NIGERIA EROSION AND WATERSHED MANAGEMENT PROJECT (NEWMAP)- (IDA Assisted)

Environmental and Social Management Plan (ESMP)

(Draft Final Report)

for

Reclamation, Channeling and Remediation Works At Ibore Flood and Gully Erosion Catchment Area in Edo State (EDS/NEWMAP/WKS/NCB/16/01)

Submitted to

Project Management Unit, Edo State Nigeria Erosion and Watershed Management Project (NEWMAP)
Ministry of Environment and Public Utilities

April 2017

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LISTS OF ABBREVIATIONS AND ACCRONYMS

AIDS	=	Acquired Immune Deficiency Syndrome
BEME	=	Bill of Engineering Measurement and Evaluation
BOD	=	Biological Oxygen Demand
CITES	=	Convention on International Trade in Endangered Species
CO	=	Carbon-Monoxide
DO	=	Dissolved Oxygen
EA	=	Environmental Assessment
EHS	=	Environment, Health and Safety
EIA	=	Environmental Impact Assessment
EMP	=	Environmental Management Plans
EIS	=	Environmental Impact Statement
ESA	=	Environmentally Sensitive Area
ESMF	=	Environmental and Social Management Framework
ESO	=	Environmental Safeguard Officer
ESMP	=	Environmental and Social Management Plan
FMEnv	=	Federal Ministry of Environment
FEPA	=	Federal Environmental Protection Agency
FRSC	=	Federal Road Safety Corps
GEF	=	Global Environmental Facility
GRMs	=	Grievance Redress Mechanisms
HIV	=	Human Immune Virus
HSE	=	Health Safety and Environmental
IFC	=	International Finance Corporation
ITCZ	=	Inter Tropical Convergence Zone
ITDZ	=	Inter-Tropical Discontinuity Zone
IMM	=	Impact Mitigation Monitoring
LGA	=	Local Government Area
MDA	=	Ministries Department and Agencies
NAST	=	Nigerian Advanced School of Theology
NESREA	=	National Environmental Standards and Regulations Enforcement Agency
NEWMAP	=	Nigeria Erosion and Watershed Management Project
NIMET	=	Nigeria Meteorological Agency
NPC	=	National Population Commission
NW	=	North Westerly
PPP	=	Polluter Pay Principle
PAP	=	Project Affected People
PPC	=	Public Compliant Commission
PCF	=	Prototype Carbon Fund
PAD	=	Project Appraisal Document
PID	=	Project Implementation Manual
PM	=	Particulate Matter
QA	=	Quality Assurance
QC	=	Quality Control
RH	=	Relative Humidity
RPF	=	Resettlement Policy Framework
SPMU	=	State Project Management Unit

STD	=	Sexually Transmitted Disease
SW	=	South Westerly
TDS	=	Total Dissolve Solid
THC	=	Total Hydrocarbon
ToR	=	Terms of Reference
TSS	=	Total Suspended Solid
TSP	=	Total Suspended Particulate
USCS	=	Unified Soil Classification System
USEPA	=	United States Environmental Protection Agency
VOC	=	Volatile Organic Compound
WB	=	World Bank

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EXECUTIVE SUMMARY

CHAPTER ONE: Introduction

Ibore, Edo State, gully site is one of the ten gully erosion sites that had been selected by the SPMU of NEWMAP for Engineering Design and Construction Works in a bid to control the erosion, inhibit the advancement of the gully from causing further damage and rehabilitate the gully. The project is financed by the World Bank (WB), Global Environment Facility, the Special Climate Change Fund, and the Government of Nigeria. The Consultant (Team leader) was engaged to prepare the ESMP for the project in line with standard procedures for environmental assessment including the applicable WB Environmental and Social Safeguard policies and Nigerian environmental assessment guidelines

Objectives of the Proposed Intervention Project In Ibore Gully Site

The aims of the Ibore gully Intervention project are:

- To route the catchment flow around the gully head so as to bypass the head of the gully and to discharge the flow back into the gully at a safe distance downstream;
- To manage the energy of the flowing waters in such a way that the flow discharges back into the gully in a controlled manner;
- To manage the flow in the downstream section of the gully so as to limit velocities, reduce lining requirements and to ensure that extensive vegetation cover is established as part of the river protection and reinstatement;
- To reinstate the backfilled gully head with suitable vegetative measures combined with appropriate landscaping;
- To provide facilities with sufficient capacity to intercept surface flows into the gully bypass system;
- To rehabilitate the damaged rural tarred road; and
- To reroute the channel to protect the gas pipeline at the downstream section of the gully.

Scope of the Project Work in Ibore

The scope of the work is as follow:

- Desk studies, a field investigation and a site assessment;
- A detailed topographical survey of the affected area;
- Hydrological studies to determine storm water runoff;
- The engineering design of all structures including:
  - Hydraulics
  - Reinforced concrete
  - Slope stability
  - Layout and earthworks
  - Design for risk and safety;
  - Preparation of a Bill of Engineering Measurement and Evaluation (BEME), priced and unpriced;
  - Tender documentation; and
  - The final design report.

Objectives of the ESMP

Specific objectives of this ESMP are to:

- Set out the measures to be taken in addressing the identified adverse impacts of the various components and activities of the project;
- Develop procedures and plans to ensure that the mitigation measures will be implemented throughout the phases for the remediation work at the Ibore Gully Erosion site; and
- Address the adequacy of the monitoring and institutional arrangements for the upper and lower watersheds in the intervention site.

Terms of Reference and Scope of Work of the ESMP

- The consultant is expected to work in close collaboration with the SPMU project team, and the various other Agencies involved in the projects;
- The consultant shall visit the intervention sites, to have a first-hand overview of the situation on ground at the site, so as to have adequate knowledge of the requirements for the ESMP; and

- Identify the proposed management strategies to ensure the environment is appropriately protected and environmental issues are appropriately mitigated.

Specific scope of work is that the Consultant:

- Prepares ESMP, taking into consideration the activities in the intervention sites at Ibore community;
- The ESMP should contain an environmental and social checklist, to be used as a screening mechanism for the identified activities of the project; and
- Identifies any regulations and guidelines, which will govern activities of the nature contemplated by the proposed project including National and State legislation and regulations.

Deliverables

The deliverables are Inception, Draft and Final ESMP Reports, acceptable to the Edo –NEWMAP SPMU, Edo State, and to the World Bank.

CHAPTER TWO: Policy, Legal and Administrative Framework

A number of relevant international, national and state environmental policies, guidelines, legal and administrative framework applicable to the operation of the NEWMAP were reviewed as they relate to the proposed NEWMAP project at Ibore, Edo State.

Specifically, World Bank OP/BP 4.01: Environmental Assessment (EA), one of the 10+2 Environmental and Social Safeguard Policies of the WB, employed by the bank to examine the potential environmental risks and benefits associated with Bank lending operations was reviewed. A detailed listing of national statutory documents put in place by the FMEnv to aid in the monitoring, control and abatement of industrial wastes and natural disasters was produced in this chapter. Similarly, Edo State Regulations Relating to Environmental Management was also reviewed.

CHAPTER THREE: Description of Biophysical Environment

Location of Ibore Gully Site in Edo State: The Ibore gully erosion site is located in the Esan Central District, approximately 6 km to the east of Ekpoma-Auchi Road. A large erosion gully has grown to a depth of approximately 20 m and has caused the collapse of a main road and several buildings in the residential area of Ibore settlement. The gully extends over a distance of approximately 1.8 km. The depth of the gully decreases as it moves into a more gently sloping topography and the erosive forces reach a state of equilibrium with the resistance of the natural soil. The depth of the gully decreases to approximately 3 m. The gully is about 5 m wide at the lower end before it crosses the gas pipeline.

A major gas pipeline traverses the natural drainage route. Markings on the pipes indicate that the pipeline belongs to the Nigerian Gas Company Ltd. Three significant catchment areas were identified upstream of the erosion gully at Ibore as follow:

- Upper catchment (approximately 17 km^2);
- Middle catchment (approximately 19 km^2); and
- Lower catchment (approximately 5 km^2).

From the recent hydrological study in Ibore, it was found that only the lower catchment presently contributes to the runoff in the gully.

Description of the Project Environment

Physical environment of Edo State:

Climate and Meteorology: Edo State has two principal seasons, rainy and dry, driven by the seasonal oscillations of the Inter-Tropical Discontinuity Zone (ITDZ) movement.

Temperature and Sunshine: Maximum temperatures typically range between 28^{0}C and 34^{0}C. The higher values are recorded in the dry months between December and March, which also coincide with periods of high sunshine. Mean sunshine hours per month vary from 53 hours in July to 176 hours in

January. The low sunshine hours in the region are associated with the thick cloud cover that prevails in this climatic belt for most of the year.

Rainfall: Rainfall in Edo State is generally high, due to the relative proximity to the coast. Rain falls all through the year with the peak between June and October and the highest number of rain days also occurred within the same period. Lowest amount of rainfall occurs in the month of December, while the lowest rain days are recorded in February. Total annual rainfall is typically in excess of 2,500mm.

Relative Humidity: The highest relative humidity (RH) in the morning (0900 hrs.) in Edo State is about 84.0% and this often occurs in July, while the lowest is obtained in January with a value of about 59.0%. The RH record is higher for 0900hrs than for 1500hrs throughout the months.

Wind System: The climatic conditions of the state are influenced by two wind systems related to a global passat system; south-westerly (SW) and the north-easterly (NE). The SW winds, which predominate from April to August, have a speed range of 5.7 to 9.0 knots (mean 7.4 ± 1.4 knots), but over the annual cycle, the overall mean is 5.7 ± 2.2 knots, and this corresponds to light breeze on the Beaufort scale. Gentle and moderate breezes occur mostly from June to September.

Air Quality and Noise Levels: Total suspended particulates in ambient air around Edo State are generally low, ranging between 25µg/m^3 and 74µg/m^3. This is far below the FMEnv limit of 250 µg/m^3, hence, the air quality in the state is of high quality. Noise level ranged between a low of 40 dB(A) and a high of 84 dB(A), with mean values at 51dB(A). In general, noise levels in the state complied with the 8-hr exposure limit of 90 dB(A) set by the FMEnv.

Geology and Geomorphology of Edo State: Edo State lies within the Niger Delta thereby making its geology typical of the Niger Delta Basin. The area forms part of a geological sequence of the Quaternary and Tertiary formations of the Niger Delta.

Biological Environment of Edo State

Vegetation: Vegetation in Edo state consists of mangrove swamps, freshwater swamps, rainforests and savanna grasslands. The savanna grasslands however occur in the northern reaches of the state.

Wildlife: Generally wildlife in Edo state consists of mammals, birds, reptiles and amphibians. Many parts of the state have been substantially modified by human activities, such that only very few original forests remain, and by extension, wildlife species composition and abundance have been seriously modified. The savanna grasslands in the state play host to rodents such as Grass-cutters, Porcupines, Snakes, etc. Avian species, because of their mobility, are ubiquitous across the state.

Description of Ibore Gully Site Environment

Findings from recent hydrological survey of Ibore and its surrounding within and around the gully site indicate as follow:

Upper Catchment:

The upper portion of the catchment, which includes the town of Irrua, drains into a large natural wetland. The upper catchment (approximately 17 km^2) forms part of the greater catchment area, it currently drains into a natural wetland and does not appear to contribute any runoff to the Ibore gully.

Middle Catchment

Middle catchment (approximately 19 km²) forms part of the greater catchment area that drains towards the Ibore gully. However, due to undulating flat gradients, a poorly defined watercourse and luxuriant vegetation, the runoff from this area also appears to dissipate before it reaches Ibore. The peak runoff from the middle catchment has been calculated to be in the order of 110 m³/s. However, this runoff does not currently contribute to the flow at Ibore gully site.

Lower Catchment

Lower catchment (approximately 5 km²) drains directly to the Ibore gully. It consists of rural and urban areas with roads and includes formalized storm water channels. It was found that only the lower catchment presently contributes to the runoff in the gully.

Slope of the Land in Ibore

Although the upper and middle catchments are fairly flat, the lower catchment forms a basin with moderate gradients towards the lowest point, where flows are concentrated at the head of the gully. The elevation at the highest point of the lower catchment is approximately 380 m above mean sea level (MSL), while the elevation at the lowest point is about 280 m above MSL. The middle catchment, which includes the settlements of Eidenu and Udowa, does appear to slope towards the Ibore gully.

Geology, Geotechnical and Soil Types at Ibore

According to the published 1:2 000 000 Geological Map of Nigeria, the site is underlain by Bende Ameki Group lithologies consisting of clay, clayey sands and shale of the Ilaro Formation. The presence of clayey sands was confirmed by the geotechnical investigation and laboratory test results.

A geotechnical investigation was conducted on 14 March 2016 at the Ibore Erosion Gully Site (D3), Edo State, Nigeria, where six soil samples were taken and tested in the laboratory. The laboratory results indicated that the site is underlain by clayey sands and are classified as ‘SC’ by the unified soil classification system (USCS).

Field soil investigation, sampling and analysis of the surface 200-cm soil depth at the lower and upper reaches of the gully erosion site in Ibore indicated predominance of fine to medium sized sand particles. No evidence of lithologic discontinuity was observed. Soils within and around the Ibore gully site are highly ferruginized, commonly dark brownish to dark reddish in colour, and often with ochric epipedon. The sand particles ranged from a minimum of 77% to 78% sand.

CHAPTER FOUR: Socio-Economic Characteristics and Consultation with Stakeholders

The socio-economic baseline information gathering on the two communities straddling the gully site documented the social risks associated with the rehabilitation and restoration of the gully. Furthermore, existing livelihoods opportunities, income, gender characteristics, age profile, health, transport access, existing community structures were also investigated. In addition, existing formal and informal grievance redress mechanisms in the communities were also investigated. Community consultation was also held at the community leader premises. The consultation was with a view to sensitizing the community on the government's plan to address the challenges posed by the gully through the rehabilitation of the damaged road infrastructure as a consequence of the gully erosion.

Findings indicated that youth accounted for 69% of the sampled respondents. This is an indication of the availability of able-bodied people that can provide labour needed during the construction phase of the project. Four major environmental concerns of the community identified during the consultation meeting are (a) irregular rainfall, (b) excessive rainfall, (c) soil loss and degradation, and (d) excessive heat. It was also documented that there is no existing formal institutional framework specifically setup to handle grievances that might arise from the gully erosion rehabilitation project in the community.

CHAPTER FIVE: Assessment of Associated and Potential Impacts

Proposed Intervention Project in Ibore Gully Site

Two options for dealing with the drainage from the lower catchment were considered in the concept design phase of this project as follows:

- Option 1: Direct discharge
- Option 2: Reducing peak flows through ponding

The draft Conceptual Design report recommended Option 2 (above) i.e. reduction of peak flows by provision of detention ponds.

Components of the Proposed Intervention Project in Ibore Gully Site

The components of intervention project planned for this gully site are as follow:

Design and Construction of Major Drainage Systems and Ancillary Structures

The damage at Ibore gully site is a direct result of the poor drainage system that is unable to cope with the peak flows. It is recommended that a major drainage system be designed to accommodate the 1 in 50 year return period event with a peak flow of 44 m^3/s. It is clear that large conduits will be required to accommodate flows of this magnitude through the urban area and that appropriate energy dissipating structures will be required at the gully to reduce flow velocities so as to prevent further erosion. Specifically, the followings shall be carried:

- Diverting the flow around the gully head will provide the most practical solution.
- Managing the flows in the gully but with the additional provision of gabion check dams.
- To manage the flow around the gas pipeline.
- The gully head upstream of the confluence with the new bypass channel will be backfilled and reinstated.
- The road that has collapsed as a result of the gully erosion will be reconstructed.
- Major inlet works are planned upstream of the gully.

- Additional open side drains will contribute to the interception during extreme events.
- The design for safety and risk primarily consists of the open channels that are lined on both sides with sloping stone pitching or riprap.
- Extensive planting of suitable vegetation.

Use of Suitable Grass and Tree Species to Stabilize the Soils: It is proposed that extensive use is also to be made of vegetation to improve the soil's resilience to erosion. The grass species to be planted are *Vetiveria zizanioides* and *Pueraria sp*. as approved by NEWMAP. The tree species is *Acacia sp*.

Quality Assurance and Quality Control (QA/QC) for the Proposed Intervention Project in Ibore

The general conditions of contract should be based on the World Bank harmonized FIDIC document for large works. The specifications are to be mostly based on the SATCC standard specifications for workmanship and materials. The British Standards are also to be used.

Associated and Potential Impacts Identified

For the purpose of impact identification, the respective project activities to be undertaken for each phase of the intervention project are indicated in the box below:

PROJECT PHASE	PROJECT ACTIVITY	AFFECTED ENVIRONMENTAL AND/OR /SOCIAL COMPONENT	PROJECT IMPACT
Pre-Construction:	General clearing and preparation of project site for gully erosion site rehabilitation and construction works	Socio-economics	❑ Increased employment opportunities for the local communities
		Socio-economics	❑ Interference with day-to-day community

			activities resulting in conflicts and complaints
Pre-Construction	Land Acquisition and demolition of existing buildings	Socio-economics	❑ Conflict over loss of land and resettlement benefits if payment is restricted to owners of the two buildings to be demolished for the construction of the diversion culvert
		Socio-economics	❑ Conflict between the NEWMAP project and the resident community over relocation benefits due to those families whose buildings, land, and lives of loved ones were lost to the gully erosion at Ibore
Pre-Construction	Physical presence of construction workers on the Ibore Gully erosion intervention project site and environ	Soil	❑ Contamination of soil and downstream water resources of the project area from indiscriminate disposal of untreated sewage
Pre-Construction	Contractor's site preparation operations	Socio-economics	❑ Increased employment opportunities for the local communities

Pre-Construction:	Transportation of equipment, materials and workers to the project site	Air Quality	❑ Ambient air quality deterioration from airborne dust particulates, fugitive emissions, exhaust of equipment/automobiles
		Noise Levels	❑ Noise and vibration from vehicular movement
		Transportation/infrastructure	❑ Traffic congestion and increased risk of occurrence of traffic accidents and injuries
Construction	Construction of sheds, equipment lay down areas, temporary office and sanitary facilities etc.	Air Quality	❑ Increase in ambient noise levels and vibration
Construction	Construction of drainage conduits upstream of the gully head and other associated road drainage infrastructure	Socio-economics	❑ Increase in employment opportunities and engagement of community labour
		Socio-economics	❑ Social and cultural structure interference and complaints;
		Community/Public Health	❑ Marginal increase in population within the settlements in close proximity to the project site will lead to an increase in negative vices such as prostitution

			(commercial sex work) and crime which would affect social and cultural systems through a negative value system;
		Socio-economics	❑ Conflicts between the project and the community as well as the pressure of the influx of potential job seekers into the project area and associated risks;
		Socio-economics	❑ New wealth among the youth would threaten the existing authority structure;
Construction	Disruption and encroachment into agricultural lands in close proximity to the gully erosion	Socio-economics	❑ Conflict over loss of agricultural lands due to gully erosion rehabilitation civil works downstream of the gully head in Ibore community
	Transportation of equipment, materials and worker to project site	Soil and Groundwater	❑ Accidental release of fuels, oils, chemicals, hazardous materials etc., to ground in the construction laydown area during delivery of materials and equipment to

			project site
Construction	Construction of 2.5m by 1.5m gully bypass closed box diversion drainage culverts	Socio-economics	❑ Conflict over loss of land and resettlement benefits for demolition of two existing buildings obstruction the construction of the diversion culvert
		Socio-economics	❑ Conflict between the NEWMAP project and the resident community over relocation benefits due to those families whose buildings, land, and lives of loved ones were lost to the gully erosion at Ibore community
		Socio-economics	❑ Disruption of community activities and movement around the gully head
Construction	Construction of Baffle Chute to the bottom of the gully	Soil and Erosion	❑ Risk of chute failure by flow undermining gully head, overtopping or bypassing. The failure occurs when storm runoff fails to enter the baffle chute properly especially when the runoff leaks and flow

			bypassing occur at the chute entrance
		Soil and erosion; Health and Safety; Socio-economics	❑ Occurrence of risks associated with large storm events that exceeds the design capacity of the Chute
		Soil and Agriculture	❑ Loss of fertile top soil for infertile sub-surface soil that would not enhance vegetation establishment
		Socio-economics; health and safety	❑ Risk of loss of life and damage of the proposed gully drainage infrastructure
Construction	Construction of Stilling Basin	Soil and Agriculture	❑ Loss of agricultural lands and increase in the exposure of erodible soil
		Soil and Agriculture	❑ Loss of valuable topsoil that the could be used for seeding vegetation
		Health and Safety	❑ Workers exposure to risk of falls into excavated pit and occurrence of accident or injuries
		Socio-economics; Health and Safety	❑ Risk of stilling basin failure and occurrence of flooding, overtopping resulting in stilling

			basing sweep out and downstream channel erosion
Construction	Filling and reclamation of the gully head	Health and Safety	❑ Occurrence of accident and safety risk incidents
		Health and Safety	❑ Waste handling and disposal
		Water Quality	❑ Increase in turbidity and sediment load in downstream receiving water bodies
Construction	Reshaping of the gully channel by cutting earth from gully side slopes to fill the gully channel floor	Soil and Erosion	❑ Increase in the amount of disturbed areas created by earthmovers used in reshaping the gully side slopes
		Water Quality	❑ Contamination of downstream receiving water bodies by fertilizers, and pesticides as well as creation of excessive bare soils by herbicides if used for the establishment of the recommended plant species seeded to control soil erosion
		Soil and Erosion	❑ Exacerbated gully erosion channel bed undermined

			and washing away of fill materials resulting in increased sediment load in receiving water bodies downstream
	Increase in the amount of disturbed areas created by earthmovers used in reshaping the gully side slopes	Soil and Erosion	❑ Risk of erosion of exposed gully side slopes and erosion of ground area above the gully channel divide
		Soil and Agriculture	❑ Loss of fertile top soil that could be used for seeding vegetation
		Soil and Erosion	❑ Occurrence of bank erosion along reshaped gully channel slopes
Construction	Placement of Gabion Drop Structures in gully channel to reduce longitudinal gradient to 0.05%	Soil and Erosion; Vegetation and Wildlife	❑ Disturbance of unnecessary large land areas for transportation of materials and heavy earthmovers
Construction	Erosion protection of gully banks by cutting and sloping the sides of the gully bank to a 1:2 gradient	Soil and Agriculture	❑ Loss of fertile top soil which could be used for seeding vegetation
		Health and Safety	❑ Risk of occurrence of accident or injury
Construction	Reconstruction of damaged road	Air Quality	❑ Ambient air quality deterioration from airborne dust particulates, fugitive emissions,

			exhaust of equipment/automobiles
		Noise Level	❑ Noise and vibration from vehicular movement
Construction	Reshaping the gully and installation of erosion protection facilities to enable safe conveyance of storm water downstream of gully head	Water Quality	❑ Water quality deterioration
		Health and Safety	❑ Risk of hearing impairment from increased noise and vibrations
		Vegetation and Wildlife	❑ Loss of wildlife
		Soil and Agriculture	❑ Loss of valuable topsoil that could be used for seeding vegetation
Construction	Transportation of heavy equipment, construction materials and workers to the project site	Air Quality	❑ Ambient air quality deterioration from airborne dust particulates, fugitive emissions, exhaust of equipment/automobiles
		Noise Level	❑ Noise and vibration from vehicular movement
		Transportation and Infrastructure	❑ Traffic congestion and increased risk of occurrence of traffic accidents and injuries
		Soil and Groundwater	❑ Accidental release of fuels, oils, chemicals, hazardous

			materials etc., to ground in the construction laydown area during delivery of materials to project site
Operation	Utilization of the rehabilitated gully site and installed storm water drainage infrastructure	Socio-economics; Infrastructure	❑ Risk of failure of the gully erosion installed drainage infrastructure to safely route storms of 1 in 50 years
		Soil and Erosion; Flooding and Infrastructure	❑ Risks from debris and sediment accumulation in the drainage channels in upstream catchment area of the gully head, Diversion Culvert, Baffle Chute, Gabion Drop Structures and Stilling Basin resulting in performance failure of the drainage infrastructure
		Infrastructure	❑ Risk of undermining and occurrence of scouring in the Baffle Chute could result in deteriorating performance of the structure

Operation	Maintenance of the gully drainage infrastructure	Soil and Erosion Health and Safety	❑ Risk of failure of the gully intervention from poor maintenance of the drainage infrastructure to achieve the desired project objectives such as (Creation of new gullies within the channel; breeding of vectors in the settling basin, undermining of the drainage infrastructure and scouring of the drainage structure, etc.)
		Soil and Erosion	❑ Disruption of the side slopes during routine maintenance of the gully channels
Decommissioning	Dismantling and removal of civil engineering equipment	Air Quality	❑ Ambient air quality deterioration from airborne dust particulates, fugitive emissions, exhaust of equipment/automobiles
		Noise levels	❑ Noise and vibration from vehicular movement
Decommissioning	Waste handling and disposal	Waste Management	❑ Solid Waste generation, handling and

			disposal
		Health and Safety	❑ Poor housekeeping and environmental sanitation
Decommissioning	Transportation of solid waste, equipment and workers out of the project site.	Transportation and Infrastructure	❑ Traffic congestion and increased risk of occurrence of traffic accidents and injuries
		Air Quality	❑ Ambient air quality deterioration from airborne dust particulates, fugitive emissions, exhaust of equipment/automobiles
		Noise Levels	❑ Noise and vibration from vehicular movement

A checklist of the Associated and Potential Impacts with each of these project activities at different project phases was documented in this chapter. The impact identification considers the magnitude, severity and duration of each of the impacts.

CHAPTER SIX : Environmental And Social Management Plan (ESMP)

This chapter presents the specific objectives of the ESMP, the environmental and social impacts of the intervention identified, a discussion of the mitigation measures recommended to address the adverse project impacts, the institutional responsibilities and accountabilities, the capacity building requirements, the public consultation plan, the mechanism for resolving community conflicts and disagreements regarding the project activities in line with the ESMF, RPF, RAP, and Project Implementation Manual.

The mitigation measures are presented in relation to specific project activities that would cause them. The usual practice is to ensure the implementation of these measures as part of the overall operational plans and procedures that will be used by the Edo State Project Management Unit of NEWMAP and its Contractors. The two monitoring that will be undertaken consists of:

(a) Environmental Auditing (Environmental impact monitoring), and

(b) Environmental and social impact mitigation compliance monitoring.

Also addressed in this chapter is the Institutional Arrangement for Monitoring Plan and the monitoring and evaluation strategies to be adopted for the proposed intervention project. The roles, responsibilities and institutional arrangements for the implementation of the mitigation measures and the monitoring activities outlined for the Ibore intervention project are clearly documented. Roles and responsibilities of the key stakeholders in the implementation of the ESMP are also clearly presented.

Capacity building training is essential for ensuring that the ESMP requirements are implemented. To this end, the relevant training and capacity building programs have been identified as pre-requisite for effective implementation of the Ibore gully erosion site rehabilitation project. The training course content, duration, target participants and the estimated cost are clearly documented.

The total cost for the implementation of the Ibore Gully Rehabilitation ESMP add up to US$ 132,857. This cost also include Monitoring and Evaluation, as well as the Capacity Building Activities.

CHAPTER SEVEN: Summary and Conclusion

Concise summary of each of the preceding chapters was presented here, and it was concluded that with careful implementation of this ESMP, the various phases of the proposed intervention project in Ibore Gully site would be realized with minimal residual impacts to the physical, biological and social environment of the project affected communities.

CHAPTER ONE
INTRODUCTION

1.1 Introduction

Erosion is one of the surface processes that sculpture the earth's landscape and constitutes one of the global environmental problems. Soil erosion is perhaps the most serious mechanism of land degradation in the tropics (El-Swaify *et al.,* 1982). However, gully erosion is visually the most impressive of all types of erosion (El-Swaify, 1990), highly visible and affects soil productivity, restricts land use and can threaten roads, fences, buildings and human life (Afegbua *et al* 2016). It has been described as a well-defined water worn channel (Monkhouse and Small, 1978); a recently extended drainage channel that transmits ephemeral flow, steep side, steeply sloping or vertical head scarf with a width greater than 0.3 m and a depth greater than 0.6 m (Brice, 1966); a V or U-shaped trench in unconsolidated materials with a minor channel in the bottom, but not necessarily linked to a major stream (Graf, 1983); as well as a relatively deep, vertical-walled channel recently formed within a valley where no well-defined channel previously existed (Bettis III 1985). Gully erosion is an advanced stage of rill erosion where surface channels have been eroded to the point where they cannot be smoothened over by normal tillage operations (Hilborn, 1985).

Like in other parts of the world, gully erosion is one of the major environmental challenges facing Nigeria. The menace is more predominant in the eastern, southeastern and some parts of southwestern part of the country with Southeastern part regarded as gully erosion region (Igbokwe *et al* 2008) probably due to susceptibility of the soils in southern part of the country to erosion as well as varied underlying geology. Whilst Edo and Kogi states are most affected in southwestern Nigeria; Abia, Anambra, Ebonyi, Enugu, and Imo states are most affected in the southeast. In Edo state which is geologically underlain by sedimentary terrain, crystalline basement as well as sedimentary/crystalline basement contact; Ibore gully site is one of the ten gully erosion sites that has been selected by the State Project Management Unit (SPMU) of the Nigeria Erosion and Watershed Management Project (NEWMAP) for Engineering design and construction works in a bid to control

the erosion, inhibit the advancement of the gully from causing further damage and rehabilitate the eroded gullies.

1.2 Overview of the Nigeria Erosion and Watershed Management Project (NEWMAP)

The Government of Nigeria is implementing the multi-sectoral Nigeria Erosion and Watershed Management Project (NEWMAP), which are financed by the World Bank, Global Environment Facility, the Special Climate Change Fund, and the Government of Nigeria. NEWMAP finances activities implemented by States and activities implemented by the Federal government. The project currently includes 7 states, namely Anambra, Abia, Cross River, Edo, Enugu, Ebonyi, and Imo.

The lead agency at the Federal level is the Federal Ministry of Environment (FMEnv), Department of Erosion, Flood and Coastal Zone Management. State and local governments, local communities and CSOs are or will be involved in the project, given that the project is a multi-sector operation involving MDAs concerned with water resources management, public works, agriculture, regional and town planning, earth and natural resources information, and disaster risk management.

The development objective of NEWMAP is: to rehabilitate degraded lands and reduce longer-term erosion vulnerability in targeted areas. At State level, NEWMAP activities involve medium-sized civil works such as construction of infrastructure and/or stabilization or rehabilitation in and around the gullies themselves, as well as small works in the small watershed where gullies form and expand. These works trigger the World Bank's Safeguard Policies including Environmental Assessment OP 4.01; Natural Habitats OP 4.04; Cultural Property OP 11.03; Involuntary Resettlement OP 4.12 Safety of Dams OP 4.37; Pest Management Safeguard Policy OP 4.09; and Projects on International Waterways OP 7.50.

1.3 Environmental and Social Safeguards Concerns

The World Bank Environmental and Social Safeguards concerns for the NEWMAP are addressed by the policies that provide guidelines for the identification, preparation, and implementation of projects. These several policies are used to address environmental and social safeguards concerns for projects and these include but not limited to EA (OP/BP 4.01), Natural Habitats (OP/BP 4.04), and Forests (OP4.36) etc.

Other documents already prepared under the project include an Environmental and Social Management Framework (ESMF), Resettlement Policy Framework (RPF), the Project Appraisal Document (PAD) and the Project Implementation Manual (PIM). Specifically engineering designs are also prepared for the site-specific gully sites.

This report therefore focuses on the Environmental and Social Management Plan (ESMP) developed for the Ibore Gully Erosion Site in Esan Central Local Government Area of Edo State. The NEWMAP intends to reclaim and rehabilitate the gully erosion site so as to reduce the environmental impacts created in the targeted area. The proposed activities will employ some civil works such as channelization, remediation works of the gully site. The drainage systems upstream of the gully and possible ways of stabilising the gully have previously been examined in the Stormwater Master Planning and Concept Design Study. Details of the study and the approved conceptual designs are included in the Stormwater Master Planning and Conceptual Design Report – Part 1, revision 02 dated 30 November 2015.

This ESMP is prepared in accordance with standard procedures for environmental assessment including the applicable World Bank (WB) Environmental and Social Safeguard policies and Nigerian environmental assessment guidelines.

1.4 Objectives of the Proposed Intervention Project in Ibore Gully Site

The Nigeria Erosion and Watershed Management Project (NEWMAP) aims to reduce vulnerability to soil erosion in targeted sub-catchments. This eight-year innovative, multi-sectoral project will finance state-led interventions to prevent

and reverse land degradation and will initially focus on gully erosion sites that threaten infrastructure and livelihoods.

The aims of the Ibore gully project are:

- To route the catchment flow around the gully head so as to bypass the head of the gully and to discharge the flow back into the gully at a safe distance downstream;
- To manage the energy of the flowing waters in such a way that the flow discharges back into the gully in a controlled manner;
- To manage the flow in the downstream section of the gully so as to limit velocities, reduce lining requirements and to ensure that extensive vegetation cover is established as part of the river protection and reinstatement;
- To reinstate the backfilled gully head with suitable vegetative measures combined with appropriate landscaping;
- To provide facilities with sufficient capacity to intercept surface flows into the gully bypass system;
- To rehabilitate the damaged rural tarred road; and
- To reroute the channel to protect the gas pipeline at the downstream section of the gully.

1.5 Scope of the Project Work In Ibore

The scope of the work is as follow:

- Desk studies, a field investigation and a site assessment;
- A detailed topographical survey of the affected area;
- Hydrological studies to determine storm water runoff;
- The engineering design of all structures including:
    - Hydraulics
    - Reinforced concrete
    - Slope stability
    - Layout and earthworks
    - Design for risk and safety;

- Preparation of a Bill of Engineering Measurement and Evaluation (BEME), priced and unpriced;
- Tender documentation; and
- The final design report.

1.6 Rationale for the ESMP

A project's environmental and social management plan (ESMP) consists of the set of mitigation, monitoring, and institutional measures to be taken during implementation and operation to eliminate adverse environmental impacts, offset them, or reduce them to acceptable levels. The plan also includes the actions needed to implement these measures. The ESMP is an essential safeguard element for Category B projects, such as the planned gully erosion rehabilitation works in Ibore, Edo State.

This Environmental and Social Management Plan (ESMP) is therefore an important project management strategy that will manage the proposed Ibore gully erosion site rehabilitation project activities such that the potential environmental and social impacts arising from the project implementation will be mitigated, avoided or eliminated.

The ESMP outlines Edo State NEWMAP Project Management Unit's corporate commitment to managing the project implementations in a sustainable manner. The ESMP will also ensure compliance with applicable environmental standards all through the life span of the projects. The Bank will disclose the ESMP document publicly, in Nigeria and at the World Bank Info- shop before project implementation.

1.7 Objectives of the ESMP

The objective of the Environmental and Social Management Plan (ESMP) is to set out the measures to be taken in addressing the identified adverse impacts of the various components and activities of the project. In addition, the ESMP is meant to develop procedures and plans to ensure that the mitigation measures will be implemented throughout the phases for the Remediation work of Ibore Gully Erosion site.

Specific objectives of this ESMP include the following:

Specifically, as indicated in the Terms of Reference (ToR) document provided as part of the contractual process for the project, the following objectives are outlined:

1) ESMP will include the measures needed to implement these actions, addressing the adequacy of the monitoring and institutional arrangements for the upper and lower watersheds in the intervention site.

1.8 Specific Tasks

The consultant is required to carry out the following tasks:

- Describe biophysical and social environment including the existing status of the sub-watershed (Upper/Lower) and gullies;
- Identify the potential environmental and social issues/risks associated with the intervention;
- Drawing on the feasibility and engineering report and site design, appropriate baseline indicators (for example, m^3/sec of runoff collected in the sub-watershed during a heavy hour-long rainfall).
- Develop a plan for mitigating environmental and social risks associated with construction and operation in the gully intervention in consultation with the relevant public and government agencies;
- Identify feasible and cost-effective measures that may reduce potentially significant adverse environmental and social impacts to acceptable levels;
- Develop a time-bound plan for mitigating environmental and social risks associated with the specific intervention in the designated sub-watershed management in consultation with the relevant public and government agencies;
- Identify feasible and cost-effective measures that may reduce potentially significant adverse environmental and social impacts to acceptable levels;

- Identify monitoring objectives and specifies the type of monitoring, with linkages to the impacts assessed and the mitigation measures described above (in bullets 1-5);
- Provide a specific description of institutional arrangements: the agencies responsible for carrying out the mitigation and monitoring measures (e.g., for operation, supervision, enforcement, monitoring of implementation, remedial action, financing, reporting, and staff training) and the contractual arrangements for assuring the performance of each implementing agency;
- Define technical assistance programs that could strengthen environmental management capability in the agencies responsible for implementation;
- Provide an implementation schedule for measures that must be carried out as part of the project, showing phasing and coordination with overall project implementation plans; and
- Provide the expected capital and recurrent cost estimates and sources of funds for implementing the ESMP and inform accordingly the design consultants so that these costs are duly taken into consideration in the designs.
- Other tasks: The consultant shall assist the SPMU to:
    i. Register the ESMP with the environmental assessment (EA) departments at Federal and State levels; and
    ii. Disclose the finalized ESMP at National, State, LGA and Community levels.

1.9 Scope of Work

Based on the terms of reference provided as part of the contract for this ESMP, it is expected that the consultant shall work in close collaboration with the SPMU project team, and the various other Agencies involved in the projects. The consultant shall visit the two intervention sites, to have a first-hand overview of the situation on ground at the sites, so that he will have adequate knowledge of the requirements for the ESMP, and identify the proposed management strategies to ensure the environment is appropriately protected and environmental issues are appropriately mitigated.

The specific scope of work will include the following:

A. The consultant is expected to prepare the Environmental and Social Management Plan (ESMP) taking into consideration the activities in the intervention sites at Ibore community.
B. The Consultant will prepare an ESMP, which will contain an environmental and social checklist, to be used as a screening mechanism for the identified activities of the project.
C. The consultant will identify any regulations and guidelines, which will govern activities of the nature contemplated by the proposed project including National and State legislation and regulations.

1.10 Deliverables

The deliverable will include the preparation of Inceptions, draft and final ESMP Report, which will be acceptable to the Edo –NEWMAP SPMU Edo State, and to the World Bank.

CHAPTER TWO

POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 Introduction

This section presents an overview of relevant regulations, treaties and conventions that apply directly or remotely to the proposed intervention project. The presentation here is essentially a brief summary of the relevant/applicable provisions of each guideline.

2.2 Legal and Administrative Framework

A number of national and international environmental guidelines are applicable to the operation of the NEWMAP. In Nigeria, the power to enforce all activities that might impact the environment is vested in the Federal Ministry of Environment (FMEnv). Internationally, agencies such as the World Bank, IFC and other financial organizations usually set environmental criteria for projects, which must be met by project proponents before the agencies could invest in them.

2.2.1 Administrative Structure for Environmental Management at the Federal (National) Level

Power for the management of the biophysical and socio-economic environment in Nigeria was vested in the now defunct Federal Environmental Protection Agency (FEPA), which was absorbed into the Federal Ministry of Environment (FMEnv) in 1999. Specific guidelines and regulations of the FMEnv are highlighted below:

2.2.1.1 Federal Ministry of Environment

The act establishing the Ministry places on it the responsibility of ensuring that all development and industry activities, operations and emissions are within the limits prescribed in the National Guidelines and Standards, and ensure compliance with the relevant regulations for environmental pollution management in Nigeria as may be specified by the Ministry. To fulfill this mandate, a number of regulations/instruments are available (see “section on National Legal Instruments on Environment”), however, the main instrument in ensuring that environmental and social issues are mainstreamed into

development projects is the Environmental Impact Assessment (EIA) Act No. 86 of 1992. With this Act, the FMEnv prohibits public and private sectors from embarking on major prospects or activities without due consideration, at the early stages, of environmental and social impacts. The act makes an EIA mandatory for any development project, and prescribes the procedures for conducting and reporting EIA studies.

As part of the effective utilization of the EIA tool, the Ministry has produced 'Sectoral Guidelines' detailing the necessary requirements of the EIA process for each Sector. One of these Sectoral Guidelines that is applicable to the proposed project is the 'Sectoral Guidelines on Infrastructure Development'.

Within the FMEnv, there is the Environmental Impact Assessment Division, headed by a Director; to take all responsibilities for EIA related issues. Still within the EIA division in FMEnv, is the Impact Mitigation Monitoring (IMM) unit, with the special responsibility for monitoring the implementation of Environmental Management Plans (EMP) contained in the approved EIAs.

As contained in FEPA Acts 58 of 1988 and EIA of 1992 (Amended as EIA Act Cap 12, LFN 2004), FMEnv has put in place statutory documents to aid the monitoring, control and abatement of industrial wastes. The statutory documents currently in place include though are not necessarily limited to:

i. National Policy on the Environment, 1999;
ii. National Environmental (Soil Erosion and Flood Control) Regulations, 2010 (S.I.12);
iii. National Environmental Protection (Effluent Limitations) Régulations (S.1.8) 1991 ;
iv. National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) (S.1.9) 2004;
v. National Environmental Protection (Management of Solid and Hazardous Wastes) Regulations (S.1.15) 1991;
vi. Guidelines and Standards
for Environmental Pollution Control in Nigeria 1991;
vii. Sectorial Guidelines for EIA 1995;
viii. Harmful Wastes (Criminal Provisions) Decree No. 42, 1988;

ix. National Policy on the Environment, 1989;
x. Environmental Impact Assessment Procedural Guidelines, 1995;
xi. Environmental Impact Assessment (EIA) Act No. 86 of 1992; and
xii. Environmental Impact Assessment (Amendments) Act, 1999.
xiii. National Guidelines and Standards for Water Quality, 1999
xiv. National Guidelines on Environmental Management Systems (EMS), 1 999
xv. National Guidelines on Environmental Audit in Nigeria, 1999

These statutory documents clearly state the restrictions imposed on the release of toxic substances into the environment and the responsibilities of all industries whose operations are likely to pollute the environment. Such responsibilities include provision of antipollution equipment and adequate treatment of effluent before being discharged into the environment.

FMEnv also has put in place procedural and sectorial guidelines detailing the EIA process including a categorization of environmental projects into Categories I, II and III (referred to by the World Bank as categories A, B and C respectively). The guidelines require that a complete EIA be performed for category I projects, Category II projects may not require an EIA depending on the screening criteria, while Category III projects do not require an EIA.

In addition to the guidelines for EIA, Decree No. 86 contains provisions for the screening of projects according to impact potential, including listed activities for which mandatory EIA preparation is required:

a. Category I projects will require a full Environmental Impact Assessment (EIA).
b. Category II projects may require only a partial EIA, which will focus on mitigation and environmental planning measures, unless the project is located near an "Environmentally Sensitive Area" (ESA) in which case a full EIA is required.
c. Category III projects are considered to have "essentially beneficial impacts" on the environment, for which Environmental Impact Statement (EIS) will be prepared.

2.2.1.2 National Environmental Standards and Regulations Enforcement Agency (NESREA)

NESREA Act 27 of 2007 established the National Environmental Standards and Regulations Enforcement Agency (NESREA), and the Agency works under the FMEnv. NESREA is saddled with the responsibility of the protection and development of the environment, biodiversity conservation and sustainable development of Nigeria's natural resources in general and environmental technology, including coordination and liaison with relevant stakeholders within and outside Nigeria on matters of enforcement of environmental standards, regulations, rules, laws, policies and guidelines. The functions of the Agency include:

- Enforcement of compliance with laws, guidelines, policies and standards on environmental matters;
- Coordinate and liaise with stakeholders, within and outside Nigeria, on matters of environmental standards, regulations and enforcement;
- Enforce compliance with the provisions of international agreements, protocols, conventions and treaties on the environment including climate change, biodiversity conservation, desertification, forestry, oil and gas, chemicals, hazardous wastes, ozone depletion, marine and wild life, pollution, sanitation and such other environmental agreements as may from time to time come into force;
- Enforce compliance with policies, standards, legislation and guidelines on water quality, environmental health and sanitation, including pollution abatement;
- Enforce compliance with guidelines and legislation on sustainable management of the ecosystem, biodiversity conservation and the development of Nigeria's natural resources;
- Enforce compliance with any legislation on sound chemical management, safe use of pesticides and disposal of spent packages thereof;
- Enforce compliance with regulations on the importation, exportation, production, distribution, storage, sale, use, handling and disposal of hazardous chemicals and wastes, other than in the oil and gas sector;

- Enforce through compliance monitoring, the environmental regulations and standards on noise, air, land, seas, oceans and other water bodies other than in the oil and gas sector;
- Ensure that environmental projects funded by donor organizations and external support agencies adhere to regulations in environmental safety and protection;
- Enforce environmental control measures through registration, licensing and permitting systems other than in the oil and gas sector;
- Conduct environmental audit and establish data bank on regulatory and enforcement mechanisms of environmental standards other than in the oil and gas sector;
- Create public awareness and provide environmental education on sustainable environmental management, promote private sector compliance with environmental regulations other than in the oil and gas sector and publish general scientific or other data resulting from the performance of its functions; and
- Carry out such activities as are necessary or expedient for the performance of its functions.

2.2.1.3 Other Relevant National Policies and Regulations

National Environmental (Soil Erosion and Flood Control) Regulations, 2010 (S.I.12)

The overall objective of this regulation is to check all earth-disturbing activities, practices or developments for non-agricultural, commercial, industrial and residential purposes.

Natural Resources Conservation Council Act 286 of 1990

This provision is aimed at establishing the Natural Resources Conservation council to be responsible for the conservation of natural resources of Nigeria and to formulate national policy for natural resources conservation.

The National Policy on the Environment 1989

The National Policy on Environment, 1989 (revised 1999), provides for "a viable national mechanism for cooperation, coordination and regular consultation, as well as harmonious 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 objective of the policy is to achieve sustainable development in Nigeria and, in particular to:

- Secure a quality environment adequate for good health and well-being;
- Conserve the environment and natural resources for the benefit of present and future generations;
- Raise public awareness and promote understanding of the essential linkages between the environmental resources and development, and encourages individual and community participation in environmental improvement efforts;
- Maintain and enhance the ecosystems and ecological processes essential for the functioning of the biosphere to preserve biological diversity; and
- Co-operate with other countries, international organizations and agencies to achieve optimal use and effective prevention or abatement of trans-boundary environmental degradation.

Proposed Nigerian Environmental Management Act No. 20 of 2004

This act was drafted following the amalgamation of FEPA and FMEnv (see section 2.1.2) but was never ratified. The proposed Act sought to repeal the 1988 FEPA Decree No.58 (amended No.59 and No.14). It does not repeal any other environmentally related legislation. As well as the general environmental provisions, which include environmental sanitation and occupational health, it specifies the powers of authorized officers, penalties and fines. The Act gives the Minister the authority to grant

environmental permits for prescribed activities that include sand mining but not any other mining activities.

Land Use Act 1978

The legal basis for land acquisition and resettlement in Nigeria is the Land Use Act 1978 and modified in 1990. The followings are the selected relevant sections:

Section 1: Subject to the provision of this Act, all land comprised in the territory of each state in the Federation are hereby vested in the Governor of each state, and such land shall be held in trust and administered for the use and common benefit of all Nigerians in accordance with the provisions of this Act.

Section 2: (a) All land in urban areas shall be under the control and management of the Governor of each State; and (d) all other land shall be under the control and management of local government within the area of jurisdiction in which the land is situated. Therefore, according to the Land Use Act, all land in Nigeria is vested in the Governor of each State, and shall be held in trust for the use and common benefit of all people.

The administration of land area is divided into urban land, which will be directly under the control and management of the Governor of each State; and nonurban land, which will be under the control and management of the Local Government. The Governor of each State will have the right to grant statutory rights of occupancy to any person or for any purpose; and the Local Government will have the right to grant customary rights of occupancy to any person or organization for agricultural, residential and other purposes.

The Act gives the government the right to acquire land by revoking both statutory and customary rights of occupancy for the overriding public interest. In doing so, the Act specifies that the State or Local Government should pay compensation to the current holder or occupier with equal value.

2.2.2 Edo State Regulations Relating to Environmental Management

Edo State Sanitation and Pollution Management Law No. 5 of 2010

The statutory responsibility of protecting and/or ensuring the protection of the environment in Edo State rests on the Edo State Ministry of Environment. Relevant sections of this provision are as follows:

Section 8 is a provision on Disposal of Refuse. Subsection 1 prescribes that 'No person shall dispose of refuse or waste except through a Waste Manager approved by the Board or appropriate authority for the area where he resides or carries on business'.

Subsection 2 states that it shall be an offence for any person to bury; burn or dispose waste in drains or moat.

Section 13 provides for Maintenance of Drains, Sewage and Septic Tanks.

Subsection 1 prescribes that every person shall:

a. Clean and maintain any drain in the frontage, sides or rear of his tenement or building; and
b. Provide suitable holding tank for liquid waste or sewage and ensure regular evacuation and disposal of it.

Subsection 2 provides that no person shall cause or knowingly permit any sewage effluent or liquid waste to be discharged into any drain or drainage system, road, gorges, water courses or any part thereof except at such place as may be authorized by the appropriate authority.

Section 16, subsection 1 prohibits throwing or burying of industrial or commercial waste on any tenement or open space.

Subsection 2 prohibits erection or construction of or use of an incinerator without prior approval or permit of the appropriate authority or its designate and

Subsection 3 prohibits the setting of fire to the contents of any owned litterbin.

Section 34 subsections 1 stipulates the periodic payment of Environmental Remediation and Pollution Management Levy for environmental remediation, management and pollution related activities in the State by all industrial or commercial establishment in the State.

Subsection 7 stipulates the right of the appropriate authority to seal-up any business or commercial organization that refuses to obey the Environmental Remediation and Pollution Management.

