NIGERIA EROSION AND WATERSHED MANAGEMENT PROJECT (NEWMAP)

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP) FOR ST LUKE'S HOSPITAL GULLY EROSION SITE, UYO, AKWA IBOM STATE

FINAL REPORT

NOVEMBER, 2017

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LIST OF ABBREVIATIONS

AIDS	-	Acquired Immune Deficiency Syndrome
AKS	-	Akwa Ibom State
AKSMOW	-	Akwa Ibom State Ministry of Works
AKSMEMR	-	Akwa Ibom State Ministry of Environment & Mineral Resources
ALARP	-	As Low As Reasonably Possible
APHA	-	American Public Health Association
a.s.l.	-	Above sea level
B. S	-	British Standard
BOD	-	Biological Oxygen Demand
BMI	-	Body Mass Index
^{o}C	-	Degrees Centigrade
^{o}E	-	Degree East
^{o}N	-	Degree North
Ca^{2+}	-	Calcium ion
CBOs	-	Community Based Organizations
Cd	-	Cadmium
CLO	-	Community Liaison Officer
cm/sec	-	Centimeters per second
Co	-	Cobalt
CO_2	-	Carbon Dioxide
CFU	-	Colony Forming Units
cfu/g	-	colony forming units per gram
CO	-	Carbon Monoxide
CaCO3	-	Calcium Carbonate
Cu	-	Copper
DO	-	Dissolved Oxygen
dB	-	Decibel
EA	-	Environmental Assessment
EC	-	Electrical Conductivity
EFCZM	-	Erosion, Flood and Coastal Zone Management
EMP	-	Environmental Management Plan
EPA	-	Environmental Protection Agency
EIA	-	Environmental Impact Assessment
ECEC	-	Effective Cation Exchange Capacity
EIA	-	Environmental Impact Assessment
EIS	-	Environmental Impact Statement
ESA	-	Environmentally Sensitive Area
ESMF	-	Environmental and Social Management Framework
ESMP	-	Environmental and Social Management Plan
ESO	-	Environmental Safeguard Officer
ESS	-	Environmental and Social Specialist

5ST	-	Five Step Tool
Fe	-	Iron
FEPA	-	Federal Environmental Protection Agency
FGD	-	Focus Group Discussion
FGN	-	Federal Government of Nigeria
FMEnv	-	Federal Ministry of Environment
FMWR	-	Federal Ministry of Water Resources
GPS	-	Global Positioning System
HMP	-	Health Management Plan
HDI	-	Human Development Index
HCN	-	Hydrogen cyanide
H2S	-	Hydrogen Sulphide
HIV	-	Human Immune Virus
HPI	-	Health Performance Indicator
HSE	-	Health Safety and Environment
ITCZ	-	Inter-Tropical Convergence Zone
ITD	-	Inter-Tropical Discontinuity
ISDS	-	Integrated Safeguards Data Sheet
ISO	-	International Organization for Standardization
KII	-	Key Informant Interviews
Km	-	Kilometer
Kg	-	Kilogram
Km2	-	Square Kilometer
LDC	-	Load Dispatch Centre
LGA	-	Local Government Area
Lmax	-	Maximum Noise Level
Lmin	-	Minimum Noise Level
m	-	Metres
mT	-	Tropical Maritime
M/s	-	metres per second
Max	-	Maximum
Min	-	Minimum
M/s	-	Meters per second
mm	-	Millimeter
mg/l	-	Milligram per liter
ml	-	Milliliter
Mn	-	Manganese
MPN	-	Most Probable Number
NESREA	-	National Environmental Standards and Regulations Enforcement Agency
NEWMAP	-	Nigeria Erosion and Watershed Management Project
NGOs	-	Non-Governmental Agency
NH_3	-	Ammonia
NIMET	-	Nigerian Meteorological Agency

