comply with all relevant local legislation, including labor laws in relation.to child labor and World Bank's safeguard policies on child labor and minimum age.

20. Take appropriate caution when photographing or filming children.

Use of children's images for work related purposes

When photographing or filming a child for work related purposes, we must:

21. Before photographing or filming a child, assess and endeavor to comply with local traditions or restrictions for reproducing personal images.

22. Before photographing or filming a child, obtain informed consent from the child and a parent or guardian of the child. As part of this we must explain how the photograph or film will be used.
23. Ensure photographs, films, videos and DVDs present children in a dignified and respectful manner and not in a vulnerable or submissive manner. Children should be adequately clothed and not in poses that could be seen as sexually suggestive.
24. Ensure images are honest representations of the context and the facts.
25. Ensure file labels do not reveal identifying information about a child when sending images electronically.

Sanctions

We understand that if we breach this Company Code of Conduct, our client can authorize disciplinary action and sanctions as appropriate and Report to the Police if warranted.

We therefore understand that it is our responsibility to ensure that the environmental, social, health and safety standards are met. That we will adhere to the occupational health and safety management plan. That we will avoid actions or behaviors that could be construed as GBV or VAC. Any such actions will be a breach of this company Code of Conduct. we do hereby acknowledge that we have read the foregoing company Code of Conduct, do agree to comply with the standards contained therein and understand our company's roles and responsibilities to prevent and respond to ESHS, OHS, GBV and VAC issues. we understand that any action inconsistent with this company's Code of Conduct or failure to act as mandated by this company's Code of Conduct may result in disciplinary action and may affect our ongoing tasks.

Company representative

Signature: _____

Printed Name: _____

Title: _____

Date: _____

Annex 11: Occupational Health and Safety Management (OHS) Plan

The management of OHS must be in accordance with the general principles, which should be applied to control workplace hazards in order to:

- eliminate the risks;
- assess the risks, which cannot be avoided;
- reduce the risk at source;
- give priority to collective protective measures over individual protective measures;
- adapt the work to the individual, especially with regard to the design of workplaces and the choice of work equipment and production methods;
- adapt working methods to technical progress;
- develop a coherent overall prevention policy, which covers technology and work organization and
- give appropriate instructions to employees.

The application of prevention and control measures to be taken against occupational hazards should be based on job safety and its hazard analyses. The risk assessment of jobs should be evaluated, and related protection/prevention actions should be designed. In order to identify priorities, risk ranking table should be used as given in Table 1.

Table 1. Risk Ranking to Classify Worker Scenarios

Likelihood	Consequences				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	Low risk	Moderate risk	Extreme risk	Extreme risk	Extreme risk
Likely	Low risk	Moderate risk	High risk	Extreme risk	Extreme risk
Moderate	Low risk	Moderate risk	High risk	Extreme risk	Extreme risk
Unlikely	Low risk	Low risk	Moderate risk	High risk	Extreme risk
Rare	Low risk	Low risk	Moderate risk	High risk	High risk

Above-mentioned rankings in Table 1 help to define potential consequences of exposure to a hazard. Low risk can be managed by routine procedures. In order to manage moderate risk

class, management responsibilities should be specified. The jobs with high risk classification require senior management attention. Extreme risks require immediate actions and it should be avoided as much as possible.

The Project operations and facility itself should be designed according to reduction of high-risk classifications and protection of employees. Training and drills to practice the procedures and plans should be undertaken periodically to minimize the risks of occupational hazards.

In this Occupational Health and Safety Management Plan, management approaches of physical, chemical, biological and radiological hazards are defined. The mitigation measures are not limited with the ones mentioned in this plan. During the operational phase, the Project operations may require additional actions to be taken. The risk assessment should be undertaken periodically, site-specific occupational hazards should be identified, and related actions should be defined and undertaken.

It will be ensured that all the personnel (including contractors) are aware of their responsibilities, risks of their jobs and precautions to be taken on the workplace. Related training with communication codes for any occupational hazard and personal protective equipment will be provided to all personnel by the Project.

OHS Management Approaches

OHSMP provides implementing programs that contribute to mitigation of health and safety risks that may arise as a direct or indirect result of the Project. By implementing the measures provided in this Plan, it is aimed to mitigate the potential risks that arises from the work during construction and operation phases of the ACReSAL Project. Following issues are specified in the main approach of this OHSMP:

- Identifying and controlling occupational hazards and eliminating OHS risks,
- Ensuring that all necessary actions which are suggested in laws, regulations, standards and guidelines are taken to prevent any OHS incident,
- Ensuring third parties such as contractors, subcontractors, visitors and suppliers understand and comply with site safety rules,
- Ensuring safe procurement and proper use of hazardous materials,
- Raising OHS awareness of all employees and third parties by providing suitable and adequate site safety information, training and instructions,
- Ensuring minimization or elimination of risks regarding points of entry and exit to the site,

- Ensuring that actions regarding risks associated with falling object, excavation work, working at height, lifting operations, working in confined spaces, working alone, etc. are taken,
- Raising driving safety awareness of employees and ensuring the compliance of safe driving provisions for all vehicles,
- Ensuring the prevention of adverse impacts of chemicals/waste on human health and the environment,
- Raising OHS awareness of employees and third parties who use, store or transport hazardous materials/wastes,
- Ensuring the compliance of all standards established in Turkish legislation,
- Ensuring that measures for fire are taken and providing to all personnel about emergency preparedness and response,
- Ensuring the prevention of traffic accidents and promoting traffic safety with all personnel and third parties.

General Facility and Operation

General Site Rules

General site rules will be applied to all employees on the project, including employees of contractors and subcontractors, all related personnel from third parties and visitors. Those rules are comprised of brief information about site emergency response plan, emergency contacts, map with permission marks and all other necessary information, and those will be shared with all employees and third parties.

Site Entrance and Exit

The entry to the Project area will be subject to the security personnel's supervision to ensure that all entries are performed in accordance with health and safety system and to prevent unauthorized access. Security personnel should be trained to meet both legislative and international standards by HSE Manager. Emergency exits of buildings and Project site should be clearly marked to be visible even in total darkness and be unobstructed at all the times.

There should be minimum two exits from any work area.

Safe Access

Passageways for pedestrians and vehicles within and outside buildings should be segregated and provide for easy, safe, and appropriate access. Equipment and installations requiring servicing, inspection, and/or cleaning should have unobstructed, unrestricted, and ready

access. Only authorized personnel have access to dangerous operation areas and measures will be taken by locked door to prevent unauthorized access to dangerous areas should be in place.

Parking in Project Area

Parking at the Project site will only be restricted to the designated area. Parking shall be reverse and in the direction of exit. It is forbidden to park in front of fire extinguishers or hydrants, waste storage areas and emergency exits. Plant Management takes the necessary measures and informs the entire plant personnel.