Subsection 9 provides a penalty of two million naira (N2, 000,000) for any corporate organization that breaks the seal and open such sealed premises.

Section 36 is Dumping of Toxic waste and electrical or electronic waste in the State.

Subsection 3 stipulates that electronic/electrical waste generated within the State may be disposed off in manner as may be specified by the appropriate authority, with emphasis on recycling of useful components.

Subsection 4 prohibits the translocation, disposal or dumping of radioactive waste in any part of the State.

Subsection 5 provides a penalty of fine as prescribed in the schedule to the State or a term of imprisonment of 10 years or both fine and imprisonment.

Section 45 is Environmental Impact Assessment (EIA) and Related Matters in the State. Subsection 1 provides that all development projects in the State shall undergo EIA process before commencement under the supervision of the appropriate authority. Subsection 4 provides a fine of not less than Five Million Naira (N5, 000,000) and/or closure of such facility of any company, establishment, corporate organization etc. who contravenes this section and is convicted.

Section 45 is Environmental Auditing of all Industrial Facilities. This section mandates the conduct of periodic (every 2 years) Environmental Audit on facilities and operations of all industrial establishments whose activities have or are likely to have environmental impacts. It also mandates such audit to be

carried out by Federal and State Ministry of Environment accredited Consultant. The section also prescribes a fine to any defaulter.

Section 47, subsection 1, prescribes the establishment of Environment, Health and Safety (EHS) units in each corporate organization or company.

Subsection 2 prescribes a minimum fine of ten thousand naira (N10, 000) and a maximum of One million naira (N1, 000,000) and/or closure of such facilities of any corporate organization or group who fails to establish or create EHS units with relevant personnel with required basic qualifications, experience and training.

Section 52, subsection 1 provides that it is the sole responsibilities of all who impact negatively on the environment to provide adequate and timely funding for the remediation of all impacted sites and ecosystems in the State; including the logistics for rapid response to distress calls/signals from the impacted/degraded zone(s). Subsection 4 prescribes a fine of not less than Ten million naira (N10, 000,000) for corporate organisations that contravenes provisions of section 52.

Section 59 provides the creation of Special Environmental Protection court for the purpose of trying cases relating to degradation, pollution and abuses of land, air and water, environmental remediation and pollution management levy and payment of compensation, claims and all other environmental quality management related matters.

Section 60 prescribes the polluter pay principle (PPP).

Subsection 1 stipulates that owners and/or operators of facilities shall be responsible for confirmatory test/experiments that shall be carried out from time to time to ascertain their various claims as to the status of their immediate impacted environment.

2.2.3 International Regulatory Framework

A number of international regulations apply to this project. Some of these regulations and guidelines include but not limited to the following:

World Bank OP/BP 4.01: Environmental Assessment (EA)

This is one of the 10+2 Environmental and Social Safeguard Policies of the World Bank. It is used in the Bank to examine the potential environmental risks and benefits associated with Bank lending operations. Under OP/BP 4.01, Bank lending operations are broadly defined to include investment lending, sector lending, rehabilitation, lending through financial intermediaries, and investment components of hybrid lending. Prototype Carbon Fund (PCF) and Global Environmental Facility (GEF) co-financed projects are also subject to the provisions of OP/BP 4.01.

Under this guideline, The Bank requires environmental assessment (EA) of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision making. EA evaluates a project's potential environmental risks and impacts in its area of influence; examines project alternatives; identifies ways of improving project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation. The Bank favours preventive measures over mitigatory or compensatory measures, whenever feasible.

EA takes into account the natural environment (air, water, and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples, and physical cultural resources); and trans-boundary and global environmental aspects. EA considers natural and social aspects in an integrated way. It also takes into account the variations in project and country conditions; the findings of country environmental studies; national environmental action plans; the country's overall policy framework, national legislation, and institutional capabilities related to the environment and social aspects; and obligations of the country, pertaining to project activities, under relevant international environmental treaties and agreements.

The Bank does not finance project activities that would contravene such country obligations, as identified during the EA. EA is initiated as early as

possible in project processing and is integrated closely with the economic, financial, institutional, social, and technical analyses of a proposed project. The Bank undertakes environmental screening of each proposed project to determine the appropriate extent and type of EA. The Bank classifies the proposed project into one of four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts.

***Category A*:** A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works. EA for a Category A project examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including the "without project" situation), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. For a Category A project, the borrower is responsible for preparing a report, normally an EIA (or a suitably comprehensive regional or sectorial EA) that includes, as necessary, elements of the other instruments referred to in paragraph 7.

***Category B*:** A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas--including wetlands, forests, grasslands, and other natural habitats--are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigation measures can be designed more readily than for Category A projects. The scope of EA for a Category B project may vary from project to project, but it is narrower than that of Category A. Like Category A EA, it examines the project's potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. The findings and results of Category B EA are described in the project documentation (Project Appraisal Document and Project Information Document).

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

***Category FI*:** A proposed project is classified as Category FI if it involves investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts.

For projects that require Banks funding, the borrower is responsible for carrying out the EA. For Category A projects, the borrower retains independent EA experts not affiliated with the project to carry out the EA. For Category A projects that are highly risky or contentious or that involve serious and multidimensional environmental concerns, the borrower should normally also engage an advisory panel of independent, internationally recognized environmental specialists to advise on all aspects of the project relevant to the EA. The role of the advisory panel depends on the degree to which project preparation has progressed, and on the extent and quality of any EA work completed, at the time the Bank begins to consider the project.

Depending on the project, a range of instruments can be used to satisfy the Bank's EA requirement: environmental impact assessment (EIA), regional or sectorial EA, environmental audit, hazard or risk assessment, and environmental management plan (EMP). EA applies one or more of these instruments, or elements of them, as appropriate. When the project is likely to have sectorial or regional impacts, sectorial or regional EA is required.

Other Banks guidelines and procedures that were considered in this study include: Natural Habitats (OP 4.04), Pest Management (OP 4.09), Physical Cultural Resources (OP 4.11), Involuntary Resettlement (OP 4.12), Safety of Dams (OP 4.37), and Projects on International Waterways (OP 7.50).

An overview of the specific World Bank Ops that are triggered by the current projects in Ibore are shown in **Table 2.1** below.

Table 2.1: Summary of IFC Performance Standards and their applicability to the proposed Project

Operational Policy	Requirements	Rationale	EIA Reference
OP 4.01: Environmental Assessment	The OP requires that the Project initiate regular assessment of the potential social and environmental risks and impacts and consistently tries to mitigate and manage these potential impacts on an on-going basis.	The Project has environmental and social aspects[1], which may pose potential E&S risks and/or impacts. These include for example, land clearing, civil work activities, and engagement of labour. Best practice suggests that all projects, as long as E&S aspects exist, should possess systems for assessing and managing the potential risks and impacts resulting from such E&S aspects. Therefore OP 4.01 is applicable.	Chapter 3 – Existing Biophysical Environment of the Project Area Chapter 6 – Project Impacts and Mitigation Measures Chapter 7 – Environmental and Social Management Plan (ESMP)
OP 4.09: Pest Management	In assisting borrowers to manage pests that affect either agriculture or public health, the Bank supports a strategy that promotes the use of biological or environmental control methods and reduces reliance on synthetic chemical pesticides. In Bank-financed projects, the borrower addresses pest management issues in the context of the project's environ-mental assessment	In the event that swamps develop in the areas where diverted floodwaters are channelled, pest issues may arise, especially disease pathogens and thus require pest management. Therefore, OP 4.09 is applicable to this project.	Chapter 6 – Impacts and Mitigation
OP 4.12: Involuntary resettlement	The Project is required to develop a resettlement action plan so that physically or economically displaced individuals have their living conditions and livelihoods restored or improved.	There will be need to acquire some land and property, including farmlands, to create room for the diversion as well as to arrest the continued development of the existing gullies. Therefore OP 4.12 is applicable to this project	Chapter 3 – Existing Biophysical Environment of the Project Area Chapter 6 – Project Impacts and Mitigation Measures Chapter 7 –

[1] *An environmental or social aspect is defined as an element of a project's activities, operations, products, or services that can or does interact with the environment, people, surrounding communities and/or the larger society.*

Operational Policy	Requirements	Rationale	EIA Reference
			Environmental and Social Management Plan (ESMP)

Other International Conventions

In her responsiveness and responsibility in regional and global efforts towards sustainable development particularly in the safeguard of the environment and natural resources, Nigeria has entered into a number of international treaties and conventions. Being signatory to the conventions, Nigeria pledges to uphold the principles of such conventions. Some of the conventions considered in this project are as follows:

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

This convention came into force in Nigeria on 7th May 1974. The objectives of the convention is to encourage individual and joint action for the conservation, utilization and development of soil, water flora and fauna for the present and future welfare of mankind, from an economic, nutritional, scientific, educational, cultural and aesthetic point of view.

Convention on Wetland of International Importance, Especially as Water Fowl Habitat, Ramsar, Iran, 1971

This provision came into force in Nigeria on 2nd February 2001 with the objective to stem the progressive encroachment on and loss of wetlands now and in the future, recognizing the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value.

Convention on Biological Diversity, Rio de Janerio, 1992

This convention came into force in Nigeria on 27th November 1994. The objectives are to conserve biological diversity, promote the sustainable use of its components and encourage equitable sharing of the benefit arising out of the utilization of genetic resources. Such equitable sharing includes

appropriate access to genetic resources as well as appropriate transfer of technology, taking into account existing rights over such resources.

Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora, Washington, D.C., on 3 March 1973; Amended at Bonn, on 22 June 1979

This convention identifies floral and/or faunal species that are threatened with extinction and in which trade and exportation may play a part in accelerating their extinction. It also places restrictions on trade in such species and stipulates measures to be taken by parties to the convention, which include penalties for trade in listed species and options for confiscation and/or return to original place the species were taken from.

CHAPTER THREE

DESCRIPTION OF BIOPHYSICAL ENVIRONMENT

3.1 Introduction

This section presents the detailed description of the gully erosion site at Ibore in Edo State and the various catchments of the gully erosion are presented in this section of the report. This section also presented an overview of the general biophysical environment setting of Edo State, along with some specific environmental information on the proposed project site. Information presented here was obtained from a combination of sources, including literature (published and unpublished), recent environmental studies around the project site and field sampling and laboratory analyses conducted specifically for this project.

3.2 Description of Erosion Gully Site

3.2.1 Location of the Erosion Gully at Ibore

The Ibore gully erosion site is located in the Esan Central District, approximately 6 km to the east of Ekpoma-Auchi Road. A large erosion gully has grown to a depth of approximately 20 m and has caused the collapse of a main road and several buildings in the residential area of Ibore settlement (**Plate 3.1**). The gully extends over a distance of approximately 1.8 km. The depth of the gully decreases as it moves into a more gently sloping topography and the erosive forces reach a state of equilibrium with the resistance of the natural soil. The depth of the gully decreases to approximately 3 m. The gully is about 5 m wide at the lower end before it crosses the gas pipeline.

A major gas pipeline traverses the natural drainage route. Markings on the pipes indicate that the pipeline belongs to the Nigerian Gas Company Ltd. The natural watercourse traverses the gas pipeline at the lower end of the erosion gully. An inspection of aerial photographs has revealed that the route of the gully has altered in the vicinity of the gas pipe crossing, with the watercourse deviating parallel to the pipeline for a few hundred meters before breaking away and returning to the natural drainage route (**Figure 3.1**). This is possibly because the material surrounding the gas

pipe is more susceptible to erosion than the natural soils alongside it, possibly due to the inadequate compaction of backfilling at the time of construction.

Plate 3.1: A section of the Gully head in Ibore, Esan Central Local Government Area of Edo State, Nigeria

Plate 3.2: Gully at Ibore showing the broken stormwater pipeline that contributes to the gully erosion and the affected Tarred Road as at February 2017

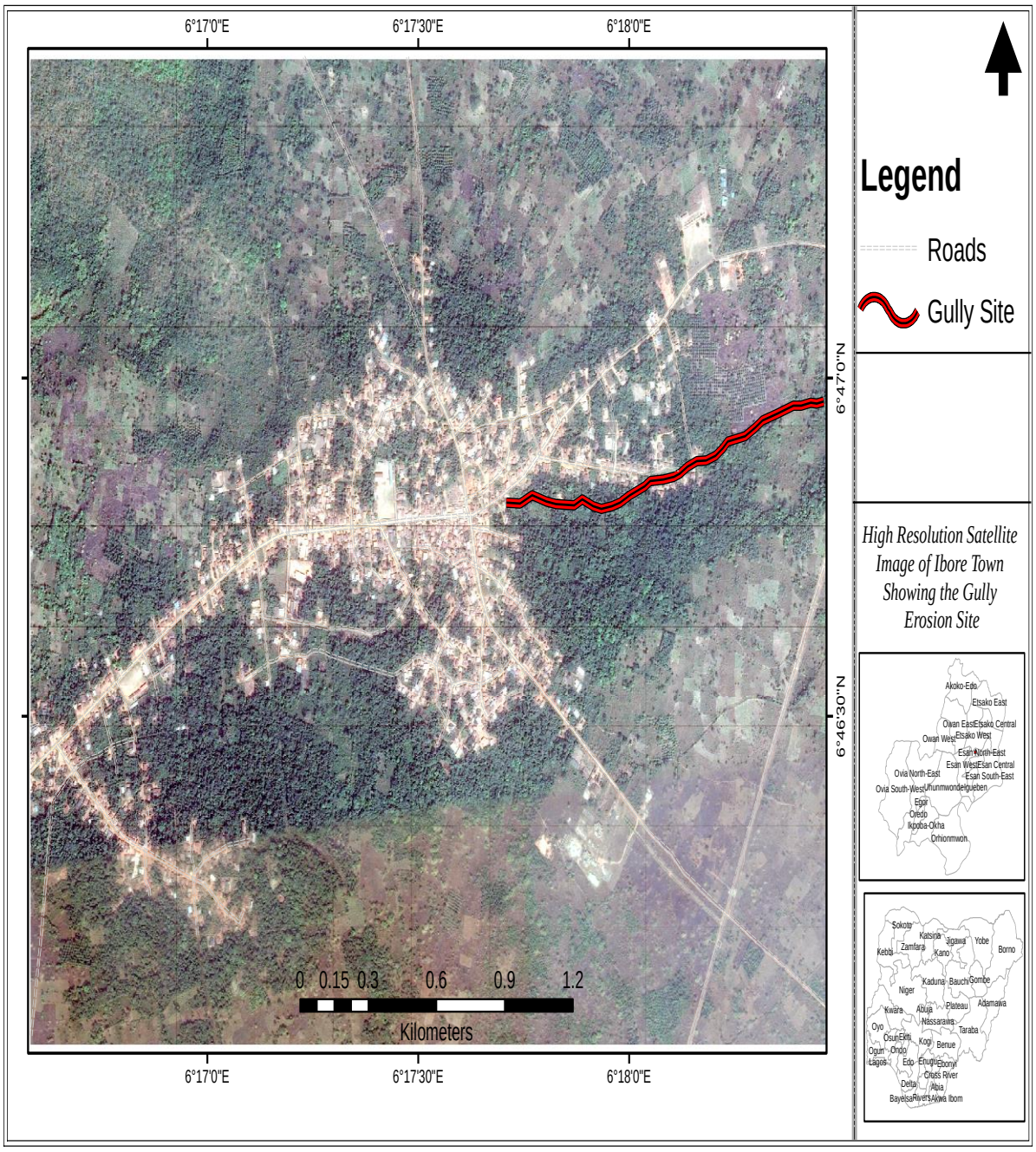


Figure 3.1: Satellite imagery of Gully Erosion Site at Ibore Town.

3.2.2 Description of Ibore Gully Erosion

Ibore gully site is about approximately 2 km long trending WSW-ENE as revealed by top-down or sub-aerial view of the site (**Figure 3.2**). It varies in depth and width with distance away from the gully head ranging about 20 m deep at the gully head to about 5.2 m deep on relatively flat plain at northern end of the gully (**Plate 3.3**). It has led to the collapse of a building (**Plate 3.4**) with some other buildings located southwestern end of the gully head as well as those on the southern side of the gully towards northeastern part under immediate threat. The gully has separated the community thus necessitating the construction of a make-shift bridge (**Plate 3.5**) and step-case on the side of the gully (**Plate 3.6**) as a means of reaching each other.

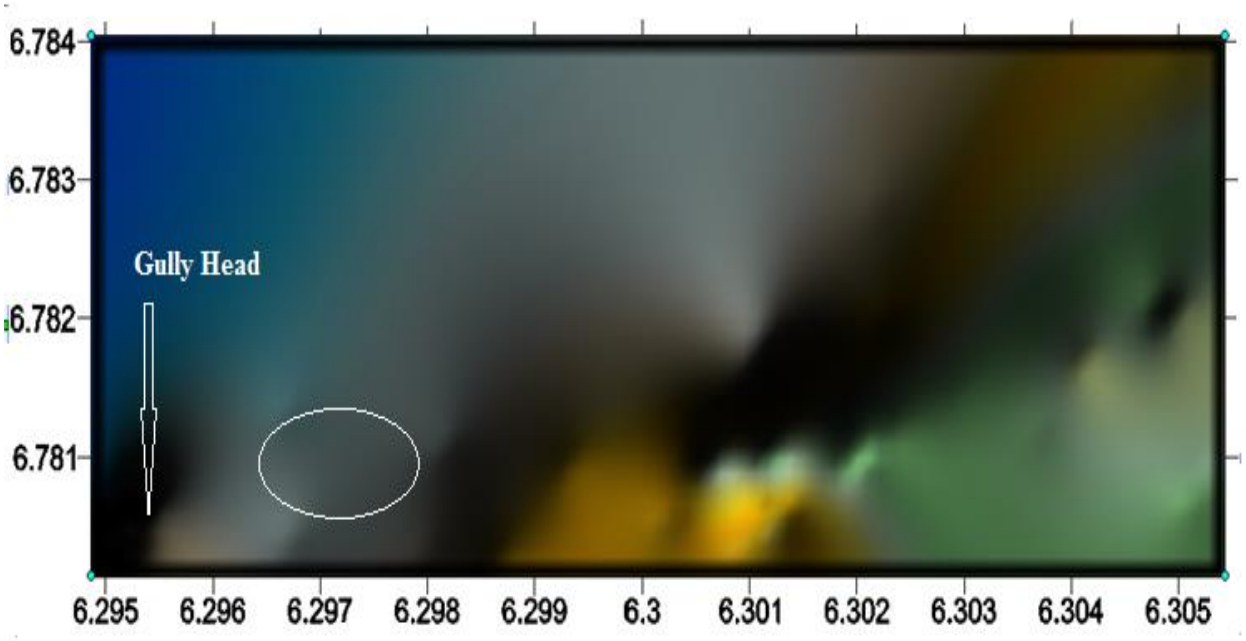


Figure 3.2: Top-down or Sub-aerial view of Ibore Gully site (The area delineated by oval shape is as a result of data gap as that portion of the gully site was in accessible as the time of field visit in February 2017)

Plate 3.3: View of Ibore gully at north-north-western end

Plate 3.4: A collapsed building at Ibore gully head.

Plate 3.5: Step-case made on the gully wall at Ibore

Plate 3.6: A make-shift bridge constructed over the gully at Ibore

A combination of factors has been identified as responsible for the problem including steeply sloping catchment area, resulting in more surface runoff and less infiltration, removal of natural vegetation for urban development, which previously absorbed water, urban development resulting in hardened surfaces, less infiltration and increased surface runoff etc. Three significant catchment areas (**Figure 3.3**) were identified upstream of the erosion gully at Ibore as follow:

- Upper catchment (approximately 17 km²);
- Middle catchment (approximately 19 km²); and
- Lower catchment (approximately 5 km²).

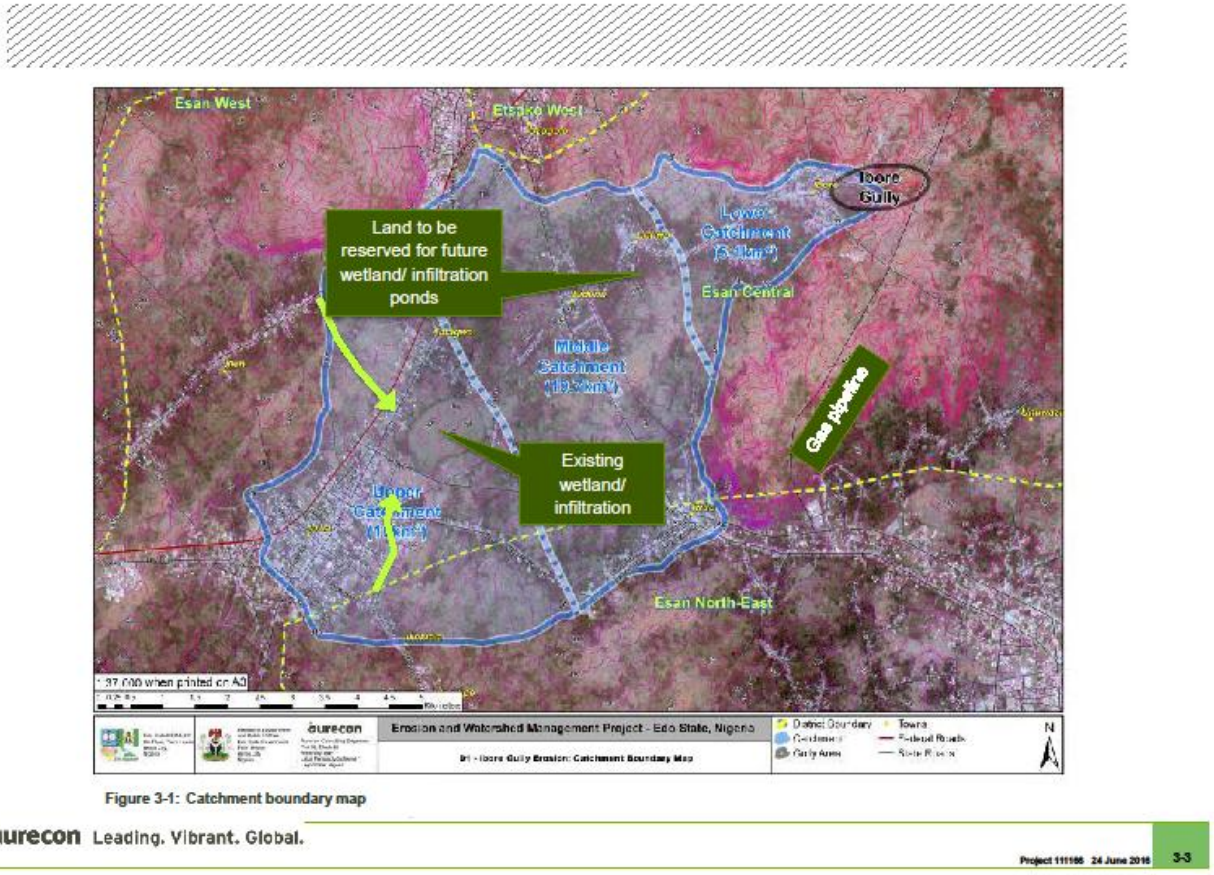


Figure 3-1: Catchment boundary map

Figure 3.3: Catchment Areas of Ibore, Edo State

Findings from recent hydrological survey of Ibore and it's surrounding within and around the gully site indicate as follow:

Upper Catchment:

The upper portion of the catchment, which includes the town of Irrua, drains into a large natural wetland. The upper catchment (approximately 17 km²) forms part of the greater catchment area, it currently drains into a natural wetland and does not appear to contribute any runoff to the Ibore gully. Runoff from this portion of the catchment accumulates in the wetland and is disposed off through the mechanisms of infiltration, evaporation and transpiration by the vegetation.

Since the upper portion of the catchment drains towards the existing wetland near Irrua and has no effect on the Ibore gully, the hydrology of this area has not been studied. It is nevertheless recommended that this area receive further consideration in the future, since ongoing development within the catchment area will result in increased volumes of water being discharged into the wetland and this could result in elevated water levels and flooding of the surrounding areas.

Middle Catchment

Middle catchment (approximately 19 km²) forms part of the greater catchment area that drains towards the Ibore gully. However, due to undulating flat gradients, a poorly defined watercourse and luxuriant vegetation, the runoff from this area also appears to dissipate before it reaches Ibore.

The peak runoff from the middle catchment has been calculated to be in the order of 110 m³/s. However, this runoff does not currently contribute to the flow at Ibore gully site. It is recommended that any future increased volumes of runoff that may develop within this catchment be managed by providing a large detention/infiltration pond in the vicinity of Udowo so as to reduce the runoff discharged to the lower catchment as far as possible. The design that follows is based on the assumption that the middle catchment will not contribute to flows at Ibore gully site. Any overflow to the lower catchment would then need to be managed through the provision of additional ponding in that area.

Lower Catchment

Lower catchment (approximately 5 km²) drains directly to the Ibore gully. It consists of rural and urban areas with roads and includes formalized storm water channels. It was found that only the lower catchment presently contributes to the runoff in the gully. If one assumes that the catchment area is free draining, the peak flows determined by using the rational method for this catchment area are as follows:

Two options for dealing with the drainage from the lower catchment were considered in the concept design phase of this project as follows:

- Option 1: Direct discharge
- Option 2: Reducing peak flows through ponding

The draft Conceptual Design report recommended Option 2 (above) i.e. reduction of peak flows by provision of detention ponds. The costs of this scheme were however fairly high and Aurecon was requested by SPMU to identify options to reduce the cost of the system.

The option of omitting the detention ponds and associated conduits upstream of the gully was then considered (Option 1 above). Although this option requires the provision of somewhat larger conduits into the gully and a larger flow capacity within the gully itself due to the flows not being attenuated, the omission of the upstream detention ponds and associated conduits did reduce costs somewhat. It was also noted that the provision of detention ponding and associated upstream conduits remains possible in the future, should it be necessary for this system to accept runoff from the middle catchment in the future.

3.2.3 Slope of the Land in Ibore

Although the upper and middle catchments are fairly flat, the lower catchment forms a basin with moderate gradients towards the lowest point, where flows are concentrated at the head of the gully. The elevation at the highest point of the lower catchment is approximately 380 m above mean sea level (MSL), while the elevation at the lowest point is about 280 m above MSL.

The middle catchment (approximately 19 km²), which includes the settlements of Eidenu and Udowa, does appear to slope towards the Ibore gully. However, due to undulating but flat gradients, a poorly defined watercourse and luxuriant vegetation, the runoff from this area would appear to dissipate before it reaches Ibore. This situation could, however, change over time, since development in the catchment area would result in increased runoff. The watercourse may also be formalized to reduce flooding and, if this is done, it is conceivable that runoff may be directed towards the Ibore gully.

The design that follows is based on the assumption that the middle catchment will not contribute to flows at Ibore. It will therefore be necessary to manage any future increases in the volumes of runoff within the middle catchment area. Providing a large detention/infiltration pond to serve this portion of the catchment in the vicinity of Udowo can do this. Any overflow to the lower catchment would need to be managed through the provision of additional ponding in that area.

The lower catchment discharges directly into the gully that has grown to enormous proportions. The head of the gully has a depth of approximately 20 m. It has caused the collapse of a main road and several buildings within the residential area of Ibore and poses a great danger to the community.

3.2.4 Topographical Survey of Ibore Gully

The surveys of existing storm water infrastructure and erosion gullies included the following:

- The gully invert and rim (main gully and sub-gullies, locally referred to as “fingers”) from the start point (inlet) to the discharge point (outlet);
- The gully surveys indicate the nature of the stage of gully development (i.e. whether V- or U-shaped) and where local slope stabilization may be needed to prevent damage to assets, etc. near the gully rim;
- The determination of the existing road / carriageway / storm water infrastructure centerline and edges;

- Fixing the infrastructure alignment by using a combination of traversing and tacheometry with total stations and GPS will be used for the control of directions and bearings;
- Cross section surveys of roadways at intervals not exceeding 20 m and not less than 15 m outside the existing right of way (ROW), if applicable;
- The establishment of benchmarks in permanent concrete posts (at 500 m intervals). All benchmarks were plotted and referenced regarding X, Y and Z values on the drawings. Secondary beacons, as required, will also be installed;
- The positions and levels of cross drainage structures, drainage channels and larger drainage structures such as culverts;
- The details of all utilities and services, trees with a girth larger than 0.3 m, buildings, huts, fencing, etc. within the ROW, if applicable; and
- The outline of critical structures that are located near erosion gullies that need to be protected against loss or damage.

The above information was used to generate digital terrain models (DTMs), on which the proposed design was based.

Topography of Ibore Area

The gully is very deeply incised and towards the outlet, becomes shallower. The length of channel in the gully, according to the proposed future alignment, will be about 1,850 m.

3.2.5 Geomorphology and Landscape

The topography around Ibore gully dips south-ward towards the gully with elevation ranging from 880 ft to 1050 ft above sea level (**Figure 3.4**).

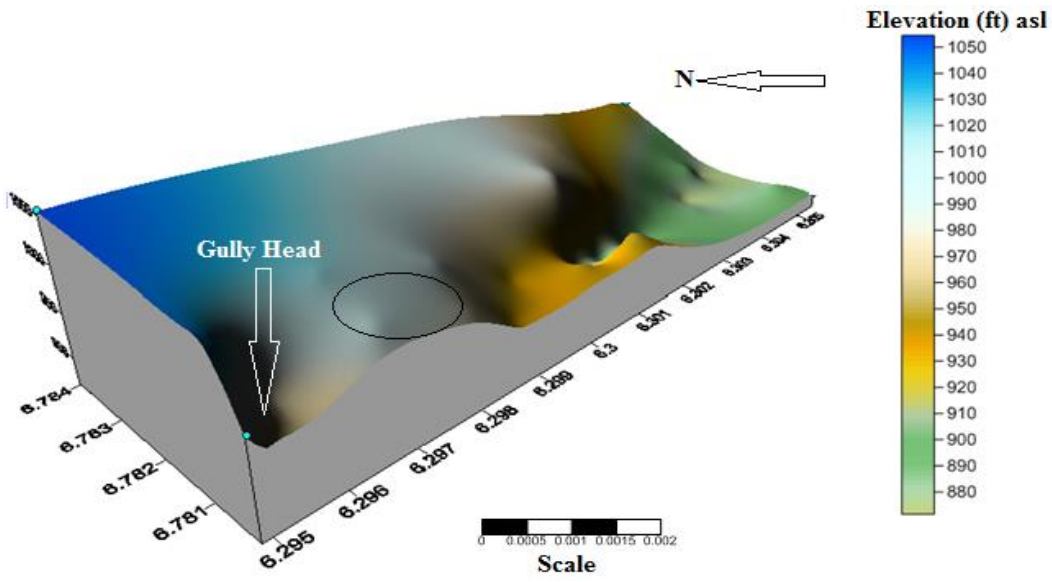


Figure 3.4: Digital Elevation model of the topography around Ibore gully site (The area delineated by oval shape is as a result of data gap as that portion of the gully site was in accessible as the time of field visit in February 2017)

3.2.6 Surface and Groundwater Hydrology

There were neither hand dug wells, water bore hole, nor surface water as at the time of field visit in February 23 through 25 2017. The major source of water is through rain harvest (**Plate 3.7**) suggesting the water table is very deep and might be below the gully bottom thus lending credence to the facts that the gully was caused rather by surface flow and not subsurface flow.

Plate 3.7: Rainwater harvest at Ibore

3.2.7 Watershed and discharge capacity of the gully

Since there were no hand-dug wells but a single borehole; the groundwater flow pattern and hence recharge and discharge area could not be delineated. Furthermore; the absence of hand-dug wells suggests the water table is very deep and might be below the gully bottom. Hence the local watershed of the gully could not be determined. This suggests the high run-offs are contributions from local run-offs/surface flow as well as run-offs from the lower watershed, which is about 5.1 km^2 in area (**Figure 3.5**). The discharge capacity of the gully could not also be established as there were no rainfalls during field visit. However, the storage capacity of the gully varies as its length, average width and depth increases and decreases/increases respectively from the gully head.

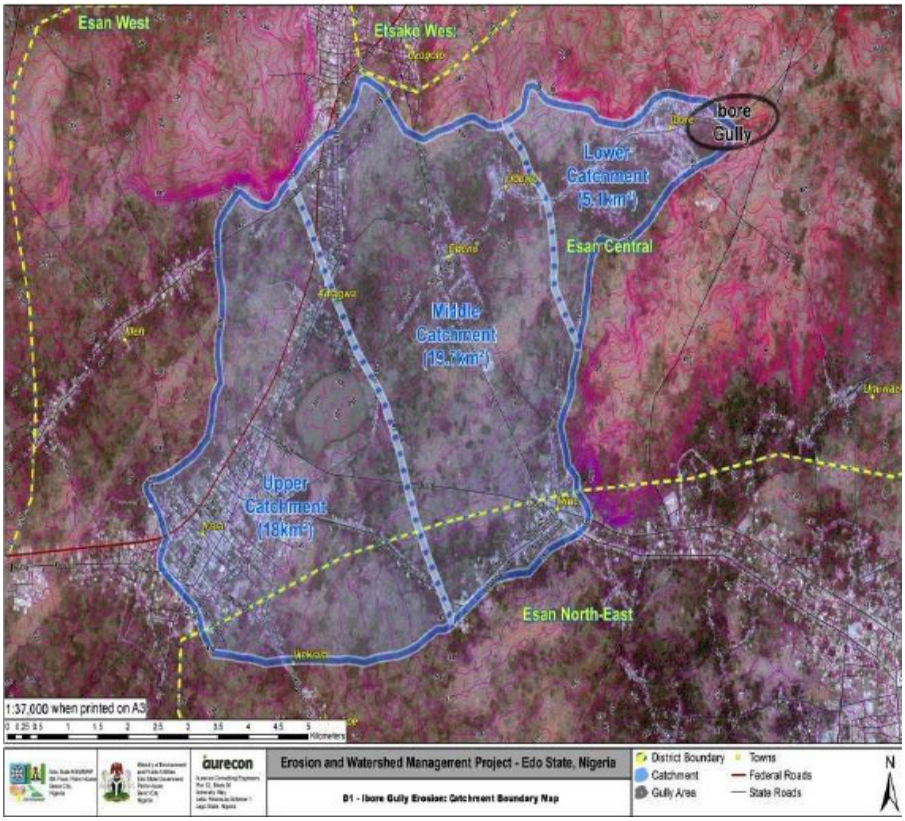


Figure 3.5. Water shed catchment of the gully head at Ibore

3.3 Overview of the Project State

Edo State with its administrative headquarter in Benin City was created out of former Bendel state in August 27, 1991 by the then regime of General Ibrahim Babangida. The state is one of the thirty-six (36) states in Nigeria. Edo state is located in the South-South geopolitical zone of the country and it is bounded in the north and east by Kogi State, in the south by Delta State and in the west by Ondo State (**Figure 3.6**). The State occupies an area of about 17,802 km². Apart from Benin City (capital of the ancient Benin kingdom), which provides administrative and industrial functions, some other major towns in the state include Ubiaja, Auchi, Ekpoma and Uromi. There are several other settlements within the state.

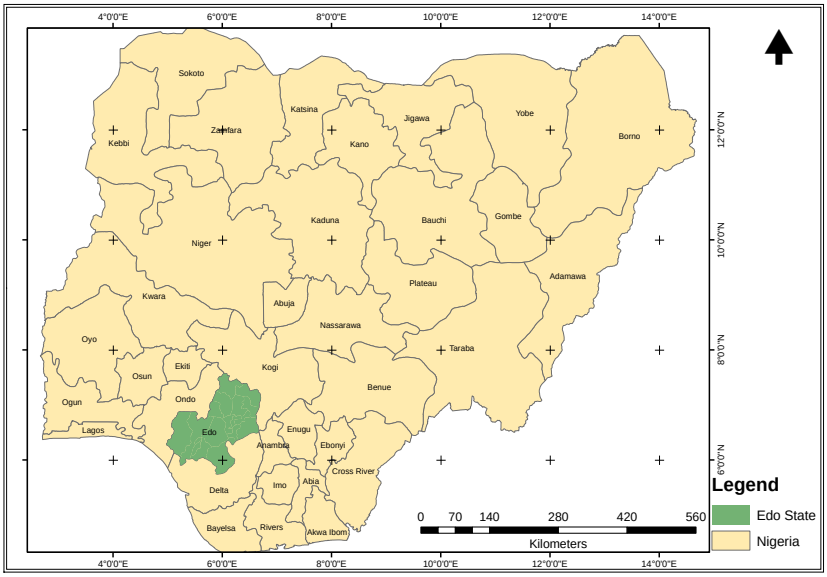


Figure 3.6: Administrative Map of Nigeria Showing Edo State

Generally, it is a low-lying area except in the north where it is marked by undulating hills. Thus, the combinations of topography, climate condition, soil condition and unregulated land use have brought about high numbers of gullies in the State. The State has over 123 gully sites and this makes it one of the states with the highest numbers of gully erosion sites in Nigeria. The Ibore gully erosion site is one the gully erosion sites that have been identified in Edo State.

3.3.1 Physical Environment of Edo State

Climate and Meteorology

The climate of Edo State, as in other parts of Nigeria is driven by the seasonal oscillations of the Inter-tropical Discontinuity Zone (ITDZ) movement. ITDZ separates two principally different air masses: Atlantic equatorial hot and humid tropical maritime air mass, and tropical warm and dry air mass of the Sahara desert. The north – south oscillation of ITDZ determines the seasonal variations in the weather and climatic conditions in Nigeria, where the two principal seasons are rainy and dry.

Temperature and Sunshine

The temperature characteristics observed in Edo State correspond to what is typically obtained in most part of the middle belt of Nigeria. Temperature here is moderated by the effect of the two dominant wind systems in the country. Maximum temperatures typically range between 28^0C and 34^0C (**Table 3.1** and **Figure 3.7**). The higher values are recorded in the dry months between December and March, which also coincide with periods of high sunshine. Mean sunshine hours per month vary from 53 hours in July (the wettest month) to 176 hours in January (the driest month). The low sunshine hours in the region are associated with the thick cloud cover that prevails in this climatic belt for most of the year.

Table 3.1: Mean Monthly Maximum Temperatures in Edo State

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Benin	33.08	34.7	33.1	32.8	31.8	29.9	28.5	28.42	29.4	30.24	31.9	31.7

Source: NIMET, Oshodi

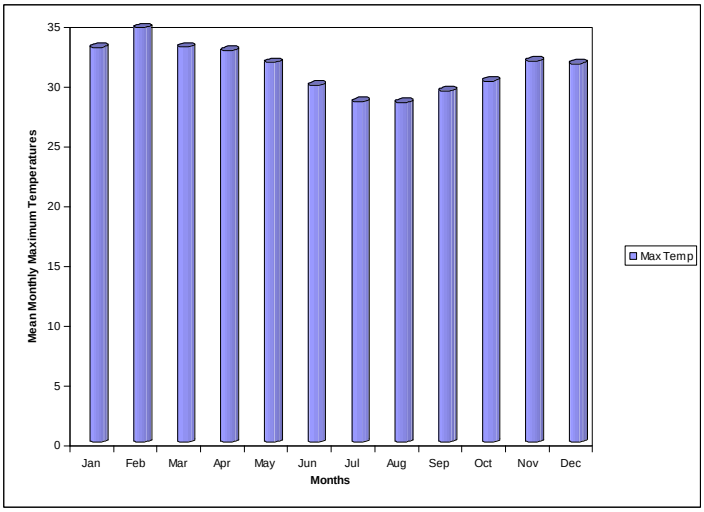


Figure 3.7: **Pattern of the Mean Monthly Maximum Temperatures in Edo State**

Rainfall

The hydrological cycle depends fundamentally on the inter-relationship between the circulation of the ocean and the atmosphere. Water is withdrawn from the oceans into the atmosphere by the process of evaporation, which is dependent on factors such as air/sea temperatures, wind strength and humidity. In addition, there is usually a dry spell on rainfall distribution annually. Rainfall in Edo State is generally high, due to the relative proximity to the coast. Rain falls all through the year with the peak between June and October and the highest number of rain days also occurred within the same period. However, the lowest amount of rainfall occurs in the month of December, while the lowest rain days are recorded in February. The mean monthly rainfall in Benin synoptic station is shown in **Table 3.2** and **Figure 3.8**. Total annual rainfall is typically in excess of 2,500mm.

Table 3.2: Mean Monthly Rainfall (mm) in Edo State

Rainfall (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Benin	43.5	56.7	125.6	200.3	285.6	230.8	383	278	398	254.7	101.4	45

Source: NIMET, Oshodi

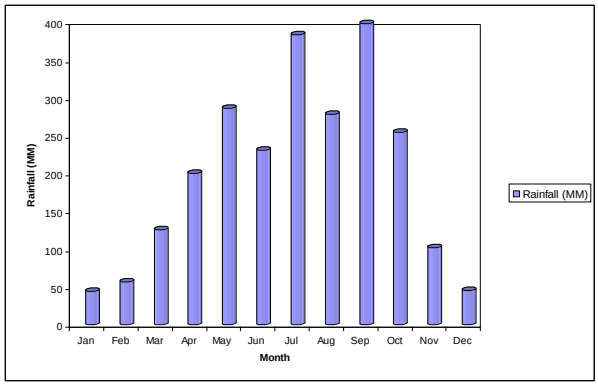


Figure 3.8: **Pattern of Rainfall Distribution in Edo State**.

Relative Humidity

The relative humidity (RH) in Edo State is high. The highest relative humidity in the morning (0900 hrs.) is about 84.0% and this often occurs in July, while the lowest is obtained in January with a value of about 59.0%. **Table 3.3** and **Figure 3.9** show that RH increases gradually from January through to September when it reaches its peak and after which it starts to decline until January. Typically, there is a direct correlation between rainfall and humidity, such that the lower humidity values coincide with the periods of low rainfall (December to March), while the higher values occur in the peak of the rains, between June and October. The RH record is higher for 0900hrs than for 1500hrs throughout the months.

Table 3.3: Mean Monthly Relative Humidity in Edo State

Rel. Humidity (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Benin	59	59	64	66	69	76	84	79	85	75	68	57

Source: NIMET, Oshodi

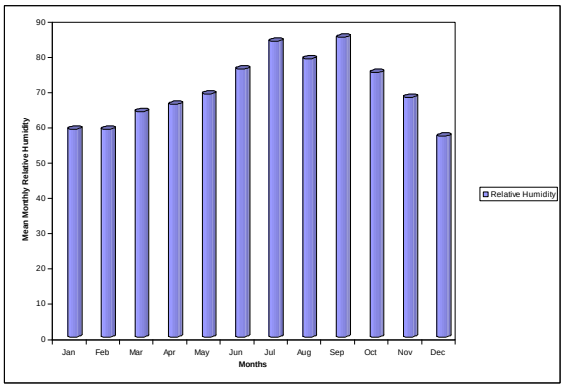


Figure 3.9: Mean Monthly Relative Humidity in Edo State

Wind System

The climatic conditions of the state are influenced by two wind systems related to a global passat system; south-westerly (SW) and the north-easterly (NE). The former (SW) is due to the influence of the Atlantic Ocean air mass, and reversed passat system of the southern hemisphere, while the latter (NE) arises from the passat system of the northern hemisphere blowing from the Sahara desert. The SW winds, which predominate from April to August, have a speed range of 5.7 to 9.0 knots (mean 7.4 ± 1.4 knots), but over the annual cycle, the overall mean is 5.7 ± 2.2 knots, and this corresponds to light breeze on the Beaufort scale. Gentle and moderate breezes occur mostly from June to September.

Air Quality and Noise Levels

No specific air quality sampling was undertaken for this ESMP. Thus, the information presented here is taken from previous studies around Edo State, including a recent EIA for proposed MTN BTS Stations around Edo State (2015).

The summary of air quality and noise measurements around Edo State is presented in **Table 3.4**. At present, air quality is being increasingly assessed against legally adopted standards, as shown in **Table 3.5**.

Table 3.4: Summary of Air Quality and Noise Measurements around Edo State

Values	**Suspended Particulate Matter ($\mu g/m^3$)**	**Noise Level**	**CO**	**NO_2**	**SO_2**	**THC**	**H_2S**	**NH_3**
		dB(A)	**(PPM)**					
Minimum	25	40	0.1	ND	ND	ND	ND	ND
Maximum	74	84	2.5	ND	ND	ND	ND	ND
Mean	49.5	51	1.5	ND	ND	ND	ND	ND

Source: MTN Base Station EIA (2015); ND = not detected

Table 3.5: Nigerian ambient air quality standard

Air Pollutants	**Limits**
Particulates	250 ($\mu g/m^3$)
SO_2	0.1 (ppm)

Non-methane *Hydrocarbon*	160 (μg/m^3)
CO	11-4 (μg/m^3) or 10 (ppm)
NO_X	0.04-0.06 (ppm)
Photochemical Oxidant	0.06 (ppm)

Source: FMEnv, 1991

In Nigeria, the Federal Ministry of Environment (FMEnv) has adopted the standards of WHO and other developed countries as the national interim standards for gaseous emissions against which air quality parameters monitored are compared in order to ascertain its "cleanliness".

Total suspended particulates in ambient air around Edo State were generally low ranging between 25μg/m^3 and 74μg/m^3. This is far below the FMEnv limit of 250 μg/m^3 and is probably reflective of the fact that the data presented here were collected in the rainy season. Typically, rainfall contributes substantially to scrubbing the atmosphere of suspended particulates through wet deposition.

When compared with the air quality standards of Jain *et al*. (1976), shown in **Table 3.6**, it can be seen that air quality in the state is of high quality.

Table 3.6: Air Quality Classification Based on TSP Values

Range of TSP Values (μg/m^3)	**Class of Air Quality**
0 – 75	High Quality
76 – 230	Moderate Quality
231 – 600	Poor Quality

Source: Jain, et. al (1976)

Noise level ranged between a low of 40dB(A) and a high of 84dB(A), with mean values at 51dB(A). To a large extent, high noise emissions arose from anthropogenic activities such as vehicular movement, generators, trading activities and even music blaring either from religious houses or from Music Recording Stores. In general, noise levels in the state complied with the 8-hr exposure limit of 90dB(A) set by the FMEnv.

Geology and Geomorphology of Edo State

Edo State lies within the Niger Delta thereby making its geology typical of the Niger Delta Basin. The area forms part of a geological sequence of the Quaternary and Tertiary formations of the Niger Delta. The Tertiary section of the Niger Delta is divided into three formations, representing prograding depositional phases that are distinguished mostly on the basis of sand-shale ratios.

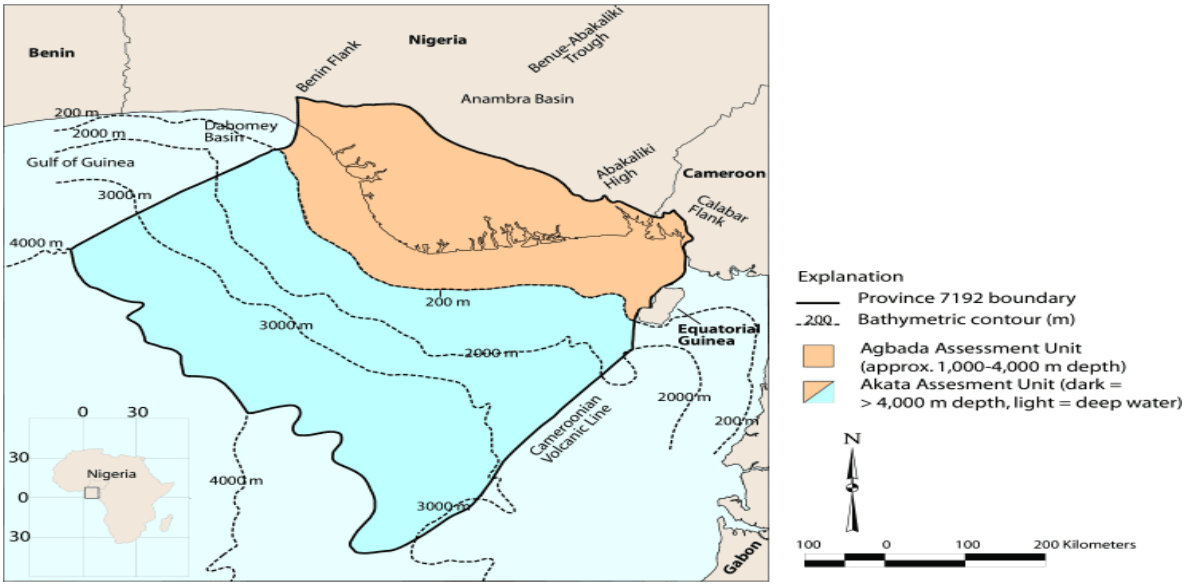


Figure 1. Map showing the extent of the Agbada Assessment Unit (71920101) and the Akata Assessment Unit (71920102). The Agbada Unit overlies the Akata Unit where the two overlap areally.

Figure 3.10: Structural Elements of the Niger delta. Source: Odoh *et, al.,* 2012.

The Akata Formation at the base of the delta is of marine origin and is composed of thick shale sequences (potential source rock), turbidite sand (potential reservoirs in deep water), and minor amounts of clay and silt. Beginning in the Paleocene and through the recent, the Akata Formation formed during low stands when terrestrial organic matter and clays were transported to deep-water areas characterized by low energy conditions and oxygen deficiency. The formation underlies the entire delta, and is typically over-pressured. Turbidity currents likely deposited deep-sea fine sands within the upper Akata Formation during development of the delta.

Deposition of the overlying Agbada Formation, the major petroleum-bearing unit, began in the Eocene. The formation consists of paralic-silicic-clastics over 3700 meters thick and represents the actual deltaic portion of the sequence. The clastics accumulated in delta-front, delta-top set, and fluvio-deltaic environments. In the lower Agbada

Formation, shale and sandstone beds were deposited in equal proportions. However, the upper portion is mostly sand with only minor shale inter-beds.