NIOSH	-	National Institute for Occupational Health and Safety
NIWRMC	-	Nigeria Integrated Water Resources Management Commission
NWRI	-	National Water Resources Institute
NO_x	-	Nitrogen Oxides
NTU	-	Turbidity unit
µg	-	microgram
µm	-	micrometer
OP	-	Operational Policy
OVA	-	Onsite Visual Assessment
%	-	Percentage
PAD	-	Project Appraisal Document
PAPs	-	Project Affected Persons
PC	-	Project Coordinator
PHC	-	Primary Health Center
P.H.C.N	-	Power Holding Company OF Nigeria
PIM	-	Project Implementation Manual
PMU	-	Project Management Unit
PPE	-	Personal Protective Equipment
Pb	-	Lead
ppm	-	Parts Per Million
PRA	-	Participatory Rural Appraisal
QA	-	Quality Assurance
QC	-	Quality Control
r.m.s	-	root mean square
RAM	-	Risk Management Matrix
RAP	-	Resettlement Action Plan
RCCC	-	Reinforced Concrete Chute Channel
RPF	-	Resettlement Policy Framework
SESA	-	Strategic Environmental and Social Assessment
SLO	-	Social Livelihood Officer
SME	-	State Ministry of Environment
SON	-	Standards Organization of Nigeria
SPC	-	State Project Coordinator
Spp	-	Species
SO_2	-	Sulphur Dioxide
SO_4^{2-}	-	Sulphate ion
SO_x	-	Oxides of Sulphur
SPM	-	Suspended Particulate Matter
SPMU	-	State Project Management Unit
STDs	-	Sexually Transmitted Diseases
STIs	-	Sexually transmitted infections
SE	-	South Easterly
SW	-	South Westerly
TDS	-	Total Dissolved Solids

TOR	-	Terms of Reference
TSS	-	Total Suspended Solids
THC	-	Total Hydrocarbon Compounds
UID	-	Urban Infrastructural Development
VOC	-	Volatile Organic Compounds
WHO	-	World Health Organization
WMP	-	Waste Management Plan
Zn	-	Zinc

EXECUTIVE SUMMARY

ES 01: Background

The Government of Nigeria is implementing the multi-sectored Nigeria Erosion and Watershed Management Project (NEWMAP), which is 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 seven (7) pioneering states of Abia, Anambra, Cross River, Ebonyi. Edo, Enugu, and Imo; and additional twelve (12) states of Delta, Gombe, Kano. Kogi, Oyo. Plateau, Sokoto, Nasarawa, Katsina, Akwa Ibom, Bauchi and Borno have joined the project.

Akwa Ibom State, being a beneficiary of NEWMAP, is utilizing part of her funds to provide a holistic and permanent solution to the problems of soil erosion and mass wasting around St. Luke's Hospital gully erosion site in Uyo. Since the erosion control and stabilization measures will involve civil engineering works, which automatically triggers World Bank's Safeguard Policies including Environmental Assessment OP 4.01, it is imperative that an Environmental and Social Management Plan (ESMP) be prepared to address the potential environmental and social impacts that could arise from the proposed projects.

ES 02: The Rationale for ESMP Study

The environmental and social safeguards concerns are being addressed through two national instruments already prepared under the project. These are: an Environmental and Social Management Framework (ESMF) and a Resettlement Policy Framework (RPF). The ESMF is relevant especially in situations where the entire range of environmental and social safeguard issues is not fully known. It involves the use of safeguard plans, as well as, serving as a statement of the policy, principles, institutional arrangements and procedures that the project management will follow in addressing possible environmental and social issues. The major development objective of the ESMF is to enable support for effective decision making in order to ensure that implementation process during the execution of a project, which may involve construction, civil and rehabilitation works are environmentally sound and well programmed to encourage community consultation and participation, enhance social wellbeing and are sustainable. Thus, the framework instrument needs to be translated into specific costed, measurable and monitorable actions for specific intervention sites through the preparation of site-specific management and action plan document called the Environmental and Social Management Plan (ESMP).