Smoking

Smoking in the construction site, in the plant and in offices is strictly forbidden. There will be a designated open-air area or areas for smoking, where smoking is allowed only. Warning signs will be placed in accordance with standard regulations. Moreover, employees smoking other than at the designated areas will be warned and fined, if necessary.

Vehicles, Construction Machinery and Trucks

Back-up alarms of construction machinery and trucks shall be operational, and all vehicles will have a fire extinguisher and a first aid kit. If there is no sight during maneuvers, a banksman shall be present. It is forbidden to dump for trucks and reverse maneuver for construction machinery without a banksman.

Industrial Hygiene

Industrial hygiene training will be included in general OHS training for all employees and further training, awareness sessions, etc. organized by workplace/company doctor to raise industrial hygiene awareness. Eating in the plant and construction site is forbidden. Only designated areas shall be used for eating purposes. Restrooms shall be cleaned, and soap and tissue dispensers shall be refilled daily.

Working environment in terms of dust, noise, lighting, temperature, airflow and quality, etc. will be adjusted according to related regulations and measurements should be completed according to the Regulation on Occupational Hygiene Measurement, Testing and Analysis Laboratories during the construction and operational phases.

Working Hours

The working hours in construction and operation phases of the Project will be in accordance with the legal work and overtime hours stated in the Labor Law. Working hours can be shortened and additional required resting hours can be provided to the workers as a result of risk assessments and exposure to a hazardous situation.

Special working hour arrangements will be made under extreme conditions such as exposure to extreme hot, cold and humid environments to prevent health risks of employees. Work and rest periods can be determined and implemented by work-specific risk assessments for the activities such as working in confined spaces, gaseous, dusty or noisy areas.

Office Works

Offices will be cleaned and ventilated regularly. If it is not ensured, necessary warning signs shall be placed indicating the floor is slippery. Deteriorations, shelves and other materials will be repaired and/or fixed. Cleaning materials will be used with proper PPE and informed with the Material Safety Data Sheets (MSDSs).

Air conditioning devices will be regularly controlled according to industrial hygiene necessities. Sufficient lighting will be provided to the personnel working in the office. All employees shall be trained on office ergonomics.

Electrical equipment will be checked and labelled color codes in every three months by the electricians. Electrical distribution panels and fuse boxes will be kept locked, labelled and prevented from unauthorized use. Office will be equipped with detectors and fire extinguishers in case of fire hazards. Emergency exit doors and roads will be set at least 80 cm in length.

Employees who are exposed to workplace violence, retaliation, mobbing or any types of discrimination will be encouraged to report the situation in accordance with the Grievance Mechanism Procedure.

Housekeeping

Employees will be informed through training that the major sources of hazards are negligence of keeping the site clean and tidy during all phases of the Project. Those training will include the some of the following consequences of lack of cleanliness and tidiness:

- Trip and fall hazards: Materials and equipment left on the floor can cause trip and fall of an employee. The result can be bone fractures and severe injury. If trip and fall is happened in a higher place without fall protection equipment, the incident may result with fatality.
- Drop of a Material: Materials left in higher places may fall down and cause injuries.
- Hygiene: Non-clean areas threaten employees' health. Biological risks that may arise in the site are also assessed in this context and are tried to be avoided. All employees should wash their hands regularly, especially prior to eating and drinking.

All wastes generated in the site will be stored in the designated waste storage areas, by segregating according to their type. Waste management implementations are specified in Waste Management Plan for all phases of the Project.

Storage Conditions

Spare parts and materials will be stored in designated areas by considering their availability in the market and storage conditions. Maximum stacking height should be 3 meters. Heavy materials will be stored on lower shelves while lighter ones on the higher shelves as a measure against falling.

Chemicals will be stored according to their hazardousness classifications and MSDSs. All chemicals will be ordered according to need and stored according to MSDSs. Bulk buying and storage will not be allowed. Hazardous materials will be stored in accordance with the relevant national regulations.

Emergency Preparedness and Response

Existing Emergency Response Plan (see Appendix A) will be followed, and the following issues should be prepared and implemented, if they are not included in the existing ERP. Moreover, existing Covid-19 Emergency Response Plan (see Appendix B) should be followed and updated, if the standards differ and become more stringent.

- Emergency scenarios and relevant emergency preparedness and response actions with the allocations of responsibilities to local communities and authorities where appropriate,
- First Aid training,
- Specific stakeholder engagement based on consultation and participation with government and communities regarding the nature and potential consequences of the Project-related risks,
- Training of the personnel for the response to emergencies in accordance with the requirements outlined in the specifications,
- Emergency drills to be conducted, frequencies and formats according to Regulation on Emergencies in Workplaces,
- Evaluation of findings and lessons learnt from drills and corrective actions.

Management of Physical Impacts

Noise and Vibration

In the construction and operation phases of the Project, noise sources include the machinery and equipment as well as the Project units such as cogeneration and wastewater treatment plant. Noise limits of workplaces is defined by the NESREA Regulations.

Mitigation measures for reducing noise both in construction and operation phases including the measures against the occupational noise exposures are provided below:

- Equipment will be selected with lower sound power levels.
- Silencers will be installed where possible.
- High noise areas will be identified and marked, and personnel will wear personal noise protecting gears all the time when working in such high noise areas where the noise level is over 85 dBA.
- Structures will be designed and constructed with effective noise isolation.
- No employee will be exposed to a noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection.
- The grievance mechanism will be used effectively.

Mitigation measures in order to minimize the impact of vibration are listed below:

- Tools and equipment with lower vibration levels will be selected.
- Protective clothing to keep the employees warm and dry will be supplied.
- Task rotation and time limits will be implemented on activities with high exposure levels.
- Right equipment for works with risks are needed to be provided and well maintenance in good condition will be ensured.
- Information on self-protection and training will be provided to employees in tool maintenance and usage, for example avoiding gripping the tool too tightly.

Electrical Works, Electrical Equipment and Hand Tools

Recommended measures to prevent, minimize and control electrical hazards that might result from electrical works, equipment and/or hand tools are presented below:

- All energized electrical devices and lines will be marked with warning signed.
- Devices will be locked-out and tagged-out during service and maintenance.
- Locked-out and tagged-out awareness will be provided by HSE Manager before the work.
- All electrical cords, cables and hand power tools for worn-out or exposed cords and manufacturer recommendations for the maximum permitted operating voltage of the portable hand tools will be checked.
- Power cords and extension cords will be protected against damage.
- Only approved extension cords will be used.