The Agbada Formation is overlain by the third formation, the Benin Formation. A continental latest Eocene to Recent deposit of alluvial and upper coastal plain sands that are up to 2000 m thick.

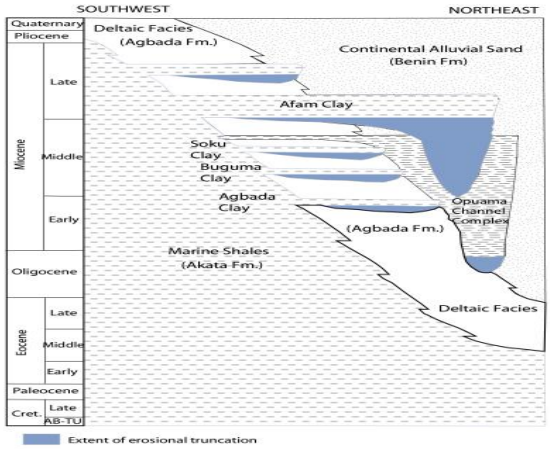


Figure 7. Stratigraphic column showing the three formations of the Niger Delta. Modified from Shannon and Naylor (1989) and Doust and Omatsola (1990).

Figure 3.11: Structural Elements of the Niger delta. Source: Odoh *et, al.*, 2012.

The younger sediments (Holocene) found near the present shoreline consist of barrier beaches, coastal-barrier sands and river mouth sand bars which merge into laminated sandy and silty clays and eventually into fine clays on the continental shelf, edge and continental slope seaward (Allen, 1965). In terms of superficial deposits, the litho-stratigraphy shows brown silty clay to a depth of 6m overlain by medium and fine silty sands at Akoku-Uno, and the southern part of the field.

Table 3.7: Geologic units of the Niger Delta

Geologic unit	Lithology	Age
Alluvium (General)	Gravel, sand, clay, silt	
Freshwater back swamp, meander belt	Sand, clay, some silt, gravel	
Saltwater mangrove swamp and back swamp	Medium-fine sands, clay and some silt	Quaternary
Active/abandoned beach ridges	Sand, clay, and some silt	
Sombreiro-Warri deltaic plain	Sand, clay, and some silt	
Benin formation (Coastal Plain Sand)	Coastal to medium sand; subordinate silt and clay lenses	Miocene-Recent

Agbada formation	Mixture of sand, clay and silt	Eocene-Recent
Akata formation	Clay	Paleocene

Source: Akpokodje, 1989

Overlying these sequences in most of the basin are Quaternary deposits. Four geomorphologic units characterize these deposits (Wigwe, 1975). These are:

(i) ***The Deltaic Plain Belt (Sombrlero-Warri):*** This is an extensive low-lying area dominated by fluvial systems, some with braided characteristics, although a few meander belts are developed. The flood plains are vegetated with raffia palms while the inter-fluvial settings are characterized by oil-palm. The typical lithology is fine-coarse grained sand.

(ii) ***The Freshwater Swamps and Meander Belts***: These are represented by abandoned meander loops (ox-bow lakes) and extensive point bars. It is capped by natural levees with the crevasse splay deposits typifying flood plains. The stratigraphy in places consists of a top grey-black organic clay or silty clay overlying a predominantly sandy lithology with intercalating clay.

(iii) ***The Saltwater Mangrove Swamp Belt***: These areas surround the estuaries, creeks and lagoons, and are dominated by a system of interconnecting fairly rectangular meandering tidal creeks, cut-off meander loops surrounded by centrally depressed tidal flats in places. Thick undergrowth's and rich mangrove vegetation characterize this belt. The stratigraphy is highly variable, made up of a top layer of black silty clay/clay underlain by a predominantly sandy lithology intercalated

(iv) ***Coastal Islands and Beach Ridges:*** This belt includes both the active and abandoned ridges facing Tile Sea, separated by the various river mouths which dissect them into small islands - 5 - 47 Km long and approximately 12 Km wide. The upper layer is made up of fine to medium grained sand below which is an organic peaty silty clay or clay. A predominantly sandy lithology with some gravely characteristic is found deeper below

Tectonics of the Niger Delta

The tectonic framework of the continental margin along the West Coast of equatorial Africa is controlled by Cretaceous fracture zones expressed as trenches and ridges in the deep Atlantic. The fracture zone ridges subdivide the margin into individual basins, and, in Nigeria, form the boundary faults of the Cretaceous Benue-Abakaliki trough, which cuts far into the West African shield. The trough represents a failed arm of a rift triple junction associated with the opening of the South Atlantic. In this region, rifting started in the Late Jurassic and persisted into the Middle Cretaceous. In the region of the Niger Delta, rifting diminished altogether in the Late Cretaceous.

After rifting ceased, gravity tectonics became the primary deformational process. Shale mobility induced internal deformation and occurred in response to two processes. First, shale diapirs formed from loading of poorly compacted, over-pressured, and pro-delta and delta-slope clays (Akata Fm.) by the higher density delta-front sands (Agbada Fm.). Second, slope instability occurred due to a lack of lateral, basin ward, support for the under-compacted delta-slope clays (Akata Fm.). For any given eco-belt, gravity tectonics were completed before deposition of the Benin Formation and are expressed in complex structures, including shale diapirs, roll-over anticlines, collapsed growth fault crests, back-to-back features, and steeply dBTSing, closely spaced flank faults. These faults mostly offset different parts of the Agbada Formation and flatten into detachment planes near the top of the Akata Formation.

Topography

Some areas in the southern fringes of Edo State are swampy mangrove forests with numerous creeks and rivers dissecting the land area. In the southwest, there are sandy plains with many rivers and streams. This portion, which is the Benin Lowlands, has a few hills and the land is drained by the lkpoba, Orhionmwon and Osse Rivers. Going northwards is the Esan Plateau, which is an extension of the plateaux and ranges that are found in the far north areas of the state. They are mainly sandstone plateaux whose heights range from 200 to 300 metres above sea level. There is a gradual fail into the Orle and Niger Valleys from the north and south, while the landmass in the south and

west descends gradually to the Benin Lowlands. A river that cut a ridge in the sandstone sub-strata of the Northern and Esan Plateaux formed the Orle Valley, which runs from the west to east. The Owan and Orle rivers drain the area. The Northern Plateau has ranges that are between 180 and 300 meters of basement rock. Granite peaks are found at random, sometimes rising above 600 meters. The southern portion of this plateau is mainly sandstone.

3.3.2 Biological Environment of Edo State

Vegetation

Vegetation is a general term for the plant life of a region; it refers to the ground cover provided by plants. It is a general term, without specific reference to particular taxa, life forms, structure, spatial extent, or any other specific botanical or geographic characteristics. It is broader than the term *flora, which* refers exclusively to species composition. Perhaps the closest synonym is plant community, but *vegetation* can, and often does, refer to a wider range of spatial scales than that term does, including scales as large as the global. Primeval redwood forests, coastal mangrove stands, sphagnum bogs, desert soil crusts, roadside weed patches, wheat fields, cultivated gardens and lawns; all are encompassed by the term *vegetation, r*ainforest, mangrove forest and rich biodiversity.

Vegetation in Edo state consists of mangrove swamps, freshwater swamps, rainforests and savanna grasslands. The mangroves and freshwater swamps occur in the southern end of the state, especially around its frontier with Delta State, where the water bodies get periodic inflow of saltwater from proximity to the sea and saline creeks flow. The savanna grasslands however occur in the northern reaches of the state, around Okpella and Igarra, which have frontiers with Kogi State.

Wildlife

As is typical of any area with such a wide range of vegetation, wildlife also varies greatly in species composition and abundance. Generally however, wildlife in Edo state consists of mammals, birds, reptiles and amphibians. Many parts of the state have been substantially modified by human activities, such that only very few original forests

remain, and by extension, wildlife species composition and abundance have been seriously modified.

The forest zones host large mammals such as Mona monkeys, Duikers, Warthogs, etc. Swamps play host to reptiles such as Crocodiles, Swamp Turtles, Monitor lizards and Buffaloes, while the savanna grasslands play host to rodents such as Grass cutters, Porcupines, Snakes, etc. Avian species, because of their mobility, are ubiquitous across the state, and range from birds of the waterside such as Pelicans, Hammerkops, Egrets and Herons to birds of the gardens such as Doves, Wild Pigeons, Robins and Weaverbirds.

3.4 Specific Environmental Baseline Information on Ibore Site

Ibore and Ewu are located within the same ecosystem, with similar microclimate, vegetation, geology, and soil. Ibore is about 6-km east of Ewu. Therefore, the two erosion sites are quite similar with regards to the various elements of their physical environment.

3.4.1 Administrative location

The Ibore gully erosion site is one of the gully erosion sites that have been identified in Edo State. Ibore is located in Esan Central local government area of Edo State, approximately 6km to the east of Ekpoma-Auchi Road (**Figure 3.12**). Ibore gully erosion problem has resulted in the collapse of a main road and several buildings within the residential area of Ibore. The gully erosion at Ibore is a direct result of the poor drainage system that is unable to cope with the peak flows. The gully has grown to a depth of approximately 20m. A major gas pipeline traverses the natural drainage route.

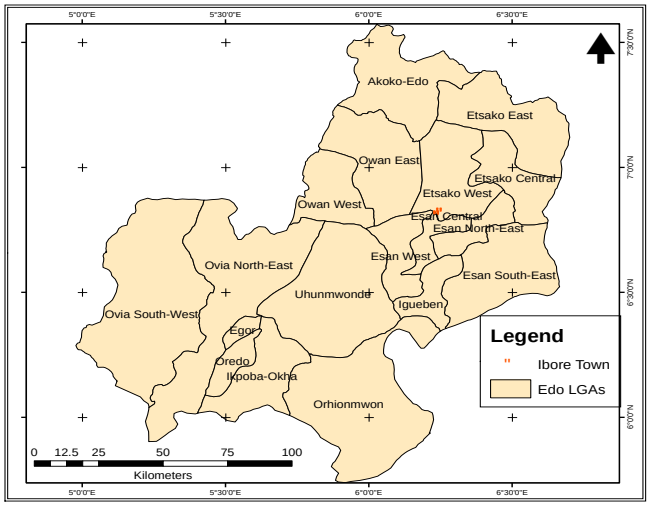


Figure 3.12: Administrative Map of Edo State Showing Ibore Community

3.4.2 Physical Environment of Ibore Erosion Gully Site

Climate and Meteorology:

The climate of the Ibore and its immediate surrounding falls within the semi-humid equatorial zone of the tropical climate area of Nigeria. The climate is determined largely by the influence of two wind systems; the southwesterly winds and the northeasterly winds. The former is due to the hot and humid tropical maritime air mass blowing in from the Atlantic Ocean while the latter are due to the warm and dry air mass from the Sahara Desert, in the north. The two air masses are separated by a front or zone of discontinuity (the Inter-tropical convergence zone, ITCZ), which oscillates from north south following the movement of the sun. This north-south oscillation of the ITCZ gives rise to the basic variation in the weather and climatic conditions prevailing in the area. Generally, the climate is humid tropical in the southern areas of the state and sub-humid in the north.

Temperature and the thermal characteristics in the area depend on the apparent movement of the sun and on the wind regime and proximity of the area to the Atlantic Ocean. The annual temperature cycle is characterised by two peaks - major and minor. The major peak occurs between March and April while the minor peak occurs in the months of November and December. The minor fall in temperature is due to the presence of the Harmattan wind, which occurs between December and January while

the major fall (or minimum values) coincides with the peak of rainfall in July. The average temperatures vary during the year by 3.0 °C. The warmest month of the year is April, with an average temperature of 27.5 °C. In July, the average temperature is 24.5 °C. It is the lowest average temperature of the whole year. Therefore, the highest and the lowest daily temperatures (32.7^0C and 20.5^0C) occur at the peak of the dry and rainy seasons respectively in March and August (**Table 3.8**).

Rainfall and humidity regimes are characterised by similar dual maximum and minimum peaks exhibiting an inverse annual pattern with temperature. The spatial and temporal distributions of disturbances that result in storm development are unpredictable. Although the spatial and temporal distribution of rainfall and its intensity are determined largely by the Atlantic Ocean surface temperature, biospheric feedbacks and behaviour of the Inter-Tropical Convergence Zone (ITCZ) as well as its associated air masses, i.e. the maritime tropical air masses or the south westerlies. The entire area is very humid; hence the high condensation level and frequent dews and fogs. Average humidity, even during dry spells is greater than 77%. Rainfall is local, mainly convective and rainy days are in excess of 200 while the warm currents further augment the tropical humidity. Annual average rainfall/precipitation ranges between 1657mm in the northern section to about 2025 mm in the southern and eastern part of the state (**Table 3.8**). The difference in precipitation between the driest month and the wettest month is 329 mm. There is no real dry season and even the driest month (January) has an average of 9 mm of rainfall. Most precipitation falls in September, with an average of 338 mm. The rainfall regime is characterized by double maxima in the months of July and September respectively with a short “August break”. The dry season lasts between mid-December to late March. Rainstorms during change in seasons are characterized by thunder and lightning. The average annual number of days with thunderstorms is between 45 and 70 days. The highest number of about 5-9 days usually occurs between April and May and towards the end of the rainy season around October when rainfall is accompanied by greater frequency of thunderstorms, line squalls and disturbance lines.

Relative Humidity (R.H) is high both night and day but usually slightly lower in the evenings than in the morning hours. While it is greater than 80% in the night, it is

between 62% and 79% during the day. Generally, the drier months between December and February have low R.H of between 60-70% whereas it ranges from 80 to over 90% in the wet season.

Mean sunshine hours per month are influenced by the amount of rainfall such that a low sunshine hour is recorded in July at the peak of the rains, while high values are recorded in January. Hours of daylight and darkness do not vary for more than one hour during any period of the year because of the latitudinal location of the region. The total sunshine hours for the year is greater than 466 with mean monthly values varying between 51 and 165.7 I July and December respectively, a factor of prevailing season depending on atmospheric attenuation by cloud and rainfall.

Table 3.8: Monthly Temperature and Precipitation within the study area (NIMET, Oshodi)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rain	9	44	109	164	199	267	331	247	338	233	62	22
No of Rain Day/Month	1	1	3	6	12	13	15	15	17	12	1	0
Humidity 10:00 (%)	89	87	82	89	92	91	96	94	95	92	96	92
Humidity 16:00 (%)	60	59	66	65	69	78	72	76	75	74	70	60
Av Wind Speed (Knots)	2.4	5.6	4.1	5.6	3.3	2.8	4.6	5.2	3.8	2.6	2.8	3.7
Min Temp	21.1	21.8	22.3	22.9	22.4	21.8	21.2	21.2	21.7	21.8	21.8	20.5
Max Temp	31.7	32.7	32.6	32.1	31.6	29.4	27.8	27.8	28.2	30.0	31.6	31.6
Average Temp	26.4	27.2	27.4	27.5	27.0	25.6	24.5	24.5	24.9	25.9	26.7	26.0

Land Use

Land use/cover in the Ibore and adjourning communities can be described as a mixture of human settlements and bush fallow occasionally interspaced by forest (**Figure 3.13**).

Bush fallow: Areas classified as bush fallow are land areas that farmers had cultivated for some years and later left for some years with the aim of restoring the fertility of the soil naturally. During this fallow period, the farmer cultivates another piece of land.

Visible of evidence of a fallow land include relics of ridges and in some cases leftover crops that were not completely harvested. Area classified as bush fallow in the map are mostly at the outskirt of the Ibore town and are more in the northwestern and southwestern section of the town.

Bush fallow / farmland: These are areas where it is difficult to distinguish between fallow and farmland because of the size of farmlands and fallow. Fallow areas and farmlands are interwoven in this area given rise to broken land use pattern. This type of land cover appears to be the second most dominant land cover in the delineated area. Cassava, cocoyam and yams were relics of crops sighted in such areas during the field survey. It should also be noted that the size of farm holding by individual farmer is relatively small.

Forest: These are areas occupied by thick forest. Forests are found mainly in the immediate vicinity of the Ibore town. They have been broken into patches mainly by urban development. The Ibore gully traverse a section of forest in the eastern section of the town.

Plantation: Three patches of plantations were observed within the delineated portion around the Ibore Town. Two were in the northeastern while one is in the western section of the delineated area. Palm tree is the dominant crop planted in these plantations. Palm tree is one of the economic tree crop in the study area. It provides consistent income and employment for the people.

Ibore Town: This is the built-up part of the delineated area. It comprises of the residential, commercial and industrial section of the town.

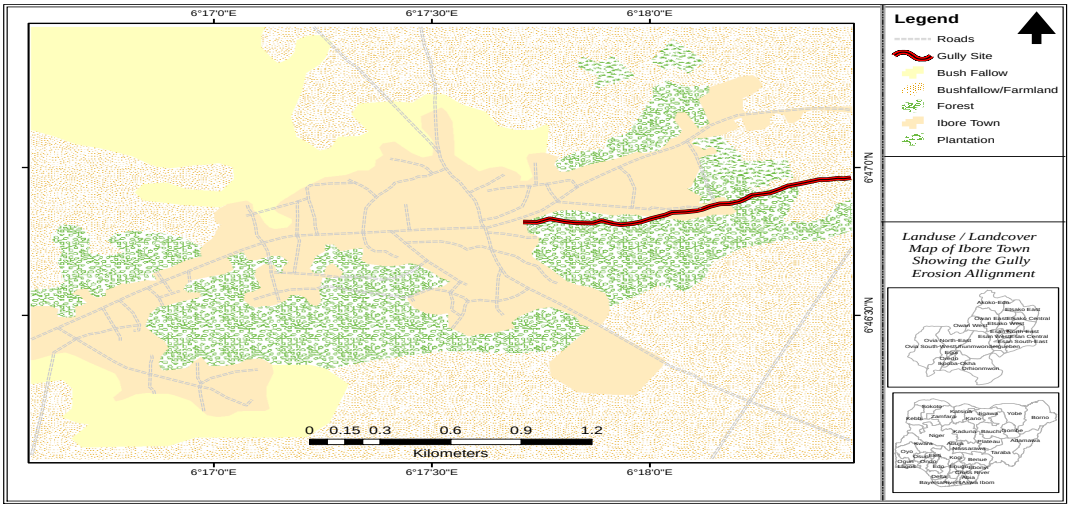


Figure 3.13: Landuse and Land cover of the Gully Erosion Site in the Ibore

Geology, Geotechnical and Soil Types at Ibore

According to the published 1:2,000,000 Geological Map of Nigeria (see **Fig. 3.14**: Geological Survey of Nigeria, 1994), the site is underlain by Imo Clay-Shale Group lithologies consisting of clay and shales with limestone intercalations of the Ewekoro Formation. The presence of clays was confirmed by the Atterberg test results. A geotechnical investigation was conducted on 14 March 2016 at the Ibore Erosion Gully Site Edo State, Nigeria, where six soil samples were taken and tested in the laboratory. The laboratory results indicated that the site is underlain by clayey sands and are classified as'SC' by the unified soil classification system (USCS).

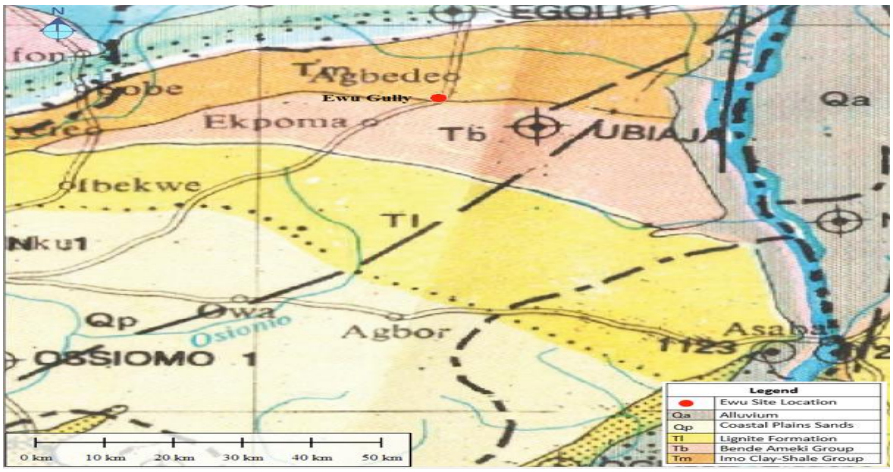


Figure 3.14: General geological map of Nigeria (Geological Survey of Nigeria, 1994)

By 24th February 2017, field soil investigation and sampling of the surface 200-cm soil depth at the lower and upper ridges of the gully erosion site in Ibore was carried out. Following the particle size (grain size) analysis of the six soil samples collected using Dutch Soil Auger (see **Tables 3.9 & 3.10**), results indicated predominance of fine to medium sized sand particles in the surface (0 – 200cm) substratum at Ibore site. No evidence of lithologic discontinuity was observed as the formation, as observed from the gully-exposed surface, shows uniform lithology.

Geo-morphologically, very long gentle slopes, with slopes not steeper than 4 - 6–%, characterize the study area. The very long slope length of the drainage catchments and the loose, incoherent, sandy nature of the soil, along with the hardened surface soils occasioned by human influence readily predispose the soils to intensive water erosion that led to gully formation in the downstream part of the study area.

Soils within and around the Ibore gully site are very highly ferruginized, commonly brownish to reddish in colour, and often with ochric epipedon (i.e. light coloured surface soil horizon). In addition, the soils are highly weathered with diffuse genetic horizon boundaries, well sorted, well drained, and high in fine to medium sand content, with low content of clay and silt. **Tables 3.9** and **3.10** show the grain size distribution of the soils as at 24th of February 2017. From the various soil samples collected at various locations in the area, the sand particles ranged from a minimum of 77% sand to 78% sand. The implication of this high sand content is that the soils in all parts of the area are sandy, porous and hence would be readily permeable to aqueous materials and or contaminants.

The pattern of distribution of the various soil particles (i.e. sand, silt and clay) within the subsoil horizons in soils of the area was not significantly different from those of the surface soil horizons, thus further justifying the absence of lithologic discontinuity.

Table 3.9: Typical Grain Size Distribution of the Surface 2-m Depth of Soils within and around the Gully Erosion Site in Ibore, as at 24th February, 2017

Soil Sampling Depth (cm)	Genetic Horizon	Soil Physical Properties			
Soil Sampling Depth (cm)	**Genetic Horizon**	**Soil Physical Properties**			
		Grain Size Analysis			
		Sand	**Silt**	**Clay**	**Texture**
0 – 2 0	A	78	4	18	SL
20 – 60	AB	77	3	20	SCL
60 - 120	B	77	3	20	SCL
120 - 200	B	77	4	19	SCL

SL = Sandy loam; SCL = Sandy clay loam

Table 3.10: Average Composition of the Grain Size Distribution of Soils within and around the Gully Erosion Site in Ibore, Edo State (24th February, 2017)

Statistics (n = 6)	0 – 100cm			100 – 200 cm		
	Grain Size Analysis (%)					
	Sand	**Silt**	**Clay**	**Sand**	**Silt**	**Clay**
Min	77	3	18	77	3	18
Max	78	4	20	78	4	20
Mean.	77.5	3.5	19	77.5	3.5	19
Sd	0.63	0.45	0.76	0.63	0.45	0.76

3.4.3 Biological Environment of Ibore Erosion Gully Site

Vegetation

As part of field studies for this ESMP, observations on the vegetal composition and situation around the intervention site at Ibore were recorded. Generally, the project site and immediate surrounding consists of secondary forests with a generous presence of oil palm, and a mosaic of forest, farmland and buildings.

Within and around homesteads that are close to the gullies, there is a preponderance of mango trees. In addition, quite a few small holding (subsistence level) farms occur, with cassava being the key crop, along with yams, cocoyam and, during the rainy season,

maize. Vegetables such as bitter-leaf okra and peppers are also planted around homesteads.

Table 3.11 presents an overview of the vegetation species observed within and around the Ibore project site, while **Plates 3.8** to **3.11** shows some of the vegetation observed in the course of field studies for this ESMP.

Table 3.11: Vegetation Species around the Project Site

	Scientific Name	Common English Name	Habit
1.	*Anthocleista vogelii*	Cabbage tree	Tree
2.	*Anthostema aubryanum*		Tree
3.	*Asystasia gagentica*		Herb
4.	*Azadirachta indica*	Neem Plant	Tree
5.	*Panicum* spp		
6.	*Calamus decratus*	Rattan palm	Climber
7.	*Commelina benghalensis*	Wandering Jew	Herb
8.	*Chromolaena odorata*	Siam Weed	herb
9.	*Dissotis erecta*		Herb
10.	*Elaeis guineensis*	Oil palm	Tree
11.	*Parinari excelsa*		Tree
12.	*Dinophora sphennerioides*		Shrub
13.	*Sacoglottis gabonensis*		Tree
14.	*Caalotropis procera*		Shrub
15.	*Chrysobalanus icaco*		Shrub
16.	*Cleistopholis patens*		Tree
17.	*Aframomum sp.*	Grain of paradise	Herb
18.	*Cocus nucifera*		Tree
19.	*Mangifera indica*		Tree
20.	*Carica papaya*	Paw paw	Tree
21.	*Musa spp*	Plantain and banana	Tree

	Scientific Name	Common English Name	Habit
22.	*Alchornea cordifolia*	Christmas tree	Shrub
23.	*Alstonia boonei*	Stool wood	Tree
24.	*Hallea ciliata*	Abura	Tree
25.	*Ipomoea mauritiana*		Climber
26.	*Lycopodium cernum*		Climber
27.	*Palisota hirsuta*		Herb
28.	*Uapaca heudelotii*		Tree
29.	Raphia hookeri	Wine palm	Tree
30.	Nephrolepis sp.		Herb
31.	*Scleria sp*	Razor grass	Herb
32.	*Syzygium guineensis*		Tree
33.	*Tetracera alnifolia*		Climber
34.	*Parkia biglobosa*	Locust bean tree	Tree
35.	*Adansonia digitata*		Tree

Source: Fieldwork (February, 2017)

Plates 3.8 to 3.11: Vegetation and crops observed around project site

In terms of biomass productivity, the productivity of the area, as assessed during field studies for this project were found to range between 215g/m^2 and 438g/m^2. These values are relatively low, compared to values recorded from previous studies around the state. However, the low records are attributed to the fact that this field study was undertaken in the dry season, when general productivity is impaired due to unfavourable climatic and edaphic factors. It is expected that productivity will be much higher in the rainy season. The values recorded agree with Al Mufti *et.al.* (1976) for areas with similar conditions.

Wildlife and Endangered Species

Based on field observations and literature information, three main groups of wildlife occur in the area. These are: Mammals, birds and reptiles. **Table 3.12** presents a list of the wildlife species observed in the area.

Mammals were mostly small rodents, antelopes and duikers and some bats. Various birds were seen in the project area during fieldwork, but were too far off to be clearly captured with the Camera taken to the field. However, these birds ranged from those of the waterside such as kingfishers, egrets and herons, to garden and forest species such as the doves and weaver-birds. Their number and variety suggests that the avian population of the area is very rich and near pristine. **Plates 3.12** and **3.13** show some of the birds caught on camera.

Table 3.12: List of Wildlife Species in the Study Area

Common Name	Biological Name	Status
Mammals		
Red-legged Sun Squirrel	*Heliosciurus rufobrachium*	Uncommon
Fire-footed Tree-Squirrel	*Funisciurus pyrrhopus*	Common
Blotched Genet (“Bush cat”)	*Genetta tigrina*	“
Marsh Mongoose (“Fox”)	*Atilax paludinosus*	Uncommon
Sitatunga (“Antelope”)	*Tragelaphus spekei*	Common
Brush-tailed porcupine	*Alterurus africanus*	Common
Bush pig (warthog)	*C. sylviculton*	Common
Grass cutter	*Thyronomys swindeianous*	Common
African palm squirrel	*Epixerus ebii*	Common
Fruit bat	*Eidolon heluum*	Common
Giant Rat	*Cricetomy gambianus*	Very common
Grimm’s Duiker	*Sylvicarpa grimmi*	common
Birds		
Cattle Egret	*Ardeola ibis*	Common
Palm-nut Vulture	*Gypohierax angolensis*	Common
Black Kite	*Milvus migrans*	Common
Red-eyed Dove	*Streptopelia semitorquata*	Common
Blue-breasted Kingfisher	*Halcyon malimbicus*	Common
Pied Kingfisher	*Ceryle rudis*	Common
Square-tailed Rough-winged Swallow	*Psalidoprocne nitens*	Common
Plain-backed Pipit	*Anthus leucophyrs*	Common
Carmelite Sunbird	*Nectarinia fuliginosa*	Common
Olive-bellied Sunbird	*Nectarinia chloropygia*	Common
Common Bulbul	*Pycnonotus barbaetus*	Common
Grey-headed Sparrow	*Passer griseus*	Common
Village Weaver	*Ploceus cucculatus*	Common

Common Name	Biological Name	Status
Pied (white collared) crow	*Corvus torquatus*	Common
Reptiles and Amphibians		
Kinixys erosa	Serrate Hinge-backed Tortoise	Common
Varanus niloticus	Nile Monitor Lizard ("Iguana")	Common
Python sebae	African Python	Common
Dasypeltis fasciata	Egg-eating Snake	Common
Dendroaspis jamesoni	Green tree viper	Common
Naja nigricollis	Spitting Cobra	Common
Rainbow lizard	Agama agama	
Chameleo gracilis	Common Chameleon	Common
Dicroglossus occipitalis	Bullfrog ("Jumping Chicken")	

Plate 3.12: Vinaceous dove observed on site

Plate 3.13: Cattle egrets around the project site

CHAPTER FOUR

SOCIO-ECONOMIC CHARACTERISTICS AND COMMUNITY CONSULTATION IN IBORE TOWN

4.0 Introduction

The socio-economic characterisation of the Ibore town provides baseline information on the social, economic, occupation and infrastructural development in the town. The various socio-economic indicators that might likely be impacted by the proposed gully erosion rehabilitation were assessed. Data used in characterising the socio-economic baseline of the Ibore town was obtained using questionnaire, key informant interviews and secondary data obtained from archival materials.

4.1 Historical Background and Authority Structure

Ibore is an ancient city located in northern part of Esan an ethnic group in Edo state, Nigeria. It is one of the major towns in the present day Esan Central Local Government Area of Edo State. The original name is *Ibhole, which* was later anglicised to Ibore by the Portuguese (*Source: Wikipedia and Public Consultation*). Unlike most Esan villages and towns whose roots are from *Bini*, Ibore the 1st son of his father migrated originally from *Otuo* (Owan) area of Edo state in the 15th and 16th century along with two younger brothers called Atuagbo and Ugbalo and their uncle, Obiabi. They had a collective family surname known as Uneah and they settled in close proximity to each other. Ibore and his uncle Obiabi lived in the same vicinity, his youngest brother (Ugbalo), were a bit further at the center and Atuagbo, his immediate younger, and were at the tail end of the locality. They co-existed and engaged themselves in common goals, as one family. They were all hunters by profession. Ibore is divided into eleven (11) quarters, and these are Afuokhuaria, Afonza, Afuomemen, Afuanko, Idumegbor, Idinegbon Udugei, Obiabi, Idunoko, Ikekihiala and Aferejoudu.

The oldest person in the community is vested with the highest authority in the community and the person is referred to as Odionwele. Iboi John is the present Odionwele in Ibore; town while Mr. S.I Okaka is his spokesperson. In addition to the Odionwele, the town also has a council of elders that assist in the day-to-day management of the town.

4.2 Methodology

4.2.1 Data Collection Approaches

The assessment of the gully erosion sites was conducted between 10 -14th February 2017. The assessment was with a view to have first-hand information on the gully erosion that has caused untold hardship to the people of the community. In addition, the assessment was also with a view to obtain socio-economic baseline information on Ibore town. The socio-economic baseline information also assessed the social risks associated with the rehabilitation and restoration of the gully erosion site. Furthermore, existing livelihoods opportunities, income, gender characteristics, age profile, health, transport access, existing community structures were also investigated. In addition, existing formal and informal grievance redress mechanisms in the communities were also investigated. A reconnaissance to the sites provided opportunities to obtain both still and motion pictures of the gullies. The present land use/cover around the gullies were also captured. Some of the local efforts at addressing the gullies expansion were observed and recorded, while the effects gully development on nearby buildings (such as cracks and exposure of building foundations) were captured. Clearly, residents used sand bags to reduce the effects of the flood water on their house, while evidence abound that people deposit waste into the gullies.

A major part of the socio-economic survey was the community consultation held in Ibore town. The consultation was held at the house of the Spokesperson for the Odionwele. The consultation was with a view to sensitise the community on the government's plan to address the challenge posed by the gully through the rehabilitation of the damaged road infrastructure consequence of the gullies. In attendance at the consultation were the council of elders and chiefs, women and youth groups. Various community development associations (youth, women and development) were also in attendance. Apart from intimating the community on the preparedness of the government to address the gully erosion challenge, the consultation provided opportunity to understand cultural issues that may affect the proposed project. In addition, community organization and conflict resolution mechanisms in the community were also discussed. Residents also raised issues of compensation.

Key informant interviews were also held with some residents most especially, those that live close to the gully site. Essentially, the interviews were to obtain information on their perception of the cause(s) of the gullies and the various challenges they have encountered as a result of their proximity to the gully site.

Finally, questionnaire administration was used in complementing the information obtained from the community. Questions regarding access to essential services (health, education and water) were framed differently when interviewing respondents. A systematic random sampling was used in administering the questionnaire to household heads in the immediate corridors of the gullies. A total of 61 questionnaires were administered with more emphasis placed on the residents living in the immediate vicinity of the gully erosion site. A purposive sampling was used as only household heads living in close proximity to the gully erosion sites were focused. This approach was adopted since the people are the direct beneficiaries (positive and or negative) of the gully erosion in the community. Respondents to the questionnaires during the public consultation indicated that they have filled some in the recent past, nevertheless, were willing to fill the questionnaire after repeated assurance that government is ready to address their plight.

4.2.2 Socio-Economic Data Analysis

Questionnaire obtained during the field survey were analysed using IBM SPSS (V22), while non-questionnaire related data collected were content analysed. Questionnaire were serially numbered and coded appropriately before being entered into the SPSS spread sheet. Thereafter, variables were defined including missing values. Frequency tables of responses were generated and these tables form the basis of description of the socioeconomic baseline characteristics of Ibore town. In addition, graphs were used to reinforce the visual impression of variables.

4.3 Socio-Economic Results

4.3.1 Demographic Characteristics

Data on demographic characteristics of small towns has always been very scarce in Nigeria. The last population census was in 2005 and till date, the breakdown of the census by towns and localities is not available yet. The present study utilised the

population estimated from the same population census that is available at the State and Local Government Area (LGA) levels to provide the demographic characterization of the population of Edo state and also by extension the Esan Central Local Government Area of Edo State. Based on the 1991 population figure from the National Population Commission, Edo State had a population of 2,172,005 in 1991 comprising of 1,147,746 Males and 1,185,980 Females and this increased to 3,233,366 comprising of 1,633,946 Males and 1,599,420 Females in 2006 (Table 5.1). Hence there was a 48.87% increase in the population over a 15-year period. At annual growth rate of 3.18%, Edo state is expected to have a population of 3,285,209 in 2007, 3,373,909 in 2008, and 3,465,005 in 2009 and 4,294,727 in 2021. The cosmopolitan nature of the Edo state may have been responsible for the slightly higher percentage of female population in the 1991, but this changed in 2006, as there were more males than females in the state. Therefore, with an area extent of 17,802km^2 and a population of 3,233,366, the state has a population density of 181.63 persons per square kilometre.

Table 4.1: Population Distribution in the Esan Central Local Government Area

LGA Name	1991 Population			2006 Population		
	Male	Female	Total	Male	Female	Total
Edo State	1,085,156	1,086,849	2,172,005	1,633,946	1,599,420	3,233,366
Esan Central LGA	53,646	56,518	110,164	53,017	52,225	105,242

Source: Annual Abstract of Statistics, 2012

Similarly, the population of Esan Central Local Government increased from 110,164 comprising of 53,646 Males and 56,518 Females in 1991 to 105,242 comprising of 53,017 Males and 52,225 Females in 2006 and a project population of 120,450 in 2011 (**Table 4.1**). The population of the LGA declined by 4.47% between 1991 and 2006, while it is expected to increase by 2.74% between 2006 and 2011. Female population in 1991 dominated the population, while there were more males in 2006. The age group between 15-64 years dominated the population in 2006 accounting for about 60,604 of the entire population. With an area estimate of 253 km^2 and a

population of 120,450 in 2011, the LGA has a population density of 476.1 person/km^2 in 2011.

4.3.2 Sex Distribution of Respondents

Sex distribution of respondents provides information on the composition of the population in the community. Based on the survey, male respondents accounted for 51.0%, while female respondents accounted for 49.0% in Ibore town (**Figure 4.1**). This is in tandem with the sex distributional pattern observed based on the National Population figure of 2006 for the Esan Central Local Government Area of Edo State. The higher number of male compared to the female in the population of Ibore town could be due to prevailing occupational activity which is farming. This occupation in largely dominated by men. The large number of male in the population stream may also be an indicator of the availability of manpower that can be deployed during the erosion rehabilitation work provided the rehabilitation work does not coincide with the peak of the planting season.

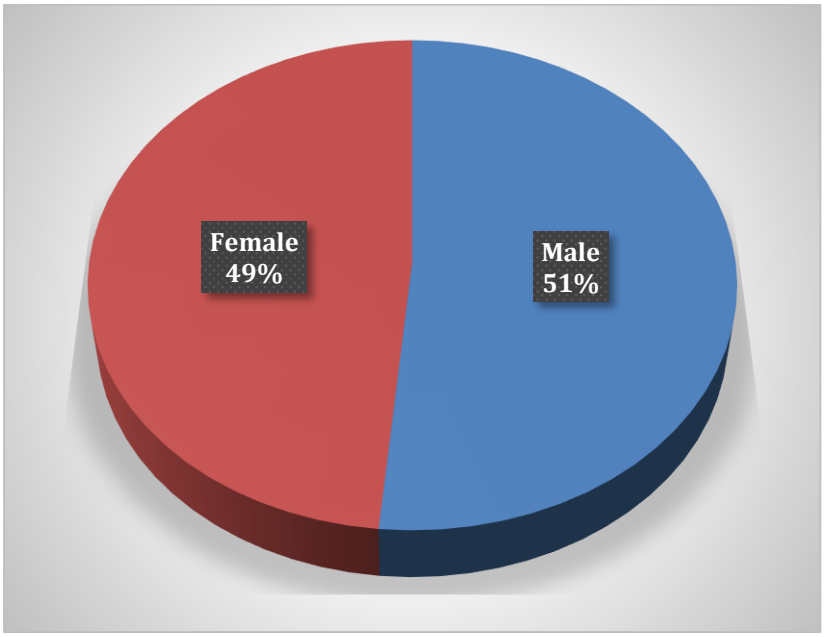


Figure 4.1: Sex Distribution among the Sampled Respondents in Ibore Community

4.3.3 Age Characteristics of Respondents

The distribution of the surveyed population into different age brackets is consistent with the typical demographic structure of the population in developing countries with high fertility and mortality rates. The age distribution of the respondents showed that

5.8 per cent of the respondents were between the ages of 18 and 24 years, 25 per cent were within the ages of 25 and 34 years, 49.8 per cent fell within the ages of 35 and 44 years, 16 per cent were within the ages of 45 and 60 years, while 4 per cent were more than 60 years (**Figure 4.2**). This implies that majority (90.2%) of the respondents are in the active age (18–45yrs.). This shows that the larger percentages of the respondents are in their active years.

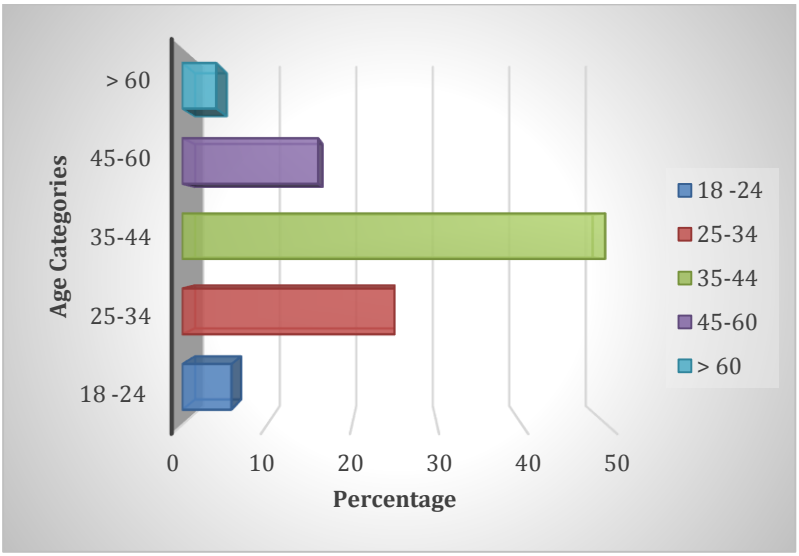


Figure 4.2: Distribution of Respondents by Age

4.3.4 Marital Status

Marital status is an important socio-demographic indicator of any population. Marital status indicated by respondents included married, divorced, widowed and single. Based on the result of the survey, 69.0% of the respondents indicated that they are married, 26.9% are single, 2.8% divorced and 1.3% widowed (**Figure 4.3**). Thus, majority of the respondents are married and this has consequence for population growth in the town.

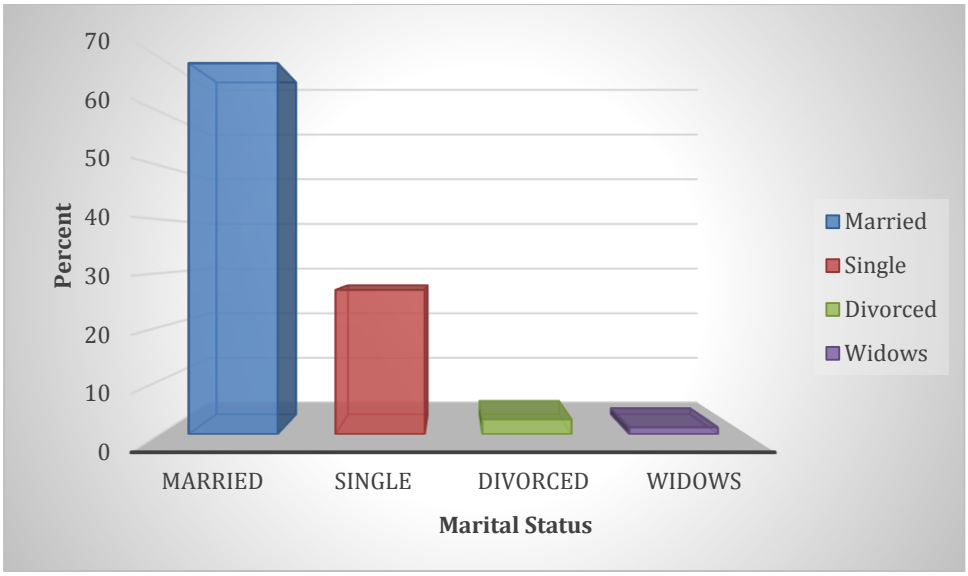


Figure 4.3: Distribution of Respondents by Marital Status

4.3.5 Religion, Tradition and Culture

Respondents in Ibore town reported three principal religions. These are Christianity Islam, traditional religion and others. The Christians accounted for 85.4% of the respondents, 8.0% were traditional believers, 4.3% indicated that they are Muslim while other religion groups accounted for the remaining 2.3% (**Figure 4.4**). Several churches of different denominations are located in Ibore town. The people practicing African Traditional Religion mostly combined it with Christianity. Clearly, Christians dominate the town. It should be noted that Ibore is one of the most culturally endowed towns in Esanland. Particularly unique among its numerous cultural heritage is the *Iruen*, Elbolo and *Igbikhio* festivals celebrated annually in the town.

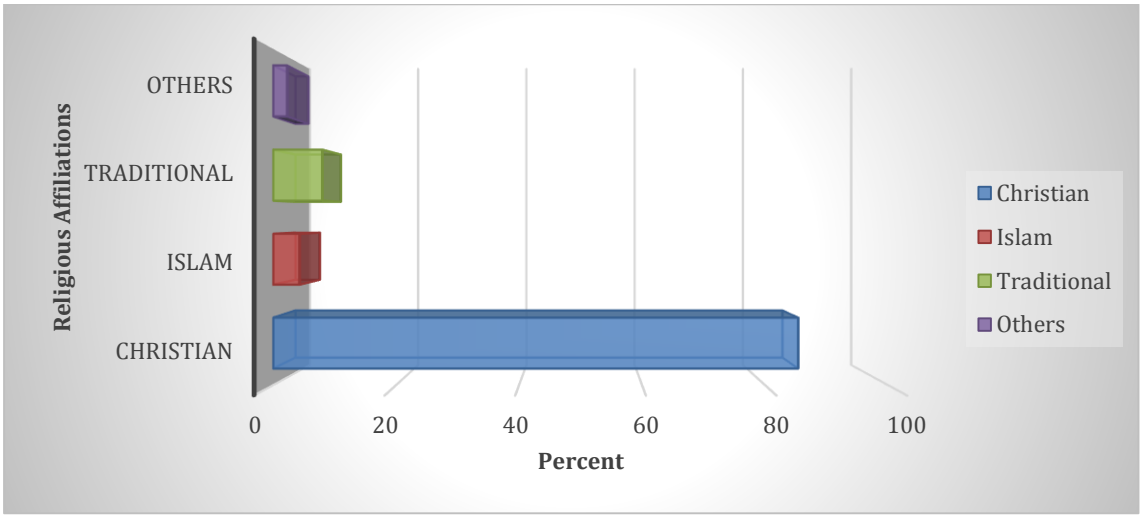


Figure 4.4: Distribution of Respondents by Religious Affiliations

4.3.6 Ethnic Composition in Ibore Town

The community is almost ethnically homogenous as 92.6% indicated that they are dominantly Esan ethnic group based on broad ethnic nationalities survey and public consultation conducted. Other ethnic groups noted included Hausa (3.2%), Yoruba (2.8%) and Igbo (1.4%) (**Figure 4.5**). People from other ethnic origin are mostly traders and artisans. This implication of this is that the social stratification, issue of compensation (if any) and resettlement plan should take cognisance of the culture and tradition of the Esan people most especially those relating to land allocation.

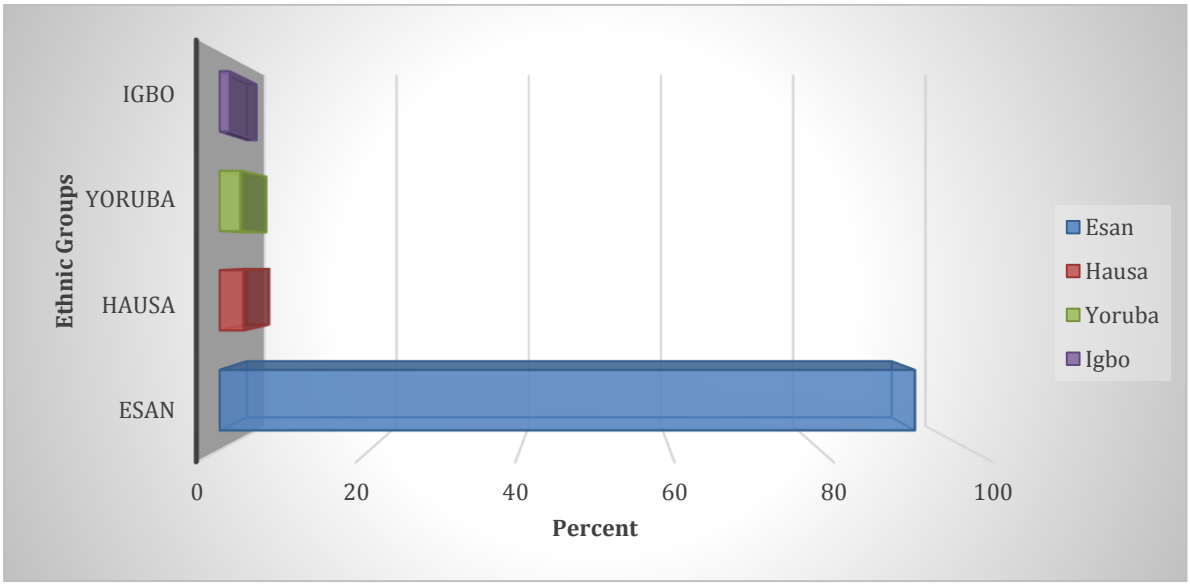


Figure 4.5: Ethnic Composition of Respondents in Ibore Community

4.3.7 Educational Attainment

The basis of assessing the level of literacy in Ibore town was based on whether the people have at least primary school leaving certificate. The percentage of respondents who indicated that they have at least primary school leaving certificate in Ibore town was 94.0% while the remaining 6.0% indicated otherwise. A breakdown of the percentage of respondents who indicated that they do not have primary school leaving certificate shows that greater percentage of female compared to males do not have at least primary school leaving certificate. In addition, greater percentage of the respondents who do not have at least primary school leaving certificate were among people who are above the age of 60 years. A breakdown of the percentage of the respondents with educational qualifications greater than or equal to primary school leaving certificates shows that 18.4% have only primary school certificate, 29.3% have secondary school leaving certificate while 46.3% were either

undergraduates or graduates from tertiary institutions (**Figure 4.6**). It was observed that gender variations exist in educational attainment between male and female with male having higher educational attainment compared to females. This educational level is therefore very high when compared with other part of the country and even other LGAs in the State. Therefore, education-wise, there are enough human resources that can be employed during the construction phase of the project. However, it is imperative that the occupational structure should also be examined. This is with a view to understand the various carrier pathways that exist in the neighbourhood.