ES 03: Description of St. Luke's Hospital Project Site

Uyo metropolis is generally low-lying with no appreciable relief. However, the north- eastern flank of the metropolis could be described as moderately undulating topography due to the presence of dry valleys. St. Luke's Hospital gully erosion site is located in the north-eastern flank of Uyo, and in the rear end of the hospital (Plate. 3.1). The ravine is less than one

kilometer from Etim Umana ravine and they both drain into the same basin of River Ikpa (Plate 3.4).

The gully erosion site at St. Luke's Hospital, Anua can best be described as an amphi-theatre due to the shape of the gully basin. From focused group discussions and field observations, the genesis of the gully could be traced to the channeling of flood water Nwainba road and environs into the once vegetated, stable ravine. The massive flood that occurs in the catchment of Anua ravine is a product of rapid urbanization of the city of Uyo. Today, residents of Anua and environs are usually afraid once it rains, because of incessant flooding of the gully's catchment area.

ES 04: Baseline Studies

(a) Biophysical Components of the Physical Environment

Biophysical surveys, experimentation and laboratory analyses were conducted on the following components of the physical environment: Climate and Meteorology, Air Quality, Ambient Noise Level, Geology, Hydrogeology, Geomorphology, Surface Water Characteristics, Groundwater characteristics, Soil Studies, Vegetation, and Wildlife. The purpose of the baseline study was to determine the pre-construction status of these parameters so that when construction work commences, their status can be measured against the baseline data, in order to determine possible impacts.

The analyses of the biophysical components showed that most of the parameters were within the Federal Ministry of Environment (FMEnv) permissible limits. For instance, air quality, noise level and bore-hole water were all found to be within acceptable limits. The climate was that of the typical humid tropical climate, with rainfall in all months of the year. However, there was evidence of the mean annual rainfall jerking upwards. The soil was the typical loosed, friable, coarse sandy soil of the Coastal Plain sands. The soil texture and profile were still intact in spite of the influence of human interference.

(b) Socio-Economic Characteristics of the people of the Project Area.

Socio-economic surveys, which involved the use of keen observation, interviewing, focus group discussion, key informants information and questionnaire, were conducted in the proposed project area to determine the socio-economic characteristics of the people, prior to the commencement of work at the project site. Again, the purpose was to establish a baseline in which potential impacts from the civil works at the erosion site, movement of people and material into the project site, and economic benefits could be measured. The surveys considered such variables as occupation, income, family size, lifestyle, common health challenges, belief systems, and so on.

The survey showed that majority of the people within the study area were living just above the poverty level. There are public and private schools. The roads are narrow and poorly maintained.

ES 05: Identification and Rating of Potential Adverse Impacts.

The proposed NEWMAP intervention involved the construction of a 7m x 50m Retaining Walls, together with Types 1 and 2 Drainage Channels that are equipped with stilling basins and check dams. Such construction activities can disturb the soil and biodiversity, change the landforms and landscapes, pollute the air and water resources, and alter the natural drainage patterns. These disturbances, if not properly planned and managed, can have catastrophic effect on the environment and people of the construction area.

A Five Step Tool (5ST) method of impact identification and rating was adopted to identify and rate possible impacts during the three phases of pre-construction, construction and operational/maintenance period. Identified beneficial and adverse impacts were categorized into environmental and social components. Greater attention was given to extreme, high and medium impacts in the preparation of the ESMP. Low and negligible impacts would be addressed through best engineering practices. The possibility of the construction work creating employment opportunities for the villagers was seen as one of the major benefits of the project to the community, as it will improve their livelihood and welfare, while the possibility of public utilities being disrupted during excavation works, through damage to underground cables and pipes, was also a major potential adverse impact.

ES 06: Consultations and Expectations

Prior to the commencement of the ESMP study, a number of consultations were held with all stakeholders including Uyo Local Government, Uyo Traditional Rulers Council, Village Heads and other Title Chiefs, Women Groups, Youth Groups, Anua Community, Ekpri Nsukara Community, Ikot Oko Idio Offot Community and all relevant stakeholders. The meetings were quite fruitful as the people showed great excitement and enthusiasm with the coming of NEWMAP to help them in their predicament. During the ESMP field studies, the people volunteered information freely. They had great expectation in the capacity of NEWMAP to solve the erosion problem and restore their land to usefulness. They also had hope that the youths in their community will find gainful employment, especially in the non-skilled areas, when construction work starts. Their major fear was that the fast approaching rainy season may delay the commencement of civil works, which could mean more misery for another season. As with Etim Umana gully erosion site, the proposed NEWMAP intervention in St. Luke's Hospital gully erosion site is most appropriate.