- No approach zones around or under high voltage power lines will be established.
- Rubber tired construction or other vehicles that come into direct contact with, or arching between high voltage wires will be taken out of service for periods of 48 hours and the tires will be replaced to prevent catastrophic tire and wheel assembly failure potentially causing serious injury or death.
- Detailed identification will be performed and all buried electrical wiring before any excavation work will be marked.
- Flexible cords to be used on construction site will be rated as heavy duty, and those cords will be either protected by a suitable enclosure or barrier or located where protected from mechanical damage, damaged by liquids or high temperature.
- Cords will not exceed the maximum length stated in the related regulations.
- Hazard warning lights will be installed inside electrical equipment enclosures to warn of inadvertent energization.
- Appropriate labelling of service rooms housing high voltage equipment and where entry is controlled or prohibited will be ensured.
- Voltage sensors will be used before and during workers' entrance into enclosures containing electrical components.
- Specialized electrical safety training will be given to those personnel working with or around exposed components of electrical works.
- Deactivation and proper grounding of live power equipment and distribution lines according to applicable legislation and guidelines whenever possible before work will be performed.
- Electrical hand tools will be inspected by a qualified electrician every three months and by workers any time before starting the work.
- Electrical equipment that does not have a control mark on it will not be used.
- Electrical equipment shall only be repaired by electricians.
- Protective parts of any electrical hand tool will not be removed.
- If the electrical hand tool is sparkling, it will be used with Hot Work Permit or in the general permitted area.
- After the completion of work, electrical hand tools will be kept with pulling their plug out to prevent trip and falls.
- When the work with electrical hand tool is finished, it will be returned to its storage place.

- The employees that will use the electrical hand tool will be trained.
- The employees conducting electrical works or using electrical equipment and tools will use the relevant PPE.

Eye Hazards

Eye hazards should be assessed in detail in risk assessment reports/plans. The protective equipment for eyes will be used depending on the work to be conducted.

Hot Works

The mitigation measures on the hot works such as welding, cutting, grinding, and post-weld heat treatment works to be conducted during the construction and operational phases of the Project are explained in this section.

Work permits will be required for the hot works and employees without Hot Work Permit will not conduct any hot work. The Work Permit might be given with necessary training, licenses or certificates. Risks of the work or related risk assessment should be read and understood by the employees who are going to involve in hot works. Minimum OHS requirements to start a hot work are: Work Permit, approved fire work equipment, fire extinguisher or fire extinguishing system, fire blanket, fire observe (if necessary) and hot work specific PPE according to related risks.

The area where the hot work will be conducted will be free of any flammables and explosives, and the area will not be left without cooling.

Industrial Vehicle Driving and Site Traffic

Traffic and traffic-related risks and impacts will be eliminated, minimized or prevented through the following measures:

- Unauthorized vehicles will not be allowed to enter the Project area.
- All drivers will comply with the Highway Traffic Regulation.
- Pedestrian walkways will be marked and kept clear.
- For pickups, heavier vehicles and all construction vehicle operators, SRC certificate is obligatory.
- On-site and off-site speed limits, which is determined by national legislation, will be complied with by employees.
- Drivers and passengers shall fasten the seat belts. Seat belts shall be fastened before driving and cannot be unfasten until the vehicle is properly parked.

- Regular and legal maintenance of the vehicles will be performed in line with the related regulations.
- Each vehicle will carry first-aid kit, fire extinguisher, reflector and spare tire.
- Overloading of the vehicles is forbidden, even if the vehicle tonnage is appropriate.
- Headlights, mirrors, windows and seat belt system of the vehicles will be operational and maintenance of those will immediately be provided when these systems have problems.
- No passenger is allowed to be carried on the back of a pickup or in heavier vehicles, or in the cabinets of construction machinery.
- Tires will be controlled regularly.
- Smoking is prohibited on vehicles.
- Cell phone usage in vehicles on the road is prohibited.

Working with Construction Machinery

Measures to be taken when working with or around the construction machinery are listed as:

- Construction machinery will be accepted to the site according to site entry rules.
- Daily and periodic maintenance of construction machinery will be ensured and shared with OHS team and the operator will perform a visual check before each use.
- Obeying general rules for operators, which are summarized below, will be ensured.

- Operators will have a valid operator license.
- Operators will have induction training.
- Operator will visually control his/her construction machinery from top and bottom.
- Operator will check any leakages such as oil, engine fluids, accumulator etc.
- Operator will check engine, gearbox, hydraulic oil and radiator fluid levels.
- Operator will check the pallets/tires, bolts, pins etc. whether they are broken or not.
- Operator will be sure there is nobody around the work area and work with the guidance of flagman.
- Operator will start the engine while parking brake is set.
- Operator will check all the displays while the engine is warming up for 2-3 minutes. Operator will control all the lights before night work.

- Operator will not work if his/her view is blocked or continue to work with one or more flagmen.
- Operator will not use cell phone while using the machinery.
- Helmet usage is not obligatory for closed cabin machinery, but the operator will use safety shoes and reflector vests.
- Operator will pay attention to power lines. If there is a risk of contact, energy will be cut-off first.
- At the end of the work, the operator will also control the machine surroundings and park the machine at a safe location. If there are malfunctions or areas to improve, the operator will inform the next shift's operator.
- When the work is finished, the operator will turn off the engine and lock and secure the machinery.

- Obeying general rules for employees, which are listed below, will be ensured.
- Employees must be aware of the hazards and dangers of nearby working machines before starting the work.
- All employees will use reflective vests/work clothes.
- Pedestrian walkways should be used. The construction machinery's work area will not be used as a shortcut.
- Employees will have the eye contact with the operator during works they perform nearby the machinery in motion.

- Refueling of construction machinery will be performed in designated areas or outside of the Project area.
- Construction machinery will not reverse without a flagman.

Working Environment Temperature

Mitigation measures for prevention and control of occupational exposure to heat occurring during the Project activities are listed below:

Pressure vessels and piping will be inspected and maintained regularly.

- Adequate ventilation will be supplied to the work areas to reduce heat and humidity.
- The time required for work in elevated temperature environments will be reduced and access to drinking water will be ensured.

- Surfaces where personnel come in close contact with hot equipment will be shielded.
- Appropriate warning signs and PPE will be used near high temperature surfaces and environments.

Ergonomics

Employees will be provided with the appropriate tools, equipment, parts and materials. Controlling and identification of ergonomic risk factors and reduction of hazards will be provided through the following means when and where necessary:

- Engineering controls; which are the most reliable means to controlling or preventing injury. This is achieved by focusing on the physical modifications of jobs, workstations, tools, equipment, or processes.
- Administrative controls; which means controlling or preventing injury by implementing administrative changes such as job rotation, job enlargement, rest/recovery breaks, work pace adjustment, redesign of methods and/or worker education.
- Work practice controls; which means controlling or preventing injury through proper work practices. These include proper work techniques, posture and conditioning.
- PPE; which is personal protective equipment and can control or prevent injury.

Working at Height

Working from a level difference and the possibility of injury as a result of falling are considered for the employees as "working at height". Travelling, conducting a stationary job, or any time under risk of exposure to a fall from a surface that is not protected by approved handrails, guardrails or some other/similar types of approved arrest or restraint devices are included in the scope of working at height.