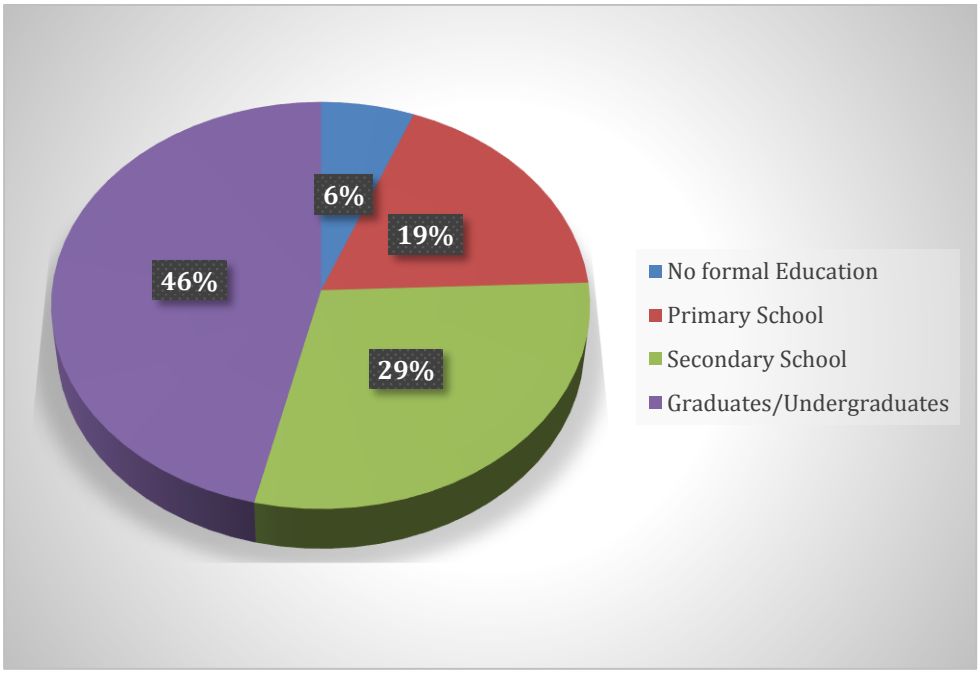


Figure 4.6: Educational Attainments among the Sampled Respondents in Ibore Community

4.3.8 Occupational Structures

Expectedly, farming is the dominant occupation in the Ibore town. It is an age long occupation and farmers largely produced food crops and few cash crops. The percentage of respondents who indicated that they are farmers was 44.7%. Although actual population of farmers may likely be more than this figure when we consider the percentage of those who engage in farming as part-time activity. Shifting cultivation is the dominant farming methods. Women mostly engage in trading, although few men also trade. The percentage of respondents who engage in trading was 23.4%. Items of trade include raw and semi processed agricultural produce and daily needs. A number of women also sell clothing materials and household utensils

etc. The percentage of respondents who indicated that they are artisans and craftsmen was 12.3%. These include those who are barber, tailor, mechanics, graphic artists, bricklayers etc. Furthermore, 8.4% of the respondents indicated that they provide labour to people who are in need. Their service is mostly utilised by people who want to farm, build a house or move things from one place to another. Those that were self-employed accounted for 6.6%, while who are unemployed were 4.6% (**Figure 4.7**).

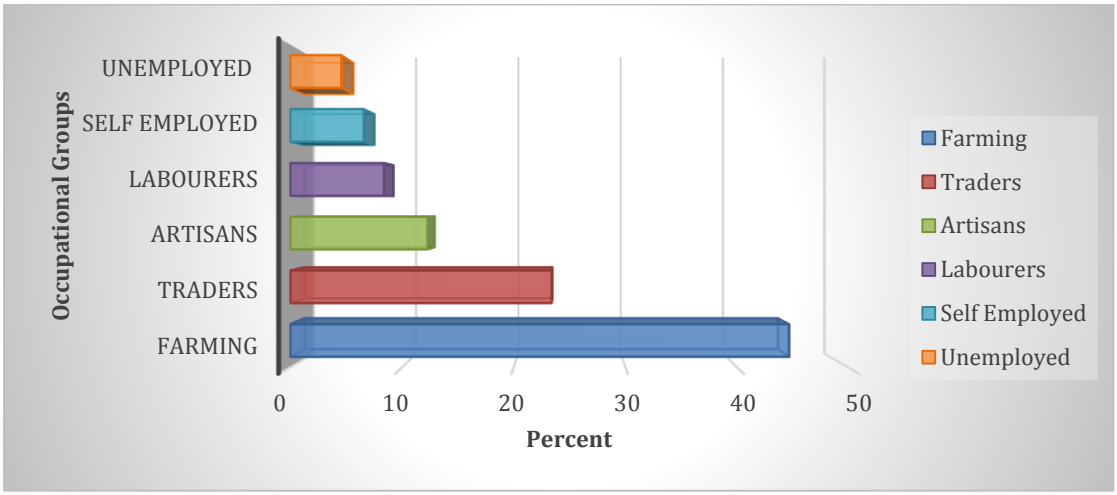


Figure 4.7: Occupational Groups of Respondents in Ibore Community

4.3.9 Income Distribution among the respondents

In terms of monthly income earned by respondents, 35.7% indicated that they earn below the national minimum wage of ₦18, 000, while 20.1% earn between ₦18, 000 and ₦36, 000. Furthermore, 18.6% earn monthly salary of between ₦37, 000 and ₦54, 000, 12.4% earn between ₦55, 000 and ₦72, 000, 8.1% earn between ₦73, 000 and ₦90, 000, 3.3% earn between ₦91, 000 and ₦108, 00 while 1.8% earned more than ₦108, 000. Based on the foregoing, more than 50% of the respondents earn below ₦36, 000 monthly. Therefore, income earnings can be described as generally low as more than 50% of the respondents earn less than twice the national minimum wage monthly (**Figure 4.8**).

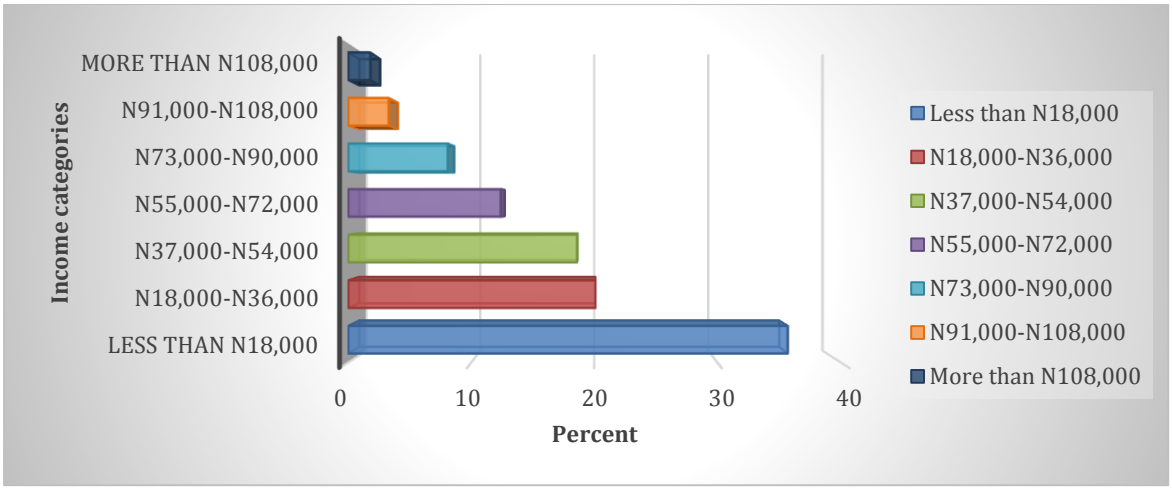


Figure 4.8: Income Distribution among the Sampled Respondents in Ibore Community

4.4 Housing Characteristics in the Ibore Town

This section focuses on the characteristics of buildings in Ibore town. Some of the characteristics examined include floor, wall and roof material.

Based on the response obtained from the questionnaire, 36.0% of the respondents live in their own houses while 51.0 % live in rented houses. Respondents who indicated living in rent-free accommodation were 10.8% and these are people who live in houses owned by member of their nuclear or extended family who reside outside of the community (**Figure 4.9**). Sometimes, some of the people living in rent-free houses are aged people who cannot afford paying rents and temporarily sheltered in houses that belong to their respective relatives, through the consent of the owners. This is a reflection of the endurance of the traditional social obligation demanding from the relatively better-off sectors of the society to assist disadvantaged categories of the population, mostly through kinship networks of reciprocal solidarity.

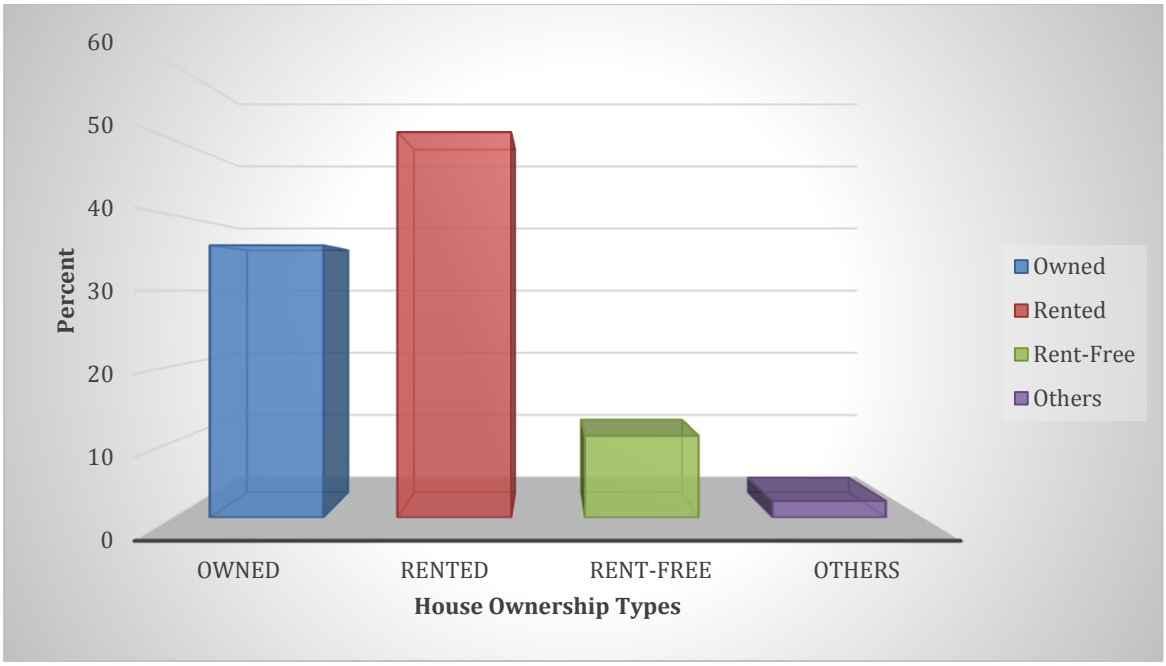


Figure 4.9: Distribution of Respondents by House Ownership

More than 80% of the buildings are bungalow (**Plate 4.1**), while storey buildings are fewer in Ibore town. Most of the buildings are also of the Brazilian type (face me I face you). Nevertheless, there are modern buildings in the community. There were few isolated huts sighted during the survey.

Plate 4.1: Detached Bungalow in Ibore Community

Floor materials used in buildings include earth/mud/mud brick (46.8%), wood/bamboo (2.7%) cement/concrete (36.6%), ceramic/ Mable tiles, (0.9%) (**Figure 4.10**). Thus, majority of the household used earth/mud/mud floor, although some put carpet or rug on such floor to make it look decent. In some of the houses visited, the

sitting room was tilled while concrete flooring was used in other rooms in the building.

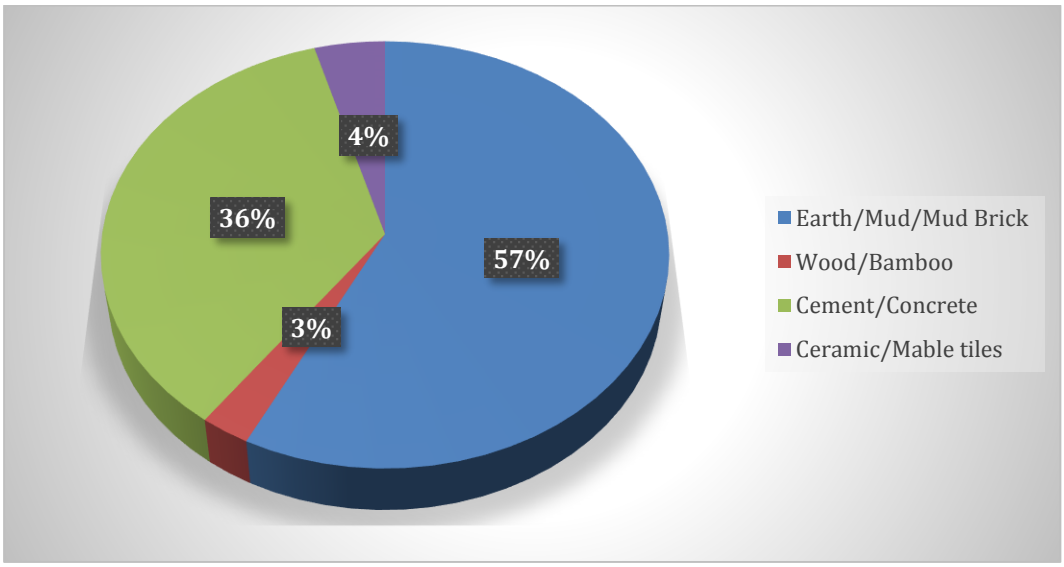


Figure 4.10: Floor Materials Used in Houses in Ibore Community

Mud (68.3%) is the most dominant wall material used in buildings in the Ibore town and this is followed by block (37.7%) (**Plate 4.2**). Respondents who indicated use of other materials such as palm fronts, wood or zinc accounted for the remaining 4.6%. The use of mud/reed is still common in Ibore community perhaps because of the abundance of red soil (clay). Some of the makeshift shops in the town used metal/iron as their wall material (**Figure 4.11**).

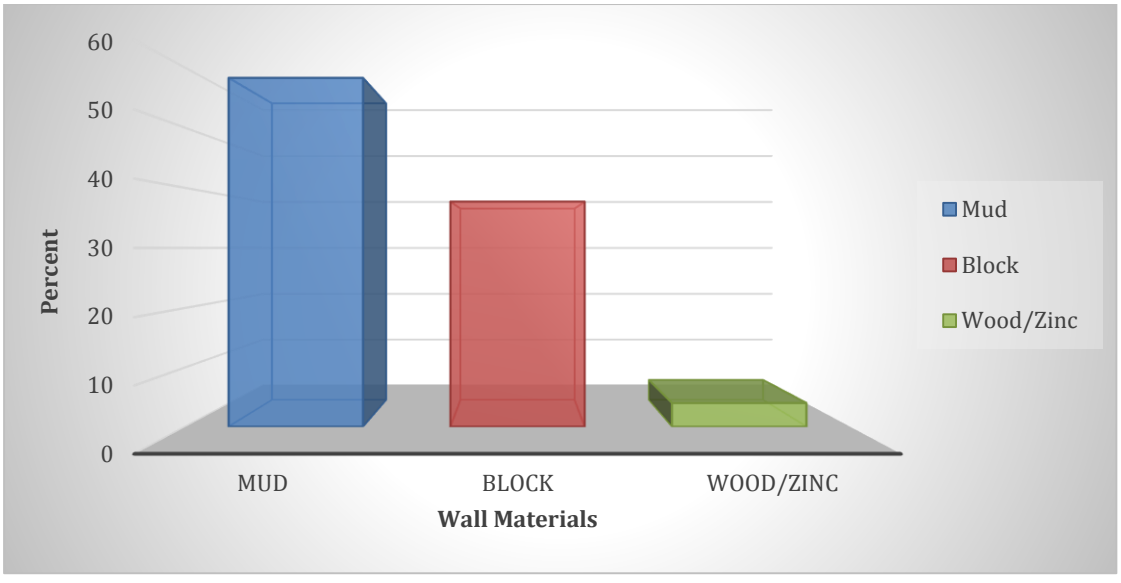


Figure 4.11: Wall Materials Used in Buildings in Ibore Community

Plate 4.2: Typical Wall Materials Used in Building in the Ibore Community

The roof material used varied from house to house. The use of corrugated metal/Zinc sheet appeared to be the most dominance (90.4%) and this was followed by the use of slate/asbestos (7.2%). The percentage that used roofing tiles was 2.4% and this is common in newer buildings in the town (**Figure 4.12** and **Plate 4.3**). Thatch/palm leaves/raffia were sighted outskirt of the town although they are few. Most of the people that use Cement/Concrete are those who are still hopeful of putting another structure on their building.

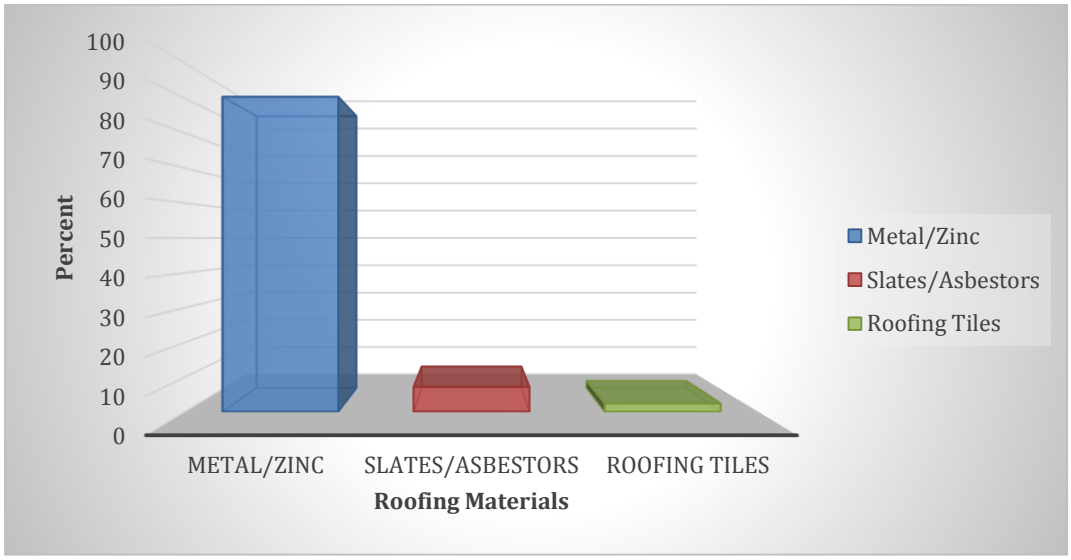


Figure 4.12: Types of Roofing Materials Used in the Ibore Community

Plate 4.3: Typical Roofing Materials Used in Building in the Ibore Community

4.5 Amenities and Facilities in Ibore Community

4.5.1 Sources of Energy:

Source of energy used in lighting houses is derived from electricity. Electricity is obtained from the national electricity grid of the Electricity Distribution Company (**Plate 4.3**). Apart from lighting house, electricity is used to power household electrical appliances that make life more comfortable for the people. Many households for cooking use kerosene, a bye product from crude oil, although its scarcity and escalated cost has forced residents to switch to alternatives such as charcoal and firewood. Charcoal is sometimes imported from the south-western and northern part of the country while firewood is obtained from nearby forest.

4.5.2 Sources of Domestic Water:

Water used for drinking and domestic purposes are obtained from rainwater, borehole, streams and water vendors. In rainy season, residents depend on rainwater for their household domestic chores. Almost all the houses have a rainwater-harvesting device, which is used to harvests and stores water during rainy season (**Plate 4.4**). Drinking water is obtained from borehole provided either by private individuals or government. However, obtaining water during the dry season is more challenging. Scarcity of quality water may have been responsible for the high incidence of typhoid fever and other water related diseases in the community.

Plate 4.4: Rainwater Harvesting Device in Ibore Community

Respondents who indicated that their major source of water is rainwater obtained through rainwater harvesting were 46.9%. Virtually every house in the town has rainwater harvesting device and associated underground tank. The percentage of respondents who indicated that boreholes are their major source of water is 17.2%, while 15.7% indicated shallow wells (**Figure 4.13**). In addition, 11.7% indicated that they obtain water from stream/river in the vicinity of the community, while 8.5% indicated that they obtain water from water vendors.

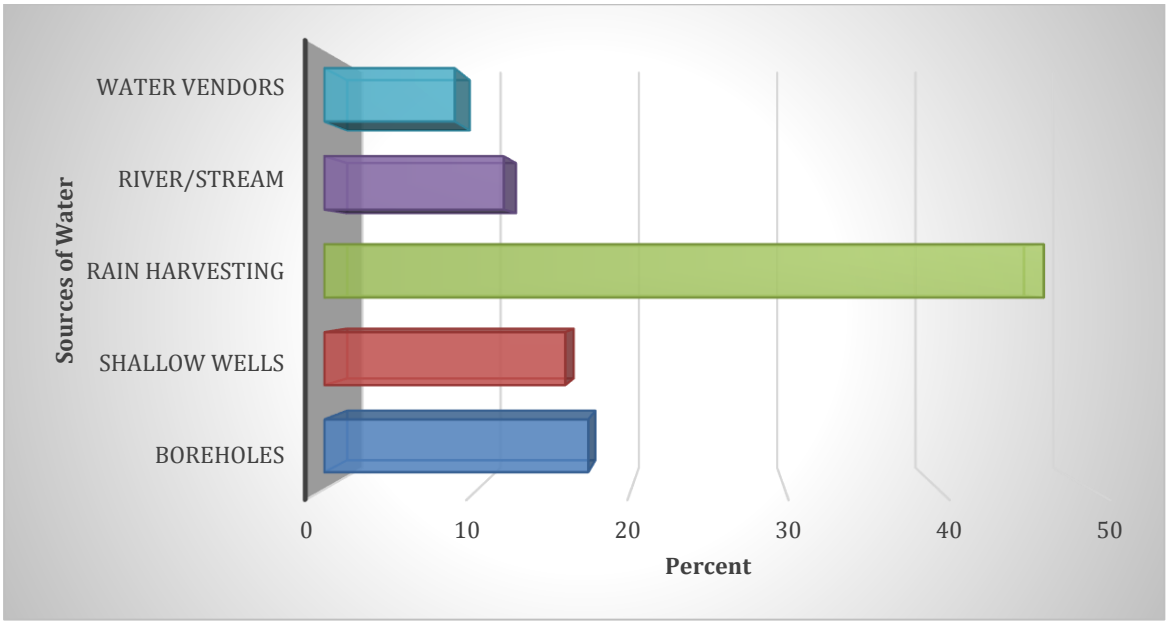


Figure 4.13: Sources of Water in Ibore Community

In terms of water storage methods adopted by respondents, 25.6% indicated that they store water underground and this is particularly for those who depend on rainwater harvesting method. Furthermore, 23.9% indicated that they store water in overhead plastic tanks (**Figure 4.14**). This is particularly for those who depend on borehole water as well as those who depend on water vendors for their water supply. Those who store their water on tank place on ground were 13.4% and some of the people in this category have pumping machines to pump the water into their house. Some of the people in this category also depend on water vendors for their water supply. Respondents who indicated that they store water in drums inside their house were 31.1%, while 6.0% store water in jerry cans.

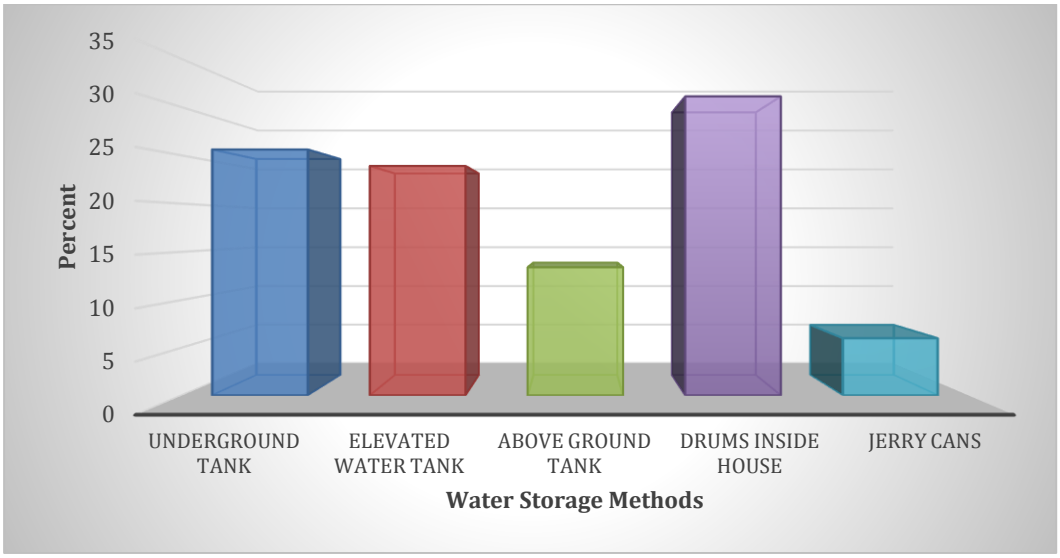
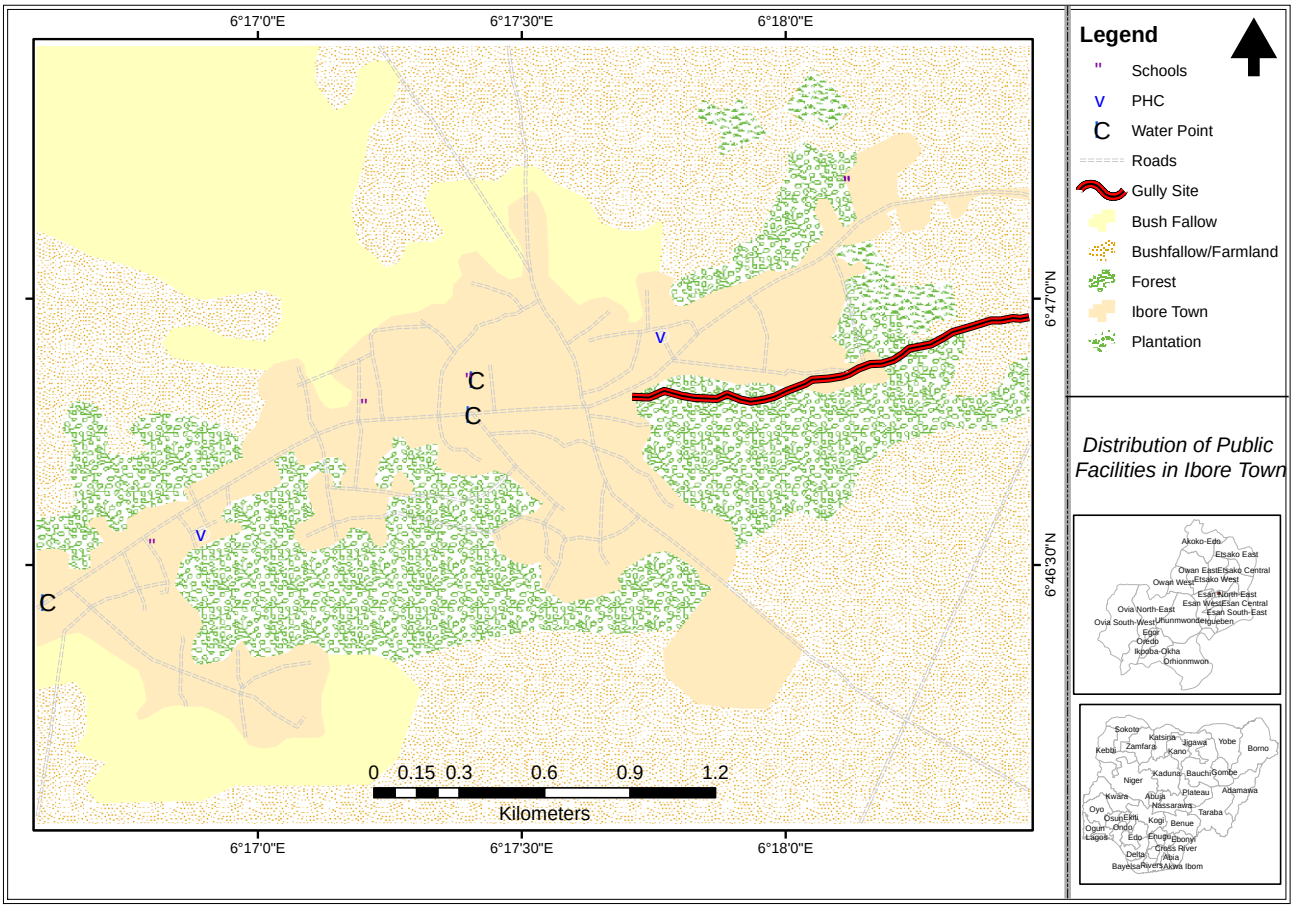


Figure 4.14: Water storage device used by respondents in Ibore Community

4.5.3 Schools, Health and Public Water Facilities

Ibore has a total of five (5) schools made up of four (4) public and one (1) private school. The breakdown of these schools shows that there are two public primary schools (Ugbokhare Primary School Irrua and Ibore Primary School), one private primary school (Ojieabu Nursery and primary school), one senior secondary school (Uneah Senior Secondary School, Ibore - Irrua) and one Junior secondary schools (Uneah Junior Secondary School Ibore - Irrua) in the town. Pupils come from not only the Ibore town but also from nearby communities. Almost all these schools do not have toilet facility except one. In terms of health care facilities, there are two prominent primary health care facilities in the town and these are the Ugbokhare



primary health Centre and Ibore primary health Centre. Furthermore, public tap water were also observed in the community (**Figure 4.15**).

Figure 4.15: Distribution of Public Facilities in Ibore Community

4.5.4 Household Waste Disposal

Waste management approach adopted by communities will determine their vulnerability to diseases. It is an indication of their level of hygiene, which may be rooted in socio-cultural and behavioural practices and moderated by income. Respondents who indicated that they deposit waste in their backyard where they ultimately burn it were 58.3%, while those who indicated that they deposit in the drainage gutter were 30.3% and 12.4% stated that they deposit in the gully because they were attempting to fill the gully (**Figure 4.16** and **Plate 4.5**).

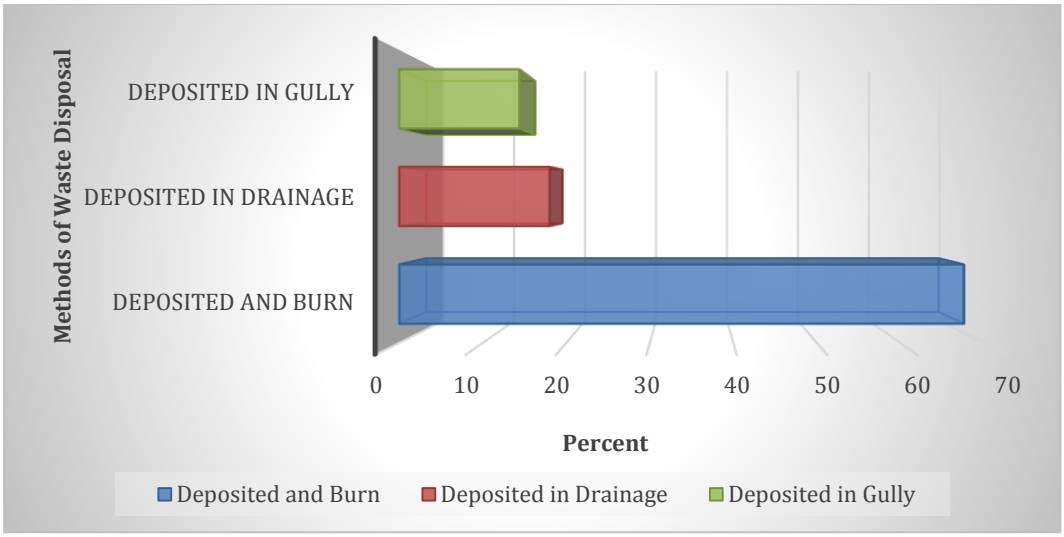


Figure 4.16: Waste Disposal Methods Adopted by Respondents in Ibore Community

Plate 4.5: Waste Deposited Inside the Gully Site

4.6 Human Health

The health services in Ibore community are precarious, like other essential services, and are dispensed by modern and traditional service providers. Modern health service is provided by different categories of health facilities operated by health personnel of different qualifications and training backgrounds, while traditional treatment ranges from faith healing to traditional medicine.

Traditional healing systems fall into three categories, which are namely, traditional medicine, spiritual healing and exorcism and out of these two are widely embraced in Ibore town. The first type of treatments consists of package of knowledge transmitted through father and mother by generations, through oral tradition and by observation of practices (traditional indigenous medical knowledge). Therapists of this kind include herbalists, bonesetters and surgeons. Cauterisation and incision of ailing parts of body are included in the traditional treatment practices. It has been noted that some of these practices have little curative value, despite their costs on the families and lapse of time. Often patients are taken to modern medicine facilities after the disease reached an advanced stage, because the appropriate time has been spent on non-effective traditional medicine. Faith healing is more spiritually based treatment conducted by religious devotee, who serve as judge, scribe and healer and possesses spiritual power, which is partly divine gift and partly transmitted by elders on his investiture following completion of pupillage training.

The health seeking population in Ibore town resort to various health facilities in the town, however, some travel as far as Benin City and sometimes Lagos to seek treatment. The total numbers of primary Health Care (PHC) units that operate in Ibore town were two. Primary health care centres are intended to provide, at district and sub-district levels, antenatal and post-natal care, delivery services immunization, growth monitoring, treatments for diseases for children under five, and health education. In addition, they are expected to provide treatment for minor ailments (common diseases found in the area), first aid services and health education for the population as a whole, while also dispensing drugs. The PHCs ensure basic preventive and minimum curative health care services are delivered to the most vulnerable. The availability of these facilities does not mean access to adequate health service delivery is guaranteed in the community. Also, both private and public health provide service providers in the community referral treatments. Other privately owned hospitals admit needy clients against payment of the cost of case treatment. Some of these facilities are fairly gaining reputation, while others are small dispensaries with few beds and with fewer facilities.

Some of the doctors in Ibore town have established private clinic, while some also manage hospitals and public health activities. Since public sector does not offer reasonable salaries, this is a pragmatic arrangement through which doctors manage to make a livelihood. Private clinics provide consultation to their clients, against payment of fee. Depending on the case, doctors prescribe drugs for common ailments or advice the patients to make laboratory tests and return with results, before taking decision on the case. Doctors may also refer patients to a secondary facility.

There has been an upsurge of retail trade in drugs in recent years. Even the most remote areas that are not served by a PHC clinic or a health post would have at least one pharmacy selling basic drugs. Opening pharmacy is no longer different from opening a kiosk or a corner shop selling cigarettes and drinks. Most pharmacies exist solely to sell as many drugs as possible, and therefore to maximize profit. The apparent profit drive for mushrooming of private pharmacies is encouraged by frequent health seeking clients who either self-prescribe drugs or approach respective pharmacy operators for advices, without consulting with medical doctor or any other senior health staff member. This has certainly improved access to medication in Ibore town, but it has also contributed to widespread abuse by dispensing drugs without doctor's prescription. Determining which medications are prescribed for which problems, and who can prescribe and dispense them is one of the key areas where policy intersect with practice.

4.6.1 Environmental Concern in the Community

Four major environmental concerns of the community identified during the consultation meeting are (a) irregular rainfall (b) excessive rainfall (c) soil loss and degradation and (d) excessive heat. It was noted during the consultation that rainfall patterns have become highly irregular and unpredictable in the recent time. This to a large extent has affected their agricultural practise. This challenge could be linked to the global climate change issue. Furthermore, when the rains come, it is always in excess leading to issue of flooding and subsequent widening of the gully site in the community. Also, the excessive rainfall is also responsible for soil loss and degradation in soil quality leading to low agricultural yield. Prolonged dry season and excessive sunshine in dry season combined to produce excessive heat. Some of the

respondents indicated that the increasing number of children with chickenpox could be linked to exposure to excessive heat, while a number of adults indicated inability to sleep at night due to excessive heat. Some of the adults indicated that they sleep outside of their house to get enough air at night. However, this has increased the vulnerability to mosquito bites and subsequent malaria fever.

4.6.2 Perceived Environmental Impacts of the Gully Erosion

The consequences of the gully erosion in the community include the destruction of road infrastructure (**Plate 4.6**), buildings (**Plate 4.7**) and threat to human and animal safety (**Plate 4.8**). One of the major concerns, which have been raised by the community people over the existence of the gully site in their community, is the effect of the gully on a major road in the community. The road has caved-in thereby making commuting between one part of the town and another difficult. The widening of the gully head is also a major concern to the community people because large amount of soils is washed away every year. Residents in the vicinity of the gully hardly sleep anytime it rains in the town because of the fear that their house may cave into the gully. There are relics of washed away and abandoned buildings in and near the gully heads (**Plate 4.7**). Therefore, the cost of the gully site to residents of Ibore community is too much for them to bear and that is why they have been calling on government at various levels over the years to come to their aid and assist with rehabilitating the gully site to ensure safety of lives and properties in the community.

Plate 4.6: Gully Encroaching into Road in Ibore Community

Plate 4.7: Building being threatening by the Expanding Gully in Ibore Community

Plate 4.8: Domestic Animal Roaming in the Vicinity of the Gully Erosion Site

4.7. Assessment of Existing Formal and Informal Grievances Redress Mechanism

Grievance Redress Mechanisms (GRMs) are defined as organizational systems and resources established by national government agencies (or, as appropriate, by regional municipal agencies or local traditional institutions) to receive and address concerns about the impact of their policies, programs and operations on external

stakeholders. The stakeholder input handled through these systems and procedures may be called “grievances,” “complaints,” “feedback,” or any other functionally equivalent term. GRMs act, as recourse for situations in which, despite proactive stakeholder engagement, some stakeholders have a concern about a project or program’s potential impacts on them. GRMs can therefore be seen as part of institutional framework to redress perceived injustice or marginalisation arising from project implementation.

GRMs are intended to be accessible, collaborative, expeditious, and effective in resolving concerns through dialogue, joint fact-finding, negotiation, and problem solving. They are generally designed to be the “first line” of response to stakeholder concerns that have not been prevented by proactive stakeholder engagement. GRMs are intended to complement, not replace, formal legal channels for managing grievances (e.g., the court system, organizational audit mechanisms, etc.). Stakeholders always have the option to use other, more formal alternatives, including legal remedies. It is important to emphasize that national GRMs are not intended to replace the judiciary or other forms of legal recourse. The existence of a GRM should not prevent citizens or communities from pursuing their rights and interests in any other national or local forum, and citizens should not be required to use GRMs before seeking redress through the courts, administrative law procedures, or other formal dispute resolution mechanisms.

Based on the foregoing, it is clear that there is no existing formal institutional frameworks specifically setup to handle grievances that might arise from the gully erosion rehabilitation project in the community. Public Complaint Commission (PCC) perhaps is the only formal agency saddled with such responsibility. The agency has its presence in virtually all the state capitals in Nigeria. Complaints about the project can therefore be lodge at their office in Benin, Edo State. This office appeared to be the closest to the project site.

In conjunction with stakeholders, the Edo state NEWMAP nevertheless will develop and implement a Grievance Redress Mechanisms (GRM) that will include the following:

i. Anyone may contact the NEWMAP, in person, by mail, or by telephone to submit a grievance;
ii. Contacts about grievances may be initiated by the affected person, through an agreed local liaison committee or through the Ibore community;
iii. All complaints will be documented by Edo State NEWMAP and tracked to resolution, and information on the status will be available to the person making the complaint;
iv. The Edo State NEWMAP will investigate the complaint and determine the response including, if applicable, proposed actions;
v. The Edo State NEWMAP will inform the person making the complaint, either verbally or in writing;
vi. Prior to rehabilitation of the Ibore gully erosion site, Edo State NEWMAP will work with stakeholders to develop arbitration system for resolving complaints;
vii. The grievance mechanism will inform complainants of their options if the complaint cannot be resolved;
viii. The Edo State NEWMAP will strive to investigate and resolve complaints promptly;
ix. There will be no cost to the person presenting the complaint;
x. All complaints will be treated with appropriate confidentiality;
xi. Complaints will be investigated and resolved without retribution to the complainant or other persons; and,
xii. Project personnel, especially those who have contact with the public, will be briefed/trained about the grievance procedure, including whom to contact within the Edo State NEWMAP or the Edo State Government about a complaint.

Ibore traditional council has been identified, as the only informal grievance redress mechanism that can be employed be residents in Ibore community. Over the years, the council has amicably resolved grievances among warring factions, families and individuals in the community. The achievement was made possible because of the high regard accorded traditional institution in the community. The council is made up of the paramount ruler and council chief. Perceived grievances arising from the gully erosion project implementation can be reported to the council. During the stakeholder engagement, the council assured that any grievance (as long as it is not criminal and is within the purview of the council) reported to them would be amicably settle. Anticipated grievances that may arise during the gully erosion project and which might be amicably resolved include trespasses on land, property and farmland by the contractor.

4.7.1 Stakeholder Engagement Plan

The Edo State NEWMAP has been implementing its Stakeholder Engagement Plan since the project inception in the state and it includes the following:

i. Identification of Project stakeholders;
ii. Summary of past consultation efforts;
iii. Planned consultation efforts to prepare for construction activities;
iv. Stakeholder engagement during construction;
v. Stakeholder engagement during operations;
vi. Resources for stakeholder engagement;
vii. Monitoring and reporting on stakeholder engagement; and
viii. Formation of the Ibore gully erosion site monitoring committees

4.7.2 Consultations with relevant stakeholders

Community consultation with residents of the Ibore community on the gully erosion site rehabilitation was with a view to inform them about government readiness to intervene in the project. In addition, it served to secure community buy-in on the project while at the same time identifying issues that can generate grievances between the community and contractor during the construction activity.

Consultation on the gully erosion was held at Ibore and in attendance were various community groups and individuals (**See Plate 4.9 - 4.12** for the stakeholder engagements held at Ibore community and **Appendix 1.0**. for list of individuals in attendance). The project team leader introduced the project to the community and thereafter, questions and the team entertained concerns. It was gathered that the erosion started about 22 years ago as small sheet erosion but has since becomes a massive gully in the community. Topography of the gully site was identified as being responsible for the emergence of the gully and it was sustained by vegetation clearance. Residents have attempted to reduce the effect of associated flood through the use of sand bags as embankment around their house however, while the initiative helped to reduce the amount of floodwater that entered their house, it did not reduce the widening of the gully. Digging of small retention ponds and clearing of drainage channel and opening up of new drainage channels were among the efforts embarked upon to reduce the speed of storm water entering into the gully site.

Plate 4.9 -4.12: View of the stakeholder engagement held at Ibore community

Some of the untoward consequences of the gully erosion identified include;

i. Some of the residents have been carried away by the flood water and later found dead
ii. Some died when their house collapsed during the flood water
iii. Some have equally lost domestic animals into the flood.
iv. Not less than 10 houses have been destroyed by the flood water, while a number of building have suffered structural defects as a result of the flood and gully erosion

It was also reported that:

i. Issues of compensation for properties that are likely to be affected during construction phase should be properly discussed ahead of the construction to forestall conflict
ii. The community frowns at stealing and would not want any of the contractor staff to trespass into resident's farmland
iii. The community has not witnessed any major conflict in the last 20 years. Neither communal nor ethno-religious conflicts have been experienced in the community.
iv. The project would not in any way impinge on the cultural values of the residents
v. The contractor should employ sizeable number of the residents for its various activities
vi. The communities assured their cooperation with the Edo state NEWMAP, contractors and consultants. They promised adequate security / protection of lives, properties and equipment during construction and other related activities.
vii. Towards a successful implementation of the NEWMAP project, the community has setup various committees to assist the contractor that would be handling the construction work

4.7.3 Anticipated Impacts of the Gully Erosion Intervention Project

Residents in the Ibore community are quite aware of the government's intention to assist them in addressing the challenge posed by the gully erosion. During the questionnaire administration and consultations, residents claimed that they have been seeing different kinds of people coming to inspect the gully erosion site and that they have helped in conducting them round the community so that they will have a first-hand view of the challenge posed by the gully erosion. Virtually all the adults in the community seems to be aware of NEWMAP intervention as they often ask strangers they see whether they are in the community because of the NEWMAP project. Based on the consultations held with the residents, their expectation is very high although some of them are sceptics whether government will address the problem immediately or deferred it till another time when money would be available. They however pleaded that in view of risks posed by the gully site to human lives,

government should urgently rise to their aid to address the problem of gully site immediately.

As parts of the community preparation, various committees have been inaugurated to interface with the consultant that would handle the erosion site rehabilitation. The committee meets regularly to educate residents on what government is doing or planning to do to address the gully erosion issue in the community. Hence, the consultant might not likely face any challenge with regard to the rehabilitation of the gully erosion site because it is a top priority project in the community. Some of the issue that the residents think could engendered crisis included; violation of customs and tradition of the community, none engagement of the community people during the construction phase of the project, improper handling of issues relating to compensation and theft of agricultural produce by workers on site.

The community is committed to the rehabilitation of the gully erosion sites and therefore not willing that anything disturb the project. It was also noted that since there would always be community people with the contractor, the contractor would be adequately guided on the local cultures and taboos. The community people would also be happy if they are engaged in the rehabilitation work. It was notice that there are able-bodied men that can provide labour for different aspect of construction during the construction and operational phase of the project. Another issue of concern relates to compensation and modalities for allocation of compensation among the projected affected people (PAP). The issue of what to pay, and who to pay as well as how much to be paid were extensively discussed during the consultations. It was clear that if the issue of compensation is not properly addressed it could result in conflict between residents and the contractor. Being an agricultural society, the residents in the Ibore community frown at theft of their produce. They therefore encourage construction workers to adhere strictly to their rule of engagement during their work in the community.

CHAPTER FIVE

ASSESSMENT OF ASSOCIATED AND POTENTIAL IMPACTS

5.1 Introduction

This chapter presents an overview of the identified impacts of the proposed NEWMAP gully erosion site rehabilitation intervention project in Ibore, Esan Central LGA of Edo State, Nigeria. The associated and potential impacts of the NEWMAP intervention in Ibore was identified based on the interaction of specific project activities with the biophysical and social characteristics of the project environment as well as the health/safety requirements of the Ibore Esan community and the construction workers. Details of the methodology adopted for impact analysis; the associated and potential impacts of the project; the residual impacts identified for the proposed NEWMAP interventions are presented herein. As much as possible, the recommendations of the Global NEWMAP environmental and social management framework (ESMF), in terms of impact assessment and analyses, were adhered to.

5.2 Overview of the Proposed Intervention Project in Ibore

5.2.1 Design and Construction of Major Drainage Systems and Ancillary Structures

The damage at Ibore gully site is a direct result of the poor drainage system that is unable to cope with the peak flows. It is recommended that a major drainage system be designed to accommodate the 1 in 50 year return period event with a peak flow of 44 m^3/s. It is clear that large conduits will be required to accommodate flows of this magnitude through the urban area and that appropriate energy dissipating structures will be required at the gully to reduce flow velocities so as to prevent further erosion by:

- Diverting the flow around the gully head will provide the most practical solution. This will allow the construction of diversion channel, discharge chutes and stilling basins to take place in relative safety, away from the gully while the flow continues to discharge into the gully head. Once completed, the newly constructed permanent diversion channels will allow rehabilitation of the gully

head and the reconstruction of the road, without having to deal with floods during construction.

- Managing the flows in the gully requires an earth channel such as the one that currently exists, but with the additional provision of gabion check dams to reduce the longitudinal gradient and thereby slow down the velocity of the flow in order to prevent further erosion.
- In order to manage the flow around the gas pipeline, it is recommended that the watercourse be re-aligned to return to a more natural route and to limit the distance over which it comes into contact with the gas pipeline.
- The gully head upstream of the confluence with the new bypass channel will be backfilled and reinstated.
- The road that has collapsed as a result of the gully erosion will be reconstructed. The road will be bitumen surfaced and will be super elevated to support the horizontal curve alignment and drain water away from the gully. The horizontal alignment curve supports the super elevated alignment to transfer surface water to a second bypass channel on the north side of the gully.
- Major inlet works are planned upstream of the gully. This will include new open channels with inlets to the new bypass conduits in and around the road intersection. Existing open rectangular side drains will discharge into the new system. During significant runoff events surplus surface runoff that is not intercepted by the new intake works at the road intersection will be intercepted by a new grating that will be installed across the full roadway width and provided with a heavy steel grid.
- Additional open side drains will contribute to the interception during extreme events.
- The design for safety and risk primarily consists of the open channels that are lined on both sides with sloping stone pitching or riprap. Should the capacity of the open channels be exceeded, surcharge capacity is still available. This same fringe infrastructure will also act as a safety zone where people can be alerted to the infrastructure ahead.

- Extensive planting of suitable vegetation reduces risk of erosion where surfaces are exposed to surface runoff. The most significant part of the geotechnical design consists of shaping the sides of the new channel to provide flat slopes (1 on 2). In addition, water energy is controlled to flow at velocities that are within the capabilities of the soils. Extensive use is also made of vegetation to improve the soil's resilience to erosion.

5.2.2 Vegetation to be planted after the Rehabilitation

The grass species to be planted are *Vetiveria zizanioides* and *Pueraria sp*. These are the only grass species approved by NEWMAP. The tree species indicated on the concept diagrams is *Acacia sp*. This species, which has a wide distribution, can be a tree or a shrub. It is also used as a pioneer species in land rehabilitation, as it is very resilient and able to tolerate extreme temperatures and rainfall. Ideally, all plants should be planted before the start of the rainy season to allow them time to establish.

Once the contractor has been appointed, he would be notified to put in an order to allow for ample propagation of the required species. It is assumed that both these grass species will be readily available, as they are widely used for commercial projects in Nigeria. It might be possible, for example, to plant three sites and then harvest from these sites for future use at other sites, as the grass species grow quite quickly. *Vetiver* grass is obtained by dividing existing clumps of grass into smaller pieces, called slips, which are single stems with roots. However, the process is quite labour intensive.