ES 07: The ESMP for St. Luke's Hospital gully erosion site

Based on the identification and rating of potential impacts that could arise from the proposed intervention in St. Luke's Hospital gully erosion site, an Environmental and Social Plan (ESMP) has been prepared in this study, with appropriate measures to eliminate, offset, or reduce adverse environmental and social impacts that could arise from the civil works in gully site. It is expected that all stakeholders in the implementation and monitoring of the plan will adhere strictly to specifications and timelines. There is no doubt that this ESMP represents a strategic roadmap, not only towards solving the St. Luke's Hospital gully erosion problem in an environmentally and socially acceptable manner, but also towards creating a wealthy and happy society, since NEWMAP projects promote the participation and capacity development of indigenous and local communities in the management of restored areas. The total budget for implementing the plan is estimated at One Hunderd and Forty Six Thousand Dollars ($146,000).

ES O8: Conclusion

The proposed St. Luke's Hospital gully erosion rehabilitation is a worthy venture and should be pursued for the sake of humanity and environment. The excitement and cooperation shown by the host community and all stakeholders are pointers to the fact that the intervention will be a huge success and is highly appreciated.

CHAPTER ONE

1 INTRODUCTION

1.1 Background

The consequences of accelerated gully erosion for society include; the destruction of lives and properties, devastation of farmlands, blockage of drainage systems and disruption of communication links. Large sections of southern Nigeria, especially the south-east and south-south, face severe problems of soil erosion and slope failure, both of which are processes of gully erosion and mass wasting. Reliable estimate suggests that over 6,000 km^2 of land in Nigeria is affected by erosion while about 3,400 km^2 is highly exposed to soil degradation. Gully erosion, with an estimated annual damage of US$100 million, has devastated many lives and destroyed essential infrastructure for economic development and poverty alleviation. This undermines economic growth and poses serious threat to Nigeria's effort at building an egalitarian society, where everyone can enjoy a fair share of the prosperity of the commonwealth.

The Government of Nigeria is implementing the multi-sectoral Nigeria Erosion and Watershed Management Project (NEWMAP), which is 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 seven (7) pioneering states of Abia, Anambra, Cross River, Ebonyi. Edo, Enugu, and Imo; and additional twelve (12) states of Delta, Gombe, Kano, Kogi, Oyo, Plateau, Sokoto, Nasarawa, Katsina, Akwa Ibom, Bauchi and Borno have joined the project.

The development objective of NEWMAP is to reduce vulnerability to soil erosion in targeted areas. Accordingly, Akwa Ibom State, being a beneficiary of the World Bank Facility, is utilizing part of her funds to provide a holistic and permanent solution to the problems of soil erosion and mass wasting at St. Luke's Hospital, Anua Gully Erosion site in Uyo. Since the proposed NEWMAP intervention in St. Luke's Hospital, Anua Gully erosion site will involve a combination of civil works and biological measures, it is imperative that an Environmental

and Social Management Plan (ESMP) be prepared to evaluate the potential environmental, social, and health impacts of the proposed project by Akwa Ibom State - Nigeria Erosion and Watershed Management Project (AKS-NEWMAP).

The World Bank has provided a number of operational and safeguards policies, which aim to prevent and mitigate undue harm to people and their environment in any development initiative involving the Bank. In order to contain any potential adverse impacts from its intervention in St. Luke's Hospital, Anua gully erosion site, NEWMAP commissions studies that address environmental and social safeguards concerns, using the framework of Environmental and Social Management Plan (ESMP). The study is site-specific, consisting of a well-documented set of mitigation, monitoring, and institutional actions to be taken before and during project implementation, with a view to eliminating adverse environmental and social impacts, offset them, or reduce them to acceptable levels. It also includes the measures needed to implement these actions and address the adequacy of the monitoring and institutional arrangements for the watersheds in the proposed intervention site.