The hazard distance for falling is measured from the employee's feet to the walking/working ground. The prevention of fall should be planned during the design stage as possible, and continuously controlled. Hazards resulting from fall risks can be eliminated by several measures. These are:

Elimination of the works at height: performing the work on the ground as much as possible or maximizing the pre-assembly works on the ground for the structural components

- Design safety and engineering controls: reviewing the project drawings, interfacing with the project owners and material suppliers to design safety features into structure, material or equipment to be used, or addition of the safety features such as attachment points for guardrail system, etc. to the project design.
- Fall prevention and protection systems: fall prevention and protection systems differ in terms of the work type. Guardrail systems, fall restraints, fall arrest systems, barricades,

etc. are some of them. The most effective one should be selected depending on the work to be performed.

- Elevated equipment: this equipment are the ones which the employees are required to be tied-off 100% of the time when conducting the job such as crane suspended works or scissors lifts.
- Housekeeping: housekeeping is also another important factors which may cause falling. The whole area should be enforced daily clean-up and free of debris, materials, unnecessary equipment and provided a sufficient number of trash containers for clean-up.

Working with Ladders

General procedures for the portable ladders are listed below in the scope of the Project:

- Handmade ladders are forbidden.
- The ladders will be checked daily before usage and controlled by the maintenance team and tagged.
- Ladder steps will be clean and anti-slide.
- There will be insulating caps on the ends of the ladders; ladders without caps will not be removed from the site.
- Ladders will not be considered as working platforms and no work will be performed on ladders more than 15 minutes.
- Ladders will be installed at 1:4 and it will be 90 cm longer than the climbed level.
- Last two steps of the ladders will not be used.
- Damaged ladders or ladders with broken steps will not be removed from the site and those ladders will be notified to the maintenance team.
- When climbing, 3-point rule (two hands and a foot, or two feet and a hand) will be maintained at all time. While climbing and going down, manual handling is forbidden.
- For vertical ladders, a cage is required after 2.5 m length and a resting platform for longer than 4 m.
- Conductive (metal) ladders will not be used in electrical works and in areas where power lines are present. In such works and areas, fiberglass and nonconductive ladders will be used.
- The ladders will not be used in strong windy weathers. Strong wind speed is determined as 12 m/s unless otherwise specified.

- The ladders will not be placed at door entrances. If it is inevitable to do so, the door will be locked.
- The ladders will not be placed on ice or snow. If it is necessary to do so, it will be fixed.
- The ladders will not be placed at places where there is active traffic. If it is necessary to do so, appropriate barriers and warning signs will be placed. This measure must be effective enough to remove vehicle crash risks.

While there is an employee on the ladder, it is forbidden to change the position or location of it.

Ladders will be carried horizontally to minimize the chance of its contact with power lines.

- Ladders will only be used for their purpose of manufacture. Ladders will not be used in a horizontal position like a walking platform, bridge, etc.
- For fixed ladders, handrails will be installed for ladders with more than four steps.
- There will be a minimum gap of 18 cm between the steps, and between the ladder and wall (or another fixed part).
- The distance between the steps will be equal and never exceed 30 cm.
- The ladder will be kept oil- and grease-free.
- Worn-out or damaged ladders will not be used.

Excavation Works

Mitigation measures for the excavation works are listed below:

- Work Permit shall be obtained to establish excavation works.
- Excavation works shall be performed under supervision.
- Excavation equipment shall be checked before use.
- Excavation team shall have training on Excavation Risks.
- Excess excavated material shall be disposed of at least 1 meter away from the excavation area.
- Risk assessment shall be done during the planning of excavation works.
- If there is a live line (electricity, gas, steam, etc.) in the excavation area, energy shall be cut off or if it is not required to cut it off, the precautions that should be taken shall be specified by Work Permit.

- If vibration will likely cause subsidence, special precautions shall be taken.
- Depending on the condition of the excavated soil, it shall be strengthened by excavation or lining or by 45 degrees angling, after the opinion of HSE Manager.
- Working in the excavated area subjects to Confined Spaces Work Permit.
- For excavations deeper than 5 m, vehicle operation around the excavation area shall be prohibited. At least two locations shall be determined to go down, if it is necessary and the slope of the excavated area shall be checked by supervisor before going down.
- The excavation area shall be normally closed within the same day. If it is not possible, the excavation area shall be surrounded by barriers and warning lights shall be located for the night.

Manual excavation shall not be preferred if it is not compulsory due to technical reasons. Excavations deeper than 50 cm shall not be performed manually. Special training shall be conducted for workers who will perform manual excavation.

- The working hours of employees are evaluated according to the condition of the ground and the working hours are shortened according to this assessment

Illumination

Light intensity of working areas should be adequate for the general purpose of the location and type of activity. Minimum limits for workplace light intensity as defined by NESREA regulations shall be adhered to. Measures regarding the illumination of the project site area are provided below:

- Energy-efficient light sources with minimum heat emission shall be used.
- Measures shall be undertaken to eliminate glare/reflections and flickering of lights.
- Precautions shall be taken to minimize and control optical radiation including direct sunlight. Exposure to high-intensity UV and IR radiation and high-intensity visible light shall also be controlled.
- Measurements shall be done according to Regulation on Health and Safety Measures to be taken in Workplace Buildings and Annexes and TS EN 12464-1: 2013.
- Emergency lighting shall be installed to all necessary areas and buildings.

Lifting Operations

Mitigation measures regarding lifting operations are provided below:

- Before lifting machinery and vehicles start to work, they shall be checked by their operators. The steel ropes, chains, hooks, sling, chain blocks, and automatic stoppers shall be checked by authorized technical personnel once a year. This period might be shortened by risk assessments.
- The crane that will be used during lifting operations shall be accepted in accordance with site acceptance rules.
- Minimum requirements of the crane are crane license (official registration certificate),periodic maintenance documentation, operation of the detection devices, condition of the operator cabin, presence of at least fire extinguisher and first-aid kit
- Minimum requirements of the operator are operator license, insurance of the operator, the medical condition of the operator, induction training of the operator and PPE usage of the operator.
- Before starting the lifting operation, the whole area or the area where the load will travel shall be enclosed with barriers to protect working under the load. If this is not possible, the area shall be controlled by several watchmen.
- Standing under the suspended load is forbidden in any case. If it is necessary to do so, the risks to people must be minimized by safe systems of work and appropriate precautions.
- The lifting shall be performed by tying down the load by a trained rigger.
- Even though the operation can be performed by only one rigger, another rigger with greater experience can be used as superintendent together with several flagmen.
- If the flagmen are more than one, the operator shall follow the only one flagman's instructions and this flagman shall be selected before the operation starts.
- The communication method between the flagman and operator shall be determined before the operation by considering any malfunctions in communication devices. For the lifting with high risks or for human lifting, free heave and barge are forbidden by considering the risk of communication gaps.
- Riggers, flagmen and superintendent shall start to the work as trained in lifting operations. This shall be recorded in the Training Plan.
- The operation shall not start without lifting plan

Management of Chemical Impacts

Air Quality

Air quality of working environment will be maintained and measured according to NESREA regulations and standards. Necessary PPE and training will also be decided according to risk assessments.