Rehabilitation and the planting of grass would be an on-going process. Once a section of construction has been completed, it should be planted and protected. This will decrease the likelihood of having to plant a huge amount of plugs at once. Ideally, plugs should be planted, especially in areas that are more prone to erosion. Hand seeding can be applied in areas less prone to erosion, but should only be seen as an option if plugs are not available.

On the design and construction model produced, different section had been indicated where vegetation growth would have to be established once the gully has been rehabilitated. On each figure, suggestions are made as to the required type of vegetation for the specific section, which the figure represents.

5.2.3 Bill of Engineering Measurement and Evaluation (BEME) Composition

After the designs and drawings were completed, a Bill of Engineering Measurement and Evaluation (BEME) were compiled to give a cost estimate of the construction works. The measurement techniques are according to the Southern Africa Transport and Communications Commission (SATCC).

The BEME has been divided into three (3) main sections:

- Bill A: General
- Bill B: Structures
- Bill C: Gully Re-Alignment and Stabilisation

Major Quantities

In the Bill of Engineering Measurement and Evaluation (BEME), the following are the major quantities:

- Concrete 2950 m^3
- Structural steel 350 t
- Formwork 8400 m^2
- Fill earthworks 95 000 m^3
- Cut earthworks 50 000 m^3
- Volume of gabions 9600 m^3
- Filter Fabric 45 600 m^2
- Area to be vegetated 5.7 ha

5.2.4 Quality Assurance (QA) and Quality Control (QC) for the Proposed Design and Construction in Ibore

The general conditions of contract are based on the World Bank's Harmonized FIDIC document for large works. The specifications are mostly based on the SATCC standard specifications for workmanship and materials. The British Standards are also used extensively. In the Bill of Engineering Measurement and Evaluation (BEME), the following are the large quantities:

- Concrete 2950 m^3
- Structural steel 350 t
- Formwork 8400 m^2
- Fill earthworks 95 000 m^3
- Cut earthworks 50 000 m^3
- Volume of gabions 9600 m^3
- Filter Fabric 45 600 m^2
- Area to be vegetated 5.7 ha

5.3 Impact Assessment Methodology

The impact assessment methodology approach utilized followed a four-step approach, which consists of:

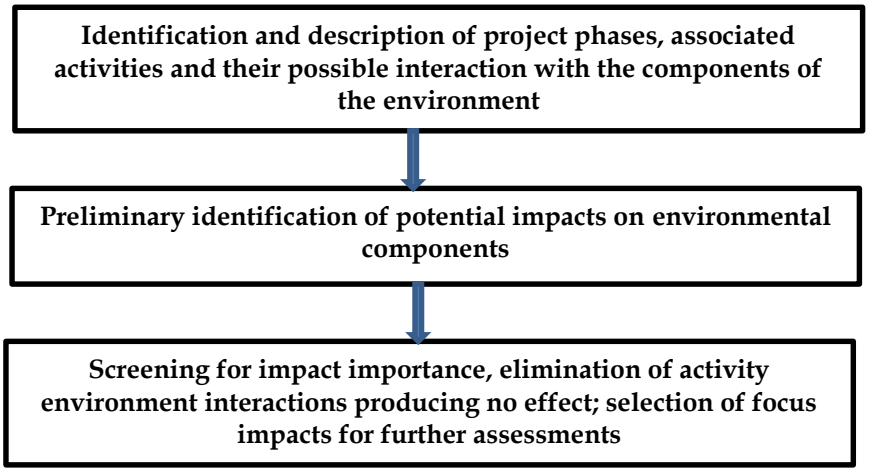
Step One:

The first step is a detailed description of the Ibore project area prior to implementation of the proposed NEWMAP gully erosion site rehabilitation. Based on this, the impact analysis focus on all components, which are anticipated to affected or modified by the project;

Step Two:

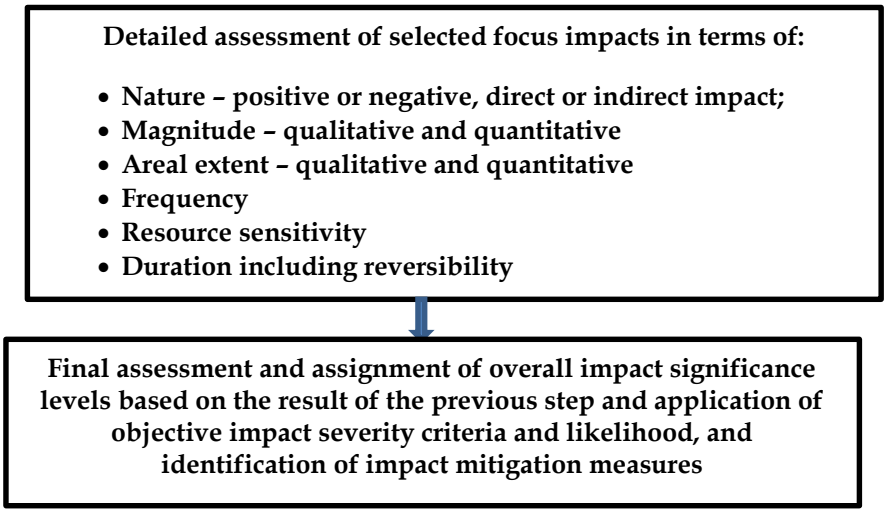
The next step is a general screening of potential impacts: The aim of the screening is to identify as exhaustively as possible all impacts, beneficial or detrimental which can reasonably result from the gully erosion site rehabilitation project implementation. A matrix approach is utilized, crossing all the parameters of the social and biophysical

environment with each project activity involved in project, during the site clearing and preparation, construction, operation and maintenance, and decommissioning phases. The impact identification and prediction approach utilizes elements of various impact identification and prediction methods such as checklists, matrices and flowcharts. To effectively perform these general screening of potential environmental impacts of the projects, the following approach was followed:



Step Three:

Impact Analysis and Elaboration of Corrective Measures: On the basis of the screening stage, the main impacts were analyzed, in order to quantify them, whenever possible and to elaborate specific measures to cancel, reduce or compensate the most detrimental ones. This step was performed by performing the following tasks:



Step Four:

On conclusion of the impact analysis, the details of the positive and negative effects of the proposed developments on the environment are outlined and appropriate solutions or mitigation measures to minimize any undesirable effects resulting from the proposed

5.4 Type of Impacts and their Consideration for the Proposed Ibore Intervention Project

For the purpose of this work, identified impacts that are likely to be associated with the proposed project have been classified to occur in three (3) phases for the lifespan of the works. The phases include:

- Construction phase
- Operational phase
- Decommissioning phase

The analysis of project impacts of the NEWMAP gully erosion site rehabilitation project involves the identification of environmental media that could be potentially affected by all project activities in the three phases of the project listed above. For the purpose of impact identification, the respective project activities to be undertaken for each phase of the project include:

Table 5.1: Project activities at the three phases of the proposed NEWMAP Intervention project in Ibore

S/No	Project Phase	Project Activities
1	Pre-construction	Contractor's Site Clearing and Preparation Activities and Logistics; ➢ General clearing and preparation of the project site for gully erosion site engineering solution construction works ➢ Surveying and setting out of the new storm water drainage infrastructure (Culverts); ➢ Utilization of existing access roads to the proposed project site; ➢ Construction of sheds and equipment lay down areas for the storage of materials.
2	Construction	➢ Construction of drainage conduits upstream of the gully head to contain and direct overland flows into the new diversion culverts; ➢ Demolition of two existing buildings to make way for the construction of the main bypass culvert;

S/No	Project Phase	Project Activities
1	Pre-construction	Contractor's Site Clearing and Preparation Activities and Logistics; - General clearing and preparation of the project site for gully erosion site engineering solution construction works - Surveying and setting out of the new storm water drainage infrastructure (Culverts); - Utilization of existing access roads to the proposed project site; - Construction of sheds and equipment lay down areas for the storage of materials.
		➢ Construction of gully bypass system, a 2.5m by 1.5m closed box diversion drainage culverts to collect and direct storm water flows from existing roadside channels and overland flows into a Chute (drop down structure) ➢ Construction of a Baffled Chute to the bottom of the gully (a drainage infrastructure for discharging storm water into the gully downstream of the gully head); ➢ Construction of Stilling Basin; ➢ Filling of the gully head ➢ Reshaping of the gully as an earth channel by a cut-and-fill civil works whereby the earth removed from the gully sides slopes is used to compact the gully floor. ➢ Placement and positioning of nine (9) regularly spaced gabion drop structures over every 500m of the gully channel to reduce the longitudinal gradient to 0.05% (with a 2m drop) and slow down the flow velocity to 1.4m/s to prevent further incidence of erosion ➢ Erosion protection of the banks by cutting and sloping the sides of the gully banks to a gradient of 1:2 ➢ Use of gully bank soil materials to fill the gully bed a few meters and the to fill the gully head ➢ Re-construction of the damaged road; ➢ Reconstruction of all associated road drainage infrastructure ➢ Reshaping the gully and installation of erosion protection facilities to enable safe conveyance of storm water downstream of the gully head; ➢ Transportation of Heavy Equipment, Construction Materials and Workers to the Project Site; ➢ Operation of Heavy Construction Equipment; ➢ Fuel Storage and Dispensing to Heavy Equipment and Vehicles.
2	Operation and Maintenance	➢ Utilization and operation of the rehabilitated gully erosion site channel and; ➢ Maintenance of the drainage infrastructure of the Ibore gully erosion site ➢ Monitoring of the Ibore gully erosion infrastructure to ensure full functionality
3	Decommissioning	➢ Dismantling and Removal of Equipment; and Vehicles ➢ Restoration of the Project Site to its natural state and ➢ Waste Management.

5.5 Associated and Potential Environmental and Social Impacts

The potential impacts on environmental and social media identified for the proposed intervention projects are as shown in **Table 5.2.** Generally, all projects have possible beneficial and/or adverse impacts.

Table 5.2: Potential Impacts of the Proposed Intervention Project on Environmental and Social Media

PROJECT PHASE	PROJECT ACTIVITY	AFFECTED ENVIRONMENTAL AND/OR /SOCIAL COMPONENT	PROJECT IMPACT
Pre-Construction:	General clearing and preparation of project site for gully erosion site rehabilitation and construction works	Socio-economics	❑ Increased employment opportunities for the local communities
		Socio-economics	❑ Interference with day-to-day community activities resulting in conflicts and complaints
Pre-Construction	Land Acquisition and demolition of existing buildings	Socio-economics	❑ Conflict over loss of land and resettlement benefits if payment is restricted to owners of the two buildings to be demolished for the construction of the diversion culvert
		Socio-economics	❑ Conflict between the NEWMAP project and the resident community over relocation benefits due to those families whose buildings, land, and lives of loved ones were lost to the gully erosion at Ibore
Pre-Construction	Physical presence of construction workers on the Ibore Gully erosion intervention project site and environ	Soil	❑ Contamination of soil and downstream water resources of the project area from indiscriminate disposal of untreated sewage
Pre-Construction	Contractor's site preparation operations	Socio-economics	❑ Increased employment opportunities for the local

PROJECT PHASE	PROJECT ACTIVITY	AFFECTED ENVIRONMENTAL AND/OR /SOCIAL COMPONENT	PROJECT IMPACT
			communities
Pre-Construction:	Transportation of equipment, materials and workers to the project site	Air Quality	❑ Ambient air quality deterioration from airborne dust particulates, fugitive emissions, exhaust of equipment/automobiles
		Noise Levels	❑ Noise and vibration from vehicular movement
		Transportation/infrastructure	❑ Traffic congestion and increased risk of occurrence of traffic accidents and injuries
Construction	Construction of sheds, equipment lay down areas, temporary office and sanitary facilities etc.	Air Quality	❑ Increase in ambient noise levels and vibration
Construction	Construction of drainage conduits upstream of the gully head and other associated road drainage infrastructure	Socio-economics	❑ Increase in employment opportunities and engagement of community labour
		Socio-economics	❑ Social and cultural structure interference and complaints;
		Community/Public Health	❑ Marginal increase in population within the settlements in close proximity to the project site will lead to an increase in negative vices such as prostitution (commercial sex work) and crime which would

PROJECT PHASE	PROJECT ACTIVITY	AFFECTED ENVIRONMENTAL AND/OR /SOCIAL COMPONENT	PROJECT IMPACT
			affect social and cultural systems through a negative value system;
		Socio-economics	❑ Conflicts between the project and the community as well as the pressure of the influx of potential job seekers into the project area and associated risks;
		Socio-economics	❑ New wealth among the youth would threaten the existing authority structure;
Construction	Disruption and encroachment into agricultural lands in close proximity to the gully erosion	Socio-economics	❑ Conflict over loss of agricultural lands due to gully erosion rehabilitation civil works downstream of the gully head in Ibore community
	Transportation of equipment, materials and worker to project site	Soil and Groundwater	❑ Accidental release of fuels, oils, chemicals, hazardous materials etc., to ground in the construction laydown area during delivery of materials and equipment to project site
Construction	Construction of 2.5m by 1.5m gully bypass closed box diversion drainage culverts	Socio-economics	❑ Conflict over loss of land and resettlement benefits for demolition of two existing buildings obstruction

PROJECT PHASE	PROJECT ACTIVITY	AFFECTED ENVIRONMENTAL AND/OR /SOCIAL COMPONENT	PROJECT IMPACT
			the construction of the diversion culvert
		Socio-economics	❑ Conflict between the NEWMAP project and the resident community over relocation benefits due to those families whose buildings, land, and lives of loved ones were lost to the gully erosion at Ibore community
		Socio-economics	❑ Disruption of community activities and movement around the gully head
Construction	Construction of Baffle Chute to the bottom of the gully	Soil and Erosion	❑ Risk of chute failure by flow undermining gully head, overtopping or bypassing. The failure occurs when storm runoff fails to enter the baffle chute properly especially when the runoff leaks and flow bypassing occur at the chute entrance
		Soil and erosion; Health and Safety; Socio-economics	❑ Occurrence of risks associated with large storm events that exceeds the design capacity of the Chute

PROJECT PHASE	PROJECT ACTIVITY	AFFECTED ENVIRONMENTAL AND/OR /SOCIAL COMPONENT	PROJECT IMPACT
		Soil and Agriculture	❑ Loss of fertile top soil for infertile sub-surface soil that would not enhance vegetation establishment
		Socio-economics; health and safety	❑ Risk of loss of life and damage of the proposed gully drainage infrastructure
Construction	Construction of Stilling Basin	Soil and Agriculture	❑ Loss of agricultural lands and increase in the exposure of erodible soil
		Soil and Agriculture	❑ Loss of valuable topsoil that the could be used for seeding vegetation
		Health and Safety	❑ Workers exposure to risk of falls into excavated pit and occurrence of accident or injuries
		Socio-economics; Health and Safety	❑ Risk of stilling basin failure and occurrence of flooding, overtopping resulting in stilling basing sweep out and downstream channel erosion
Construction	Filling and reclamation of the gully head	Health and Safety	❑ Occurrence of accident and safety risk incidents
		Health and Safety	❑ Waste handling and disposal
		Water Quality	❑ Increase in turbidity and sediment

PROJECT PHASE	PROJECT ACTIVITY	AFFECTED ENVIRONMENTAL AND/OR /SOCIAL COMPONENT	PROJECT IMPACT
			load in downstream receiving water bodies
Construction	Reshaping of the gully channel by cutting earth from gully side slopes to fill the gully channel floor	Soil and Erosion	❑ Increase in the amount of disturbed areas created by earthmovers used in reshaping the gully side slopes
		Water Quality	❑ Contamination of downstream receiving water bodies by fertilizers, and pesticides as well as creation of excessive bare soils by herbicides if used for the establishment of the recommended plant species seeded to control soil erosion
		Soil and Erosion	❑ Exacerbated gully erosion channel bed undermined and washing away of fill materials resulting in increased sediment load in receiving water bodies downstream
	Increase in the amount of disturbed areas created by earthmovers used in reshaping the gully side slopes	Soil and Erosion	❑ Risk of erosion of exposed gully side slopes and erosion of ground area above the gully channel divide
		Soil and Agriculture	❑ Loss of fertile top soil that could be used for seeding vegetation
		Soil and Erosion	❑ Occurrence of bank erosion along

PROJECT PHASE	PROJECT ACTIVITY	AFFECTED ENVIRONMENTAL AND/OR /SOCIAL COMPONENT	PROJECT IMPACT
			reshaped gully channel slopes
Construction	Placement of Gabion Drop Structures in gully channel to reduce longitudinal gradient to 0.05%	Soil and Erosion; Vegetation and Wildlife	❑ Disturbance of unnecessary large land areas for transportation of materials and heavy earthmovers
Construction	Erosion protection of gully banks by cutting and sloping the sides of the gully bank to a 1:2 gradient	Soil and Agriculture	❑ Loss of fertile top soil which could be used for seeding vegetation
		Health and Safety	❑ Risk of occurrence of accident or injury
Construction	Reconstruction of damaged road	Air Quality	❑ Ambient air quality deterioration from airborne dust particulates, fugitive emissions, exhaust of equipment/automobiles
		Noise Level	❑ Noise and vibration from vehicular movement
Construction	Reshaping the gully and installation of erosion protection facilities to enable safe conveyance of storm water downstream of gully head	Water Quality	❑ Water quality deterioration
		Health and Safety	❑ Risk of hearing impairment from increased noise and vibrations
		Vegetation and Wildlife	❑ Loss of wildlife
		Soil and Agriculture	❑ Loss of valuable topsoil that could be used for seeding vegetation
Construction	Transportation of heavy equipment, construction materials and workers to the project site	Air Quality	❑ Ambient air quality deterioration from airborne dust particulates, fugitive emissions, exhaust of equipment/automobiles

PROJECT PHASE	PROJECT ACTIVITY	AFFECTED ENVIRONMENTAL AND/OR /SOCIAL COMPONENT	PROJECT IMPACT
		Noise Level	❑ Noise and vibration from vehicular movement
		Transportation and Infrastructure	❑ Traffic congestion and increased risk of occurrence of traffic accidents and injuries
		Soil and Groundwater	❑ Accidental release of fuels, oils, chemicals, hazardous materials etc., to ground in the construction laydown area during delivery of materials to project site
Operation	Utilization of the rehabilitated gully site and installed storm water drainage infrastructure	Socio-economics; Infrastructure	❑ Risk of failure of the gully erosion installed drainage infrastructure to safely route storms of 1 in 50 years
		Soil and Erosion; Flooding and Infrastructure	❑ Risks from debris and sediment accumulation in the drainage channels in upstream catchment area of the gully head, Diversion Culvert, Baffle Chute, Gabion Drop Structures and Stilling Basin resulting in performance failure of the drainage infrastructure
		Infrastructure	❑ Risk of undermining and occurrence of scouring in the Baffle Chute could result in deteriorating

PROJECT PHASE	PROJECT ACTIVITY	AFFECTED ENVIRONMENTAL AND/OR /SOCIAL COMPONENT	PROJECT IMPACT
			performance of the structure
Operation	Maintenance of the gully drainage infrastructure	Soil and Erosion Health and Safety	❑ Risk of failure of the gully intervention from poor maintenance of the drainage infrastructure to achieve the desired project objectives such as (Creation of new gullies within the channel; breeding of vectors in the settling basin, undermining of the drainage infrastructure and scouring of the drainage structure, etc.)
		Soil and Erosion	❑ Disruption of the side slopes during routine maintenance of the gully channels
Decommissioning	Dismantling and removal of civil engineering equipment	Air Quality	❑ Ambient air quality deterioration from airborne dust particulates, fugitive emissions, exhaust of equipment/automobiles
		Noise levels	❑ Noise and vibration from vehicular movement
Decommissioning	Waste handling and disposal	Waste Management	❑ Solid Waste generation, handling and disposal
		Health and Safety	❑ Poor housekeeping and environmental sanitation

PROJECT PHASE	PROJECT ACTIVITY	AFFECTED ENVIRONMENTAL AND/OR /SOCIAL COMPONENT	PROJECT IMPACT
Decommissioning	Transportation of solid waste, equipment and workers out of the project site.	Transportation and Infrastructure	❑ Traffic congestion and increased risk of occurrence of traffic accidents and injuries
		Air Quality	❑ Ambient air quality deterioration from airborne dust particulates, fugitive emissions, exhaust of equipment/automobiles
		Noise Levels	❑ Noise and vibration from vehicular movement

5.5.1 Potential Positive Impacts of the Project

The project is envisaged to have a range of positive environmental and social impacts. Some of these are a function of the objectives of the project, while others are a function of the way in which the project is designed to meet its objectives.

Some of the benefits impacts associated with the project include:

- Provision of employment
- Reduction in hunger through the harnessing of previously degraded land for agricultural purposes
- Improved agricultural productivity
- Community development programs
- Reintegration of community and diversification of sources of livelihood
- Minimization of flooding and control of erosion
- Provision of proper and well-designed road drainage systems
- Rehabilitation of affected lands, vegetation and forests
- Reduced fear perception of loss of property, inhabitation and ancestral origins of the communities
- Control and Reduction of water body sedimentation rates due to erosion
- Reduction in siltation of rivers due to improved land vegetation covers and decreases in slope
- Reduction in mortality/morbidity from landslides
- Increase in business/commerce during and after the construction works
- Job creation opportunities.

In spite of these positive impacts however, a number of potential adverse effects could attend the proposed intervention, and these are highlighted in the following sub-section.

5.5.2 The Potential Adverse Impacts

Implementation of Ibore Gully Rehabilitation could exert some negative impacts on the social and physical environment. The crucial ones are discussed below. For ease of comprehension, they are discussed based on the affected environmental attributes.

5.5.2.1 Soil and Erosion Impacts

Generally, most of the impacts of the proposed interventions on soil are positive, since the aim is to stop the advancement of the Ibore gully, and to undertake restoration of affected soil. However, the process of undertaking the activities will lead to some minor effects on soil. Most of these effects are during the construction stage and are elucidated below:

- There will be movement of heavy-duty vehicles and machinery to the site during mobilization. If these vehicles and machinery are moved over open soil surfaces, they could cause compaction and alteration of soil structure
- Site clearing during site preparation could expose new soil surfaces to denudation and the consequent erosion.
- Accidental spills of hazardous materials such as fuels and oils could be leached into the soil, thus leading to contamination/pollution of the soil.

5.5.2.2 Impacts on Vegetation and Wildlife

The key impacts of the proposed intervention on vegetation and wildlife are as follows:

- During construction, campsites for construction workers and equipment/machinery laydown areas will have to be cleared. This could lead to destruction of vegetation within such sites. By extension, this could lead to wildlife kill and destruction of their habitats;
- Accidental spills of fuels and oils for machinery and vehicles, which would normally be stored on site could toxify vegetation. If herbivorous animal species feed on such vegetation, this could also poison them, or lead to bioaccumulation of toxins in wildlife species, with the possibility of bio-magnification up the food chain;
- There is a possibility for project workers to poach on wildlife species, especially burrowing rodents such as grass-cutters, ground squirrels, and larger mammals like duikers, during site preparation;
- During operations, the flood runoff diverted from the existing Ibore gully could lead to ecological modifications, as it is emptied into undeveloped areas of the vicinity, as planned. Swamps could develop, leading to introduction and possible

invasion of the area by exotic vegetation species, and by extension, wildlife species;

- The development of swamps in undeveloped area of the project vicinity as a result of floodwater diversion could serve as habitat for disease vectors, especially those that are waterborne, such as malaria, *bilharzia* and *schisctosomiasis*.

5.5.2.3 Air Quality and Noise Impacts

A number of impacts are likely to be expressed on air quality and noise levels during the project. Virtually all of the impacts will be expressed during the construction phase of the project. They include the following:

- Generally, various vehicles, machinery and equipment will be used during project construction phase. These vehicles will run on fossil fuels and will therefore produce gaseous and particulate emissions, which could contrive to negatively alter ambient air quality around the site;
- Noise from vehicles and machinery could elevate ambient noise levels around the site;
- Dust and particulates from trenching activities could be suspended in the atmosphere, leading to elevation of suspended particulate matter (SPM) levels in the ambient air around the project site;
- No impacts are anticipated during operations except for maintenance phase;
- During decommissioning, the same impacts anticipated during construction are likely to recur. Specifically, various vehicles, machinery and equipment will be used during project decommissioning will run on fossil fuels and will therefore produce gaseous and particulate emissions, which could contrive to negatively alter ambient air quality around the site;
- Noise from vehicles and machinery used for decommissioning could elevate ambient noise levels around the site.

5.5.2.4 Hydrology and Hydrogeology

- During construction, stockpiling of excavated materials, equipment and machinery as well as creation of construction camps could obstruct natural drainage routes. This could lead to flooding in upstream areas, and drying up in downstream areas;
- Construction of diversion route could alter the existing hydrological layout of the area, leading to significant changes;
- Accidental spills of fuels and other hazardous materials such as lube oils could percolate into groundwater, altering the existing quality of hydrogeological resources;
- During operation, the diversion of floodwaters from the existing Ibore gully could create microclimatic modifications, leading to hydrological modifications.

5.5.2.5 Socio-economic Impacts

Quite a lot of positive impacts are expected to arise from the proposed intervention, including the restoration of affected areas, possible employment opportunities on a temporary basis during construction, and increase in value of properties around the gullies, following the restoration of the gully area. However, a number of adverse effects are also expected. These are iterated below:

- During mobilization and construction activities, Interference with day-to-day community activities could result in conflicts and complaints
- As part of construction activities, land may need to be acquired and existing structures demolished to give room for the alternative drainage channel. Conflicts may arise if adequate compensation is not paid for acquired land, including structures and economic crops on the land;
- In the event that compensation is to be paid to people who have lost property to the gully, and/or loved ones, conflicts could arise between community members and NEWMAP project team, if there are disputes about how much is to be paid, and to whom;

- During mobilization and construction activities, project associated vehicular movement could lead to traffic congestion and increased risk of occurrence of traffic accidents and fatalities;
- Conflicts could arise over loss of agricultural lands due to gully erosion rehabilitation civil works downstream of the gully head in Ibore community;
- During operations, there is the risk of increase in occurrence of waterborne diseases such as malaria, *bilharziasis* and *schistosomiasis* due to emptying of diverted runoff into undeveloped areas of the community;
- Runoff from project area could enter surface waters in downstream areas, leading to contamination of receiving water bodies, especially by fertilizers, and pesticides as well as creation of excessive bare soils by herbicides if used for the establishment of the recommended plant species seeded to control soil erosion;
- Risks from debris and sediment accumulation in the drainage channels in upstream catchment area of the gully head, Diversion Culvert, Baffle Chute, Gabion Drop Structures and Stilling Basin resulting in performance failure of the drainage infrastructure and flooding in upstream areas.

5.5.3 Residual and Cumulative Impacts

Residual impacts are those that remain even after implementing recommended mitigation measures. Cumulative Impacts, on the other hand, are those that occur in addition to existing impacts. For instance, when a construction project is to happen close to a quarry that is already emitting particulates into the ambient air, then the particulate impact is cumulative. If, on the other hand, an impact is rated major, but applying mitigation measures can reduce the significance to minor, then the minor impact is the residual impact.

For the current project, no major impacts were identified. The application of mitigation measures, as recommended in the next chapter of this report will effectively reduce the moderate impacts to minor residual impacts, while the minor impacts are completely eliminated (no residual impact) or leave only negligible impacts. In terms of cumulative impacts, no cumulative impacts are expected from the planned project activities.

However, some of the impacts elucidated above require fit-for-purpose mitigation measures, which can either completely eliminate or at least reduce the impacts to tolerable levels. These measures are discussed in the next chapter of this report.

CHAPTER SIX
ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

6.1 Introduction

The Environmental and Social Management Plan (ESMP) for the NEWMAP rehabilitation of Ibore gully erosion site identifies the procedures, methods and measures that will be used to mitigate, control and minimize the environmental and social impacts of the construction and operation project activities associated with the project. The ESMP is a project management strategy designed to ensure that all the impact mitigation measures recommended for implementation in the NEWMAP gully rehabilitation project are effectively implemented and complied with during the construction and operation phases of the project. The primary goal is to assure that all the identified environmental and social project impacts of the NEWMAP gully erosion rehabilitation project activities are actually mitigated, minimized, avoided or eliminated.

This chapter presents the specific objectives the ESMP shall achieve, the identified environmental and social impacts of the intervention, the mitigation measures recommended to address the adverse project impacts, the institutional responsibilities and accountabilities, the capacity building requirements, the mechanism for resolving community conflicts and disagreements related to the project in line with the ESMF, RPF, RAP, and Project Implementation Manual, the Environmental Monitoring Plan indicating the suitable monitoring indicators for the project and the costs of implementation of the ESMP. In order for the ESMP to address the environmental and social issues that would arise from the implementation of the civil engineering works and gully erosion control infrastructure development, this ESMP shall achieve the following specific objectives:

- Ensure that all social and environmental considerations that assure compliance with sustainable development tenets are incorporated at all phases of the gully erosion intervention;

- Proactively initiate strategies to identify any sign of environmental stress, deterioration or degradation within the Ibore gully watershed arising from the proposed gully erosion site rehabilitation through scientific investigation of specific environmental monitoring parameters and comparing them to regulatory stipulated standards and limits;
- Provide assurance that the environmental impact mitigation measures recommended for implementation during the construction and operation/maintenance project phases are adequate for effective amelioration of the project impacts and indicate whether the respective impact monitoring parameters investigated are within the stipulated environmental limits of regulatory agencies;
- Provide early warning of environmental damage so that actions may be taken during the construction phase of the NEWMAP intervention to reduce such harmful impacts;
- Ensure that regulatory standards for pollutants are not exceeded;
- Assure adequate stakeholder engagement and consultation in the implementation of the NEWMAP gully erosion rehabilitation project;
- Verify the compliance of the project Contractors and NEWMAP Edo SPMU with regulatory requirements and the Environmental Management and Monitoring Plan proposed in this ESMP;
- Establish and explicitly indicate the roles and responsibilities of all pertinent stakeholders in the implementation of the proposed Ibore, Edo State NEWMAP ESMP;
- Establish the required reporting procedures, the appropriate line of communication of complaints and for managing and monitoring the environmental and social concerns of the gully erosion rehabilitation intervention project;
- Ensure that all the impact mitigation measures recommended for the NEWMPA gully erosion site rehabilitation interventions project works are effectively implemented;

- Ensure that all project contractors and relevant stakeholders comply with the recommended impact mitigation measures in the proposed ESMP and other relevant regulatory requirements;
- Determine the training, capacity building and technical assistance needed to successfully implement the provisions of the Ibore, Edo State NEWMAP ESMP;
- Verify NEWMAP's compliance with the recommended Environmental and Social Management Plan; and
- Estimate the cost and budget for the implementation of the Ibore, Edo State NEWMAP gully erosion rehabilitation project.

6.2 The Proposed Project Intervention in the Rehabilitation of Ibore Gully Erosion

Specific project tasks or activities shall be performed in the rehabilitation of the Ibore gully erosion site from the gully head to the outfall downstream. These project activities are deemed to exert potential environmental and social impacts on the Ibore gully erosion watershed. To enhance the effective amelioration and control these project impacts, it is imperative that the proposed NEWMAP intervention in the rehabilitation of the Ibore gully erosion site has to be explicitly defined. Hence, the checklist of the NEWMAP gully erosion intervention in Ibore, Esan Central LGA is as shown in **Table 6.1.**

Table 6.1: Checklist of the NEWMAP Gully Erosion Intervention Projects at Ibore

AREAS OF FLOW MANAGEMENT	PROJECT COMPONENT	PROJECT ACTIVITY
In the vicinity of the Gully Head	Construction of Diversion Channels	Construction of Main Diversion Channel consisting of: a) An underground concrete box culvert with in the built-up areas b) Open rectangular concrete channel construction beyond the built-up areas c) Stone pitching will be installed d) A Type II or III Stilling Basin shall be constructed upstream of a Baffle Chute e) A smaller Baffle Chute shall be installed
Within the Gully Channel	Installations within the existing gully earth channel	a) Installation of 16 Gabion Drop Structures (Check Dams) to reduce longitudinal gradient of the gully channel and reduce flow velocity and prevent further channel bed erosion; b) Reshaping of the entire gully channel to a base

AREAS OF FLOW MANAGEMENT	PROJECT COMPONENT	PROJECT ACTIVITY
		width of 15m throughout the channel and to tally with the spillway of the Gabion Drop Structure (Check Dam) c) Stabilization of the gully edges to prevent water from undercutting the side slopes using Rip-Rap
In the vicinity of the Gas Plant	Reshaping of the water course to a more natural route	Re-channelization of the water course to flow along the natural route away from the gas pipeline -
Diversion Channels around the gully head	Construction of diversion channels around the gully head	a) Construction of the drainage systems to convey runoff to the primary diversion channel; b) Construction of the primary diversion channel and installation of Baffle Chute c) Construction of Secondary Channel and installation of Baffle Chute d) Construction of Stilling Basin to receive flows from both the Primary and Secondary Diversion Channels e) Rehabilitation of the Gully Head by filling and compaction in preparation for the reconstruction of the damaged road f) Reshaping the gully bed slope to be at 1 in 2 slope g) Planting appropriate vegetation along the gully slope and provide it with Contour Drainage Berms h) Stabilization of the gully channel from the Stilling Basin to the Outfall
Construction of the Main Conduit Drainage System	The Main Conduits – Primary Drainage System	a) Construction of side drains intake along the Northern road (90m long Rectangular Open Drainage Channel of 1.8m wide x 1.8m deep) with Stone Pitching b) Construction of side drains intake along the Southern road (90m long Rectangular Open Drainage Channel of 1.5m wide x 1.8m deep) with Stone Pitching c) Construction of 20m long Southern Bypass Main Culvert / Channel (A Rectangular Box Culvert of 1.5m wide x 1.8m deep) with Stone Pitching d) Construction of 180m long Southern Bypass Main Culvert/Channel (A Rectangular Box Culvert of 2.5m wide x 2.0m deep) with Stone Pitching e) Construction of 200m long Southern Bypass Main Channel (A Rectangular Open Channel of 4.0m wide x 1.5m deep) with Stone Pitching f) Construction of 32m long Southern Main Channel and installation of Baffle Chutes with Stone Pitching g) Construction of 16m long Northern Secondary Bypass Channel (A Rectangular Box Culvert of

AREAS OF FLOW MANAGEMENT	PROJECT COMPONENT	PROJECT ACTIVITY
		1.0m long x 1.0m deep) with Stone Pitching h) Construction of 158m long Northern Secondary Bypass Channel (A Rectangular Open Channel of 1.0m long x 1.0m deep) with Stone Pitching i) Construction of 50m long Northern Secondary Bypass Channel (A Rectangular Box Culvert of 1.0m long x 1.0m deep) with Stone Pitching j) Construction of a USBR Type III Stilling Basin with Main Channel Baffle Chutes Stone Pitching installed

6.3 Mitigation Measures

Mitigation measures are options that can be used to either completely eliminate or minimize identified negative impacts of a development project to levels that can be acceptable. The traditional approach to design and operations is to ensure compliance with the applicable safety codes and standards during design. However, compliance with regulations, codes and standards may not be sufficient to achieve an appropriate level of Health Safety and Environmental (HSE) performance in design. Design codes are generic and applicable to facilities in a number of geographical areas that face a wide range of technical challenges unique to the project. The design of the proposed gully intervention project in Ibore, Edo state is based on the strictest of international codes and best-practices. The HSE objective with respect to the design and construction plan is to implement all cost effective measures to reduce the risk and effects from major hazards, including accidents. The approach has been to use this as a goal rather than a prescriptive objective that cannot be achieved without following a documented process of identification, assessment, reduction and continuous monitoring.

Thus the steps taken in the HSE process for the project included the following:

- Design based on Codes, Standards and Regulations.
- Improved design based on Quantitative Risk Assessment and Environmental Impact Assessment
- Improved design from human factors evaluation

The hierarchical order of importance of these HSE design elements is illustrated in Figure 6.1 below.

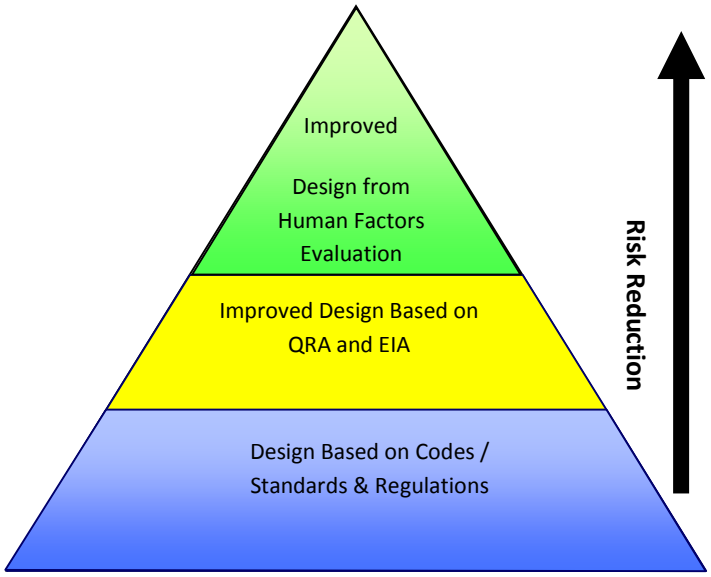


Figure 6.1: Risk Based Design Strategy

6.3.1 Mitigation Measures for Identified Project Impacts

The mitigation measures discussed here are designed to reduce, avoid or eliminate the negative project impacts to acceptable levels. The mitigation measures are presented in relation to specific project activities that would cause them. The usual practice is to ensure the implementation of these measures as part of the overall operational plans and procedures that will be used by the Edo State Project Management Unit of NEWMAP and its Contractors. To engender a holistic presentation of the mitigation strategy, **Table 6.1** presents the details of the project activities constituting the NEWMAP intervention at Ibore gully watershed at the pre-construction, construction, operation and maintenance and decommissioning project phase. The respective environmental and social impacts and the recommended impact mitigation measures recommended for implementation in the ESMP are outlined in **Table 6.2.**This constitutes the impact mitigation measures the project Contractor will comply with and implement under the supervision and monitoring of NEWMAP Edo State Project Management Unit (SPMU) and the Federal Ministry of Environment under close supervision of the World Bank.

Table 6.2: Mitigation measures recommended for the impacts of Ibore Gully Erosion site rehabilitation

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
1	Pre-Construction	General clearing and Preparation of laydown area for equipment/materials, office, workshop, storage facilities and other utility area;	Increased employment opportunities for the local communities	NEWMAP-Edo SPMU and Contractors shall ❑ Utilize available workforce from the communities
			Interference with day-to-day community activities resulting in conflicts and complaints	NEWMAP-Edo SPMU shall ❑ Consult regularly with the communities (i.e. before, during and after site clearance) ❑ Demarcate boundaries of acquired location.
			Waste handling and disposal	NEWMAP-Edo SPMU and Contractors shall ❑ Solid waste management should be addressed in Contractor HSE Plan
2	Pre-Construction	Physical presence of construction workers on the Ibore Gully erosion intervention project site and environ	Contamination of soil and downstream water resources of the project area from indiscriminate disposal of untreated sewage	NEWMAP-Edo SPMU and Contractors shall ❑ Provide adequate sanitary facilities for their site workers; ❑ Open air defecation shall be sternly discouraged among the project workers
3	Pre-Construction	Transportation of equipment, materials and workers to the project	❑ Ambient air quality deterioration from airborne dust particulates,	NEWMAP-Edo SPMU and Contractors shall:

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
		site	fugitive emissions, exhaust of equipment/automobiles	❑ Use equipment with high combustion efficiency. ❑ Use dust suppressants on the project site
			❑ Noise and vibration from vehicular movement	NEWMAP-Edo SPMU and Contractors shall ❑ Provide ear protective device to workers at the site clearing stage; ❑ Install acoustic mufflers on large equipment where necessary to limit noise levels at fence line
			❑ Traffic congestion and increased risk of occurrence of traffic accidents and injuries	NEWMAP-Edo SPMU and Contractors shall avoid impeding traffic and traffic disruption around the project site by: ❑ Adjusting work schedules not to disturb traffic; ❑ Establishing an adequate system of road signs and detour; ❑ Notifying communities of pending work scope, duration and location ❑ Avoid blocking public access roads; ❑ Complying with road bearing capacity and repairing damage caused to roads during and at the end of the work; ❑ Circumventing access roads to gathering places in Ibore and neighbouring communities

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
4	Pre-Construction	Land Acquisition and demolition of existing buildings	Conflict over loss of land/building and resettlement benefits	NEWMAP-Edo SPMU and Contractors shall: ❑ Consult extensively with the Ibore community on land acquisition and payment of building demolition benefits ❑ Develop a sound implementable Resettlement Action Plan for the Ibore NEWMAP gully erosion intervention
5	Pre-Construction	Disruption and encroachment into agricultural lands in close proximity to the gully erosion channel	Conflict over loss of agricultural lands due to gully erosion rehabilitation civil works downstream of the gully head	NEWMAP-Edo SPMU shall ❑ Consult extensively with the Ibore community on land acquisition and payment of relocation benefits ❑ Develop a sound implementable Resettlement Action Plan for the Ibore NEWMAP gully erosion intervention
6	Construction	Transportation of equipment, materials and worker to project site	Accidental release of fuels, oils, chemicals, hazardous materials etc., to ground in the construction laydown area during delivery of materials and equipment to project	NEWMAP-Edo SPMU and Contractors shall ❑ Establish appropriate protocols for materials delivery and handling to ensure there are no

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
			site	spills; ❑ Develop HSE plan to address prevention and containment of oil spills, chemicals and hazardous materials releases during all phases of the project; ❑ Store and handle hazardous materials according to and approved hazardous materials management plan ❑ Maintain transportation vehicles, heavy civil engineering machinery and construction equipment in good working order so as to avoid exhaust emissions as well as oil and fuel leaks ❑ Report any oil/chemical spill to FMEnv and Edo State Ministry of Environment
			Ambient air quality deterioration from airborne dust particulates, fugitive emissions, exhaust of equipment/automobiles	NEWMAP-Edo SPMU and Contractors shall ❑ Use equipment with high combustion efficiency. ❑ Use dust suppressants on the project site
			Noise and vibration from vehicular movement	NEWMAP-Edo SPMU and Contractors shall ❑ Provide ear protective device to workers at the site clearing stage; ❑ Install acoustic mufflers on large equipment where necessary to limit noise levels at fence line

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
			Traffic congestion and increased risk of occurrence of traffic accidents and injuries	NEWMAP-Edo SPMU and Contractors shall avoid impeding traffic and traffic disruption around the project site by: ❑ Adjusting work schedules so as not to disturb traffic; ❑ Establishing an adequate system of road signs and detour; ❑ Notifying communities of pending work scope, duration and location ❑ Avoid blocking public access roads; ❑ Using road signs to notify work in progress; ❑ Complying with road bearing capacity and repairing damage caused to roads during and at the end of the work; ❑ Circumventing access roads to gathering places in Ibore
7	Construction: Storm water drainage conduit	❑ Demolition of existing road side drainage channel, excavation and construction of new road side rectangular open drainage channel ❑ Excavation works and installation of Box Culverts to connect road side channel flows	Increase in employment opportunities and engagement of community labour	NEWMAP-Edo SPMU and Contractors shall ❑ Utilize available workforce from the communities
			Solid waste handling and disposal problems	❑ Solid waste management should be addressed in Contractor HSE Plan
			Increase in traffic congestion along	NEWMAP-Edo SPMU and Contractors shall avoid impeding

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
		into the 2500mmx2000mm Culverts ❑ Construction of Rectangular 2500mm x 2000mm Culverts to channel storm water flows into the Primary Channel ❑ Construction of 1000mm x 1000mm Closed Culvert at road crossing	the major roads involved	traffic and traffic disruption around the project site by: ❑ Adjusting work schedules not to disturb traffic; ❑ Establishing an adequate system of road signs and detour; ❑ Notifying communities of pending work scope, duration and location ❑ Avoid blocking public access roads; ❑ Complying with road bearing capacity and repairing damage caused to roads during and at the end of the work; ❑ Circumventing access roads to gathering places in Ibore
			Risk of accident and injury from excavation trench collapse	NEWMAP-Edo SPMU and Contractors shall ❑ Ensure that a suitable equipment is utilized in the excavation operations ❑ Monitor all excavation operation on a daily basis
			Risk of injury from falls from height into excavation trench	NEWMAP-Edo SPMU and Contractors shall ❑ Ensure a competent machine operator is utilized ❑ Provide suitable access to trenches ❑ Put in place perimeter fencing

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
				and signage to ensure safety and secure the excavations and trenches
8	Construction: Construction of Main Diversion Channels around the Gully Head	❑ Excavation and Construction of Rectangular 2500mm x 2000mm Culverts to channel flows into the 4000mm x 1500mm Main Rectangular Concrete Channel south of the gully head ❑ Excavation and Construction of the 4000mm x1500mm Main Rectangular Concrete Channel (The Southern Primary Diversion Channel) south of the gully head	Increase in employment opportunities and engagement of community labour	NEWMAP-Edo SPMU and Contractors shall ❑ Utilize available workforce from the communities
			Solid waste handling and disposal problems	❑ Solid waste management shall be addressed in Contractor HSE Plan
			Increase in traffic congestion along the major roads involved	NEWMAP-Edo SPMU and Contractors shall avoid impeding traffic and traffic disruption around the project site by: ❑ Adjusting work schedules not to disturb traffic; ❑ Establishing an adequate system of road signs and detour; ❑ Notifying communities of pending work scope, duration and location ❑ Avoid blocking public access roads; ❑ Complying with road bearing capacity and repairing damage caused to roads during and at the end of the work; ❑ Circumventing access roads to gathering places in Ibore

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
			Risk of accident and injury from excavation trench collapse	NEWMAP-Edo SPMU and Contractors shall ❑ Ensure that a suitable equipment is utilized in the excavation operations ❑ Monitor all excavation operation on a daily basis
				❑ Set out the location of the proposed drainage on ground by marking with spray paint and pegs at pit locations. ❑ Where excavation works are along the edge of existing roadway traffic, light or stop/go system shall be set up to carry out the works; ❑ Excavated materials shall be loaded to dump truck for stockpiling at appropriate designated location
			Risk of failure from mal-alignment with channel, extreme flow capacity, debris control and energy dissipation	NEWMAP-Edo SPMU and Contractors shall ❑ Ensure that the design specification and basis applied in the construction of the culvert such that the appurtenant entrance and outlet structures will efficiently discharge storm water bedload and floating debris at all stages of flood flows;

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
			Risk of failure of the culvert, property damage, accumulation of sediment, culvert clogging and detrimental upstream deposit of debris	NEWMAP-Edo SPMU and Contractors shall ❑ Ensure that culverts are designed and constructed to avoid excessive ponding at the entrance and screen out material that will not pass through the culvert. ❑ Ensure that culvert alignment shall be such that water enters and exists it freely and directly without causing any abrupt changes in flow that could cause ponding, and buildup of debris at the culvert entrance.
			Risk of injury from falls from height into excavation trench	NEWMAP-Edo SPMU and Contractors shall ❑ Ensure a competent machine operator is utilized ❑ Provide suitable access to trenches ❑ Put in place perimeter fencing and signage to ensure safety and secure the excavations and trenches
			Risk of people drowning	NEWMAP-Edo SPMU and Contractors shall ❑ Ensure that appropriate side structures and well as signs and detour are provided

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
		Construction of 10,000mm x 5000mm Stilling Basin	Risk of drowning	NEWMAP-Edo SPMU and Contractors shall ❑ Ensure that weep holes are provided to empty the stilling basin; ❑ Provide mentis grids or steel grids at strategic locations where extreme danger of drowning exists and pedestrian movement is intense.
			Risk of accident and injury from excavation trench collapse	NEWMAP-Edo SPMU and Contractors shall ❑ Ensure that a suitable equipment is utilized in the excavation operations ❑ Monitor all excavation operation on a daily basis
			Risk of injury from falls from height into excavation trench	NEWMAP-Edo SPMU and Contractors shall ❑ Ensure that the gully remediation intervention is performed during the dry season when there is no flow of storm water from the catchment area above the gully head; ❑ Ensure that excavation and fill operations are conducted in compliance with all HSE

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
				measures in manners that does not endanger lives and properties. ❑ Ensure a competent machine operator is utilized ❑ Provide suitable access to trenches ❑ Put in place perimeter fencing and signage to ensure safety and secure the excavations and trenches
			Risk of loss of functionality and failure resulting into exacerbation of the gully erosion channel, flooding and loss of life and properties	NEWMAP-Edo SPMU and Contractors shall ❑ Ensure that the design basis and specifications in the Detail Design Report Ibore D1 Edo State NEWMAP are fully achieved in the construction of the Stilling Basin ❑ Ensure the stilling basin is designed to the correct capacity to handle the intended purpose in the management of a 1 in 50 years storm flows
			Loss of agricultural lands and increase in the exposure of erodible soil	NEWMAP-Edo SPMU and Contractors shall ❑ Adopt staged earthworks approach by working in staged sections to ensure no more than a specified area of soil is disturbed or exposed at any point

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
				in time
			Risk of scouring and failure	NEWMAP-Edo SPMU and Contractors shall ❑ Ensure the stilling basin is inspected after every high flows to see if there is any scouring beneath the riprap and if any stone has been dislodged. And repairs should be initiated immediately
		Installation of Main Rectangular Concrete Channel Baffled Chute	Risk of chute failure by flow undermining gully head, overtopping or bypassing. Chute failures could result in severe gully erosion and head-cutting within a short time. The failure occurs when storm runoff fails to enter the baffle chute properly especially when the runoff leaks and flow bypassing occur at the chute entrance	NEWMAP-Edo SPMU and Contractors shall ❑ Ensure Specialist supervision should be engaged to supervise the construction of the Chute to avoid the potential by undermining, overtopping or bypassing ❑ Ensure periodic visual inspection of the Chute during operation for signs of failure in the lining as well as evidence of scour between the lining and vegetated areas ❑ Initiate immediate repair of any failure in the chute
			Occurrence of risks associated with large storm events that exceeds the design capacity of the Chute	❑ Assess the capacity of the Chute to handle the conveyance of a large runoff event that exceeds storms of 1 in 50 years

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
				recurrence interval
			Loss of fertile top soil for infertile sub-surface soil that would not enhance vegetation establishment	❑ During the construction of Chutes, topsoil should be removed and stockpiled before shaping the gully head. On completion of the filling the topsoil should be spread to a depth of 150mm over the face and sides of the chute
			Risk of loss of life and damage of the proposed gully drainage infrastructure	❑ Chute should be constructed on firm excavated soil rather than on the fill ❑ Ensure that storm water leaving the chute and outlet structure will flow freely without causing undesirable ponding or scour
		Installation of Stone Pitching in the entire Main Rectangular Concrete Channels south of the gully head	Risk of failure due to poor design and construction of the stone pitching. This results in the displacement of the pitched stone and scouring of the secondary channel	NEWMAP-Edo SPMU and Contractors shall ❑ Ensure that the installation of the pitching stones is in compliant with the design specifications recommended in the Detail Design Report Ibore D1 Edo State NEWMAP
9	Construction of Secondary Diversion Channels around the Gully Head	Construction of 1000mm x 1000mm Closed Culvert at road crossing north of the gully head north of the gully head	Risk of failure from mal-alignment with secondary channel, extreme flow capacity, debris control and energy dissipation	NEWMAP-Edo SPMU and Contractors shall ❑ Effectively implement the design specifications and basis as indicated in the Detail Design

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
				Report Ibore D1 Edo State NEWMAP ❑ Ensure that the design specification and basis applied in the construction of the culvert such that the appurtenant entrance and outlet structures will efficiently discharge storm water bedload and floating debris at all stages of flood flows;
		Construction of 1000mm x 1000mm Secondary Rectangular Concrete Channel north of the gully head	Risk of failure of the culvert, property damage, accumulation of sediment, culvert clogging and detrimental upstream deposit of debris	NEWMAP-Edo SPMU and Contractors shall ensure that: ❑ The culverts shall be designed and constructed to avoid excessive ponding at the entrance and screen out material that will not pass through the culvert. ❑ The culvert alignment shall be such that water enters and exists it freely and directly without causing any abrupt changes in flow that could cause ponding, and buildup of debris at the culvert entrance
		Construction of Secondary Rectangular Concrete Channel Stilling Basin north of the gully head	Risk of drowning	NEWMAP-Edo SPMU and Contractors shall ❑ Ensure that weep holes are provided to empty the stilling basin;

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
				❑ Provide mentis grids or steel grids at strategic locations where extreme danger of drowning exists and pedestrian movement is intense
			Risk of accident and injury from excavation trench collapse	NEWMAP-Edo SPMU and Contractors shall: ❑ Ensure permit is issued by the site engineer before any excavation work can commence and all persons involved in the task should be fully briefed ❑ Ensure that a suitable equipment is utilized in the excavation operations ❑ Monitor all excavation operation on a daily basis
			Risk of injury from falls from height into excavation trench	NEWMAP-Edo SPMU and Contractors shall ❑ Ensure that the gully remediation intervention is performed during the dry season when there is no flow of storm water from the catchment area above the gully head; ❑ Ensure that excavation and fill operations are conducted in compliance with all HSE measures in manners that does not endanger lives and properties. ❑ Ensure a competent machine

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
				operator is utilized ❑ Provide suitable access to trenches ❑ Put in place perimeter fencing and signage to ensure safety and secure the excavations and trenches
			Risk of loss of functionality and failure resulting into exacerbation of the gully erosion channel, flooding and loss of life and properties	NEWMAP-Edo SPMU and Contractors shall ❑ Ensure that the design basis and specifications in the Detail Design Report Ibore D1 Edo State NEWMAP are fully achieved in the construction of the Stilling Basin ❑ Ensure the stilling basin is designed to the correct capacity to handle the intended purpose in the management of a 1 in 50 years storm flows
			Loss of agricultural lands and increase in the exposure of erodible soil	NEWMAP-Edo SPMU and Contractors shall ❑ Adopt staged earthworks approach by working in staged sections to ensure no more than a specified area of soil is disturbed or exposed at any point in time
			Risk of scouring and failure	NEWMAP-Edo SPMU and Contractors shall:

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
				❑ Ensure the stilling basin is inspected after every high flows to see if there is any scouring beneath the riprap and if any stone has been dislodged. And repairs should be initiated immediately
		Stabilization of Gully edges to prevent undercutting of side slopes by the construction of D50 = 500mm Rip Rap	Risk of scouring and failure resulting in riprap rock wash away; apron displacement; scour occurrence around apron or riprap and erosion of the outlet of structures	NEWMAP-Edo SPMU and Contractors shall ❑ Ensure that the recommended D50 = 500mm Rip Rap stones are used. Considering the flow rate 44m3/s anticipated in the choice of whether loose riprap rocks or grouted riprap is appropriate. Grouted riprap rocks is preferred in high flows ❑ Replace riprap rocks washed away with a larger diameter rock based on the discharge velocity anticipated or experienced and repair the underlining fabric ❑ Repair outlet of structures and replace lost riprap with grout riprap ❑ Ensure the gully channel is inspected after every high flows to see if there is any scouring beneath the riprap and if any stone has been dislodged. And repairs should be initiated

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
				immediately ❑ Inspect regularly during rainy seasons for scour beneath riprap and around the outlets of structures and immediately initiate repairs as necessary
		Installation of St one Pitching in the entire Secondary Rectangular Concrete Channels	Risk of failure due to poor design and construction of the stone pitching. This results in the displacement of the pitched stone and scouring of the secondary channel	NEWMAP-Edo SPMU and Contractors shall: ❑ Ensure that the installation of the pitching stones is compliant with the design specifications recommended in the Detail Design Report Ibore D1 Edo State NEWMAP
10	Construction within the vicinity of the Gas Pipeline	Channelization of the water course to flow along the natural drainage route away from the pipeline	Risk of drowning	NEWMAP-Edo SPMU and Contractors shall: ❑ Ensure that no unauthorized person is allowed access to the project site without permit; ❑ Ensure that the entire work is performed during the dry season when there is no flow of storm water from the catchment area above the gully head ❑ Ensure that excavation and channelization are conducted in compliance with all HSE measures in manners that does not endanger lives and properties.