The lead agency at the Federal level is the Federal Ministry of Environment (FME), Department of Erosion, Flood and Coastal Zone Management. State and Local Governments, Local Communities and Civil Society Organizations (CSOs) are also involved in the project, given that the project is a multi-sector operation involving Ministries, Departments and Agencies (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 reduce vulnerability to soil erosion in targeted areas. At the 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 Project on International Waterways OP 7.50.

The environmental and social safeguards concerns are being addressed through two national instruments already prepared under the project. These are: an Environmental and Social Management Framework (ESMF) and a Resettlement Policy Framework (RPF). The ESMF is relevant especially in situations where the entire range of environmental and social safeguard issues is not fully known. It involves the use of safeguard plans, as well as, serving as a statement of the policy, principles, institutional arrangements and procedures that the project management will follow in addressing possible environmental and social issues. The major development objective of the ESMF is to enable support for effective decision making in order to ensure that implementation process during the execution of a project, which may involve construction, civil and rehabilitation works are environmentally sound and well programmed to encourage community consultation and participation, enhance social wellbeing and are sustainable. Thus, the framework instrument needs to be translated into specific costed, measurable and monitorable actions for specific intervention sites through the preparation of site-specific management and action plan document called the Environmental and Social Management Plan (ESMP).

1.2 Description of the St. Luke's Hospital gully erosion Site

Akwa Ibom State is one of the thirty-six (36) states in the Nigerian Federation. It is located in the south-south geo-political zone of Nigeria and, within the trigonometrical boundaries of $4^{0}32^{1}$ and $5^{0}33^{1}$ North Latitude and $7^{0}25^{1}$ and $8^{0}25^{1}$ East Longitude. The state is bordered to the north-east flank by Cross River State; to the north-west flank by Abia State; to the west by Rivers State; and to the south and part of the south-eastern flank by the Atlantic Ocean. The state has a landmass of about 7,081 km^2 and is made up of 31 Local Government Areas (LGAs), with Uyo as the capital. The state lies entirely on the coastal plain physiography of south-eastern Nigeria, with no appreciable positive relief in any part of the state. The landscape can best be described as generally low-lying, with slight gently rolling to up-arching, undulating landscape in the north to north-eastern tip of the state, around Ini LGA. In general, no part of the state exceeds 175 m in elevation, above mean sea level. It is this low-lying to gentle rolling topography, together with a predominantly coastal plain sands physiography, and a rainfall of the humid equatorial type. These physical characteristics have made the landscape of Akwa Ibom State to be highly susceptible to several environmental challenges, including gully erosion and flooding.

St. Lukes Hospital, Anua is located along Nwaniba Road in Uyo. The gully erosion site is located at the "rear-end" of the hospital, along the axis of the Nursing School and the Anti-Natal outpatient block. In between these two building, there is a church building. All these structures are in danger of being swallowed by the advancing erosion, if urgent measures are not taken to control the problem. The gully erosion site creates an image of an Amphitheatre and is accessible to the edge of the gully from Nwaniba Road in Uyo Metropolis. In strict trigonometrical sense, the gully erosion site is found at the intersection between latitude 5.031348N and longitude 7.958886E.

The origin of St. Luke's Hospital gully erosion site can be traced to the channeling of runoff from Nwaniba Road and adjoining residential layouts in Anua village to the Anua ravine head, following the urban renewal programme of the early 2000s. Runoff from the built-up environment of the Anua Hospital, the School of Nursing and Midwifery, and the Catholic Church Anua, also contributed in no small measure to the rapid expansion of the gully. Efforts made in the past to control the erosion were largely unsuccessful as the volume of runoff from the Anua catchment area seriously overwhelmed the concrete gutters and destroyed the entire construction (Plate 3.3). Indeed, the gully developed following the collapse of the then outfall structures at the ravine head.