Fire and Explosions

Mitigation measures regarding fires and explosions resulting from self-heating fuel piles, ignition of flammable materials and sources are presented:

- Flammables shall be stored away from ignition sources and oxidizing materials.
- Flammables storage area shall be remote from entry and exit points into buildings, away from plant ventilation and intakes or vents. It should have natural or passive floor and ceiling level ventilation and explosion and use spark-proof mixtures.
- Electrical grounding, spark detection and if needed quenching systems shall be provided where the flammable material is mainly comprised of dust.
- Fire hazard areas shall be defined and labelled to warn of special rules such as prohibition in use of smoking materials, cellular phones, or other potential spark generating equipment.
- Specific worker training in handling of flammable materials and fire prevention and suppression shall be provided.
- Fire extinguisher equipment (ladders, ventilation devices, fire extinguishers, etc.) will be purchased and will be kept in good condition.
- Fire extinguisher equipment will be labelled /signed according to related regulations and will be placed at easily accessible locations.
- Fire extinguishers will be placed close to areas that have fire risks such as chemical storage and welding areas.
- Personnel shall not be allowed to interfere with electrical appliances; only authorized personnel will be allowed to change the electrical installation. Electrical appliances will be closed and unplugged when they are not in use.
- Personnel who are responsible for the management of inflammable materials shall be appointed and shall be trained. Storage, transportation, and use of these inflammables will be established in compliance with national and international standards.
- Leakage and spillage of inflammable liquids shall be immediately cleaned and repaired.
- Fire exits and exit doors will be installed in both temporary and permanent structures/buildings and will be kept open all the time.

- A smoking area out of the plant will be designated and a fire extinguisher will be provided for this area.
- Fire practices will be established according to health and safety regulations.

Working in Flammable and Explosive Environments

Risk assessment shall be performed before working in flammable and explosive environments. Necessary signs should be placed on the site. Emergency communication numbers shall be placed. Conditions and situations to be aware of are defined under this section. These conditions and related mitigation measures are as follows:

Flammable and explosive liquid storage shelves and barrels shall be earthed against static electricity hazards. Static electricity is the most important fire cause.

- Hot works such as welding, cutting etc. shall not be performed near flammable and explosive liquids. Special precautions shall be taken when it is necessary to do so.
- It shall be ensured that there is no spill, leakage etc. where flammable and explosive liquids are present.
- Fire extinguishers shall be placed to appropriate locations where there is a work with flammable and explosive liquids.
- Training shall be conducted on the use of fire extinguishers.
- The storage areas of flammables and explosives shall have ventilation and the area shall be ventilated three times in an hour. The frequency might be increased in special occasions.
- Flammable and explosive materials shall be stored in their original packages. For small usage quantities, they shall be carried with special safety containers, not in glass or plastic containers.
- Gasoline and thinner shall not be used in cleaning works. Non-flammable solvents shall be used.
- During the operation of the Project classification should be assessed beforehand where explosive mixtures could be generated by biogas releases,
- The employees shall be trained on the explosive gases and their potential impacts.
- In order to prevent unauthorized access, area limitations and labelling shall be done.
- Places, where potentially explosive atmospheres to be able to occur, are marked with specific signs.

Hazardous Materials

Measures shall be taken to avoid or minimize the potential for occupational exposure to hazardous materials and substances that may be released by the Project. Mitigation measures regarding hazardous materials are presented below:

- All hazardous materials shall be assessed in accordance with relevant regulatory and international requirements.
- All chemicals purchased from suppliers used on the site will be accompanied by their MSDSs that meet the standards.
- Storage of fuel will be in tanks equipped with locking devices and which have secondary containment (with %110 volume capacity) that are located on a platform in a designated area located away from any watercourse or drain.
- Spill kits, protective equipment, and other necessary equipment will be available where hazardous materials are handled, to enable any spills to be cleaned up.
- Appropriate first aid will be located close to hazardous material storage areas such as eyewash, showers, and first aid kits.
- Hazardous materials will only be transported in vehicles authorized for the transport of hazardous substances.

The transfer of hazardous materials from vehicles to storage tanks shall be conducted on impervious hard standing, which is sloped to a collection or a containment structure, not connected to municipal wastewater/storm water collection system.

- Incompatible materials (acids, bases, flammables, oxidizers, reactive chemicals) shall be stored in separate areas, and with containment facilities separating material storage areas.
- The storage and use of hazardous substances shall be done under conditions of maximum security.
- Drummed hazardous materials shall be stored in areas with impervious surfaces that are sloped to retain any spills/leaks.
- Containers holding flammable and/or toxic materials will be kept permanently closed and covered. They shall be kept in their original packaging and they shall be handled and transported under maximum security.
- Any accidental leaks of fuel or oil will be immediately cleaned up with absorbent material and collected in closed and labelled containers - temporarily stored in specially designed spaces until delivery to an operator.

- Chemicals with different hazard symbols shall not be stored together.
- All Hazardous Materials shall be disposed of according to the requirements of relevant regulation.

Management of Biological Impacts

Biological agents, which include bacteria, viruses, fungi (mold), other microorganisms and their associated toxins, have the ability to adversely affect human health in a variety of ways, ranging from relatively mild, allergic reactions to serious medical conditions, even death. These organisms are widespread in the natural environment; they are found in air, water, soil, plants, and animals. Because many microbes reproduce rapidly and require minimal resources for survival, they are a potential danger in a wide variety of occupational settings.

Exposure to Biological Hazards

Exposure to biological hazards may occur during demolition, renovation, sewer work, work on air handling systems, or other construction work from contact with contaminated or diseasecarrying materials, such as soil, water, insects (mosquitoes, ticks) and animals. In the site, biological health hazards will be most commonly found from an accumulation of animal waste and the presence of rodents and insects. Common areas has potential of biological hazards.

Fungi (Mold) Hazards

Fungi (mold) are found both indoors and outdoors, all year round. There are many thousands of species of mold and most, if not all, of the mold found indoors comes from outdoor sources. Mold seems likely to grow and become a problem only when there is water damage, high humidity, or dampness. Molds are organized into three groups according to human responses: Allergenic, Pathogenic and Toxigenic. Potential health effects and symptoms associated with mold exposures include allergic reactions, asthma, and other respiratory complaints. There is no practical way to eliminate all molds and mold spores in the indoor environment; the way to control indoor mold growth is to control moisture.

- If mold is a problem in the workplace, the mold and eliminate sources of moisture must be cleaned up.
- Fixation of the source of the water problem or leak is needed to prevent mold growth.
- Reduction of indoor humidity (to 30-60%) is required to decrease mold growth.
- Cleaning mold off from hard surfaces with water and detergent, and drying it completely is required.
- Absorbent materials, such as ceiling tiles that are moldy may need to be replaced.
- Condensation on cold surfaces can be prevented by adding insulation.

- In areas where there is a perpetual moisture problem, do not install carpeting.