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
			Risk of accident and injury from excavation trench collapse	NEWMAP-Edo SPMU and Contractors shall: ❑ Ensure that a suitable equipment is utilized in the excavation operations ❑ Monitor all excavation operation on a daily basis
			Risk of injury from falls from height into excavation trench	NEWMAP-Edo SPMU and Contractors shall: ❑ Ensure that the entire work is performed during the dry season when there is no flow of storm water from the catchment area above the gully head; ❑ Ensure that excavation and channelization are conducted in compliance with all HSE measures in manners that does not endanger lives and properties. ❑ Ensure a competent machine operator is utilized ❑ Provide suitable access to trenches ❑ Put in place perimeter fencing and signage to ensure safety and secure the excavations and trenches
11	Construction: Rehabilitation of gully head	Filling and compaction of gully head to enable the construction of the damaged road	Occurrence of accident and safety risk incidents	NEWMAP-Edo SPMU shall ❑ Ensure Contractor's HSE Plan is developed and implemented

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
				❑ Ensure that all undertaken with earthmoving activities in steep sided gullies where undercut has occurred with great care, observance of safety measures and use of appropriate PPE ❑ Ensure the usage of earthmoving equipment with strict adherence to all recommended safety procedures ❑ Ensure that all construction equipment, earthmovers and demolition equipment shall be located, guarded, shielded to prevent contact with the public ❑ Ensure that Stockpile non-dispersive topsoil are used as final cover soil after the gully head has been filled to encourage vegetation growth and establishment
			Waste handling and disposal	NEWMAP-Edo SPMU and Contractors shall: ❑ Ensure adequate sanitary facilities area provided during the construction and operation phases of the project ❑ Ensure that good housekeeping is maintained on the project site and all areas used ❑ Ensure that all areas of the

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
				project site used by the public is properly maintained and are free from debris, solid waste litter, equipment, materials ❑ Ensure that Solid waste management are addressed in Contractor HSE Plan and ❑ Ensure the Contractor develop and implement a Solid Waste Management Plan approved by NEWMAP and FMEnv in compliance with appropriate World Bank Safeguard Policies
			Increase in turbidity and sediment load in downstream receiving water bodies	NEWMAP-Edo SPMU and Contractors shall: ❑ Ensure that storm water flows from upstream catchment of the gully head are safely diverted away from the gully head ❑ Ensure that the Ibore gully rehabilitation project is carried out during the dry season to prevent mobilization of sediment into downstream receiving water bodies
		Construction of the damaged road	Ambient air quality deterioration from airborne dust particulates, fugitive emissions, exhaust of equipment/automobiles	NEWMAP-Edo SPMU and Contractors shall: ❑ Ensure the usage of equipment with high combustion efficiency. ❑ Ensure the use of dust suppressants on the project site

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
			Noise and vibration from vehicular movement	❑ Ear protective device to be provided to workers at the site clearing stage; ❑ Install acoustic mufflers on large equipment where necessary to limit noise levels at fence line
		Reshaping the gully head side slope to 1 in 2 slope	Loss of fertile top soil which could be used for seeding vegetation	NEWMAP-Edo SPMU and Contractors shall: ❑ Conserve topsoil with its leaf litter and organic matter in stockpiles and used this material as cover soil in the filled gully head and the stabilized bank slopes of the channel to promote the growth of local native vegetation
			Risk of occurrence of accident or injury from: ❑ Falls from site vehicles; ❑ Tipping or overturning of vehicles ❑ Contact with moving parts of machinery ❑ Struck by mater dropped while in lift	❑ Ensure that Worker Briefings are carried out before commencement of work every day. All personnel entering the site must receive safety induction and attend a job toolbox talk. ❑ Ensure that plant used are operated by Competent Personnel ❑ Ensure that plant and equipment are in good working order and inspected prior to commencement of any work on site ❑ Utilize Vehicle Banksmen where required ❑ Segregate traffic from public and work force as much as possible

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
				❑ Implement work exclusion zones where appropriate ❑ Develop and implement an appropriate Traffic Management Plan ❑ Ensure all personnel use appropriate PPE and high visibility clothing ❑ Ensure that the Ibore gully erosion rehabilitation is carried out before the rainy season ❑ Plant the appropriate vegetation along the edge of the top of the edge of the top of the slope to serve as a protective buffer for the slope faces. The greenbelt would serve provide a buffer between the slop face and resident structures in residential areas
12	Construction: Installation of Gully erosion control infrastructure within the existing downstream gully earth channel	Installation of 16 Gabion Drop (Check Dams) Structures within the downstream gully earth channel to reduce longitudinal gradient of the gully channel, slow down flow velocity and prevent further channel bed erosion	Risk of chute failure by flow undermining gully head, overtopping or bypassing. The failure occurs when storm runoff fails to enter the baffle chute properly especially when the runoff leaks and flow bypassing occur at the chute entrance	NEWMAP-Edo SPMU and Contractors shall: ❑ Ensure specialist supervision are engaged to supervise the construction of the Chute to avoid the potential by undermining, overtopping or bypassing
			Occurrence of risks associated with large storm events that exceeds the design capacity of the Chute	❑ Assess the capacity of the Chute to handle the conveyance of a large runoff event that exceeds

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
				storms of 1 in 50 years recurrence interval
			Loss of fertile top soil for infertile sub-surface soil that would not enhance vegetation establishment	❑ During the construction of Chutes, topsoil should be removed and stockpiled before shaping the gully head. On completion of the filling the topsoil should be spread to a depth of 150mm over the face and sides of the chute
			Risk of loss of life and damage of the proposed gully drainage infrastructure	❑ Chute shall be constructed on firm excavated soil rather than on the fill ❑ Ensure that storm water leaving the chute and outlet structure will flow freely without causing undesirable ponding or scour
		Reshaping the entire length of the downstream gully channel to a base width of 15m to align with the Gabion Drop Structures	Increase in the amount of disturbed areas created by earthmovers used in reshaping the gully side slopes	NEWMAP-Edo SPMU and Contractors shall: ❑ Ensure that storm water flows have been completely diverted above the gully head ❑ Undertake all earthmoving activities with great care especially with steep sided gullies where undercutting has occurred ❑ Ensure that use earthmoving equipment is in compliance with all workplace safety procedures

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
			Contamination of downstream receiving water bodies by fertilizers, and pesticides as well as creation of excessive bare soils by herbicides if used for the establishment of the recommended plant species seeded to control soil erosion	❑ If necessary, use herbicides with caution and precision to avoid excessive creation of large areas of bare soil and only use herbicide selected by a specialist to maintain the desired plant species
			Exacerbated gully erosion channel bed undermined and washing away of fill materials resulting in increased sediment load in receiving water bodies downstream	❑ The shaping of the gully walls shall be carried out only in the dry season after the gully head has been established with a structure such as a Chute;
			Increase in the amount of disturbed areas created by earthmovers used in reshaping the gully side slopes Risk of erosion of exposed gully side slopes and erosion of ground area above the gully channel divide	❑ Stabilize cut and fill slopes with vegetative contour or anchored rock ❑ Develop nurseries for the recommended plant species to serve as sustainable plant source for gully erosion side slope stabilization throughout the life span of the infrastructure
			Loss of fertile top soil that could be used for seeding vegetation	❑ Stockpile non-dispersive topsoil with its leaf litter and organic matter, and use as final cover soil after the gully head has been filled to encourage vegetation growth and establishment

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
			Occurrence of bank erosion along reshaped gully channel slopes	❑ Ensure that the placement and anchorage of the earth materials cut from the gully sides are done properly; ❑ Ensure that the soil materials used to fill the gully bed are well compacted in dry no flow conditions; ❑ Plant or seed the recommended plant species in close growing positions immediately after placement of gull fill materials to serve as vegetative buffer strips to reduce the erosion of soil particles; ❑ Perform the entire civil work of reshaping the gully sides/banks and the filling of the channel bed and gully head as one operation
		Stabilization of the entire gully bed and edges through lining the trapezoidal channel with 500mm Rip Rap to prevent water undercutting the side slopes and the channel bed	Risk of failure resulting in the occurrence of scouring of the structures	NEWMAP-Edo SPMU and Contractors shall: ❑ Ensure that Riprap placement by hand will be done to the extent necessary to prevent damage to the conduits, structure etc. Equipment shall also be used in the placement of the riprap as required.
13	Operation	Utilization of the rehabilitated gully site and installed storm water	Risk of failure of the gully erosion installed drainage infrastructure to	NEWMAP-Edo SPMU and Contractors shall:

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		drainage infrastructure	safely route storms of 1 in 50 years	❑ Ensure that the design basis and specifications in the Detail Design Report Ibore D1 Edo State NEWMAP is accurately followed and achieved during the construction implementation
			Risks from debris and sediment accumulation in the drainage channels in upstream catchment area of the gully head, Diversion Culvert, Baffle Chute, Gabion Drop Structures and Stilling Basin resulting in performance failure of the drainage infrastructure	❑ Develop and implement on a regular basis, a systematic Ibore Gully Erosion Channel and Drainage Infrastructure Management Plan to remove sediments, debris, solid waste materials and aquatic plants from the channel, prevent the incidence of undercutting and scouring of the drainage infrastructure
			Risk of undermining and occurrence of scouring in the Baffle Chute could result in deteriorating performance of the structure	❑ Scouring of the infrastructure and accumulation of sediment, litter and vegetation in drainage infrastructure are some of the factors that can cause under-functioning of the infrastructure To effectively and regularly monitor the operation and functionality of the gully erosion control devices by a dedicated Contractor Representative in collaboration with a Project Manager/Site Engineer from Edo State Project Monitoring Unit, a five-year maintenance contract

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
				should be added to the contractor's existing contract
14	Operation	Maintenance of the gully drainage infrastructure	Risk of failure of the gully intervention from poor maintenance of the drainage infrastructure to achieve the desired project objectives such as (Creation of new gullies within the channel; breeding of vectors in the settling basin, undermining of the drainage infrastructure and scouring of the drainage structure, etc.)	NEWMAP-Edo SPMU and Contractors shall: ❑ Develop and implement on a regular basis, a systematic Ibore Gully Erosion Channel and Drainage Infrastructure Management Plan to remove sediments, debris, solid waste materials and aquatic plants from the channel, prevent the incidence of undercutting and scouring of the drainage infrastructure ❑ Conduct site inspection and monitoring as follows: ➢ Inspect erosion and sediment control devices installed at Ibore gully erosion intervention site within 24 hours of every rainfall or storm event; ➢ The erosion, sediment and drainage control devices inspection should be by a person qualified and certified to perform this role. He could be a project manage, site supervisor, or engineer working in Edo State SPIM

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
				unit of NEWMAP. ➢ The Ibore gully erosion control infrastructure inspection and monitoring to: - Ensure that the Ibore Gully Erosion Channel and Drainage Infrastructure Management Plan is appropriate for the gully erosion site and is being implemented efficiently; - Ensure the erosion - sediment control and drainage infrastructure are properly maintained
			Disruption of the side slopes during routine maintenance of the gully channels	❑ Ensure special precautions are taken when using backhoe to remove aquatic plants or sediment from the channel during maintenance. Ensure that the earthmover with vented slotted or cross-drilled bucket that allow water to seep out is used for maintenance operations. Once a bucketful of sediment or aquatic vegetation is picked up, the bucket should be raised to allow most of the water to drain out over the gully channel or stilling basin. Then the earthmover\s boom should be swung far from

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
				the gully channel bank so that water remaining in the spoil removed will flow away from the gully channel to prevent the erosion of the banks.
15	Decommissioning	Dismantling and removal of civil engineering equipment	Ambient air quality deterioration from airborne dust particulates, fugitive emissions, exhaust of equipment/automobiles	NEWMAP-Edo SPMU and Contractors shall: ❑ Ensure the use of equipment with high combustion efficiency. ❑ Ensure the use of dust suppressants on the project site
			Noise and vibration from vehicular movement	❑ Provide ear protective device to to workers at the site clearing stage; ❑ Install acoustic mufflers on large equipment where necessary to limit noise levels at fence line
16	Decommissioning	Waste handling and disposal	Solid Waste generation, handling and disposal	NEWMAP-Edo SPMU and Contractors shall: ❑ Ensure that Solid waste management shall be addressed in Contractor HSE Plan
			Poor housekeeping and environmental sanitation	❑ Ensure the Contractor develop and implement a Solid Waste Management Plan approved by NEWMAP and FMEnv in compliance with appropriate World Bank Safeguard Policies
17	Decommissioning	Transportation of solid waste, equipment and workers out of the project site.	Traffic congestion and increased risk of occurrence of traffic accidents and injuries	NEWMAP-Edo SPMU and Contractors shall avoid impeding traffic and traffic disruption around the project site by:

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES
				❑ Adjusting work schedules so as not to disturb traffic; ❑ Establishing an adequate system of road signs and detour; ❑ Notifying communities of pending work scope, duration and location ❑ Avoid blocking public access roads; ❑ Circumventing access roads to gathering places in Ibore and neighbouring communities
			Ambient air quality deterioration from airborne dust particulates, fugitive emissions, exhaust of equipment/automobiles	❑ Ensure the use of equipment with high combustion efficiency. ❑ Ensure the use of dust suppressants on the project site
			Noise and vibration from vehicular movement	❑ Provide ear protective device to workers at the site clearing stage; ❑ Install acoustic mufflers on large equipment where necessary to limit noise levels at fence line

For ease of comprehension, the mitigation measures that have been recommended for the identified impacts of the proposed erosion gully intervention project in Ibore are further presented with respect to the environmental attributes impacted in tabular form of **Table 6.3** below.

Table 6.3: Summary of Identified Impacts and Recommended Mitigation Measures

S/N	ENVIRONMENTAL ATTRIBUTE	IDENTIFIED IMPACTS	RECOMMENDED MITIGATION	RESIDUAL IMPACT
1.	Soil	There will be movement of heavy-duty vehicles and machinery to the site during mobilization. If these vehicles and machinery are moved over open soil surfaces, they could cause compaction and alteration of soil structure	As much as possible. Vehicles and machinery shall be moved to site following existing roads and routes, so as to minimize the possibility of soil compaction by heavy duty machinery	NEGLIGIBLE
		Site clearing during site preparation could expose new soil surfaces to denudation and the consequent erosion.	Care shall be taken to ensure that erosion does not occur in cleared areas. To this end adequate erosion protection measures shall be provided around areas cleared for project activities.	MINOR
		Accidental spills of hazardous materials such as fuels and oils could be leached into the soil, thus leading to contamination/pollution of the soil	Adequate protection shall be provided around fuel and hazardous materials storage, to prevent accidental spills into soils. Such measures will include the paving of storage areas, and the provision of bund walls around stored products.	MINOR
2.	Vegetation and Wildlife	During construction, campsites for construction workers and equipment/machinery laydown areas will have to be cleared. This could lead to destruction of vegetation within such sites. By extension, this could lead to wildlife kill and destruction of their habitats	Clearing of sites for construction shall be limited to needed areas only. Cleared but unused spaces shall be promptly revegetated using fast growing species that are native to the area All project workers shall be strictly	NEGLIGIBLE

S/N	ENVIRONMENTAL ATTRIBUTE	IDENTIFIED IMPACTS	RECOMMENDED MITIGATION	RESIDUAL IMPACT
			prohibited from killing wildlife species on site, except when there is danger to human life,	
		Accidental spills of fuels and oils for machinery and vehicles, which would normally be stored on site could toxify vegetation. If herbivorous animal species feed on such vegetation, this could also poison them, or lead to bioaccumulation of toxins in wildlife species, with the possibility of biomagnification up the food chain.	Care shall be taken in handling fuels and hazardous materials, to prevent accidental spills. Adequate emergency response plans shall be provided, to promptly handle accidental spills, if they occur.	NEGLIGIBLE
		There is a possibility for project workers to poach on wildlife species, especially burrowing rodents such as grasscutters, ground squirrels, and larger mammals like duikers, during site preparation	All project workers shall be strictly prohibited from killing wildlife species on site, except when there is danger to human life,	NEGLIGIBLE
		During operations, the flood runoff diverted from the existing Ibore gully could lead to ecological modifications, as it is emptied into undeveloped areas of the vicinity, as planned. Swamps could develop, leading to introduction and possible invasion of the area by exotic vegetation species, and by extension, wildlife species	Diverted runoff from the gully site shall be sent to an existing watercourse, to prevent ecological modifications to the project site	MINOR
		The development of swamps in undeveloped area of the project vicinity as a result of floodwater diversion could serve as habitat for disease vectors, especially those that are waterborne, such as malaria, bilharzia and schisctosomiasis.	All diverted drainage from the project site shall be channeled to appropriate receptive channels to prevent development of swamps in the project area and associated proliferation of waterborne diseases	MINOR

S/N	ENVIRONMENTAL ATTRIBUTE	IDENTIFIED IMPACTS	RECOMMENDED MITIGATION	RESIDUAL IMPACT
3.	Air Quality and Noise Levels	Generally, various vehicles, machinery and equipment will be used during project construction phase. These vehicles will run on fossil fuels and will therefore produce gaseous and particulate emissions, which could contrive to negatively alter ambient air quality around the site	All vehicles and machinery to be used for the project shall be regularly maintained to ensure that emissions from these vehicles and equipment comply with international emission standards	NEGLIGIBLE
		Noise from vehicles and machinery could elevate ambient noise levels around the site	Noise attenuation measures shall be effectively provided for all vehicles and machinery to be used for the project. Project workers will be provide with hearing protection so that their hearing will not be affected by noise from the vehicles and machinery	NEGLIGIBEL
		Dust and particulates from trenching activities could be suspended in the atmosphere, leading to elevation of suspended particulate matter (SPM) levels in the ambient air around the project site	Open soil surfaces and stacks of excavated materials shall be sprinkled with water to prevent suspension of dust from there	MINOR
		During decommissioning, the same impacts anticipated during construction are likely to recur. Specifically, various vehicles, machinery and equipment will be used during project decommissioning will run on fossil fuels and will therefore produce gaseous and particulate emissions, which could contrive to negatively alter ambient air quality around the site	All vehicles and machinery to be used for the project shall be regularly maintained to ensure that emissions from these vehicles and equipment comply with international emission standards	NEGLIGIBLE

S/N	ENVIRONMENTAL ATTRIBUTE	IDENTIFIED IMPACTS	RECOMMENDED MITIGATION	RESIDUAL IMPACT
		Noise from vehicles and machinery used for decommissioning could elevate ambient noise levels around the site	Noise attenuation measures shall be effectively provided for all vehicles and machinery to be used for the project. Project workers will be provide with hearing protection so that their hearing will not be affected by noise from the vehicles and machinery	NEGLIGIBLE
4.	Hydrology and Hydrogeology	During construction, stockpiling of excavated materials, equipment and machinery as well as creation of construction camps could obstruct natural drainage routes. This could lead to flooding in upstream areas, and drying up in downstream areas.	Stockpiles of materials and creation of construction camp will be done with due cognizance for existing drainage routes in the area, so that there will be no obstruction of the natural hydrology of the project area	NEGLIGIBLE
		Construction of diversion route could alter the existing hydrological layout of the area, leading to significant changes	In selecting the diversion route for the erosion gully at Ibore, due cognizance will be paid to the existing hydrological layout in the area, to avoid unwholesome alterations to the natural hydrology of the area.	MINOR
		Accidental spills of fuels and other hazardous materials such as lube oils could percolate into groundwater, altering the existing quality of hydrogeological resources	Care shall be taken in handling fuels and hazardous materials, to prevent accidental spills. Adequate emergency response	MINOR

S/N	ENVIRONMENTAL ATTRIBUTE	IDENTIFIED IMPACTS	RECOMMENDED MITIGATION	RESIDUAL IMPACT
			plans shall be provided, to promptly handle accidental spills, if they occur.	
		During operation, the diversion of floodwaters from the existing Ibore gully could create microclimatic modifications, leading to hydrological modifications	In selecting the diversion route for the erosion gully at Ibore, due cognizance will be paid to the existing hydrological layout in the area, to avoid unwholesome alterations to the natural hydrology of the area.	MINOR
5.	Socio-economics	During mobilization and construction activities, Interference with day-to-day community activities could result in conflicts and complaints	Mobilization activities shall be properly planned to avoid undue interference with normal/routine community activities in the project area	MINOR
		As part of construction activities, land may need to be acquired and existing structures demolished to give room for the alternative drainage channel. Conflicts may arise if adequate compensation is not paid for acquired land, including structures and economic crops on the land	Adequate compensation shall be paid for any land and/or property acquired for the project. Payments shall only be made after proper agreements have been reached with the communities.	MINOR
		In the event that compensation is to be paid to people who have lost property to the gully, and/or loved ones, conflicts could arise between community members and NEWMAP project team, if there are disputes about how much is to be paid, and to whom.	Compensation for losses shall only be paid after proper agreements have been reached with community members, to avoid conflicts and disputes	MINOR
		During mobilization and construction activities, project associated vehicular movement could lead to traffic congestion and increased risk of occurrence of traffic	Project associated vehicular movements shall be timed to avoid peak periods in the area, in	MINOR

S/N	ENVIRONMENTAL ATTRIBUTE	IDENTIFIED IMPACTS	RECOMMENDED MITIGATION	RESIDUAL IMPACT
		accidents and fatalities	order to avoid traffic build up All project drivers will be given adequate training on defensive driving to avoid accidents occurring during mobilization	
		Conflicts could arise over loss of agricultural lands due to gully erosion rehabilitation civil works downstream of the gully head in Ibore community	As part of compensation for land acquisition, provision shall be made for the inclusion of owners/operators of agricultural lands that may be affected by rehabilitation works for the erosion gully in Ibore	MINOR
		During operations, there is the risk of increase in occurrence of waterborne diseases such as malaria, bilharziasis and schistosomiasis due to emptying of diverted runoff into undeveloped areas of the community	In selecting the diversion route for the erosion gully at Ibore, due cognizance will be paid to the existing hydrological layout in the area, to avoid unwholesome alterations to the natural hydrology of the area Contingency plans and emergency response plans shall be put in place to prevent the proliferation of waterborne diseases. This will include adequate public enlightenment.	MINOR
		Runoff from project area could enter surface waters in downstream areas, leading to contamination of receiving	The stilling basin shall be properly constructed and regularly	MINOR

S/N	ENVIRONMENTAL ATTRIBUTE	IDENTIFIED IMPACTS	RECOMMENDED MITIGATION	RESIDUAL IMPACT
		water bodies, especially by fertilizers, and pesticides as well as creation of excessive bare soils by herbicides if used for the establishment of the recommended plant species seeded to control soil erosion	monitored to ensure that it functions effectively for the reduction of suspended particulates, which can be carried into recipient surface waterbody downstream, thus effectively reducing the possibility of contamination/pollution of downstream waterbodies As much as possible, biodegradable organic fertilizers will be used for this project. Pesticides/herbicides usage for this project shall be kept to a barest minimum, to avoid excessive contamination/pollution of downstream recipient waterbodies.	
		Risks from debris and sediment accumulation in the drainage channels in upstream catchment area of the gully head, Diversion Culvert, Baffle Chute, Gabion Drop Structures and Stilling Basin resulting in performance failure of the drainage infrastructure and flooding in upstream areas	Adequate enlightenment shall be provided to upstream communities, to prevent indiscriminate disposal of refuse and debris, which could clog drainage channels and lead to flooding in upstream areas	MINORS

From the foregoing, it is clear that a number of impacts are likely to attend the proposed Ibore Erosion Gully rehabilitation project. While there are several positive impacts anticipated, a number of negative impacts are equally possible and have the potential to occur.

Mitigation measures have been recommended for adverse effects, as identified. However, there is a need to ensure that these measures are effective. This can only be done through the institution and implementation of a sound and cost-effective monitoring program. The monitoring program provided for this project is presented in subsequent sections of this report.

6.4 Institutional Arrangement for ESMP and Monitoring Plan

The roles, responsibilities and institutional arrangements for the implementation of the mitigation measures and the monitoring activities outlined in the Ibore NEWMAP ESMP are presented in this section. NEWMAP involves many Federal and State Ministries, Departments and Agencies (MDAs), Local Governments, Communities and Civil Societies. These in addition to the private sector and independent Consultants constitute the stakeholders. Effective implementation of the NEWMAP intervention project requires the participation of inter-ministerial and inter-State coordination, collaboration, and information sharing. The MDAs responsible for planning, the economy and finance, works, water resources, agriculture, power, transportation, forestry, emergency response, climate and meteorology, hydrological information and river basin development all have roles and responsibilities in the NEWMAP intervention. It is imperative that all stakeholders involved in the implementation of the NEWMAP intervention projects to explicitly understand their roles and responsibilities.

Edo State NEWMAP finances the Ibore gully erosion site rehabilitation while Edo State Government is primarily responsible for land management and land allocations requirement of the project. The Federal Ministry of Environment (FMEnv) is the lead-implementing Agency for NEWMAP. The Federal Project Management Unit (FPMU) headed by a Federal Project Coordinator hosted by FMEnv is responsible for the overall coordination of NEWMAP interventions at the national level. The Edo State Project

Management Unit (Edo SPMU) headed by the State Project Coordinator hosted by the Edo State Ministry of Environment and Public Utility is responsible for coordinating activities of the Ibore gully erosion NEWMAP intervention project and the required implementation of the proposed ESMP. Environmental Officers are provided for the NEWMAP intervention from both the Federal and State Coordinating Units with responsibility for mainstreaming environmental issues into the NEWMAP project interventions. Edo State Environmental Officer is responsible for coordinating the implementation of the Ibore gully erosion site ESMP on behalf of the State Project Coordinator. At the community level, an Ibore Gully Erosion Site Monitoring Committee will be established to participate on ensuring full compliance with all cooperative alliances during the implementation of the gully rehabilitation construction works project activities.

An explicit understanding of the roles and responsibilities of all stakeholders and the establishment of sound institutional arrangements is highly essential for the implementation of the proposed Ibore NEWMAP ESMP. The execution of the environmental and social safeguard measures recommended requires the involvement of relevant Ministries, Departments and Agencies (MDAs) at Federal and State administrative levels, public and private sectors, Community Associations and Community Based Organizations (CBOs), community based committees, and the Development Partners (World Bank).

The specific institutional arrangements, the roles and responsibilities of the stakeholders involved in the implementation of the ESMP during the pre-construction, construction, and operation and maintenance project phases are presented as follows:

Pre-Construction Phase

The stakeholders with roles in the implementation of the ESMP during the pre-construction phase consists of:

- The Federal NEWMAP Project Monitoring Unit (PMU);
- Edo State NEWMAP-PMU;

- Edo State Ministries, Departments and Agencies in Environment, Water Resources Management, Information, Health, Lands, Finance, Physical Planning and Urban Development; Agriculture,
- Community Based Organizations in Ibore;
- Ibore Gully Erosion Site Committee and
- The World Bank.
- The Global Environment Facility and
- The Special Climate Change Fund

Roles of Agencies and Stakeholders Involved in the ESMP Implementation

Monitoring of the implementation of the ESMP during the pre-construction phase:

- Site Engineer;
- Federal Ministry of Environment
- Edo State Ministry of Environment
- Edo State Ministry of Health

Implementation and Reporting of the ESMP:

- The Construction Contractor (Service Provider/Contractor)

Pre-construction Community Engagement and Consultation Meetings:

- Ibore Gully Erosion Site Committee;
- Community Associations in Ibore Esan Central;
- Ibore Esan Central Based Community Based Associations. and
- Concerned members of the Ibore Community in the area

Liaising with NEWMAP-PMU and Edo SPMU on issues during the Community Engagement and Consultation in order to satisfy international safeguard policies of the World Bank shall be the sole responsibility of:

- The Construction Contractor and
- The Independent Environmental Consultant

Communication of the concerns of the resident communities to the appropriate Edo State Ministries and their respective Departments and Agencies (MDAs) for prompt actions on the issues raised shall be the sole responsibility of:

- Edo State Project Monitoring Unit (Edo SPMU)

Responsibility for Reporting and Follow-Up

Submission of Community Meetings held at the local level on the project to Edo NEWMAP SPMU shall be the sole responsibility of the appointed Secretary of the following community groups:

- Ibore Gully Erosion Site Committee;
- Community Associations in Ibore Esan Central;
- Ibore Esan Central Based Community Based Associations. And
- Concerned members of the Ibore Community in the area

The Community Secretary shall perform all follow-up actions to ensure feedback, prompt reporting and sound follow-up mechanisms are in place for the issues raised and monitor their implementation. Issues raised shall be forwarded with the recommendations of Edo State NEWMAP based on the outcome of their review of the comments raised within the scope of the project and compliance with the World Bank requirements to Federal NEMAP-PMU and the World Bank.

The Construction Contractor shall ensure that the comments are promptly implemented as agreed with the communities and feedback should be communicated to Edo State NEWMAP-PMU. This cycle of community engagement/consultation – reporting – feedback – follow-ups – response mechanism actions shall continue until the completion of the pre-construction phase of the proposed Ibore NEWMAP intervention.

Construction Phase

Stakeholders responsible for ESMP implementation during the Construction Phase are:

- The Independent Environmental Consulting Firm;
- The Construction Contractor and any other relevant Service Provider Contractor;

- Edo State NEWMAP-PMU;
- Federal NEWMAP-PMU;
- Edo State Ministries, Departments, and Agencies (Works and Infrastructure, Environment, Water Resources, Health, Agriculture and Forestry, and Physical Planning and Urban Development)
- Environmental Officers of Federal NEWMAP-PMU;
- Environmental Officers of Edo State NEWMAP-PMU;
- Federal Ministry of Environment
- NESREA;
- World Bank.

Roles of the stakeholders during the Construction Phase implementation of the ESMP is as follows:

NEWMAP Edo State Project Monitoring Unit (SPMU) Environmental and Safeguard Officer

Responsible for the provision of feedbacks to the Project Coordinator of Edo SPMU, on the implementation of the ESMP and other environmental issues. He shall be responsible for carrying out the supervision, control and monitoring of the implementation of the ESMP and the NEWMAP gully erosion intervention project. The Edo NEWMAP SPMU Environmental Officer shall perform daily inspection of the gully erosion rehabilitation intervention works and monitor the implementation of the ESMP.

Independent Environmental Consultancy Firm's Environmental Supervisor and Safeguard Specialist

The sole responsibility for the implementation of the ESMP during the Construction Phase shall be given to an Environmental Supervisor and Safeguard Specialist appointed by an Independent Environmental Consulting Firm under Contractual Agreement with NEWMAP Edo SPMU to actually carryout the implementation of the ESMP on its behalf.

Site Engineer and Construction Contractors

The Environmental Supervisor will be present on weekly basis to implement the ESMP during the construction phase. However, the Construction Contractor and its Site Engineer shall be responsible for:

- monitoring and reporting on weekly basis to Edo State NEWMAP-PMU the ESMP implementation activities of the independent Environmental Consultant;
- provision of adequate support, information and logistics requirements for the monitoring of the compliance of the Construction Contractor and other service provider contractors with the implementation of the recommended mitigation measures and the impact monitoring otherwise called environmental auditing processes;
- regular supervision and reporting of the ESMP implementation to Edo State PMU

Edo State MDAs

Edo State MDAs, especially the Ministries of Environment, Works and Infrastructure, Health, Agriculture and Forestry should monitor the ESMP implementation to ensure that the internal mechanisms, policies, established laws of the State are complied with in the Ibore gully erosion site rehabilitation works. The MDAs shall carry out periodic site visits with the representatives of Federal NEWMAP SPMU and Edo State NEWMAP SPMU during the construction phase implementation of the ESMP. The report of their findings should be submitted to the World Bank.

Federal Ministry of Environment, NESREA and Edo State Ministry of Environment

Environmental Officers from Federal Ministry of Environment and NESREA as well as Officials of Federal NEWMAP shall periodically visit the project site to observe the level of implementation of the ESMP and the compliance of the Construction Contractors with the recommended mitigation measures.

Reporting and Follow-Up during the Construction Phase

The responsibility for ESMP reporting belongs to the independent Environmental Consulting Firm's representative (Environmental Supervisor / Safeguard Specialist) who

shall prepare weekly Environmental Compliance Monitoring Reports and Quarterly Environmental Impact Monitoring (Environmental Auditing) Reports for submission to Edo State NEWMAP-PMU Project Coordinator for review, comments, observations, recommendations and approval. Thereafter the review of the ESMP implementation documentations, the Edo State NEWMAP-PMU will send feedback to the Site Engineer and the Construction Contractor Environmental Officer when urgent action is required in cases on non-compliance to mitigation measures or there was an occurrence of spillage of hazardous chemicals or petrochemical spillage or any other safety incidence. The Environmental Supervisor from the independent Environmental Consultancy Firm and the Construction Contractor's Environmental Officer shall be responsible for checking and reporting on the implementation of all follow-up actions during the construction phase.

Furthermore, the Construction Contractor's Environmental Officer and the Site Engineer shall submit monthly reports on the implementation of the ESMP to Edo State NEWMAP-PMU Project Coordinator. The Edo State NEWMAP-PMU's Environmental Officer shall advise the SPMU Project Coordinator after thorough review of the ESMP Report. In the advent of any non-compliance or discrepancy on any environmental or social issue, the Edo SPMU Project Coordinator shall convene a Project Environmental Management (PEM) meeting to discuss the way forward on the issue.

Operation and Maintenance Phase

The responsibility for the implementation recommendations of the ESMP during the operation and maintenance phase of the Ibore gully erosion site drainage infrastructure belongs to the relevant Edo State MDAs such as the Ministry of Environment, Ministry of Health, Ministry of Water Resources, Ministry of Physical Planning and Urban Development. These MDAs of Edo State shall work in collaboration on behalf of Edo State Government to ensure relevant Project Officers are transferred to the Edo State NEWMAP Office to supervise the operations, daily inspection and monitoring the operations of the drainage infrastructure and maintenance works during the operation phase. Edo State NEWMAP SPMU framework will have to be transferred to the Edo

State Government composed government officials and professionals that will handle the day-to-day operations of the gully erosion site infrastructure, maintenance operations and implementation of the requirements of the ESMP at the operation and maintenance phase.

Key MDAs in Edo State Government

During the operation and maintenance phase, the major ministries the Edo State NEEWMAP will absorb include:

- Edo State Ministry of Environment;
- Edo State Ministry of Water Resources;
- Ministry of Works and Infrastructure
- Edo State Ministry of Transportation
- Edo State Ministry of Agriculture and Forestry
- NIMET
- NEMA
- Nigerian Police;
- Ministry of Health and
- The Ibore Esan Central Local Government Administrative Council

Roles of the Relevant MDAs

The roles of the respective ministries and their professionals / specialists in the operation and maintenance of the Ibore Gully Erosion site drainage infrastructure are as follows:

- Edo State Ministry of Health and their relevant departments and agencies should carry out regular site visits to the rehabilitated gully erosion site and channel to check and confirm that the operation and maintenance of the infrastructure is adequate and does not constitute any threat to public health.
- The Ministry of Environment should conduct regular inspection to the gully erosion infrastructure to ensure its functionality, the adequacy of its maintenance, the status quo of the different storm water drainage infrastructure to ensure there

is no form of performance failure and to ensure prompt remedial actions is taken in case of any occurrence of performance failure.

- Edo State Ministry of Transportation shall be responsible for checking the status of vehicular traffic and road transportation in the area to ensure safety and ensure adequate road detours and signs are in place to protect vehicular accidents around the gully erosion channel.
- Edo State Ministry of Agriculture and Forestry shall conduct periodic inspections to ensure compliance with Watershed Management Plans for the establishment of vegetation cover in the upstream watershed areas of the gully head and the channel stabilization downstream of the gully head.
- Nigerian Police shall ensure that crime and criminal activities are monitored and minimized as much as possible to prevent the association of such activities with the operation of the gully erosion infrastructure;
- NEMA shall be responsible for all emergency response requirements in case of any incidence of performance failure in advent of the arrival of flood greater than the anticipated 1 in 50 year recurrence interval.
- NIMET shall be responsible for provision of climatic alerts on the occurrence of heavy rainfall events during the operation phase of the rehabilitated gully erosion site.

Responsibility for the Implementation of the ESMP at the Local Level

The responsibilities of the local government in the implementation of the ESMP during the operation and maintenance phase includes:

- Provision of oversight function across the LGAs for ESMP compliance
- Participate in awareness campaign for the effective operation of the Ibore gully erosion drainage infrastructure amongst the various relevant grass root interest groups to ensure people does not dump refuse and solid waste into the gully drainage channel.

- Organize, coordinate and ensuring safe use of volunteers in a response action, and actually identifying where these volunteers can best render services effectively and
- Providing wide support assistance helpful in the effective operation of the drainage infrastructure and ensure that implementation of the operation and maintenance phase ESMP mitigation measures

Responsibility for Financing the Implementation of the ESMP at all the Project Phases

The financing of the ESMP during the pre-construction and construction phases shall be the responsibility of Federal NEWMAP under the financial previsions made available for the project in Edo State by the World Bank and the other financial institutions. However, upon the completion of the rehabilitation construction phase, during the operation and maintenance phase, the financial responsibility for ESMP financing shall be given to the Edo State Government and any assistance available from development partners on the project. The Edo NEWMAP SPMU during the operation phase shall consist of NEWMAP Staffs and relevant Edo State MDAs Government Officials. This new Edo State NEWMAP structure shall be responsible for the supervision of the operation of the infrastructure, the enforcement of all ESMP measures, monitoring of the performance of the drainage infrastructure, initiation and implementation of remedial actions, reporting and staff training as required.

The details of the institutional arrangements, and the roles and responsibilities of the pertinent stakeholders in the implementation of the ESMP are as shown in **Table 6.4** below.

Table 6.4: Roles and responsibilities of the key stakeholders in the implementation of the ESMP

S/No.	KEY STAKEHOLDER	RESPONSIBILITIES
	NEWMAP Federal Project Management Unit	• Overall coordination of the implementation of a multi-sectorial NEWMAP in seven Nigerian States • Establishment of the development objectives to be achieved by the NEWMAP intervention • NEWMAP Federal Project Support Unit (FPSU) manage the coordination and provision of program support to State counterpart Agencies

S/No.	KEY STAKEHOLDER	RESPONSIBILITIES
	NEWMAP Edo State Project Management Unit (SPMU) Project Coordinator	Project Coordinator of Edo SPMU is responsible for the implementation of the ESMP and ensure compliance with the requirements of the environmental and social impact mitigation measures. The Project Coordinator of Edo SPMU should perform the following roles and responsibilities: ➢ Overall management of the Project Contractor and ensure compliance with recommended impact mitigation measures and the requirements of the ESMP ➢ Liaise with FMEnv and the World Bank to coordinate the preparation and implementation of the ESMP ➢ Enforce the integration of the recommended environmental and social impact mitigation measures and requirement for the implementation of the ESMP in the tender documents and contract award documents ➢ Supervise and monitor the implementation of the mitigation measures in the ESMP and take adequate steps ➢ Compilation and submission of periodic ESMP reports to the World Bank
	NEWMAP Edo State Project Management Unit (SPMU) Environmental and Safeguard Officer	The Environmental and Safeguard Officer of Edo SPMU shall be responsible for the provision of feedbacks to the Project Coordinate of Edo SPMU on the implementation of the ESMP and other environmental issues. He shall be responsible for carrying out the supervision, control and monitoring of the implementation of the ESMP and the NEWMAP gully erosion intervention project. He shall also be responsible for the following ➢ Review all Environmental Assessment and Social Assessment documents prepared by Consultants and ensure adequacy under the World Bank policies including OP4.01; ➢ Ensure that the project design and specifications adequately conform with the recommendations of the ESMP ➢ Coordinate application, follow up processing and obtain requisite clearances required for the project on behalf of the Contractor if required; ➢ Develop, organize and deliver training programs for the Project Implementation Unit (PIU) staffs, the Contractors and others involved in the implementation of the NEWMAP intervention in collaboration with the Project Management Unit (PMU); ➢ Review and approve the Contractor's Implementation Plan for the impact mitigation measures as documented in the ESMP and any other supplementary environmental studies that may need to be carried out by the PIU; ➢ Liaise with the Contractor on the implementation of the ESMP / RAP ➢ Liaise with various Federal and State Government agencies on environmental, resettlement and other regulatory matters ➢ Interact consistently with NGOs and CBOs that are involved in

S/No.	KEY STAKEHOLDER	RESPONSIBILITIES
		the project; ➢ Establish dialogue with the resident communities in Ibore to ensure that the environmental concerns and suggestions are incorporated in the implementation of the NEWMAP gully erosion rehabilitation ➢ Review the performance of the project through an assessment of the periodic environmental monitoring reports; provide a summary report to the Project Coordinator, and initiate follow-up actions; ➢ Provide support and assistance to the Government Agencies and the World Bank in their efforts at supervising the implementation of the ESMP and the NEWMAP intervention
	Federal Ministry of Environment, EIA Department and NESREA	• Perform the role of the lead environmental regulator overseeing the compliance of the Contractor with the ESMP mitigation requirements, granting consent on the ESMP implementation, supervision and monitoring of the gully erosion rehabilitation implementation; • Lead role in the provision of advice on screening, scoping, review of draft ESMP report in liaison with State Ministry of Environment; receiving comments from stakeholders, public hearing of the project proposals, and convening a technical decision making panel, project categorization for EA, applicable standards, environmental and social liability investigations, monitoring and evaluation process and criteria; • Provision of approval, required clearance and other environmental clearance for the ESMP in association with State Ministry of Environment • Review environmental monitoring reports • Ensure corrective actions are taken to mitigate significant environmental and social impacts • Conduct periodic site visits to investigate and verify the nature and occurrence of the identified impacts
	Federal Ministry of Environment, Department of Erosion, Flood and Coastal Zone Management	• The Department of Erosion, Flood and Coastal Zone Management is the implementing authority for the NEWMAP gully erosion intervention with the following responsibilities: ➢ Coordinate all policies, programs and actions of NEWMAP across the States in Nigeria; ➢ Ensure smooth and efficient implementation of the project's various technical programs; ➢ Cooperate with relevant stakeholders through a Steering Committee that provides guidance on the technical aspects of all project activities of the gully erosion rehabilitation; ➢ Maintain and manage all fields effectively and efficiently for the projects
	Edo State Ministry of Environment.	• Oversee the implementation of the ESMP, compliance with the recommended mitigation measures, at State level. • Ensure that all the project activities involved in the gully erosion site

S/No.	KEY STAKEHOLDER	RESPONSIBILITIES
		rehabilitation comply with the Edo State environmental laws and requirements • Perform regular compliance monitoring and periodic inspection of all the stages and phases of the NEWMAP intervention in Ibore gully erosion site
	State Government MDAs (Ministry of Lands, Surveys and Urban Development etc.)	• Compliance overseer at State Level; • Other MDAs come in as and when relevant areas or resources under their jurisdiction or management are likely to be affected • Compliance overseer at State level on matters of land allocation, compensation and other resettlement issues • They participate in the EA processes and in project decision making that helps prevent or minimize impacts and to mitigate them. These institutions could be required to issue consent or approval for an aspect of the project, allow an area to be included in a project, or allow impact to a certain extent or impose restrictions on conditions, monitoring responsibilities or supervisory oversight
	Site Manager	• Ensure minimum land areas are disturbed and all land disturbance activities are conducted in accordance with relevant legislations; • Minimize on-site erosion and control sediment in accordance with the site Erosion and Sediment Control Plan; • Communicate the content of any changes made to the Site Erosion and Sediment Control Plan to all employees and Contractors; • Inspect the operations of the erosion and sediment control devices installed in the Ibore gully erosion channel and initiate repairs or maintenance as required; • Instruct employees and contractors in the purpose and operation of erosion and sediment control devices and the need to maintain them in proper working condition at all times; • Provide adequate onsite waste collection bins and ensue proper solid waste handling and disposal that eliminates waste littering and creation of environmental nuisance
	Site Engineers/Supervisor	• Provide oversight function during construction and decommissioning
	Service Provider/Contractor	• Compliance with Bills of Quantities specifications in procurement of materials and construction
	Esan Central Local Government	• Provide over sight function across subproject in LGAs for ESMP compliance • Liaising with the PMU to verify the adequacy of resettlement location and provide approval for such sites, providing additional resettlement area if the designated locations are not adequate, provide necessary infrastructure in relocated areas, engage and encourage carrying out comprehensive and practical awareness campaign for the proposed project, amongst the various relevant grassroot interest groups
	Community Development Associations (CDAs)	• Ensure community participation by mobilizing, sensitizing community members
	Community Based	• Assisting in their own respective ways to ensure effective response

S/No.	KEY STAKEHOLDER	RESPONSIBILITIES
	Organizations / CSOs	actions. Conducting scientific researches alongside government groups to evolve and devise sustainable environmental strategies and rehabilitation techniques; • Organize, coordinate and ensuring safe use of volunteers in a response action, and actually identifying where these volunteers can best render services effectively and • Providing wide support assistance helpful in management planning, institutional / governance issues and other livelihood related matter, project impacts and mitigation measures, and awareness campaign
	Resident Community Representatives	• Participation in community engagement and consultations; • Communication of grievances and complaints on the project • Identify issues that could derail the project; and • Support project impact mitigation measures implementation and compliance requirements • Participate in awareness campaigns on the NEWMAP intervention
	The World Bank	The World Bank shall perform the following roles: • Ensure that the Safeguard Policies of the World Bank are complied with in the implementation of the ESMP; • Recommend additional measures for strengthening the ESMP and implementation performance; • Carry out the final review, clearance and approval of the ESMP • Ensure that environmental safeguards are complied with during World Bank supervision mission
	The Construction Contractor	• For day-to-day onsite implementation of the ESMP and coordination of all environmental and safety related activities of the Company, the Contractor shall appoint: ❑ An Environmental Officer; ❑ Site Engineer and ❑ An Independent Consultant • The Environmental Officer or Representative of the Contractor shall be responsible for performing the following: - Development of a sound Environmental Management Plan for the proposed gully erosion rehabilitation project; - Ensure that all construction site staff including all subcontractors comply with the requirements of the ESMP; - Supervise the implementation of all the mitigation measures and preparation of the required monitoring reports; - Perform regular inspection of the Ibore gully erosion site to ensure adherence to all relevant environmental management actions specified by the ESMP; - Preparation of work plans for environmental management in line with the ESMP; - Provide inputs into the regular environmental report to be compiled by the Environmental Safeguard Officer (ESO); - Maintain adequate records of environmental and safety incidence as well as corrective and preventive actions taken;

S/No.	KEY STAKEHOLDER	RESPONSIBILITIES
		↓ Ensure that any changes made during the construction process that may have a significant environmental and social impact are communicated to the ESO on time and managed accordingly; ↓ Ensure ESO is adequately informed about the Contractor's monitoring results •
	Independent Environmental Consultant	• Coordinate the implementation of the requirements of the EMP during the phases of the project; • Coordinate the environmental monitoring activities at the field level; • Communicate the results of monitoring and auditing inspections to appropriate offices through submission of reports, summaries of reports, periodic formal and informal reports as appropriate; • Communicate with the HSE Manager regarding emerging environmental and social matters and concerns; • Conduct independent monitoring and auditing to ensure compliance with the requirements of this EMP and Contractor's HSE plan and other site-specific plans; • Review EMP compliance monitoring reports and conduct site visits/inspections; • Collaborate with the EIA Consultant regarding environmental and social concerns and conducting stakeholders consultation; • Advise the Contractor field personnel concerning environmental and social issues and the implementation of the environmental and social regulatory requirements • Compile a comprehensive report on the implementation of this EMP for submission to the regulatory agencies and other relevant stakeholders.