Today, St. Luke's Hospital gully erosion is very active and has already engulfed several acres of once productive land and a good number of economic trees within its vicinity. It is advancing very rapidly towards the recently renovated Dr. Ward's office complex, the out-patient anti-natal ward, the Catholic Church old worship hall and three blocks of one storey-building hostel and two classroom buildings belonging to the school of Nursing and Midwifery. On the average, the depth of the gully is put at 20 meters while the width at 30 meters, with a length of over 300 meters. There are numerous sliding and slumping activities along the walls of the gully basin. The bank walls have generally very steep slopes that are nearly vertical in some places, indicating high shearing capacity of soil. Most of the ravine walls hang precariously at slopes ranging from 70^0 to 90^0 inclination. The landscape of the ravine area is occupied by structures of St. Luke's Hospital, the St. Joseph's Catholic Church and the School of Nursing and Midwifery. The gully basin and the immediate slopes are generally forested (Plate 3. 1).

1.3 Rationale for NEWMAP Intervention

As a result of the rapid rate at which the erosion site in St. Luke's Hospital, Uyo, Akwa Ibom State is advancing to engulf structures within its vicinity, the intervention by NEWMAP is quite apt and indeed deeply cherished by the people of the project area, especially the staff and management of St. Luke's Hospital, Anua; staff and students of the School of Nursing and Midwifery; the Priests and Congregation of St. Joseph's Catholic Church, Anua; as well as the entire Akwa Ibom State. The Project Development Objective of NEWMAP is to reduce vulnerability to soil erosion in targeted areas and component one of NEWMAP activities focuses on Erosion and Watershed Management Investments. The aim of any NEWMAP project is to support on-the-ground interventions to prevent and reverse land degradation, using a combination of civil engineering, biological, community-centered and livelihood improvement measures to stabilize severe erosion sites, prevent emerging erosion problems early when intervention costs are low, and improve landslide and flood preparedness. For some NEWMAP projects, interventions could include structural, vegetative and adaptive natural resource based livelihood measures, together with sub-watershed planning.

NEWMAP intervention in the St. Luke's Hospital, Anua gully erosion site in Uyo, Akwa Ibom State is a total package that involves not only the structural and vegetative measures to stabilize and rehabilitate the devastated erosion site, but also livelihood measures and sub-watershed planning. The intervention will generate important local, national and global public goods related to disaster and climate risk reduction, ecosystem function, biodiversity, terrestrial carbon, soil health, and siltation reduction. The major features of the intervention include: (i) creating conditions for gully and watershed rehabilitation and alternative livelihood development, including community sensitization, social mobilization and capacity building to ensure ownership and a strong foundation for subsequent interventions; (ii) implementation of sub-watershed management plans, including disaster response, as well as, alternative rural livelihoods, in some cases including resettlement of affected households; and (iii) continuing financial and technical support for gully and sub-watershed rehabilitation and livelihood activities while phasing out project activities.

The civil works, together with vegetative measures that will be undertaken for St. Luke's Hospital gully stabilization project will provide a permanent solution to problems of gullying, landslides and intense soil erosion, as well as, boost the urban renewal programme of

Governor Udom Emmanuel led administration in the state through the restoration of the ravine area and creation of enhanced aesthetics of the ravine. Other benefits include among others, increase in accessibility to resources within the drainage basin, strengthening of local markets and industry and laying of foundation for future development in areas such as agriculture and recreation. Indeed, the people of St. Luke's Hospital gully area are already very enthusiastic, happy and hopeful the finally, rescue has come to salvage them from the plight. Many of them will transit from the present state of hopelessness to becoming owners of adaptive natural resource based livelihoods. The environment of the gully area which presently scary and frightful to behold, will be rehabilitated and redesigned into a beautiful landscape to behold. Birds and wildlife will return and the once abandoned landscape will be restored. St. Luke's Hospital gully erosion site is located less than one kilometer away from Etim Umana gully erosion site, and both share the same Ikpa River basin downstream. This ESMP report is prepared for St. Luke's Hospital gully erosion site.