Respiratory protection for exposure to mold will depend on the size of the particle and its level of toxicity. It is important to take precautions to limit your exposure to mold and mold spores. To limit the exposure to airborne mold, at a minimum, an N-95 respirator is suggested. If oil is present in the air, make sure to use either an R or a P designed filter.

Poisonous and Infectious Animals

Many different poisonous and infectious animals might be found in or around the Project site and workers should be aware of these health hazards before starting work in a specific location. All bites by such wildlife must be considered a possible exposure to the biological hazards. Rodents can exist around the Project site. The most sensible way to avoid contact with rodents is to prevent them from infesting the work site. Safety precautions should be taken. Safe disposal of rodents and proper cleaning and disinfection of rodent-inhabited areas are keys to minimizing exposure to the virus.

Special Hazard Environments

Working in Confined Spaces

Management measures for confined spaces are presented:

- Engineering measures shall be implemented to eliminate, to the degree feasible, the existence and adverse character of confined spaces.
- Permit-required confined spaces shall be provided with permanent safety measures for venting, monitoring, and rescue operations, to the extent possible. The area adjoining access to a confined space shall provide ample room for emergency and rescue operations.
- Confined spaces shall be identified and labelled by HSE Manager.
- Works in confined spaces shall require a Work Permit. Working without a permit shall require disciplinary action.
- Work Permits for confined spaces shall be given after the following inspections:

- Control of proper entrance and escape,
- Gas measurement,
- Confirmation that all workers are trained (at least two employees go in and one employee as watchmen),
- If a continuous gas measurement is required, the measurement device shall be given to the employees that go in,

- Ventilation and lighting control.
- The works to be performed inside the confined areas shall be performed for the periods determined by the risk assessments.
- The watchmen shall not leave his/her workplace. If he/she needs to do so, another watchman shall be appointed, or the work shall be stopped.
- If there is no natural ventilation or if there is hazardous gas accumulation, a ventilation system shall be installed.
- A rescue kit shall be ready for fainting and other situations in confined spaces.
- Employees entering the confined space shall use PPE in accordance with the risk assessments.
- If lighting is not enough in confined spaces, lighting shall be provided. In case of a presence of gas in the environment, ex-proof lightning equipment shall be used to prevent any possible explosion risks.
- Instead of using 220 V electrical hand tools, air-powered or low power hand tools shall be preferred for confined spaces. However, if the work requires 220 V or more, an isolation transformer shall be used.
- The decision on the power of the isolation transformer shall be made depending on the work to be done and the opinion of the electricity team.

Working Alone

General procedure for Working Alone are presented below:

Risk Assessment: Risks arising from the conditions and circumstances of the work site will be assessed with the Occupational Health and Safety Committee and Risk Assessment Team, including input from the worker, in order to reduce the probability of an incident. Refer to the Risk Assessment Procedure.

Eliminate or Reduce the Risk: All reasonable measures will be taken to eliminate the risks identified, which include the development of safe work procedures, establishment of an effective communication system, training of workers, and ensuring access to emergency services in case of injury or incident.

Key Steps to Follow:

- Perform a risk assessment.
- Identify the risks in working alone.
- Establish safe work procedures.

- Keep work alone procedures current.

Certain circumstances make working alone hazardous. Identifying the hazards inherent to these circumstances depends on accurately defining what working alone is and evaluating the situation and the degree of risk. Whether a situation poses, a high or low risk will depend on the type of work activity, the work environment, and the potential consequences of an emergency, accident, or injury. The wide range of factors makes it important to assess hazards specific to each work alone situation; determine the level of risk; and consider the employee's knowledge, skills, and training. Working Alone or Working in Isolation describes situations when a worker performs a job function during employment, where they:

- Are the only worker for the employer at a workplace at any time;
- Work at a worksite remote from other workers;
- Work in circumstances where assistance is not readily available;
- Do not have direct supervision by the employer or a supervisor;
- Are not in the presence of another employee directly associated with the same employer;
- Work in an area where the worker does not have visual contact with a co-worker; or
- Travel away from a base office to perform job tasks; for example, client meetings.

Employees who travel alone may be exposed to the risks of injury from a vehicle accident, extreme weather conditions, or being stranded in remote areas. Doing fieldwork alone carries a degree of risk in relation to the location and access to communication and emergency response. The employer must identify workplace hazards to ensure the health and safety of the employee who works alone. Determining the level of risk involved with the type of activity, task, and environment helps form safe work procedures and develop controls to eliminate or reduce the risks.

A worker representative must participate in assessing the hazards and risks and developing the necessary controls. Employers must inform affected workers of the hazards identified and the methods they will use to control or eliminate the hazards in working alone. The worker should also receive a copy of the hazard assessment.

Factors to consider in hazard identification will be:

- Locations where employees work alone.
- Type of work activity (for example, welding).
- Hazards inherent to the work activity (for example, equipment failure, toxic gasses).
- Hazards inherent to the work environment (for example, heat, cold, hostility, drug abuse).
- Previous incidents, injuries, reports, and near misses.

- Control measures and precautions currently in use.
- Details on how to seek or provide emergency assistance.
- Evacuation and emergency procedures.
- Equipment needed for employees working alone.
- Information and training provided to the worker.
- Gaps or patterns to address.

After all hazards have been identified, reducing risks requires safety measures and systems suitable to the worker's needs. Before any employee can work alone or in isolation, employers must develop a procedure that both the employer and employee sign. Each working alone activity requires procedures specific to that activity and work environment. The worker must have adequate training in the use of the equipment, systems, and procedures for their effective application.

Consulting with the occupational health and safety committee representing the worker or with the worker directly is key to developing and successfully implementing safe work practices.

Workers experience the hazards first-hand and can help identify controls.

Written safe work procedures shall include an effective communication system and a way for employees to get help if there is an incident. The communications system must be responsive to the type and level of risk of the work and worksite. The three main components of effective communication are the frequency of check-in, dependability of the system, and training.

Effective communication systems include:

- Radio communication;
- Phone or cellular communication; and
- Any means that provide effective communication considering the risks involved (for example, satellite phone, two-way radios, silent alarms).

Effective communication may require constant or intermittent mechanical or electrical surveillance or use of security systems, personal pagers, two-way radios, emergency sounding devices, visual monitoring systems, or similar equipment. Post telephone numbers of the regular and emergency contacts in easily visible locations.

The level of risk identified in the hazard assessment will determine the frequency of check-in or call-in times to contact the worker. Using the telephone for communication at regular intervals may be adequate in low risk situations. For personnel working in high hazard environments or at night in work environments that attract criminal victimization, check-in would be more frequent.

Check-in scheduled at regular intervals ensures the safety and well-being of the employee working alone. Check-in procedures must clearly define time intervals (time between checkins), shift end check-in, and procedures to follow when you cannot contact the worker.

The employer, another employee, or the person the employer designates to check on the employee who is working alone, must know about that employee's activities and be capable of putting the emergency response plan into effect.

Personnel Protective Equipment (PPE)

Other than office and allowed areas, minimum acceptable PPE that shall be used in the plant area are not limited with but determined as below.