Contractual Arrangement for Assuring the Performance of each Implementing Agency

Schedule of Monitoring is mostly ongoing and on daily basis as indicated in **Table 6.4.** But the Environmental Impact Monitoring (Environmental Auditing) shall be performed on quarterly basis for effective monitoring of the profile of the impact mitigation and occurrence if predicted project impacts actually occur. .

6.5 Capacity Building and Training Plan

Giving consideration to the composition of stakeholders in public and private sector, the resident communities, community based organizations and the development partners that will perform key roles and responsibilities in the implementation of the proposed NEWMAP gully erosion rehabilitation and the ESMP, capacity building and training of

the relevant stakeholders is imperative. Capacity building training is essential for ensuring that the ESMP requirements are implemented. To this end, the relevant training and capacity building programs have been identified and recommended to NEWMAP Edo SPMU and other stakeholders as prerequisite for effective implementation of the Ibore gully erosion site rehabilitation project and the recommended ESMP:

The training will enhance their capability to function effectively and perform their roles on the project. They will be aware of the environmental and social policy and safeguards regulating their areas of responsibilities; the potential adverse environmental and social impacts of various project activities; their roles and responsibilities in the achievement of conformance with the policy and procedures, and with the requirements of this ESMP. The World Bank procedure ensures that any person performing tasks on a World Bank financed project that have the potential to cause significant adverse environmental or social impact identified should have the requisite competence on the basis of appropriate education, training or experience. NEWMAP personnel having responsibility of performing site inspections will receive training on how to do so with the help of external resources Consequently, Edo State NEWMAP will develop and institute training for SPMU, community and other relevant stakeholders with defined roles and responsibilities on the project that will raise their awareness and competence in the following areas:

- The environmental and social impacts that could arise from the project activities;
- The necessity of conforming to the requirements of the NEWMAP Ibore ESMP in order to avoid or reduce the identified project impacts; and
- The roles and responsibilities that NEMAP personnel must assume to achieve the desired ESMP Conformity and impact compliance
- Safeguard training for the entire SPMU on World Bank safeguard policy triggered by the NEWMAP;
- GIS Analysis and Image Processing training for the Safeguard Officers to enhance their capability to interpret gully erosion site imagery that will be delivered along with the ESMP as contained in the TOR;

- Training of SPMU on emergency response procedures for handling emergency incidence during phases of the NEWMAP gully erosion intervention.

The training of Contractor personnel and workforce shall be designed to enhance their awareness of the various aspects of the ESMP in relations to their roles and responsibilities in its implementation. The training will be specified as a requirement Contactor personnel must fulfill to fully qualify to possess full work permit to participate in the project and a requirement of contract for the Contractor. Moreover, related specific training shall be provided to workers with responsibilities related to the implementation of the ESMP. The Contractor personnel training shall include but not limited to:

- Training on environmental management, monitoring and conservation, project impact mitigation and Environmental and Social Management Plan implementation;
- Induction Courses on Environmental Management and Safety Management;
- Safety Briefing and the relevance of Daily Tool Box Talks

The capacity building training program proposed for the implementation of the ESMP is as shown in **Table 6.5**.

Table 6.5: Capacity Building Training Program Proposed for the implementation of the ESMP

CAPACITY BUILDING TRAINING MODULE	DESCRIPTION OF COURSE CONTENT	REQUIRED PARTICIPANTS	DURATION	COST (Naira)
Module One: Sensitization and Induction Training	Basic Environmental Awareness Training: (a) Definition of key word such as Environment, Environmental Management, Protection and Conservation; Environmental Awareness; Environmental and Social Management Plan; NEWMAP Gully Erosion Site Remediation; Integrated Watershed Management; etc. (b) The Potential Impacts and hazards of the interaction of gully erosion site rehabilitation project activities with biophysical and social components of the environment; (c) Need for impact mitigation for protection of the environment and livelihood of the host communities; (d) Training on Ibore NEWMAP rehabilitation Environmental and Social Management Plan and its implementation (e) Safety induction course; (f) Emergency and spill response preparedness and drill; (g) Social responsibility during the construction phase and the modalities for community communication, interaction and relations; (h) Basic First Aid Training and In-depth Training for selected personnel; (i) The importance of Personal Protection Equipment (PPE) as a safety measure in occupational safety; (j) The Permit to Work System (k) Environmental and Safety Awareness Training	❑ Edo State NEWMAP Staff; ❑ The Principal Contractor; ❑ Site Personnel of the Principal Contractor; ❑ Host Community Representatives and the General Public	3 Days	N6,550, 000:00
Module Two: Training on Environmental and	❑ Environmental and Social Impact Assessment Process in Nigeria	FMEnv Staff; Edo SPMU Officials; Edo State Ministry	2Days	N2, 950, 000:00

CAPACITY BUILDING TRAINING MODULE	DESCRIPTION OF COURSE CONTENT	REQUIRED PARTICIPANTS	DURATION	COST (Naira)
Social Management Plan Implementation	❑ The NEWMAP Project Environmental and Social Impacts ❑ The Impact Control and Mitigation Measures for the Ibore NEWMAP Intervention; ❑ Ibore NEWMAP ESMP; ❑ ESMP Implementation Approach, ❑ Environmental Impact Monitoring ❑ Mitigation Measures Compliance Monitoring ❑ ESMP Communications and Reporting	of Environment Officer; Officials of relevant MDAs; Local Government Officers; NGOs and CBOs; Principal Contractor Personnel;		
Module Three: Training on Construction HSE	❑ Primer on Construction Best Management Practices and HSE ❑ Health and Safety Hazards in Gully Erosion Drainage Infrastructure Construction Works ❑ Incidence, Causation, Investigation and Reporting ❑ Excavation Safety ❑ Construction Site Inspection ❑ Personal Protection Equipment	FMEnv Staff; Edo SPMU Officials; Edo State Ministry of Environment Officer; Officials of relevant MDAs; Local Government Officers; NGOs and CBOs; Principal Contractor Personnel;	2Days	N2,950,000:00
Module Four: Integrated Watershed Management Approach in NEWMAP Intervention	Integrated Watershed Management in Gully Erosion Site Rehabilitation: ❑ Primer on Integrated Watershed Management; ❑ Watershed Delineation in ArcHydro - ArcGIS 10.3 ❑ Gully Erosion Drainage Infrastructure in NEWMAP intervention ❑ Gully Erosion Slope Stabilization and Erosion Control Using Vegetation ❑ Erosion and Sediment Control - A Field Guide for Construction Site Managers ❑ Dispute Resolution Mechanism	FMEnv Staff; Edo SPMU Officials; Edo State Ministry of Environment Officer; Officials of relevant MDAs; Local Government Officers; NGOs and CBOs; Principal Contractor Personnel;	2 Days	N6, 050,000:00
Total Cost of Training				**N18,500,000.00**

NOTES ON COSTING FOR CAPACITY BUILDING

It has been assumed that the capacity building trainings will be undertaken by a team of 4 consultants for module 1, 2 consultants for module 2, 4 consultants for module 3 and 4 consultants for module 4. The costs for each training module will typically consist of consultants' costs and costs of participation by regulators (SPMU and State Ministry of Environment). A breakdown of the costs is presented below:

MODULE 1:

- Honorarium for Consultants N800,000.00
- Per diem for consultants and training secretariat (Assuming 10 people for 3 days each @N75, 000/day) N2, 250,000.00
- Transportation costs for training team N250, 000.00
- Cost of venue (including lunch and tea breaks each day) N1, 500,000.00
- Course materials and certificates N250, 000.00
- Cost of participation by Regulators N1, 500,000.00
- Total cost for module 1 N6, 550,000.00

MODULE 2:

- Honorarium for Consultants N400, 000.00
- Per diem for consultants and training secretariat (Assuming 6 people for 2 days each @N75, 000/day) N900, 000.00
- Transportation costs for training team N250, 000.00
- Cost of venue (including lunch and tea breaks) N500, 000.00
- Course materials and certificates N150, 000.00
- Cost of participation by Regulators N750, 000.00
- Total cost for module 2 N2, 950,000.00

MODULE 3:

- Honorarium for Consultants N400, 000.00
- Per diem for consultants and training secretariat (assume 6 people for 2 days each @N75, 000/day) N900, 000.00

- Transportation costs for training team N250, 000.00
- Cost of venue (including lunch and tea breaks) N500, 000.00
- Course materials and certificates N150, 000.00
- Cost of participation by Regulators N750, 000.00
- Total cost for module 3 N2, 950,000.00

MODULE 4:

- Honorarium for Consultants N800, 000.00
- Per diem for consultants and training secretariat (Assuming 10 people for 3 days each @N75, 000/day) N2, 250,000.00
- Transportation costs for training team N250, 000.00
- Cost of venue (including lunch and tea breaks) N1, 000,000.00
- Course materials and certificates N250, 000.00
- Cost of participation by Regulators N1, 500,000.00
- Total cost for module 4 N6, 050,000.00

The total costs for the 4 modules come to N18, 500,000.00. Converting this to US$ at an official rate of US$1: N350, this gives US$52,857.00 for the 4 modules.

6.6 Grievance Redress Mechanism

The grievance redress mechanism allow NEWMAP project affected persons or the general public to file complaints and receive adequate timely response from NEWMAP SPMU. Land acquisition is an inevitable issue in the project that raise grievances from the community. The grievance address mechanism that shall be utilized on the Ibore NEWMAP gully erosion site rehabilitation shall be consistent with the Grievance Redress Mechanism outlined in the NEWMAP Environmental and Social Framework document of NEWMAP.

6.7 Environmental and Social Management/Monitoring Plan

This section presents the Environmental and Social Management Plan (ESMP) and the Environmental Monitoring Plan proposed for implementation during the pre-

construction, construction, operation and maintenance and decommissioning phases of the proposed NEWMAP gully erosion site rehabilitation intervention in Ibore, Edo State.

The implementation approach for the proposed ESMP involves the performance of two types of monitoring that constitutes surveillance and monitoring techniques that shall be used to detect if any negative impact has occurred during the life cycle of the project. The approach offers a quantitative estimate of the magnitude of the identified environmental and social impacts. The proposed monitoring will provide information on the occurrence of the identified impacts. The monitoring explicitly indicate the specific monitoring indicators that shall be investigated, the sampling location and the frequency of monitoring that shall be performed. The two monitoring that will be undertaken consists of:

(c) Environmental Auditing (Environmental impact monitoring), and

(d) Environmental and social impact mitigation compliance monitoring.

The environmental impact monitoring involves sample collection as well as laboratory analysis. The field plan and parameters to be monitored are detailed below:

6.7.1 Environmental and Social Management Plan (ESMP)

The proposed ESMP is as shown in **Table 6.6** with details of the mitigation measures recommended for the amelioration of the adverse environmental and social impacts of specific project activities constituting the gully erosion site rehabilitation intervention; the impact monitoring indicators or parameters the be measured, the frequency of monitoring, the stakeholders responsible for monitoring implementation; the type of monitoring that shall be performed and the cost implication of the implementation and monitoring of the impact mitigation measures.

Table 6.6: Environmental and Social Management Plan for Ibore Gully Erosion Site Rehabilitation

IMPACT ID	PROJECT PHASE	PROJECT ACTIVITY	PROJECT IMPACT	MITIGATION MEASURES	MONITORING		RESPONSIBILITY		COST (N)
					Indicator	Frequency	Implementation	Monitoring	
1	Pre-Construction	General clearing and Preparation of laydown area for equipment/materials, office, workshop, storage facilities and other utility area;	Increased employment opportunities for the local communities	❑ Utilize available workforce from the communities	Daily observation of employment records	Daily	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	• FMEnv • Edo State Ministry of Environment • Edo State NEWMAP	1,300,000
			Interference with day-to-day community activities resulting in conflicts and complaints	❑ Consult regularly with the communities (i.e. before, during and after site clearance) ❑ Demarcate boundaries of acquired location.	Sighting of the following: ❑ Number of consultation held ❑ Minutes of meetings held;	Once before commencement of pre-construction works, say three (3) months before Construction starts	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	• Esan Central District; • CDAs / CBOs • Community Rep. • Edo State NEWMAP • FMEnv • World Bank	0
			Waste handling and disposal	❑ Ensure adequate sanitary facilities area provided during the construction and operation phases of the project ❑ Solid waste management should be addressed in Contractor HSE Plan	Visual Observation of the general environmental sanitation of the site Site inspection for the adequacy and placement of sanitary facilities and solid waste storage bins onsite Sighting the Waste Tracking Logbook	Weekly	Contractor Site Manager; Contractor HSE Manager	NEWMAP ESO; SME; FMEnv World Bank	0

					Review the Project Waste Management Plan and Contractor's HSE Plan to assess the compliance of the contractor				
2	Pre-Construction	Physical presence of construction workers on the Ibore Gully erosion intervention project site and environ	Contamination of soil and downstream water resources of the project area from indiscriminate disposal of untreated sewage	❑ Contractors are to provide adequate sanitary facilities for their site workers; ❑ Open air defecation should be sternly discouraged among the project workers	Adequacy of sanitary facilities available on site	Ongoing or Daily	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State NEWMAP; Edo State Ministry of Environment ;	0
								Total costs for Item 1-2	**1,300,000**
3	Pre-Construction	Transportation of equipment, materials and workers to the project site	❑ Ambient air quality deterioration from airborne dust particulates, fugitive emissions, exhaust of equipment/automobiles	❑ Use equipment with high combustion efficiency ❑ Premob equipment and automobiles before usage ❑ Use dust suppressants on the project site	In-situ measurement of ambient air quality parameters: • CO, NO_x, SO_x VOC and Particulate Matter, SPM, THC, VOC, CH_4; Vehicle exhaust measurement; • Records of maintenance	Once in the first month and then once midway, and once at the end of construction work	• Independent Environmental Consulttant • Contractor • Site Manager; • Site Engineer • SPMU Project Coordinato	Edo State Ministry of Environment FMEnv	

					for all machinery, equipment and vehicles.		r		
			❑ Noise and vibration from vehicular movement	❑ Ear protective device to be provided to workers at the site clearing stage; ❑ Install acoustic mufflers on large equipment where necessary to limit noise levels at fence line	Ambient noise and vibration level monitoring; Comparison of ambient noise level to regulatory limit of 90dB(A) Daily Observation of large equipment operating onsite Examine the number of complaints in the complaint register Sight the records of equipment maintenance	Ongoing Daily	• Contractor • Independent Environmental Consultant	FMEnv Edo SME ESO NEWMAP	
			❑ Traffic congestion and increased risk of occurrence of traffic accidents and injuries	NEWMAP-Edo SPMU and Contractors shall avoid impeding traffic and traffic disruption around the project site by: ❑ Adjusting work schedules not to disturb traffic; ❑ Establishing an adequate system of road signs and detour; ❑ Notifying communities of pending work scope, duration and location	Daily observation of traffic volume and level of congestion	Ongoing	• Contractor • Site Manager; • Site Engineer • NEWMAP-Edo SPMU • SPMU Project Coordinator	FMEnv Edo State Ministry of Environment	

				❑ Avoid blocking public access roads; ❑ Complying with road bearing capacity and repairing damage caused to roads during and at the end of the work; ❑ Circumventing access roads to gathering places in Ibore and neighbouring communities					
4	Pre-Construction	Land Acquisition and demolition of existing buildings	Conflict over loss of land/building and resettlement benefits	❑ Consult extensively with the Ibore community on land acquisition and payment of building demolition benefits ❑ Develop a sound implementable Resettlement Action Plan for the Ibore NEWMAP gully erosion intervention	Number of consultation held; Sighting of the following: ❑ Number of consultation held ❑ Minutes of meetings held; ❑ Report of implementation of RAP with signatures showing community participation ❑ Compliance with RAP provisions	Once before commencement of pre-construction works, say three (3) months before Construction starts	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	• Edo State NEWMAP • FMEnv • World Bank	
5	Construction	Disruption and encroachment into agricultural lands	Conflict over loss of agricultural lands due to gully erosion	❑ Consult extensively with the Ibore community on land	Sighting of the following:	Once every two months	• Contractor • Site Manager;	• Edo State NEWMAP • FMEnv	

		in close proximity to the gully erosion channel	rehabilitation civil works downstream of the gully head	acquisition and payment of relocation benefits ❑ Develop a sound implementable Resettlement Action Plan for the Ibore NEWMAP gully erosion intervention	❑ Number of consultation held ❑ Minutes of meetings held; ❑ Report of implementation of RAP with signatures showing community participation ❑ Compliance with RAP provisions		• Site Engineer • SPMU Project Coordinator	• World Bank	
6	Construction	Transportation of equipment, materials and worker to project site	Soil contamination from accidental release of fuels, oils, chemicals, hazardous materials etc., to ground in the construction laydown area during delivery of materials and equipment to project site	❑ Establish appropriate protocols for materials delivery and handling to ensure there are no spills; ❑ The contractor HSE plan to address prevention and containment of oil spills, chemicals and hazardous materials releases during all phases of the project; ❑ Store and handle hazardous materials according to and approved hazardous materials management plan ❑ Maintain transportation vehicles, heavy civil engineering	Soil quality sampling, visual inspection, in-situ / lab measurements of soil physico-chemistry (pH, Nitrates, Heavy Metals, etc) Evidence of Contractor's compliance with HSE Plan, Protocol for material delivery and handling to prevent occurrence of any form of spillages; Records of incidence of leakages of oil	Quarterly	Contractor	Environmental and Safety Officer NEWMAP; FMEnv; SME; World Bank	

				machinery and construction equipment in good working order so as to avoid exhaust emissions as well as oil and fuel leaks ❑ Any oil/chemical spill should be reported to FMEnv and Edo State Ministry of Environment	and fuels Evidence of oil and fuel leakage or spillage like oil sheen on topsoil Sighting and Inspection of the storage facility for hazardous materials, fuel, Photographs of storage facility taken with dates				
			Ambient air quality deterioration from airborne dust particulates, fugitive emissions, exhaust of equipment/automobiles	❑ Use equipment with high combustion efficiency. ❑ Use dust suppressants on the project site	In-situ measurement of ambient air quality parameters: • CO, NO_x, SO_x VOC and Particulate Matter, SPM, THC, VOC, CH_4; Vehicle exhaust measurement; • Records of maintenance for all machinery, equipment and vehicles.	Once in the first month and then once midway, and once at the end of construction work	• Independent Environmental Consulttant • Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State Ministry of Environment FMEnv	
			Noise and vibration from vehicular	❑ Ear protective device to be provided to	Ambient noise and vibration level monitoring;	Ongoing	• Contractor • Independent	FMEnv Edo SME ESO NEWMAP	

			movement	workers at the site clearing stage; ❑ Install acoustic mufflers on large equipment where necessary to limit noise levels at fence line	Comparison of ambient noise level to regulatory limit of 90dB(A) Daily Observation of large equipment operating onsite Examine the number of complaints in the complaint register Sight the records of equipment maintenance	Daily	Environmental Consultant		
			Traffic congestion and increased risk of occurrence of traffic accidents and injuries	❑ NEWMAP-Edo SPMU and Contractors shall avoid impeding traffic and traffic disruption around the project site by: ❑ Adjusting work schedules so as not to disturb traffic; ❑ Establishing an adequate system of road signs and detour; ❑ Notifying communities of pending work scope, duration and location ❑ Avoid blocking public access roads; ❑ Using road signs to notify work in progress;	Daily observation of traffic volume and level of congestion	Ongoing	• Contractor • Site Manager; • Site Engineer • NEWMAP-Edo SPMU • SPMU Project Coordinator	FMEnv Edo State Ministry of Environment	

				❑ Complying with road bearing capacity and repairing damage caused to roads during and at the end of the work; ❑ Circumventing access roads to gathering places in Ibore					
7	Construction: Storm water drainage conduit	❑ Demolition of existing road side drainage channel, excavation and construction of new road side rectangular open drainage channel ❑ Excavation works and installation of Box Culverts to connect road side channel flows into the 2500mmx2000mm Culverts ❑ Construction of Rectangular 2500mm x	Increase in employment opportunities and engagement of community labour	Utilize available workforce from the communities	Daily observation of employment records	Ongoing	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	• FMEnv • Edo State Ministry of Environment • Edo State NEWMAP	
			Solid waste handling and disposal problems	❑ Ensure adequate sanitary facilities area provided during the construction and operation phases of the project ❑ Solid waste management should be addressed in Contractor HSE Plan	Visual Observation of the general environmental sanitation of the site Site inspection for the adequacy and placement of sanitary facilities and solid waste storage bins onsite Sighting the Waste Tracking Logbook Review the Project Waste Management Plan	Weekly	Contractor Site Manager; Contractor HSE Manager	NEWMAP ESO; SME; FMEnv World Bank	

		2000mm Culverts to channel storm water flows into the Primary Channel ❑ Construction of 1000mm x 1000mm Closed Culvert at road crossing			and Contractor's HSE Plan to assess the compliance of the contractor				
			Increase in traffic congestion along the major roads involved	NEWMAP-Edo SPMU and Contractors shall avoid impeding traffic and traffic disruption around the project site by: ❑ Adjusting work schedules not to disturb traffic; ❑ Establishing an adequate system of road signs and detour; ❑ Notifying communities of pending work scope, duration and location ❑ Avoid blocking public access roads; ❑ Complying with road bearing capacity and repairing damage caused to roads during and at the end of the work; ❑ Circumventing access roads to gathering places in Ibore	Daily observation of traffic volume and level of congestion	Ongoing	• Contractor • Site Manager; • Site Engineer • NEWMAP-Edo SPMU • SPMU Project Coordinator	FMEnv Edo State Ministry of Environment	
			Risk of accident and injury from excavation trench collapse	❑ Ensure that a suitable equipment is utilized in the excavation operations ❑ Monitor all excavation operation on a	❑ Daily observation of the suitability of equipment used on site and the competence of all equipment	Daily during the construction of stilling basin	Site Engineer; Site Manager; Contractor	Edo State SPMU Project Coordinator	

				daily basis	operators; ❑ Contractor's compliance with HSE Plan and Design Specifications ❑ Warning Signs; ❑ Number of Accident incidents;				
			Risk of injury from falls from height into excavation trench	❑ Ensure a competent machine operator is utilized ❑ Provide suitable access to trenches ❑ Put in place perimeter fencing and signage to ensure safety and secure the excavations and trenches	❑ Daily observation of the suitability of equipment used on site and the competence of all equipment operators; ❑ Contractor's compliance with HSE Plan and Design Specifications ❑ Warning Signs; ❑ Number of Accident incidents;	Daily during the construction of stilling basin	Site Engineer; Site Manager; Contractor	Edo State SPMU Project Coordinator	
8	Construction: Construction of Main Diversion Channels around the Gully Head	❑ Excavation and Construction of Rectangular 2500mm x 2000mm Culverts to channel flows into the 4000mm x 1500mm Main	Increase in employment opportunities and engagement of community labour	Utilize available workforce from the communities	Daily observation of employment records	Daily	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	• FMEnv • Edo State Ministry of Environment • Edo State NEWMAP	
			Solid waste handling and	❑ Ensure adequate sanitary facilities	Visual Observation of the general	Weekly	Contractor Site	NEWMAP ESO; SME; FMEnv	

		Rectangular Concrete Channel south of the gully head ❑ Excavation and Construction of the 4000mm x1500mm Main Rectangular Concrete Channel (The Southern Primary Diversion Channel) south of the gully head	disposal problems	area provided during the construction and operation phases of the project ❑ Solid waste management should be addressed in Contractor HSE Plan	environmental sanitation of the site Site inspection for the adequacy and placement of sanitary facilities and solid waste storage bins onsite Sighting the Waste Tracking Logbook Review the Project Waste Management Plan and Contractor's HSE Plan to assess the compliance of the contractor		Manager; Contractor HSE Manager	World Bank	
			Increase in traffic congestion along the major roads involved	NEWMAP-Edo SPMU and Contractors shall avoid impeding traffic and traffic disruption around the project site by: ❑ Adjusting work schedules not to disturb traffic; ❑ Establishing an adequate system of road signs and detour; ❑ Notifying communities of pending work scope, duration and location ❑ Avoid blocking public access roads; ❑ Complying with road	Daily observation of traffic volume and level of congestion	Ongoing	• Contractor • Site Manager; • Site Engineer • NEWMAP-Edo SPMU • SPMU Project Coordinator	FMEnv Edo State Ministry of Environment	

				bearing capacity and repairing damage caused to roads during and at the end of the work; ❑ Circumventing access roads to gathering places in Ibore					
			Risk of accident and injury from excavation trench collapse	❑ Ensure that a suitable equipment is utilized in the excavation operations ❑ Monitor all excavation operation on a daily basis	❑ Daily observation of the suitability of equipment used on site and the competence of all equipment operators; ❑ Contractor's compliance with HSE Plan and Design Specifications ❑ Warning Signs; ❑ Number of Accident incidents;	Daily during the of the excavation operation and drainage system construction	Site Engineer; Site Manager; Contractor	Edo State SPMU Project Coordinator	
				❑ Set out the location of the proposed drainage on ground by marking with spray paint and pegs at pit locations. ❑ Where excavation works are along the edge of existing roadway traffic, light or stop/go system should be set up to carry out the works; ❑ Excavated materials should be	Daily observation to ensure all safety measures are complied with and make adequate documentation of the process with photographic evidences	Daily during the of the excavation operation and drainage system construction	Site Engineer; Site Manager; Contractor	Edo State SPMU Project Coordinator	

				loaded to dump truck for stockpiling at appropriate designated location					
			Risk of failure from mal-alignment with channel, extreme flow capacity, debris control and energy dissipation	❑ Ensure that the design specification and basis applied in the construction of the channel/culvert such that the appurtenant entrance and outlet structures will efficiently discharge storm water bedload and floating debris at all stages of flood flows; ❑ Specialist supervision should be engaged to supervise the construction of the Chute to avoid the potential by undermining, overtopping or bypassing	Site inspection of the construction of the drainage infrastructure to ensure compliance with design basis and specifications	Daily during the construction of the drainage system	Site Engineer; Site Manager; Contractor	Edo State SPMU Project Coordinator	
			Risk of failure of the culvert, property damage, accumulation of sediment, culvert clogging and detrimental upstream deposit of debris	❑ The culverts should be designed and constructed to avoid excessive ponding at the entrance and screen out material that will not pass through the culvert. ❑ The culvert alignment should be such that water enters and exists it freely and directly without causing any abrupt	Site inspection of the construction of the drainage infrastructure to ensure compliance with design basis and specifications	Daily during the construction of the drainage system	Site Engineer; Site Manager; Contractor	Edo State SPMU Project Coordinator	

				changes in flow that could cause ponding, and buildup of debris at the culvert entrance					
			Risk of injury from falls from height into excavation trench	❑ Ensure a competent machine operator is utilized ❑ Provide suitable access to trenches ❑ Put in place perimeter fencing and signage to ensure safety and secure the excavations and trenches	Site inspection of the all excavation works to ensure compliance with design basis and specifications and safety requirements	Daily during the construction of the drainage infrastructure	Site Engineer; Site Manager; Contractor	Edo State SPMU Project Coordinator	
			Risk of people drowning	Ensure that appropriate side structures and well as signs and detour are provided	Site inspection of the all excavation works to ensure compliance with design basis and specifications and safety requirements	Daily during the construction of the drainage infrastructure	Site Engineer; Site Manager; Contractor	Edo State SPMU Project Coordinator	
		Construction of 10,000mm x 5000mm Stilling Basin	Risk of drowning	❑ Ensure that weep holes are provided to empty the stilling basin; ❑ Provide mentis grids or steel grids at strategic locations where extreme danger of drowning exists and pedestrian movement is intense	Site inspection of the all excavation works and monitoring workers movement and public access to the work area to ensure compliance with design basis and specifications and safety requirements	Daily during the construction of the drainage infrastructure	Site Engineer; Site Manager; Contractor	Edo State SPMU Project Coordinator	

			Risk of accident and injury from excavation trench collapse	❑ Ensure that a suitable equipment is utilized in the excavation operations ❑ Monitor all excavation operation on a daily basis	Site inspection of the all excavation works and monitoring workers movement and public access to the work area to ensure compliance with design basis and specifications and safety requirements	Daily during the construction of the drainage infrastructure	Site Engineer; Site Manager; Contractor	Edo State SPMU Project Coordinator	
			Risk of injury from falls from height into excavation trench	❑ Ensure that the gully remediation intervention is performed during the dry season when there is no flow of storm water from the catchment area above the gully head; ❑ Ensure that excavation and fill operations are conducted in compliance with all HSE measures in manners that does not endanger lives and properties. ❑ Ensure a competent machine operator is utilized ❑ Provide suitable access to trenches ❑ Put in place perimeter fencing and signage to ensure safety and secure the excavations and trenches	❑ Daily observation of the suitability of equipment used on site and the competence of all equipment operators; ❑ Contractor's compliance with HSE Plan and Design Specifications ❑ Warning Signs; ❑ Number of Accident incidents;	Daily during the construction of stilling basin	Site Engineer; Site Manager; Contractor	Edo State SPMU Project Coordinator	

			Risk of loss of functionality and failure resulting into exacerbation of the gully erosion channel, flooding and loss of life and properties	❑ Ensure that the design basis and specifications in the Detail Design Report Ibore D1 Edo State NEWMAP are fully achieved in the construction of the Stilling Basin ❑ Ensure the stilling basin is designed to the correct capacity to handle the intended purpose in the management of a 1 in 50 years storm flows	Site inspection of the construction of the drainage infrastructure to ensure compliance with design basis and specifications	Daily during the construction of the drainage system	Site Engineer; Site Manager; Contractor	Edo State SPMU Project Coordinator	
			Loss of agricultural lands and increase in the exposure of erodible soil	❑ Adopt staged earthworks approach by working in staged sections to ensure no more than a specified area of soil is disturbed or exposed at any point in time	Sighting of the following: ❑ Number of consultation held ❑ Minutes of meetings held; ❑ Report of implementation of RAP with signatures showing community participation ❑ Compliance with RAP provisions	Once every two months	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	• Edo State NEWMAP • FMEnv • World Bank	
			Risk of scouring and failure	❑ Ensure the stilling basin is inspected after every high flows to see if there is any scouring beneath the riprap and if any stone	Daily site inspection, supervision and monitoring by an experience construction engineer during	Daily during the operation and maintenance phase of the drainage	• Contractor • Site Manager; • Site Engineer • SPMU	Edo State Ministry of Environment	

				has been dislodged. And repairs should be initiated immediately	the construction phase of the gully drainage and sediment control infrastructure installation to ensure that the design specifications are achieved Daily inspection of the drainage and sediment control infrastructure to ensure sound functionality and check for any form of scouring or undermining of any of the structures installed Inspection of the infrastructure within 24 hours of occurrence of any major storm or rainfall event to assess the integrity of the infrastructure and functionality Sighting and review of weekly reports on the status of the	and sediment control infrastructure	Project Coordinator		

					infrastructure especially during the wet season as well as during the dry season				
		Installation of Main Rectangular Concrete Channel Baffled Chute	Risk of chute failure by flow undermining gully head, overtopping or bypassing. Chute failures could result in severe gully erosion and head-cutting within a short time. The failure occurs when storm runoff fails to enter the baffle chute properly especially when the runoff leaks and flow bypassing occur at the chute entrance	❑ Specialist supervision should be engaged to supervise the construction of the Chute to avoid the potential by undermining, overtopping or bypassing ❑ Ensure periodic visual inspection of the Chute during operation for signs of failure in the lining as well as evidence of scour between the lining and vegetated areas ❑ Initiate immediate repair of any failure in the chute	Daily site inspection, supervision and monitoring by an experience construction engineer during the construction phase of the gully drainage and sediment control infrastructure installation to ensure that the design specifications are achieved Daily inspection of the drainage and sediment control infrastructure to ensure sound functionality and check for any form of scouring or undermining of any of the structures installed Inspection of the infrastructure within 24 hours of occurrence of any	Daily during the operation and maintenance phase of the drainage and sediment control infrastructure	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State Ministry of Environment	

					major storm or rainfall event to assess the integrity of the infrastructure and functionality Sighting and review of weekly reports on the status of the infrastructure especially during the wet season as well as during the dry season				
			Occurrence of risks associated with large storm events that exceeds the design capacity of the Chute	❑ Assess the capacity of the Chute to handle the conveyance of a large runoff event that exceeds storms of 1 in 50 years recurrence interval	Daily inspection of the drainage and sediment control infrastructure to ensure sound functionality and check for any form of scouring or undermining of any of the structures installed Inspection of the infrastructure within 24 hours of occurrence of any major storm or rainfall event to assess the integrity and functionality of the infrastructure	Daily inspection during the operation and maintenance phase of the drainage and sediment control infrastructure	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State Ministry of Environment	

					Visual observation to determine if there is any placement of debris or sediment accumulation in the gully erosion control infrastructure Sighting and review of weekly reports on the status of the infrastructure especially during the wet season as well as during the dry season				
			Loss of fertile top soil for infertile sub-surface soil that would not enhance vegetation establishment	❑ During the construction of Chutes, topsoil should be removed and stockpiled before shaping the gully head. On completion of the filling the topsoil should be spread to a depth of 150mm over the face and sides of the chute	Daily observation of the placement of stockpiles of topsoil and how they are finally used in the Ibore gully erosion site rehabilitation	Daily observation and documentation with photo gallery and video recording if necessary	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State Ministry of Environment	
			Risk of loss of life and damage of the proposed gully drainage infrastructure	❑ Chute should be constructed on firm excavated soil rather than on the fill ❑ Ensure that storm	Daily inspection of the drainage and sediment control infrastructure to ensure sound functionality and	Daily inspection during the operation and maintenance	• Contractor • Site Manager; • Site Engineer • SPMU	Edo State Ministry of Environment	

				water leaving the chute and outlet structure will flow freely without causing undesirable ponding or scour	check for any form of scouring or undermining of any of the structures installed Inspection of the infrastructure within 24 hours of occurrence of any major storm or rainfall event to assess the integrity and functionality of the infrastructure Visual observation to determine if there is any placement of debris or sediment accumulation in the gully erosion control infrastructure Sighting and review of weekly reports on the status of the infrastructure especially during the wet season as well as during the dry season	phase of the drainage and sediment control infrastructure	Project Coordinator		

		Installation of Stone Pitching in the entire Main Rectangular Concrete Channels south of the gully head	Risk of failure due to poor design and construction of the stone pitching. This results in the displacement of the pitched stone and scouring of the secondary channel	Ensure that the installation of the pitching stones is compliant with the design specifications recommended in the Detail Design Report Ibore D1 Edo State NEWMAP					
9	Construction of Secondary Diversion Channels around the Gully Head	Construction of 1000mm x 1000mm Closed Culvert at road crossing north of the gully head north of the gully head	Risk of failure from mal-alignment with secondary channel, extreme flow capacity, debris control and energy dissipation	❑ Effectively implement the design specifications and basis as indicated in the Detail Design Report Ibore D1 Edo State NEWMAP ❑ Ensure that the design specification and basis applied in the construction of the culvert such that the appurtenant entrance and outlet structures will efficiently discharge storm water bedload and floating debris at all stages of flood flows;	Daily site inspection, supervision and monitoring by an experience construction engineer during the construction phase of the gully drainage and sediment control infrastructure installation to ensure that the design specifications are achieved Daily inspection of the drainage and sediment control infrastructure to ensure sound functionality and check for any form of scouring or undermining of any of the structures installed	Daily during the operation and maintenance phase of the drainage and sediment control infrastructure	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State Ministry of Environment	

					Inspection of the infrastructure within 24 hours of occurrence of any major storm or rainfall event to assess the integrity of the infrastructure and functionality Sighting and review of weekly reports on the status of the infrastructure especially during the wet season as well as during the dry season				
		Construction of 1000mm x 1000mm Secondary Rectangular Concrete Channel north of the gully head	Risk of failure of the culvert, property damage, accumulation of sediment, culvert clogging and detrimental upstream deposit of debris	❑ The culverts should be designed and constructed to avoid excessive ponding at the entrance and screen out material that will not pass through the culvert. ❑ The culvert alignment should be such that water enters and exists it freely and directly without causing any abrupt changes in flow that could cause ponding, and	Daily site inspection, supervision and monitoring by an experience construction engineer during the construction phase of the gully drainage and sediment control infrastructure installation to ensure that the design specifications are achieved	Daily during the operation and maintenance phase of the drainage and sediment control infrastructure	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State Ministry of Environment	

				buildup of debris at the culvert entrance Daily inspection of the drainage and sediment control infrastructure to ensure sound functionality and check for any form of scouring or undermining of any of the structures installed Inspection of the infrastructure within 24 hours of occurrence of any major storm or rainfall event to assess the integrity of the infrastructure and functionality Sighting and review of weekly reports on the status of the infrastructure especially during the wet season as well as during the dry season				
		Construction of Secondary Rectangular Concrete Channel Stilling Basin north	Risk of drowning	❑ Ensure that weep holes are provided to empty the stilling basin; ❑ Provide mentis	Site inspection of the all excavation works and monitoring workers movement and	Daily during the construction of the drainage	Site Engineer; Site Manager;	Edo State SPMU Project Coordinator	

		of the gully head		grids or steel grids at strategic locations where extreme danger of drowning exists and pedestrian movement is intense	public access to the work area to ensure compliance with design basis and specifications and safety requirements	infrastructure	Contractor		
			Risk of accident and injury from excavation trench collapse	❑ Ensure permit is issued by the site engineer before any excavation work can commence and all persons involved in the task should be fully briefed ❑ Ensure that a suitable equipment is utilized in the excavation operations ❑ Monitor all excavation operation on a daily basis	❑ Daily observation of the suitability of equipment used on site and the competence of all equipment operators; ❑ Contractor's compliance with HSE Plan and Design Specifications ❑ Warning Signs; ❑ Number of Accident incidents; ❑ Site inspection of the all excavation works and monitoring workers movement and public access to the work area to ensure compliance with design basis and specifications and safety requirements	Daily during the construction of the drainage infrastructure	Site Engineer; Site Manager; Contractor	Edo State SPMU Project Coordinator	
			Risk of injury from falls from height	❑ Ensure that the gully remediation	❑ Daily observation of	Daily during the	Site Engineer;	Edo State SPMU Project	

			into excavation trench	intervention is performed during the dry season when there is no flow of storm water from the catchment area above the gully head; ❑ Ensure that excavation and fill operations are conducted in compliance with all HSE measures in manners that does not endanger lives and properties. ❑ Ensure a competent machine operator is utilized ❑ Provide suitable access to trenches ❑ Put in place perimeter fencing and signage to ensure safety and secure the excavations and trenches	the suitability of equipment used on site and the competence of all equipment operators; ❑ Contractor's compliance with HSE Plan and Design Specifications ❑ Warning Signs; ❑ Number of Accident incidents;	construction of stilling basin	Site Manager; Contractor	Coordinator	
			Risk of loss of functionality and failure resulting into exacerbation of the gully erosion channel, flooding and loss of life and properties	❑ Ensure that the design basis and specifications in the Detail Design Report Ibore D1 Edo State NEWMAP are fully achieved in the construction of the Stilling Basin ❑ Ensure the stilling basin is designed to the correct capacity to handle the intended	❑ The culverts should be designed and constructed to avoid excessive ponding at the entrance and screen out material that will not pass through the culvert. ❑ The culvert alignment	Daily site inspection, supervision and monitoring by an experience construction engineer during the construction phase of the gully drainage and	Daily during the operation and maintenance phase of the drainage and sediment control infrastructure	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	

				purpose in the management of a 1 in 50 years storm flows	should be such that water enters and exists it freely and directly without causing any abrupt changes in flow that could cause ponding, and buildup of debris at the culvert entrance	sediment control infrastructure installation to ensure that the design specifications are achieved Daily inspection of the drainage and sediment control infrastructure to ensure sound functionality and check for any form of scouring or undermining of any of the structures installed Inspection of the infrastructure within 24 hours of occurrence of any major storm or rainfall event			

						to assess the integrity of the infrastructure and functionality Sighting and review of weekly reports on the status of the infrastructure especially during the wet season as well as during the dry season			
			Loss of agricultural lands and increase in the exposure of erodible soil	❑ Adopt staged earthworks approach by working in staged sections to ensure no more than a specified area of soil is disturbed or exposed at any point in time	Sighting of the following: ❑ Number of consultation held ❑ Minutes of meetings held; ❑ Report of implementation of RAP with signatures showing community participation Compliance with RAP provisions	Once every two months	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	• Edo State NEWMAP • FMEnv • World Bank	

			Risk of scouring and failure	❑ Ensure the stilling basin is inspected after every high flows to see if there is any scouring beneath the riprap and if any stone has been dislodged. And repairs should be initiated immediately	Daily site inspection, supervision and monitoring by an experience construction engineer during the construction phase of the gully drainage and sediment control infrastructure installation to ensure that the design specifications are achieved Daily inspection of the drainage and sediment control infrastructure to ensure sound functionality and check for any form of scouring or undermining of any of the structures installed Inspection of the infrastructure within 24 hours of occurrence of any major storm or rainfall event to assess the integrity of the infrastructure and	Daily during the operation and maintenance phase of the drainage and sediment control infrastructure	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State Ministry of Environment	

					functionality Sighting and review of weekly reports on the status of the infrastructure especially during the wet season as well as during the dry season				
		Stabilization of Gully edges to prevent undercutting of side slopes by the construction of D50 = 500mm Rip Rap	Risk of scouring and failure resulting in riprap rock wash away; apron displacement; scour occurrence around apron or riprap and erosion of the outlet of structures	❑ Ensure that the recommended D50 = 500mm Rip Rap stones are used. Considering the flow rate 44m3/s anticipated in the choice of whether loose riprap rocks or grouted riprap is appropriate. Grouted riprap rocks is preferred in high flows ❑ Replace riprap rocks washed away with a larger diameter rock based on the discharge velocity anticipated or experienced and repair the underlining fabric ❑ Repair outlet of structures and replace lost riprap with grout riprap ❑ Ensure the gully channel is	Daily site inspection, supervision and monitoring by an experience construction engineer during the construction phase of the gully drainage and sediment control infrastructure installation to ensure that the design specifications are achieved Daily inspection of the drainage and sediment control infrastructure to ensure sound functionality and check for any form of scouring or undermining of any of the structures	Daily during the operation and maintenance phase of the drainage and sediment control infrastructure	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State Ministry of Environment	

				inspected after every high flows to see if there is any scouring beneath the riprap and if any stone has been dislodged. And repairs should be initiated immediately ❑ Inspect regularly during rainy seasons for scour beneath riprap and around the outlets of structures and immediately initiate repairs as necessary	installed Inspection of the infrastructure within 24 hours of occurrence of any major storm or rainfall event to assess the integrity of the infrastructure and functionality Sighting and review of weekly reports on the status of the infrastructure especially during the wet season as well as during the dry season				
		Installation of St one Pitching in the entire Secondary Rectangular Concrete Channels	Risk of failure due to poor design and construction of the stone pitching. This results in the displacement of the pitched stone and scouring of the secondary channel	Ensure that the installation of the pitching stones is compliant with the design specifications recommended in the Detail Design Report Ibore D1 Edo State NEWMAP	Daily site inspection, supervision and monitoring by an experience construction engineer during the construction phase of the gully drainage and sediment control infrastructure installation to ensure that the design specifications are	Daily during the operation and maintenance phase of the drainage and sediment control infrastructure	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State Ministry of Environment	

					achieved Daily inspection of the drainage and sediment control infrastructure to ensure sound functionality and check for any form of scouring or undermining of any of the structures installed Inspection of the infrastructure within 24 hours of occurrence of any major storm or rainfall event to assess the integrity of the infrastructure and functionality Sighting and review of weekly reports on the status of the infrastructure especially during the wet season as well as during the dry season				