1.4 Rationale for ESMP

The Environmental and Social Management Plan (ESMP) is developed in order to address the environmental and social issues that may arise as a result of NEWMAP's proposed intervention in the St. Luke's Hospital gully erosion site in Uyo, Akwa Ibom State. It is an instrument of environmental auditing that aims to achieve environmental health and safety, environmental regulatory compliance objectives, institutional responsibilities and other related commitments. The focus of the instrument is on policy, management, personnel, competence building, communications with the public, and monitoring.

The ESMP study is site-specific, and consists of a well-documented set of mitigation, monitoring, and institutional actions to be taken before and during project implementation, with a view to eliminating adverse environmental and social impacts, offset them, or reduce them to acceptable levels. It also includes the measures needed to implement these actions and address the adequacy of the monitoring and institutional arrangements for the watersheds in the proposed intervention site.

The major objective of the ESMP is to facilitate effective decision making and to ensure that activities before, during and after NEWMAP intervention in a project are environmentally

sound through the promotion of community consultation and participation for society's wellbeing and sustainability. The specific objectives of ESMP are to:

(i) ensure that a project is carried out in accordance with contemporary sustainable development tenets;
(ii) provide a structure/strategy for the integration of social and environmental consideration at all stages of the project planning, design, execution and operation of various sub-projects;
(iii) ensure overall positive, social and environmental impacts of sub-projects and avoid/minimize, and manage any potential adverse impacts;
(iv) establish clear procedures and methodologies for incorporating environmental management requirements, including stakeholders engagement in the implementation of the project and all sub-projects;
(v) provide guidelines t appropriate roles and responsibilities, and outline he necessary reporting procedures for managing and monitoring environmental and social concerns of the program and sub-projects;
(vi) determine the training, capacity building and technical assistance needed to successfully implement the provisions of the ESM;
(vii) comply with regulatory and policy requirements (local and international) that are applicable to the program and sub projects;
(viii) assess the potential environmental and social impacts of the sub-projects (rehabilitation, extensions of or new constructions in gully erosion sites, livelihood adaptation, etc) whether positive or negative, and propose measure and plans to reduce or mitigate adverse environmental impacts and enhance the positive impacts of the project;
(ix) identify potential environmental policies, legal and institutional framework pertaining to the project;
(x) establish clear directives and methodologies for the environmental and social impact Assessment (ESIAs) as might be needed for specific sub-projects;
(xi) identify modalities for estimating and budgeting the costs of the implementation of the Environmental Management Plan for the project; and
(xii) ascertain the agencies responsible for the implementation of the project's Environmental Management Plans and the projects' Monitoring & Evaluation (M&E).

The ESMP report will be used by the Akwa Ibom State NEWMAP as environmental and social safeguards throughout the life-cycle of the St. Luke's Hospital, Anua Gully Erosion Site Project.

1.5 Scope of the Work

The cardinal objective of this study is to develop an environmental and social management plan (ESMP) for the St. Luke's Hospital, Anua Gully Erosion Site in Uyo, Akwa Ibom State. To achieve this objective, the following specific tasks will be undertaken to:

- describe biophysical and social environment, including the existing status of the sub-watershed (Upper/Lower) and gullies
- identify the potential environmental and social issue/risks associated with the intervention;
- draw 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 risk associated with construction and operation in the gull 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 designate sub-watershed management in consultation with the relevant pubic and government agencies;
- identify mentoring objectives and specifies the type of monitoring with linkages to the impacts assessed and the mitigation measures described above (in a-e);
- provide a specific description of institutional arrangement: 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 arrangement for assuring the performance of each implementing agency.
- define technical assistance programs that could strengthen the 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, 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 as well as inform accordingly the design consultants so that these costs are duly taken into consideration in the designs.

Other tasks:

- The consultant shall collaborate with the SPMU to: (i) Register the ESMP with the Environmental Assessment (EA) Department at the Federal and State levels; and (ii) Disclose the Finalized ESMP at the National, State, LGA and Community levels.