- Helmet (TS EN 397 +A1)
- Eye Protection Goggles (TS 5560 EN 166)
- Work Shoes (TS EN ISO 20345, TS EN 13832-3)
- Ear Protection PPE according to Decibel (dB), comply with standards (TS EN 352-1, 352-2, 352-3)
- Working at Height PPE;
- Positioning Points and Safety Rope (TS EN 358)
- Parachute Type Seat Belt (TS EN 361)
- Personnel Protective Equipment to prevent falling from a height-seat belt (TS EN 813)
- Rescue Equipment-Rescue Belts (TS EN 1497)
- Rescue Equipment-Rescue Rings (TS EN 1498)
- High Visibility Jacket (According to weather conditions) (TS EN ISO 20471)
- Respiratory Protection – Face Mask against dust biological risks FFP-1,2,3 (TS EN 12942/A2)

The requirements of special PPE or any change according to site needs shall be determined by HSE Manager. Mitigation measures for PPE usage are provided below:

- If alternative technologies, work plans or procedures cannot eliminate, or sufficiently reduce a hazard or exposure, work-appropriate PPEs shall be used actively.
- Appropriate PPE that offers adequate protection to the worker, co-workers, and third parties, without incurring unnecessary inconvenience to the individual shall be identified and provided.
- PPE shall be maintained properly including cleaning when dirty and shall be replaced when damaged or worn out.
- Training programs for employees shall include proper use of PPE.

- Selection of PPE shall be based on the hazard and risk ranking and selected according to criteria on performance and testing established.

Implementation Schedule

This Plan will be reviewed on a minimum of a three-monthly basis during construction phase and annually during operation. During steady state operations, this Plan will be reviewed on an annual basis and any necessary revisions made to reflect the changing circumstances or operational needs of the Project. Revision of this Plan will be the responsibility of project Contractor HSE Manager during construction and the environmental safeguard specialist during operations.

If the circumstances change, this Plan may be updated on an "as required" basis.

Any revisions to this Plan will be uploaded to the Document Control Centre (DCC) to ensure that all Project staff and Contractors have access to the latest version of this OHSMP.

MONITORING

Overview of Monitoring Requirements

The monitoring measures that are to be implemented during the construction and operation phase to assess the compliance of the Project with the relevant Project Standards are described in this section. In case that any non-conformances with the Project Standards are identified, these will be investigated, and appropriate corrective actions will be put forward.

Key Performance Indicators (KPI)

The table below summarizes the key performance indicators and associated key monitoring measures that can be used to assess the progress and effectiveness of the proposed mitigation strategies.

Table 2: Key Performance Indicators (KPI)

KPI	Target	Monitoring Measure
Number of the recorded worker (internal) grievances relevant to OHS	Minimize and achieve continuous improvement in the number of the recorded internal grievances related to OHS (Target: Zero)	Internal Grievance records
Number of the reported OHS incidents	Minimize and achieve continuous improvement in the number of the reported OHS incidents (Target:	Regular internal inspections

	Zero)	(incident reports) and audits
Total number of non-compliances with the measures identified in this Plan.	Minimize the number of non-compliances (Target: Zero)	Audit records

Record Keeping and Reporting

The records of audits, inspections, complaints, trainings and incidents will be managed in accordance with the Project's ESMS and DCC.

Annex 12: Summary of the database of information collected for ESMP.

ACReSAL

Our Ref: GEN/ACR/ADM/Vol/3 Your Ref: Date: 12/02/2024

The Commissioner of Police,
Gombe State Command,
Gombe State.

LETTER OF INTRODUCTION AND NOTIFICATION

I am writing to introduce ***Prof. Murtala Muhammad Bardamasi,*** the Consultant working for the Agro-Climatic Resilience in Semi-Arid Landscapes – ACReSAL, Gombe State on the Environmental and Social Management Plan (ESMP) for the Government Girls College Doma Gully Control and River Stabilization work.

2. The Consultant has engaged 39 residents of the Gombe metropolis for a week (13th – 20th February 2024) to survey traffic/vehicular movement on roads around the intervention site; from Behind the official residence of the Commissioner of Police to the downstream of Doma gully.

3. Given the above, I would like to formally introduce the consultant and seek the support and cooperation of the Police for a seamless and hitch-free exercise.

4. The Consultant and the ACReSAL Communications Officer can be reached on 08037061200, and 08039256995 should the need arise.

6. Thank you for your usual cooperation.

DESPATCHED
SIGN
DATE 12-02-24

Sani Adamu Jauro,
PC, Gombe State ACReSAL

5c. **ESMP (Environmental and Social Management Plan) workshop at Hajiya Amina Hall (12/02/2024)**

The engagement started at 4:30. The leaders and representatives of the different communities were recognized. The purpose of the engagement was stated and the need for the invited guests to attend and pay attention, as matters to be discussed affects them directly, that is gully erosion.

Opening prayers were said by two (2) of the participants of both religious faiths (Islam and Christianity). The consultant, expert and team lead of the ESMP was introduced and handed over the discussion.

He started by introducing himself and the role he is meant to play for this development of gully erosion control. He also highlighted the problem of gully erosion, alongside the effects, such as loss of lives, farmlands and homes.

It was reiterated that it is part of the world bank's policy, that for such initiatives and projects to be executed, there must be a community engagement of the affected persons/persons to be impacted by the project. It is also paramount to take into account the baseline conditions of the socio-economic environment, in terms of what is on ground and what could be the possible impacts of the project/development.

The participants defined erosion in their own words, to be the effect of the rain sweeping away the top soil.

Some the effects identified include loss of wealth and lives, mental illness among others. They also exclaimed how happy and excited they are with the gully erosion project and praying that this work comes to be. One of the respondents stated that;

These gullies are really scary. We are woken up in the middle of the night and informed of house caving in along gullies. I remember asking some officers assessing gullies, that what of the gully Infront of my house, and I was told it only needed filling. These later expanded and form part of the gully sites of Tudun wadar Pantami.

Aishatu Buba Pantami added that;

My house is close to a gully too. Whenever the rain comes, I do not get a peaceful sleep, for myself and my children. I know erosion is that the soil is levelled, then the rain comes and for some reason it is blocked, the water deepens a hole and eventually enlarges into a gully.

What to do to stop the erosion

Some of the causes of the gullies they believe to as a result of agricultural activities, and from cutting down of trees. Thus, when the rain comes, nothing is there to control the flow, then sheet erosion develops to rill then to gullies.

Mukhtar Umar Abubakar of Abacha riyal community, believes that constructing culverts/drainages to block the water, tree planting and halting the expansion of gully fingers are the best strategies to prevent gullies from further forming.

Sani Ibrahim Pantami stated that the nature of the soil, being soft has a great deal to do with the formation of gullies. It is neither a one man's business; government's involvement is very important.

Where the water is strongest, there should be drainages

People also need to be stopped from developing their homes on water ways,/natural drains that could lead to erosion.