10	Construction within the vicinity of the Gas Pipeline	Channelization of the water course to flow along the natural drainage route away from the pipeline	Risk of drowning	❑ Ensure that no unauthorized person is allowed access to the project site without permit; ❑ Ensure that the entire work is performed during the dry season when there is no flow of storm water from the catchment area above the gully head ❑ Ensure that excavation and channelization are conducted in compliance with all HSE measures in manners that does not endanger lives and properties.	Site inspection of the all excavation works and monitoring workers movement and public access to the work area to ensure compliance with design basis and specifications and safety requirements	Daily during the construction of the drainage infrastructure	Site Engineer; Site Manager; Contractor	Edo State SPMU Project Coordinator	
			Risk of accident and injury from excavation trench collapse	❑ Ensure that a suitable equipment is utilized in the excavation operations ❑ Monitor all excavation operation on a daily basis	❑ Daily observation of the suitability of equipment used on site and the competence of all equipment operators; ❑ Contractor's compliance with HSE Plan and Design Specifications ❑ Warning Signs; ❑ Number of Accident incidents; ❑ Site inspection of the all	Daily during the construction of the drainage infrastructure	Site Engineer; Site Manager; Contractor	Edo State SPMU Project Coordinator	

					excavation works and monitoring workers movement and public access to the work area to ensure compliance with design basis and specifications and safety requirements				
			Risk of injury from falls from height into excavation trench	❑ Ensure that the entire work is performed during the dry season when there is no flow of storm water from the catchment area above the gully head; ❑ Ensure that excavation and channelization are conducted in compliance with all HSE measures in manners that does not endanger lives and properties. ❑ Ensure a competent machine operator is utilized ❑ Provide suitable access to trenches ❑ Put in place perimeter fencing and signage to ensure safety and secure the	❑ Daily observation of the suitability of equipment used on site and the competence of all equipment operators; ❑ Contractor's compliance with HSE Plan and Design Specifications ❑ Warning Signs; ❑ Number of Accident incidents;	Daily during the construction of stilling basin	Site Engineer; Site Manager; Contractor	Edo State SPMU Project Coordinator	

				excavations and trenches					
11	Construction: Rehabilitation of gully head	Filling and compaction of gully head to enable the construction of the damaged road	Occurrence of accident and safety risk incidents	❑ Contractor's HSE Plan should be developed and implemented ❑ Undertake all earthmoving activities in steep sided gullies where undercut has occurred with great care, observance of safety measures and use of appropriate PPE ❑ Use earthmoving equipment with strict adherence to all recommended safety procedures ❑ All construction equipment, earthmovers and demolition equipment shall be located, guarded, shielded to prevent contact with the public ❑ Stockpile non-dispersive topsoil to be used as final cover soil after the gully head has been filled to encourage vegetation growth and establishment	Check the HSE Statistics in the HSE Report; Number of Accidents and Injuries; Evaluate the worker\s use of PPE Carry out Routine Inspection on the project site	Daily	HSE Manager of the Contractor; Site Manage and Engineer	ESO-NEWMAP SME; FMEnv;	
			Waste handling and disposal	❑ Ensure adequate sanitary facilities area provided during the construction and	Visual Observation of the general environmental sanitation of the site	Weekly	Contractor Site Manager; Contractor HSE	NEWMAP ESO; SME; FMEnv World Bank	

				operation phases of the project ❑ Ensure that good housekeeping is maintained on the project site and all areas used ❑ Ensure that all areas of the project site used by the public is properly maintained and are free from debris, solid waste litter, equipment, materials ❑ Solid waste management should be addressed in Contractor HSE Plan and ❑ Ensure the Contractor develop and implement a Solid Waste Management Plan approved by NEWMAP and FMEnv in compliance with appropriate World Bank Safeguard Policies	Site inspection for the adequacy and placement of sanitary facilities and solid waste storage bins onsite Sighting the Waste Tracking Logbook Review the Project Waste Management Plan and Contractor's HSE Plan to assess the compliance of the contractor		Manager		
			Increase in turbidity and sediment load in downstream receiving water bodies	❑ Ensure that storm water flows from upstream catchment of the gully head are safely diverted away from the gully head ❑ Ensure that the Ibore gully	In-situ measurement and lab analyses of water quality parameters: (pH, TDS, TSS, BOD5, COD, Turbidity, THC Heavy Metals)	Monthly	Independent Environmental Consultant; Contractor;	NEWMAP ESO; SME FMEnv; World Bank	

				rehabilitation project is carried out during the dry season to prevent mobilization of sediment into downstream receiving water bodies	Site investigation and visual observation Check Contractor's compliance with Storm Water Management Plan				
		Construction of the damaged road	Ambient air quality deterioration from airborne dust particulates, fugitive emissions, exhaust of equipment/automobiles	❑ Use equipment with high combustion efficiency. ❑ Use dust suppressants on the project site	In-situ measurement of ambient air quality parameters: ❑ CO, NO_x, SO_x VOC and Particulate Matter, SPM, THC, VOC, CH_4; Vehicle exhaust measurement; ❑ Records of maintenance for all machinery, equipment and vehicles	. Once in the first month and then once midway, and once at the end of construction work	• Independent Environmental Consultant • Contractor Site Manager; • Site Engineer	• SPMU Project Coordinator	
			Noise and vibration from vehicular movement	❑ Ear protective device to be provided to workers at the site clearing stage; ❑ Install acoustic mufflers on large equipment where	❑ Ambient noise and vibration level monitoring; ❑ Comparison of ambient noise level to	Daily Observation of large equipment operating onsite	• Contractor • Independent Environmental Consultant	• FMEnv • Edo SME • ESO NEWMAP	

				necessary to limit noise levels at fence line	regulatory limit of 90dB(A) ❑ Examine the number of complaints in the complaint register ❑ Sight the records of equipment maintenance				
		Reshaping the gully head side slope to 1 in 2 slope	Loss of fertile top soil which could be used for seeding vegetation	❑ Conserve topsoil with its leaf litter and organic matter in stockpiles and used this material as cover soil in the filled gully head and the stabilized bank slopes of the channel to promote the growth of local native vegetation		❑	❑	❑	❑
			Risk of occurrence of accident or injury from: ❑ Falls from site vehicles; ❑ Tipping or overturning of vehicles ❑ Contact with moving parts of machinery ❑ Struck by mater dropped while in lift	❑ Ensure that Worker Briefings are carried out before commencement of work every day. All personnel entering the site must receive safety induction and attend a job toolbox talk. ❑ Ensure that plant used are operated by Competent Personnel ❑ Ensure that plant and equipment are in good working order and inspected prior to	❑ Daily observation of the suitability of equipment used on site and the competence of all equipment operators; ❑ Contractor's compliance with HSE Plan and Design Specifications ❑ Warning Signs; ❑ Number of Accident incidents; ❑ Site inspection	Daily during the construction of the drainage infrastructure	Site Engineer; Site Manager; Contractor	Edo State SPMU Project Coordinator	

				commencement of any work on site ❑ Utilize Vehicle Banksmen where required ❑ Segregate traffic from public and work force as much as possible ❑ Implement work exclusion zones where appropriate ❑ Develop and implement an appropriate Traffic Management Plan ❑ Ensure all personnel use appropriate PPE and high visibility clothing ❑ Ensure that the Ibore gully erosion rehabilitation is carried out before the rainy season ❑ Plant the appropriate vegetation along the edge of the top of the edge of the top of the slope to serve as a protective buffer for the slope faces. The greenbelt would serve provide a buffer between the slop face and resident structures in residential areas	of the all excavation works and monitoring workers movement and public access to the work area to ensure compliance with design basis and specifications and safety requirements				
12	Construction: Installation of	Installation of 16 Gabion Drop (Check Dams)	Risk of chute failure by flow undermining gully	❑ Specialist supervision should be engaged to	Daily site inspection, supervision and	Daily during the operation	• Contractor • Site Manager;	Edo State Ministry of	

	Gully erosion control infrastructure within the existing downstream gully earth channel	Structures within the downstream gully earth channel to reduce longitudinal gradient of the gully channel, slow down flow velocity and prevent further channel bed erosion	head, overtopping or bypassing. The failure occurs when storm runoff fails to enter the baffle chute properly especially when the runoff leaks and flow bypassing occur at the chute entrance	supervise the construction of the Chute to avoid the potential by undermining, overtopping or bypassing	monitoring by an experience construction engineer during the construction phase of the gully drainage and sediment control infrastructure installation to ensure that the design specifications are achieved Daily inspection of the drainage and sediment control infrastructure to ensure sound functionality and check for any form of scouring or undermining of any of the structures installed Inspection of the infrastructure within 24 hours of occurrence of any major storm or rainfall event to assess the integrity of the infrastructure and functionality	and maintenance phase of the drainage and sediment control infrastructure	• Site Engineer • SPMU Project Coordinator	Environment	

					Sighting and review of weekly reports on the status of the infrastructure especially during the wet season as well as during the dry season				
			Occurrence of risks associated with large storm events that exceeds the design capacity of the Chute	❑ Assess the capacity of the Chute to handle the conveyance of a large runoff event that exceeds storms of 1 in 50 years recurrence interval	Daily site inspection, supervision and monitoring by an experience construction engineer during the construction phase of the gully drainage and sediment control infrastructure installation to ensure that the design specifications are achieved Daily inspection of the drainage and sediment control infrastructure to ensure sound functionality and check for any form of scouring or undermining of any of the structures installed	Daily during the operation and maintenance phase of the drainage and sediment control infrastructure	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State Ministry of Environment	

					Inspection of the infrastructure within 24 hours of occurrence of any major storm or rainfall event to assess the integrity of the infrastructure and functionality Sighting and review of weekly reports on the status of the infrastructure especially during the wet season as well as during the dry season				
			Loss of fertile top soil for infertile sub-surface soil that would not enhance vegetation establishment	❑ During the construction of Chutes, topsoil should be removed and stockpiled before shaping the gully head. On completion of the filling the topsoil should be spread to a depth of 150mm over the face and sides of the chute	Daily observation of the placement of stockpiles of topsoil and how they are finally used in the Ibore gully erosion site rehabilitation	Daily observation and documentation with photo gallery and video recording if necessary	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State Ministry of Environment	
			Risk of loss of life and damage of the proposed gully drainage infrastructure	❑ Chute should be constructed on firm excavated soil rather than on the fill ❑ Ensure that storm water leaving the	Daily site inspection, supervision and monitoring by an experience construction engineer during	Daily during the operation and maintenance phase of the drainage	• Contractor • Site Manager; • Site Engineer • SPMU Project	Edo State Ministry of Environment	

				chute and outlet structure will flow freely without causing undesirable ponding or scour	the construction phase of the gully drainage and sediment control infrastructure installation to ensure that the design specifications are achieved Daily inspection of the drainage and sediment control infrastructure to ensure sound functionality and check for any form of scouring or undermining of any of the structures installed Inspection of the infrastructure within 24 hours of occurrence of any major storm or rainfall event to assess the integrity of the infrastructure and functionality Sighting and review of weekly reports on the status of the	and sediment control infrastructure	Coordinator		

					infrastructure especially during the wet season as well as during the dry season				
		Reshaping the entire length of the downstream gully channel to a base width of 15m to align with the Gabion Drop Structures	Increase in the amount of disturbed areas created by earthmovers used in reshaping the gully side slos	❑ Ensure that storm water flows have been completely diverted above the gully head ❑ Undertake all earthmoving activities with great care especially with steep sided gullies where undercutting has occurred ❑ Ensure that use earthmoving equipment is in compliance with all workplace safety procedures	Daily site inspection, supervision and monitoring by an experience construction engineer during the construction phase of the gully drainage and sediment control infrastructure installation to ensure that the design specifications are achieved	Daily during the operation and maintenance phase of the drainage and sediment control infrastructure	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State Ministry of Environment	
			Contamination of downstream receiving water bodies by fertilizers, and pesticides as well as creation of excessive bare soils by herbicides if used for the establishment of the recommended plant species seeded to control soil erosion	❑ If necessary, use herbicides with caution and precision to avoid excessive creation of large areas of bare soil and only use herbicide selected by a specialist to maintain the desired plant species	In-situ measurement and lab analyses of water quality parameters: (pH, TDS, TSS, BOD5, COD, Turbidity, THC Heavy Metals) Site investigation and visual observation Check Contractor's	Monthly	Independent Environmental Consultant; Contractor;	NEWMAP ESO; SME FMEnv; World Bank	

					compliance with Storm Water Management Plan				
			Exacerbated gully erosion channel bed undermined and washing away of fill materials resulting in increased sediment load in receiving water bodies downstream	❑ The shaping of the gully walls should be carried out only in the dry season after the gully head has been established with a structure such as a Chute;	Daily site inspection, supervision and monitoring by an experience construction engineer during the construction phase of the gully drainage and sediment control infrastructure installation to ensure that the design specifications are achieved	Daily during the operation and maintenance phase of the drainage and sediment control infrastructure	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State Ministry of Environment	
			Increase in the amount of disturbed areas created by earthmovers used in reshaping the gully side slopes Risk of erosion of exposed gully side slopes and erosion of ground area above the gully channel divide	❑ Stabilize cut and fill slopes with vegetative contour or anchored rock ❑ Develop nurseries for the recommended plant species to serve as sustainable plant source for gully erosion side slope stabilization throughout the life span of the infrastructure	Daily site inspection, supervision and monitoring by an experience construction engineer during the construction phase of the gully drainage and sediment control infrastructure installation to ensure that the design specifications are achieved	Daily during the operation and maintenance phase of the drainage and sediment control infrastructure	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State Ministry of Environment	

			Loss of fertile top soil that could be used for seeding vegetation	❑ Stockpile non-dispersive topsoil with its leaf litter and organic matter, and use as final cover soil after the gully head has been filled to encourage vegetation growth and establishment	Daily observation of the placement of stockpiles of topsoil and how they are finally used in the Ibore gully erosion site rehabilitation	Daily observation and documentation with photo gallery and video recording if necessary	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State Ministry of Environment	
			Occurrence of bank erosion along reshaped gully channel slopes	❑ Ensure that the placement and anchorage of the earth materials cut from the gully sides are done properly; ❑ Ensure that the soil materials used to fill the gully bed are well compacted in dry no flow conditions; ❑ Plant or seed the recommended plant species in close growing positions immediately after placement of gull fill materials to serve as vegetative buffer strips to reduce the erosion of soil particles; ❑ Perform the entire civil work of reshaping the gully sides/banks and the filling of the channel bed and gully head as one operation	Daily inspection of the drainage and sediment control infrastructure to ensure sound functionality and check for any form of scouring or undermining of any of the structures installed Inspection of the infrastructure within 24 hours of occurrence of any major storm or rainfall event to assess the integrity and functionality of the infrastructure Visual observation to determine if there is any placement of debris or sediment	Daily inspection during the operation and maintenance phase of the drainage and sediment control infrastructure	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State Ministry of Environment	

					accumulation in the gully erosion control infrastructure Sighting and review of weekly reports on the status of the infrastructure especially during the wet season as well as during the dry season				
		Stabilization of the entire gully bed and edges through lining the trapezoidal channel with 500mm Rip Rap to prevent water undercutting the side slopes and the channel bed	Risk of failure resulting in the occurrence of scouring of the structures	Riprap placement by hand will be done to the extent necessary to prevent damage to the conduits, structure etc. Equipment shall also be used in the placement of the riprap as required.					
13	Operation	Utilization of the rehabilitated gully site and installed storm water drainage infrastructure	Risk of failure of the gully erosion installed drainage infrastructure to safely route storms of 1 in 50 years	❑ Ensure that the design basis and specifications in the Detail Design Report Ibore D1 Edo State NEWMAP is accurately followed and achieved during the construction implementation	❑ Ensure that the design basis and specifications of the proposed Edo State NEWMAP gully erosion rehabilitation project is accurately followed and	Daily site inspection, supervision and monitoring by an experience construction engineer during the construction phase of the gully	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State Ministry of Environment	

					achieved during the construction implementation	drainage and sediment control infrastructure installation to ensure that the design specifications are achieved Daily inspection of the drainage and sediment control infrastructure to ensure sound functionality and check for any form of scouring or undermining of any of the structures installed Inspection of the infrastructure within 24 hours of occurrence of any major			

						storm or rainfall event to assess the integrity of the infrastructure and functionality Sighting and review of weekly reports on the status of the infrastructure especially during the wet season as well as during the dry season			
			Risks from debris and sediment accumulation in the drainage channels in upstream catchment area of the gully head, Diversion Culvert, Baffle Chute, Gabion Drop Structures and Stilling Basin resulting in performance failure of the drainage infrastructure	❑ Develop and implement on a regular basis, a systematic Ibore Gully Erosion Channel and Drainage Infrastructure Management Plan to remove sediments, debris, solid waste materials and aquatic plants from the channel, prevent the incidence of undercutting and scouring of the	Daily inspection of the drainage and sediment control infrastructure to ensure sound functionality and check for any form of scouring or undermining of any of the structures installed Inspection of the infrastructure within 24 hours of occurrence of any major storm or	Daily inspection during the operation and maintenance phase of the drainage and sediment control infrastructure	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State Ministry of Environment	

				drainage infrastructure	rainfall event to assess the integrity and functionality of the infrastructure Visual observation to determine if there is any placement of debris or sediment accumulation in the gully erosion control infrastructure Sighting and review of weekly reports on the status of the infrastructure especially during the wet season as well as during the dry season				
			Risk of undermining and occurrence of scouring in the Baffle Chute could result in deteriorating performance of the structure	❑ Scouring of the infrastructure and accumulation of sediment, litter and vegetation in drainage infrastructure are some of the factors that can cause under-functioning of the infrastructure To effectively and regularly monitor the operation and	Daily inspection of the drainage and sediment control infrastructure to ensure sound functionality and check for any form of scouring or undermining of any of the structures installed	Daily inspection during the operation and maintenance phase of the drainage and sediment control infrastructure	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State Ministry of Environment	

				functionality of the gully erosion control devices by a dedicated Contractor Representative in collaboration with a Project Manager/Site Engineer from Edo State Project Monitoring Unit, a five-year maintenance contract should be added to the contractor's existing contract	Inspection of the infrastructure within 24 hours of occurrence of any major storm or rainfall event to assess the integrity and functionality of the infrastructure Visual observation to determine if there is any placement of debris or sediment accumulation in the gully erosion control infrastructure Sighting and review of weekly reports on the status of the infrastructure especially during the wet season as well as during the dry season				
14	Operation	Maintenance of the gully drainage infrastructure	Risk of failure of the gully intervention from poor maintenance of the drainage infrastructure to achieve the desired project objectives such as (Creation	❑ Develop and implement on a regular basis, a systematic Ibore Gully Erosion Channel and Drainage Infrastructure Management Plan	Daily inspection of the drainage and sediment control infrastructure to ensure sound functionality and check for any form of scouring or undermining of any	Daily inspection during the operation and maintenance phase of the drainage and	• Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State Ministry of Environment	

			of new gullies within the channel; breeding of vectors in the settling basin, undermining of the drainage infrastructure and scouring of the drainage structure, etc.)	to remove sediments, debris, solid waste materials and aquatic plants from the channel, prevent the incidence of undercutting and scouring of the drainage infrastructure ❑ Conduct site inspection and monitoring as follows: ➢ Inspect erosion and sediment control devices installed at Ibore gully erosion intervention site within 24 hours of every rainfall or storm event; ➢ The erosion, sediment and drainage control devices inspection should be by a person qualified and certified to perform this role. He could be a project manage, site supervisor, or	of the structures installed Inspection of the infrastructure within 24 hours of occurrence of any major storm or rainfall event to assess the integrity and functionality of the infrastructure Visual observation to determine if there is any placement of debris or sediment accumulation in the gully erosion control infrastructure Sighting and review of weekly reports on the status of the infrastructure especially during the wet season as well as during the dry season	sediment control infrastructure			

				engineer working in Edo State SPIM unit of NEWMAP. ➢ The Ibore gully erosion control infrastructure inspection and monitoring to: - Ensure that the Ibore Gully Erosion Channel and Drainage Infrastructure Management Plan is appropriate for the gully erosion site and is being implemented efficiently; - Ensure the erosion - sediment control and drainage infrastructure are properly maintained.					

			Disruption of the side slopes during routine maintenance of the gully channels	Ensure special precautions are taken when using backhoe to remove aquatic plants or sediment from the channel during maintenance. Ensure that the earthmover with vented slotted or cross-drilled bucket that allow water to seep out is used for maintenance operations. Once a bucketful of sediment or aquatic vegetation is picked up, the bucket should be raised to allow most of the water to drain out over the gully channel or stilling basin. Then the earthmover\s boom should be swung far from the gully channel bank so that water remaining in the spoil removed will flow away from the gully channel to prevent the erosion of the banks.					
15	Decommissioning	Dismantling and removal of civil engineering equipment	Ambient air quality deterioration from airborne dust particulates, fugitive emissions, exhaust of equipment/automobiles	❑ Use equipment with high combustion efficiency. ❑ Use dust suppressants on the project site	In-situ measurement of ambient air quality parameters: • CO, NO_x, SO_x VOC and Particulate Matter, SPM, THC, VOC, CH_4; Vehicle exhaust measurement; • Records of maintenance	Once in the first month and then once midway, and once at the end of construction work	• Independent Environmental Consultant • Contractor • Site Manager; • Site Engineer • SPMU Project Coordinato	Edo State Ministry of Environment FMEnv	

					for all machinery, equipment and vehicles.		r		
			Noise and vibration from vehicular movement	❑ Ear protective device to be provided to workers at the site clearing stage; ❑ Install acoustic mufflers on large equipment where necessary to limit noise levels at fence line	Ambient noise and vibration level monitoring; Comparison of ambient noise level to regulatory limit of 90dB(A) Daily Observation of large equipment operating onsite Examine the number of complaints in the complaint register Sight the records of equipment maintenance	Ongoing Daily	• Contractor • Independent Environmental Consultant	FMEnv Edo SME ESO NEWMAP	
16	Decommissioning	Waste handling and disposal	Solid Waste generation, handling and disposal	❑ Solid waste management should be addressed in Contractor HSE Plan	Visual Observation of the general environmental sanitation of the site Site inspection for the adequacy and placement of sanitary facilities and solid waste storage bins onsite Sighting the Waste Tracking Logbook Review the Project Waste Management Plan	Weekly	Contractor Site Manager; Contractor HSE Manager	NEWMAP ESO; SME; FMEnv World Bank	

					and Contractor's HSE Plan to assess the compliance of the contractor				
			Poor housekeeping and environmental sanitation	❑ Ensure the Contractor develop and implement a Solid Waste Management Plan approved by NEWMAP and FMEnv in compliance with appropriate World Bank Safeguard Policies	Visual Observation of the general environmental sanitation of the site Site inspection for the adequacy and placement of sanitary facilities and solid waste storage bins onsite Sighting the Waste Tracking Logbook Review the Project Waste Management Plan and Contractor's HSE Plan to assess the compliance of the contractor	Weekly	Contractor Site Manager; Contractor HSE Manager	NEWMAP ESO; SME; FMEnv World Bank	
17	Decommissioning	Transportation of solid waste, equipment and workers out of the project site.	Traffic congestion and increased risk of occurrence of traffic accidents and injuries	NEWMAP-Edo SPMU and Contractors shall avoid impeding traffic and traffic disruption around the project site by: ❑ Adjusting work schedules so as not to disturb traffic; ❑ Establishing an adequate system of road signs and detour;	Daily observation of traffic volume and level of congestion	Ongoing	• Contractor • Site Manager; • Site Engineer • NEWMAP-Edo SPMU • SPMU Project Coordinator	FMEnv Edo State Ministry of Environment	

				❑ Notifying communities of pending work scope, duration and location ❑ Avoid blocking public access roads; ❑ Circumventing access roads to gathering places in Ibore and neighbouring communities					
			Ambient air quality deterioration from airborne dust particulates, fugitive emissions, exhaust of equipment/automobiles	❑ Use equipment with high combustion efficiency. ❑ Use dust suppressants on the project site	In-situ measurement of ambient air quality parameters: • CO, NO_x, SO_x VOC and Particulate Matter, SPM, THC, VOC, CH_4; Vehicle exhaust measurement; • Records of maintenance for all machinery, equipment and vehicles.	Once in the first month and then once midway, and once at the end of construction work	• Independent Environmental Consulttant • Contractor • Site Manager; • Site Engineer • SPMU Project Coordinator	Edo State Ministry of Environment FMEnv	
			Noise and vibration from vehicular movement	❑ Ear protective device to be provided to workers at the site clearing stage; ❑ Install acoustic mufflers on large equipment where necessary to limit noise levels at fence line	Ambient noise and vibration level monitoring; Comparison of ambient noise level to regulatory limit of 90dB(A) Daily Observation of large equipment	Ongoing Daily	• Contractor • Independent Environmental Consultant	FMEnv Edo SME ESO NEWMAP	

					operating onsite Examine the number of complaints in the complaint register Sight the records of equipment maintenance				
								Cost for Items 3-17	**N28,000,000 .00**

NOTES ON COSTING ABOVE:

1. Items 1 and 2 on the table above can be covered with a single monitoring visit. Thus, the assumption is that 2 representatives each from the SPMU, the State Ministry of Environment as well as 2 community representatives will be involved in the monitoring visit. The costs provided here include: per diem for project personnel from SPMU and the State Ministry of Environment, logistics costs (transportation, etc.). Transportation is put at N300, 000.00, per diem for the 4 personnel (2 each from the SPMU and the State Ministry of Environment) is put at N75, 000 /person for 2 days, equalling N600, 000.00. In addition, provision is made for allowances for community representative's @N25, 000/person (N100, 000.00). Entertainment of guests at consultation meetings and gifts for community heads is put at N300, 000.00 (N150, 000/community). This gives a total of N1, 300,000.00. At an exchange rate of US$1: N350, this comes to US$3,714.00
2. Impact mitigation and compliance monitoring are covered in items 3-17 in the table above. Generally, two sets of costs are covered here: The cost of impact mitigation monitoring, and compliance monitoring. Impact mitigation monitoring will be carried out by, a third party (independent) consultant, to be appointed by the SPMU. Monitoring will be carried out during pre-construction, construction and first 3 years of operations. There will be two monitoring visits during the pre-construction and construction phases, while there will be two monitoring visits per annum for the first 3 years of operation. Altogether, there will be eight monitoring visits. For each monitoring visit, a team of the consultants will work in conjunction with representation from the SPMU, State Ministry of Environment and the project contractors. The cost of each monitoring will consist of N2, 500,000.00 for consultant's costs, and N1, 000,000.00 for regulatory (SPMU and State Ministry of Environment

costs). Thus, the total costs for items 5-24 as highlighted above, comes to N28, 000,000.00 (Twenty-eight million naira only). Converted to US$ at an exchange rate of US$1: N350, this comes to US$80,000.00.

3. The participation of SPMU and the State Ministry of Environment is what comprises to monitoring and evaluation aspect of this project

6.7.2 Environmental Monitoring Plan

6.7.2.1 Environmental Monitoring and Evaluation

The Monitoring and Evaluation proposed for implementation in the ESMP for the Ibore NEWMAP gully erosion intervention is designed to monitor specific indicators of the biophysical and social environments for the achievement of the following objectives:

- Proactively initiate strategies to identify any sign of environmental stress, deterioration or degradation within the Ibore watershed arising from the gully erosion site rehabilitation civil engineering works by scientific investigation of specific environmental monitoring parameters and comparing them to established background values stipulated by regulatory agencies;
- Provide assurance that the environmental impact mitigation measures recommended for implementation during the project phases are adequate for effective amelioration of the project impacts and indicate whether the respective impact monitoring parameters investigated are within the stipulated environmental limits of regulatory agencies;
- Provide early warning of environmental damage so that actions may be taken during the implementation of the NEWMAP intervention to reduce such harmful impacts;
- Ensure that regulatory standards for pollutants are not exceeded;
- Assure adequate stakeholder engagement and consultation in the implementation of the NEWMAP gully erosion rehabilitation project; and
- Verify the compliance of the project Contractors and NEWMAP Edo SPMU with regulatory requirements and the Environmental Management and Monitoring Plan proposed in this ESMP.

Consequently, the overall monitoring proposed for the Ibore NEWMAP intervention sets out to determine the effectiveness of the environmental and social impact mitigation measures in minimizing, ameliorating or preventing the occurrence of the project impacts. This will enable NEWMAP to establish that the mitigation measures adequately and benignly reduced the project impacts. To this end, the environmental and social

indicators that shall be mainstreamed into the overall monitoring and evaluation process for the Ibore NEWMAP intervention are as shown in **Table 6.7**, on the Environmental, Social and Health Impact Indicators.

Table 6.7: Environmental, Social and Health Components and Impact Indicators

Components	Impact Indicators
Biophysical	
Geology	Changes to geology, geomorphology, topography
Soil	Changes to physical and chemical properties and soil ecology
Surface Water	Changes to water quality indices, (physicochemical properties, hydrocarbons, metals);
Vegetation	Changes in vegetal cover due to excessive land disturbance during movement and operation of heavy equipment and vehicles; Changes to vegetation population, health, species abundance and diversity and impact on endangered and economic species, etc.
Wildlife	Changes to wildlife assemblages, impact on endangered and economic species
Air	Emissions of NO_x, SO_x, PM, CO, VOC, greenhouse gases (CO_2, CH_4, and N_2O), ozone and changes to ground level concentrations of pollutants
Vibration and Noise	Change in ambient noise or vibration levels at sensitive receptors
Aesthetics	Physical presence of drainage and erosion control infrastructures,
Social	
Population	Changes in population indices, total population, gender ratio, age distribution
Infrastructure	Improvement or pressure on existing urban/rural infrastructure including waste handling facilities
Macro and Micro economy	Change in macro and micro economy, employment, standard of living, occupation
Social and Cultural Structure	Disruption in local authority and governance structure; change in social behaviours; intra and inter-ethnic clashes;
Physical and Economic Displacement	Permanent physical displacement from residence as a result of project land take, or activities; permanent or temporary displacement from land or water based livelihood activities; partial or whole severance from social and cultural networks
Cultural and Archaeological resources	Physical disturbance of shrines, burial grounds, archaeological resources or other desecration
Transportation	Alteration in means of transportation or ability to move efficiently
Health Determinants	
Pollution Related Health Effects	Increase in concentration of, and exposure to air pollutants of concern (NOx, SOx, VOC, CO, PM), contamination of surface waters and potable ground water, increased vibration and noise beyond regulatory limits, increased night time light beyond acceptable limits.
Communicable and Non Communicable Diseases	Change in incidence of communicable and non-communicable diseases or disease causing factors
Morbidity and Mortality	Changes in health of workers and of general public, change in security of the area
Health Care/Recreational Facilities	Changes in availability of and access to health care and recreational facilities
Psychosocial factors	Drug use/abuse, communal violence, crime, suicide, depression and prostitution; changing expectations of quality of life
Fertility	Changes to fertility levels, changes in birth rates
Accidents/Fires/Explosions	Changes to rate of occurrence and severity of accidents/fires/explosions

Upon completion of the field data collection, sampling and monitoring of selected parameters guided by appropriate Instrumentation, Standard Operating Procedures and Quality Control and Quality Assurance, laboratory analysis of field samples shall be performed. The evaluation of the resulting scientific data shall be based on the comparison of monitoring data with baseline data and recommended regulatory background standards to determine if the Ibore NEWMAP intervention has resulted in any form of environmental damage, stress, deterioration or degradation within the Ibore watershed or exacerbation of the background values of specific monitoring parameters considered.

6.7.*2.2 Environmental Monitoring Plan*

The proposed environmental monitoring plan shall provide the platform for measuring the effectiveness of the proposed impact mitigation measures and the means for evaluating environmental performance of the NEWMAP Gully Erosion Remediation intervention in Ibore – Esan Central, Edo State. The monitoring plan intends to document, track and report temporal changes in specific environmental monitoring parameters that could be associated with the proposed construction and installation of the drainage and erosion control infrastructure in the Ibore gully erosion site. In principle, positive or negative changes are expected in the environmental monitoring parameters over time, both in magnitude and direction, which would result in either positive or negative consequences. Hence the monitoring plan proposed herein seeks to identify the variations in the monitoring parameters engendered by the construction project activities and also the nature of the consequences of such changes whether beneficial or detrimental.

Visual inspections, field note writing, photograph records, environmental sampling, and in-situ measurements of environmental monitoring parameters for soil, water and air quality samples etc., are all the methods that will be employed during the monitoring and inspection activities. Thus the empirical sampling during environmental impact monitoring and qualitative analysis shall be distinct from the non-empirical monitoring

and visual inspection activities (qualitative monitoring) for mitigation measure compliance.

The outcome will clearly show the effectiveness of the impact mitigation measure implemented and lead to the evolution of more efficient control measures that will guarantee the environmental sustainability of the project throughout its lifecycle.

6.7.2.3 Implementation Approach for the Environmental Monitoring

The two types of environmental monitoring will be undertaken in the process of implementation of this ESMP consists of:

1) Impact Mitigation Compliance Monitoring;

The mitigation measure-monitoring component of the ESMP shall focus mainly on monitoring the compliance of the Principal Contractor and NEWMAP Edo SPMU with the impact mitigation measures recommended for implementation during the site preparation and construction phase project. The inspection activities to be performed is the non-empirical monitoring or qualitative monitoring involving visual inspection and documentation through photography and regular self-reported inspection and monitoring activities conducted by the Contractor and an Independent Environmental Consultant under the supervision of NEWMAP Edo Sate SPMU, FMEnv and Edo SME on daily basis to ensure compliance with the recommended mitigation measures. The Contractor's Site Manager must make the results of these inspections and monitoring activities available to NEWMAP Edo SPMU's Project Coordinator on a weekly basis.

2) Environmental Impact Monitoring

The Environmental Impact Monitoring process shall involve on-site investigation of the project area, adoption of scientific methodologies for key indicators of environmental and social impacts of the site preparation and construction project activities and laboratory analyses. In all cases, standard methods approved by the regulatory bodies (Federal Ministry of Environment, NESREA and World Bank) shall be followed. Adequate quality control and quality assurance measures shall be taken at every stage

of the ESMP implementation. Data obtained shall be subjected to relevant statistical analyses to show general trends and the extent of spatial variations in the parameters

The environmental impact monitoring component shall adopt scientific methodologies and standard operation procedures to monitor and capture, among other things, the occurrence of predicted and fresh unpredicted environmental impacts as well as effectiveness of the impact mitigation measures adopted. The field sampling and collection of environmental data shall cover the following areas:

- Environmental Characterisation
    - Air Quality Studies
    - Noise and Vibration Studies
    - Water (Surface water and Groundwater) Quality Studies
    - Vegetation and Wildlife Studies (Ecology)
    - Soil Studies
    - Sewage and Wastewater Management
    - Solid Waste Management
    - Landscape and Visual Effect/Aesthetics
- Socio-economics Survey
    - This survey will cover Ibore Esan community in the project area. The survey will focus on issues and concerns of the Ibore community and address other socio-economic issues that could result in Community strive and conflict with NEWMAP Edo SPMU and the site preparation and construction project activities.
    - Occupational Safety and Public Health Studies

The environmental monitoring plan proposed for the Ewu Esan NEWMAP gully erosion site rehabilitation ESMP is as stated in **Table 6.8** below.

Table 6.8: Environmental components, monitoring parameters and frequency of monitoring for the project

S/N	Environmental Component	Empirical Parameters /Non-Empirical Observations	Target Regulatory (FMEnv) Standards/Limits	Monitoring Frequency and Responsible Parties
1	**Air Quality** **Air Quality:** ❑ Ambient Air Quality within Ibore Community upstream of the Gully Head ❑ Ambient Air Quality within Ibore Gully Channel downstream of the Gully Head at 3 locations: (C lose to the gully head; midway of the whole gully channel and farthest reach of the channel close to the receiving water body)	Combustion efficiency CO2	NS	Once in the first month and then once midway, and once at the end. Two air quality sampling per day for 4 stations for 2 field visits at 2 days per visit (32 Samples)
		CO	Daily average of daily values 1 hour:10 ppm	
		TSP	Daily average of daily values 1 hour:250µ/m3	
		NOX	Daily average of hourly values: 0.04 - 0.05 ppm (75 -113 µ/m3)	
		SO2	Daily average of hourly values: 0.1 ppm (260 µ/m3)	
		THC	5 µ/m3	
		CH4	5 µ/m3	
		VOC	160 µ/m3	
		Noise	8 Hours Exposure limit: 90.0dB	Noise monitoring 2 times in four (4) locations per day in 2 field visits
2	**Water Quality:** Water quality samples should be collected from the receiving water body downstream of the gully head and groundwater wells close to the project site	Temperature pH,	< 8.5	Once at the beginning of construction works and once at the end
		Salinity	NS	
		TDS	500 mg/l	
		TSS	500 mg/l	
		Turbidity	5 mg/l	
		Conductivity	NS	
		Calcium	10/l0mg	
		Magnesium	5 mg/l	
		Iron	0.2 mg/l	
		Manganese	0.2 mg/l	
		Copper	NS	
		Aluminium	0.5 mg/l	
		DO	NS	
		BOD	NS	
		TOC	NS	
		THC	NS	
		TPH	NS	
		NO_3,	10 mg/l	
		PO4	NS	
		Chloride,	250 mg/l	
		Sulphate	250 mg/l	

S/N	Environmental Component	Empirical Parameters /Non-Empirical Observations	Target Regulatory (FMEnv) Standards/Limits	Monitoring Frequency and Responsible Parties
		Bicarbonate	NS	
		Organic Matter	NS	
3	Soil	Grain size/Textures, Soil Physico-Chemistry; TOC; Heavy Metals Microbiology:	NS	Three times at the beginning, midway and the end of construction works
4	Vegetation	Monitoring will cover vegetation health status, and re-instatement criteria; survey and verify the presence of any endangered or protected plant species and disturbed areas within the project site before site clearance and preparation	Not Required	Once before site clearing and preparation
5	Socio-economics	Employment status during construction works, public complaint and community relations	Not Required	Three times at the beginning, midway and the end of construction works
6	Waste Management	Waste handling and disposal Practices	Not Required	Weekly
7	Sewage and Wastewater Management	Sewage disposal and wastewater treatment /management practices	Not Required	Once in the first month and then once midway, and once at the end.
8	Land scape, Visual Effect/Aesthetics	Monitoring will cover changes in topography, soil erosion, trenching activities and general compliance with applicable mitigation measures	Not Required	Once in the first month and then once midway, and once at the end.
	Transportation	Alteration in means of transportation or ability to move efficiently	Not Required	Once in the first month and then once midway, and once at the end.
	General Compliance Monitoring to check compliance with mitigation measures	Monitor on weekly basis for three day per week	Not Required	Monitor general compliance of contractor with all required mitigation measures including Waste Handling.

Note: NS = Not Specified

6.8 ESMP Budget and Schedule of Work

6.8.1 ESMP Budget

The implementation of the mitigation compliance monitoring and the environmental /social impact monitoring recommended in this ESMP will inevitably require adequate funding. The cost implication for the implementation of the ESMP has been estimated and it's presented in this section. As indicated above, there are two key components of the ESMP that require funding. These are: Capacity Building costs, and Impact Mitigation and Compliance Monitoring Costs. The total cost for the implementation and monitoring, as well as the Capacity Building Activities add up to US$ 132,857.The details of the cost estimation is as shown in **Table 6.9**

Table 6.9: Summarized Cost estimates for the implementation of the Ibore NEWMAP ESMP

S/No	ESMP Implementation Activity	Supervisory/Participating Stakeholder	Implementation Stakeholder	Estimated Budget	
				US Dollars	Naira
1	Capacity Building Costs	❑ Edo State NEWMAP Staff; ❑ The Principal Contractor; ❑ Site Personnel of the Principal Contractor; ❑ Host Community Representatives	Independent Consultant	52,857.00	18,500,000.00
2	Impact Mitigation and Compliance Monitoring	Edo SPMU NEWMAP; SME; FMEnv; NESREA; FRSC; Edo State Waste Management Authority; Nigerian Police; World Bank	Independent Environmental Consultant appointed by Edo SPMU - NEWMAP	80,000.00	28,000,000.00
Total				**132,857**	**46,500,000.00**

6.8.2 Schedule of Work for ESMP Implementation

The tasks to be performed in the ESMP is integrated in the overall construction work schedule as shown in **Table 6.10**

Table 6.10: ESMP Implementation Schedule of Work

S/No	Activity	Responsible Stakeholder for Monitoring	Pre-Construction				Construction				Operation			
ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN			1	2	3	4	5	6	7	8	9	10	11	12
			(Months)											
	Contract Award and Formal Disclosure of ESMP	NEWMAP												
	Inclusion of Environmental and Social Management Requirements in the Bid Documents	NEWMAP												
	Inclusion of ESMP in Contract Documents	NEWMAP												
	Review and Approval of Contractor's ESMP	FMEnv and SME												
	Implementation of the RAP	NEWMAP												
	ESMP Capacity Building and Training Program	Contractor; NEWMAP; SME; FMEnv												
	Implementation ESMP: Mitigation Measures Compliance Monitoring	Contractor; Independent Environmental Consultant												
	Environmental Auditing: Environmental and Social Impact Monitoring Aspect of ESMP Implementation	Contractor; Independent Environmental Consultant												
	Supervision of ESMP Implementation	NEWMAP												
	ESMP Implementation Report Compilation	Contractor; Independent Environmental Consultant; NEWMAP; SME; FMEnv												
CONSTRUCTION														
	Competitive Bidding for Contract	Contractor												
	Contract Award and Signing	NEWMAP												
	Preparation and Submission of Construction Schedule	Contractor												
	Contractor Mobilizes to Site*	Contractor												
	Finalizing Size Layout Plan Construction	Contractor												
	Site Clearing	Contractor												
	Installation of Equipment and Drainage/Erosion Control Infrastructures	Contractor												
	Excavation, Borrowing, Filling, Backfilling	Contractor												

	and Compaction													
	Civil Engineering Works	Contractor												
	Transportation of Construction Materials	Contractor												
	Operation of Gully Site Drainage and Erosion Control Infrastructure Installations	Contractor												
	Gully Erosion Site Stabilization with Vegetation Seeding	Contractor												
	Maintenance of Erosion Control Structures	Contractor												

***Construction works cannot begin until the RAP is implemented**

6.9 Contractual Award Measures

The implementation of the recommended impact mitigation measures is a mandatory obligation of the Principal Contractor. For this reason, it is pertinent that the mitigation measures as described in this ESMP should be incorporated in the tender document with appropriate flexibility given to the Contractor to modify these mitigation measure to suite site characteristics. Consequently, the Contractor shall be legally committed to comply with all the requirements of the mitigation measures as indicated in this ESMP. To enhance the compliance of the Contractor, the mitigation measures should be translated into a suite of environmental and social specifications that are included in the contract award document. This will ensure that the obligations and commitment to implement the recommended mitigation measures is clearly communicated to the Contractor.

It should be explicitly stated in the tender documents that non-inclusion of the mitigation measures in the Contractor's proposal will lead to a disqualification of the proponent. Furthermore, the Contractor should demonstrate his understanding of the need for the implementation of an ESMP in the proposed NEWMAP gully erosion rehabilitation intervention. Hence, the contract to be drawn with the successful bidder should contain the environmental management measures as the regulatory requirements to be complied with.

CHAPTER SEVEN

SUMMARY AND CONCLUSION

This Environmental and Social Management Plan (ESMP) has provided an effective approach for the implementation of the proposed intervention projects for the Ibore gully erosion site in Esan Central Local Government Area in Edo State. The ESMP also provided the action plans for the environmental and safeguards consideration. In addition to the various biophysical and anticipated project impact evaluations,

Generally, for problems such as erosion and flooding, proactive measures are substantially preferable to reactive measures, therefore basic preventive measures and watershed management activities are required. As indicated earlier, soil in Ibore area are easily eroded, therefore preventive management is required. Basically, the following are necessary:

- Storm water flows need to be managed so that they do not cause unwanted erosion problems, like the gully that has formed. Bad landuse practices in the catchment can lead to the erosion of soil from fields, which will then cause sedimentation of the channels downstream. This sedimentation leads to flooding in the areas downstream due to the reduced capacity of the downstream channels. Thus, settlement basins, which reduces sediment load in runoff need to be provided around the area, thus reducing the chances of gullies developing
- Erosion can be reduced by routing storm water around fields, contour ploughing, planting crops and minimizing the clearing of natural forest and bush that hold the soils and reduce peak flows effectively.
- Proper watershed management will include managing the peak flows in the catchment through maintaining natural watercourses and wetland areas that currently attenuate flows naturally. Thus the planning of future development needs to include the protection of these natural features.
- Where required, peak flows can be further reduced through the construction of detention ponds. These ponds are constructed to compensate for the unnatural increase in hardened areas, such as roofs and roads. Corridors and areas should

be reserved for future and existing watercourses and detention facilities to prevent future flooding problems on properties that are currently undeveloped, but may be developed in the future.

- It is very useful and practical to use vegetation to improve the soil's resilience to erosion. The grass species to be planted are *Vetiveria zizanioides* and *Pueraria sp*. as approved by NEWMAP. The tree species is *Acacia sp*. This species, which has a wide distribution, can be a tree or a shrub. It is also used as a pioneer species in land rehabilitation, as it is very resilient and able to tolerate extreme temperatures and rainfall.

In addition to the foregoing, the following environmental and safety considerations are recommended in the course of Implementation of the Proposed Intervention Project in Ibore Community:

1. To arrest further damage to life and properties within the area of influence of the proposed intervention project in Ibore Community, there would be need to relocate the inhabitants of the houses bordering the gully head. The alternative to their relocation to safe distance is to carry out "Resettlement Action Plan – RAP" for the people and their livelihood. Following well-coordinated RAP program, the project-affected people would need to be adequately compensated. This is envisaged to create conducive project implementation environment, ensure the safety of the project workmen and at the same time engendering the cooperation of the project affected people and indeed that of the entire Ibore community residents.

2. Within the mid-reach and lower end of the gully on both sides are crops/plants of economic, medicinal and cultural values. Proper enumeration and appropriate costing of these plants are desirable to ensure the payment of commensurate compensation prior to the commencement of the intervention project. These crops form part of the livelihood of the project affected people and therefore, the loss of the peoples' livelihood to the project implementation would need to be carefully compensated for to enhance conducive project implementation

environment, guarantee the safety of the project workmen and gain the support of the project affected people and indeed that of the entire Ibore community residents.

3. Engagement of Locals (skilled and unskilled), especially the youths cutting across the gender divides, as workmen for the intervention project is a panacea for peaceful, hitch free and successful intervention project implementation in the community. This is envisaged to encourage residents' support for the project and a means of economic empowerment/improvement to the community especially during the construction phase of the intervention project.

4. As much as it is possible and provided the desired goods and or services meet up the required standards meant for the intervention project's implementation, sourcing and procurement of some of the materials and services required at the intervention project's site during the intervention project's construction should be sourced and procured locally to further improve and or bring about economic empowerment of the locals. This will further ensure greater support for the project by the residents. Thus the safety of life and properties of the project's facilities would further be enhanced.

5. During the construction phase of the intervention project, significant increase is envisaged in traffic density into and out of Ibore community especially along the route leading into and out of the gully site. Adequate traffic planning and management arrangement should be put in place to reduce the possibility of road traffic accidents. The use of appropriate traffic warning signs, caution signs and related speed regulatory measures are required. The project drivers need to be carefully trained on defensive, safe and cautious driving to avoid accidents.

6. There is need to hire and retain at the intervention project site, particularly during the project construction phase, a competent and certified Health, Safety and Environmental (HSE) manager, who will ensure the safety of workmen, project's sub-contractors and visitors to the project's site at all time. He is expected to maintain the log of project's workers on daily basis, keep records of injury, near-

misses, man-hour utilized for the project, maintain First Aid Box at the project site that are well stocked of necessary medicals and also be in constant touch with the Retainer Clinic secured for emergency cases that may arise from time to time especially during the project construction phase.

7. Daily safety pet-talk (also called tool box discussion) should also be regularly held prior to the commencement of daily project activities with all the project workers on the need to ensure their safety, those of the project affected people and the project's contractors/sub-contractors and visitors alike. It is the duty of the site HSE Manager to arrange and present the daily safety briefing prior to the commencement of daily project activities.

8. The project construction site should be very carefully condoned off with conspicuous caution tape to warn non-project workers. This is necessary to reduce work site accidents, falls and related hazards.

9. The project campsite needs to be adequately secured with gate properly manned to ensure that non-authorized individuals are not allowed into the campsite.

10. Project construction works should be restricted to daylight so as not to disturb the residents through significant increase in the ambient noise and vibration levels that may emanate from the project construction activities. This is more so that the project site is located within built up area of the community.

11. A Manual detailing what should be done and what should not be done within the project camp site and at the project construction site should be prepared and made readily available to all the project workers, the sub-contractors and the visitors to the project site.

12. A clearly identified Mustering Station or Point should be created especially during the construction phase of the project. The appropriate use of the mustering point should be made known to all the project workers.

While Edo State and the SPMU have existing capability for environmental management, it is obvious that there is a need for capacity building, especially in terms of project monitoring and evaluation, as well as preventive/proactive environmental management. Thus, in addition to the recommended training in the ESMP section of this report, there is a need to make provision for additional capacity building for personnel of State Ministry of Environment and the SPMU environmental management unit. This will enhance their capability to manage the current project, as well as others that may emanate. In addition, the ability to undertake preventive environmental management can be enhanced through these.

If the ESMP and the general conclusion above are carefully implemented, it is envisaged that the pre-construction, construction, and commissioning phases of the planned intervention project will be devoid of accidents, while the possible project impacts will be greatly reduced. The successful implementation of the intervention project could then be envisaged.

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ANNEXES

ANNEX 1

LIST OF ATTENDANCE AT THE STAKEHOLDERS ENGAGEMENT HELD AT IBORE COMMUNITY

STAKEHOLDER ENGAGEMENT FOR THE EDO-NEWMAP FLOOD AND GULLY EROSION PROJECT

ATTENDANCE LIST

NAME OF COMMUNITY..... IBORE

LOCAL GOVERNMENT AREA..... ESAN CENTRAL

DATE..... 11 - 02 - 2017

S/NO	NAMES	POSITION IN THE COMMUNITY	TELEPHONE NUMBER
1	Honourable Barr. Emi A. Babalu		08035373798
2	Mr. Peter Okoeki		07039405358
3	Mr. Okaka S.I.		07062590826
4	Mr. Monday Aisuebeogu		08064358510
5	Mr. Johnbull Odiase		08060543156
6	Hon. Oseghale Sunday		07062636635
7	Orukpe Friday		07033568817
8	Owonlenigbusi Samuel		080 6771 8354
9	Okoro Comfort		081 0739 6478
10	Okoh Edughe		08065765794
11	Ahyu Abdul Ahad		08068893364
12	Amaru Omonigho Joy		07034921085
13			
14			
15			
16			
17			
18			
20			
21			
22			

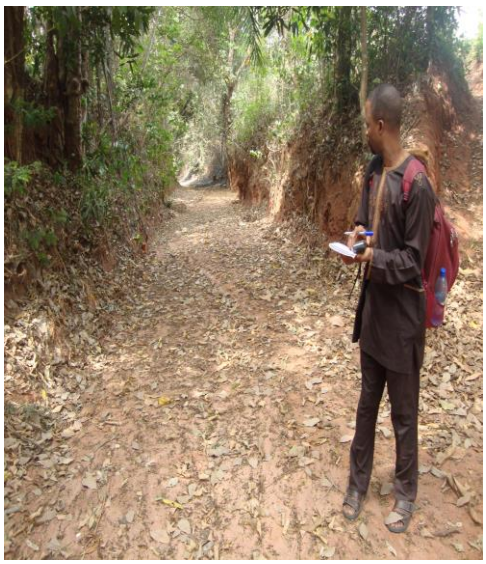
ANNEX 2

PICTORIAL EVIDENCE OF EXISTING FEATURES AND THE FIELDWORK ACTIVITIES AT IBORE GULLY EROSION SITE


10/02/2017 17:00


10/02/2017 17:02


10/02/2017 16:59




10/02/2017 17:31


MP001 (1)
NEWMAP
SEBS
FIELD STAFF
04/03/2017 14:32


04/03/2017 14:58


04/03/2017 14:59


11/02/2017 16:04


11/02/2017 16:58