What is it that is needed to fix the issue?

Musa ibn Khalid believes that Community cooperation, integrity from the side of experts/government officials, when it comes to compensation. Resources are also needed from the government.

Muhammad, chairman, is of the opinion that desisting from dumping of refuse in the gullies, as this would only widen the gullies overtime.

We can contribute bricks to build embarkments that would reduce the speed of the water.

It is only when the intervention is beyond us, then we can go to the government authorities.

Aliyu Abubakar

There is need for sensitization by community leaders to educate their people on where to dump refuse.

After it has been fixed, what are our thoughts?

Adamu Musa, feels that this government would do a good job. That the drainage would be able to contain the water, and prevent the formation of more gullies. That there would be trees planted alongside to prevent the action of water towards erosion.

Female

I want to see it clean, devoid of dirt. That the drainage is kept neat, to see the water flowing freely, with the erosion controlled.

How was it managed in the past without the foreign intervention?

Aliyu Mamman Barunde narrated that in the olden days, it is the old people that come together with the use branches, corn stalks etc.

They also study the direction of the water, where the planting on the farms would be made to be in the opposite direction.

Nowadays, we make use of sacks, filled up with sand and used to make embarkments. However, these are no more as effective. This could be due to increase in population, attitudinal change, they no more look after the environment. There was no plastic pollution, we mostly made more use of paper, but now people are dumping refuse in the gullies. He reminisced that;

About 47 years ago, our parents used to also plant Jema tree along of the gullies or depressions, the gullies were small. Where we find even fishes and had farm lands around those areas. However, today the gullies are taller than me.

Maryam sa'adu of Nayi nawa, strongly believes it has to do with greed and selfish attitude. We have to change our attitude. My parents used to try to stop the water from eroding the surface. I live in a house close to the gully, and I bought the house, where there are no trees.

What is the way out?

We must put our heads together.

We should not use refuse to attempt filling up the gullies, we can use wood instead, then sensitize our people about gully erosion, its effects and ways to manage it through community participation.

How do we ensure sustainability?

Aishatu Buba, Malam Kuri

If we can be selfless and stop selling land along gullies and for people to desist from buying. Our elders should be watchful of what plots of land are bought. It is better you build on a small plot, rather than buying a 100m by 100m plot that one would likely lose completely to gullies, when the rain comes.

People should stop dumping refuse and making holes in the ground to burn wood (kiln? charcoal production?).

Wakilin Dagacin Barunde

Stop refuse dumping in the drainages. People should abide by the laid laws governing waste management.

Effective community cooperation and ownership.

Ali is tilted towards planting of *kiri kiri* grass and *kafi kansila* to control erosion.

Pantami

Houses were built along the kwari and they fell in. the youths would come with diggers and break away the houses to take the iron rods. I feel this is wrong. There is need for cooperation between the people and the dagatai. We that live in these places; hence we should be empowered to take care of our community. When we report the youth that do this, it should be followed up and the right thing done.

If the project runs through your house or enterprise, what do you think should be done? Or be handled?

Abdullahi, Riyal, Abacha quarters

The community is of most priority, but there should be a standard of operation. There must be community leader involvement in the compensation process, they should also be people of integrity.

Is there need for knowing how to manage the projects?

Yes, there is need for capacity building, trainings or sensitization campaigns on the management of the project.

Who should be involved in the project?

Muhammad, chairman

There should be ownership, community heads and leaders (such as mai unguwa, dagatai) must be involved and their approval sought before the projects are executed. As well as

security agencies, should be involved, so that if any defaulters are cut, they should be punished accordingly.

Wakilin dagaci

The issue is that, the people are not following the proper channel anymore. It is only when there are problems that the leaders are informed. So, there is a disconnect between the people and the leadership.

The leaders we are aware, and are involved in such activities. We are also going to give a 100% support to this intervention.

It is our pride as leaders, that our people are helped. We are here for them and are ready to support this project 100%.

Back in the days. our parents give us a piece of land, for free. But now times have changed. We need to be patient. My land has been taken, but I can stand it, however the poor among us may not have another land or place to go back to, or what is given may not be enough, however we should still be patient.

When should the project be executed?

It should be done during rani.

This type of work may take years to be done.

Haruna idris, community secretary

It should be done during the rainy season, so that the experts can understand the behavior and intensity of the water.

Although, we would be happier if the construction starts right away. this sense of urgency is due to the fact that, during the last rainy season 20 houses from international hotel down to the commissioner of police's residence were lost. Thus, the expectation of loss of lives and properties may be more this year.

The expert further described the extent of the project, as well as constructing a dam at new Liji to cater for water point for animals, farming etc.

What areas should be given the most priority?
Usman Shuaiba, community secretary

We feel all places identified are just as important. The most affected areas in my opinion are however Riyal, Abacha quarters, Gabadaza, Gabukka, wuraburji, bagadaza, and Wuroshiye.

Grace, Micah, Nayi nawa

The areas that should be given top most priority should be Nayi nawa and behind Commissioner's house. During the raining season, the water drowns children on their way to school, floods the road, and everyone is held at a standstill. No movement till the water moves.

Where should the government ban residential settlements to be built?

We should look at where the populace is most affected.

The maianguwa should sensitize their people on where to build houses. Instead, these vulnerable places should be used for tree planting.

The water that flows from the roofing, gives the water more speed and encourages erosion. That excess water from the roof could be harvested. If we can all do that, then we can prevent gullying. I am doing it in my house, if I had not, I would have moved out of my residence by now, my neighbor is here, he can attest to that.

The expert used this opportunity to educate the participants on the importance of water harvesting, especially to reduce the formation of gullies.

The role of government/laws/legislations

Isa Muhammad, chairrman, Nayi nawa and Kuwait

Laws should be laid down towards the management of the project.

Pledge!!!

Haruna idris, community sec, kamakuri

We are here to take on this pledge. The community association are pledging to take care of the project and manage it for the rest of our lives.

Yan banga

We are for this movement and are here to support it and ensured that it is managed.

From the expert: may we be able to report as it was discussed in this gathering.

One of the dagatai added that he is happy that the problem of gullies is coming to an end, and hopes for the community's cooperation, towards resolving especially misunderstandings between neighbors.

From the expert:

The issue of houses or enterprises that affected, the census done to aid the compensation. That some of them have been skipped, some households are yet to be accounted for. I have therefore taken upon me to get your concerns across to him.

Women, orphanages, and physically challenged? What is their situation? Are they being affected? Have they been compensated? We urge you to find out.

A lady from the participants had this to say in summing up the menace of gullies at Nayi Nawa;

The governor should look at Nayi nawa community. We are frustrated and unhappy and we do not have access to modes of transportation, even before the raining season, not to talk of the raining season. We have to walk to the main road and this throws us into a lot of hardship. Please take our cries to the governor to intervene and relieve us of this suffering.

Closing prayers were said and the workshop was ended at 6:30 pm.