CHAPTER TWO

2 INSTITUTIONAL AND LEGAL FRAMEWORK

2.1 Federal Policy, Legal, Regulatory and administrative Frameworks

A number of national and local environmental guidelines are applicable to the operations of the NEWMAP. Brief discussions of these are provided in Table 2.1.

Table 2.1: Relevant Federal/State Policies, Legislation, Regulations and guidelines

S/N	Policy Instrument	Year	Provision
1	National Policy on the Environment	1989 Revised 1991	This describes both the conceptual and theoretical framework and strategies for archiving sustainable development in Nigeria
2	National Erosion and Flood Control Policy	2005	This addresses the need to combat erosion in the country through the procedure outlined in the National Action Plan for Flood and Erosion Technical Guidelines
	Legal/Regulatory Instrument	**Year**	**Provision**
1	Environmental Impact Assessment Act No. 86	*1992 (FMEnv)*	This provides guidelines for regulating the activities of development projects for which EIA is mandatory in Nigeria. The Act also stipulates the minimum content of an EIA as well as a schedule of projects that require mandatory EIAs
2	The National Guidelines and Standards for Environmental Pollution Control in Nigeria	*1991*	These represent the basic instrument for monitoring and controlling pollution in Nigeria
3	National Guidelines on Environmental Management Systems	*1999*	This establishes the requirements for an Environmental Management System (EMS) in all organizations/facilities in Nigeria
4	National Air Quality Standard Decree No. 59	*1991*	This defines the levels of air pollutants that should not be exceeded in order to protect public health

5	The National Environmental Standards and Regulations Enforcement Agency Act (NESREA Act)	*2007*	This makes provision for solid waste management and its administration and prescribes sanctions for offences or acts, which run contrary to proper and adequate waste disposal procedures and practices
6	The National Oil Spill Detection and Response Agency Act (NOSDRA ACT)	*2005*	This statutory regulation makes adequate regulations on waste emanating from oil production exploration and its potential consequences to the environment.
7	Land Use Act	*1978* *Modified 1990*	This is the primary legal means to acquire land in the country. The Act vests all lands comprised in the territory of each state in the federation in the Governor of the State and requires that 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
8	Forestry Act	*1958* *Modified 1994*	This provides for the preservation of forests and the setting up of forest reserves
9	Endangered Species Act	*1985*	This provides for conservation and management of wild life in Nigeria and the protection of some of her endangered species from extinction as a result of over exploitation.
10	FEPA/FMEnv. EIA Procedural Guidelines	*1995*	These indicate the steps to be followed in the EIA process through project life cycle.
11	S115 National Environmental Protection: The Management of Solid and Hazardous Wastes Regulations	*1991*	Regulate the collection, treatment, and disposal of solid and hazardous wastes for municipal and industrial sources and give the comprehensive list of chemicals and chemical wastes by toxicity categories.
12	S19 National Environmental Protection: The NEP (Pollution Abatement in Industries and Facilities Generating Waste) Regulations	*1991*	These are imposed restrictions on the release of toxic substances and requirements of Stipulated Monitoring of pollution to ensure that permissible limits are not exceeded.
13	S18 National Environmental Protection: National Effluents Limitations Regulation	*1991*	This makes it mandatory for industrial facilities to install anti-pollution equipment. It also makes provision for further effluent treatment, prescribe maximum limit of effluent parameters

			allowed for discharge, and spells out penalties for contravention.
14	Public Health Law		This deals with public health matters
15	Environmental Sanitation Edits, Law and Enforcements		This deal with the general environmental health and sanitation. Implementation and enforcement in the state.
16	Workmen Component Act	*1987* *Revised 2010*	This provides for occupational health and safety
17	Akwa Ibom State Ministry of Environment (AKSME)		They are responsible for waste management, flood and erosion control, forest depletion and degradation and general environmental and atmospheric pollution control
18	Akwa Ibom State Environmental Protection Agency (AKSEPA)		General monitoring and protection of the environment. It also involves in formulation of policies for environmental protection and control at the state level
19	Akwa Ibom State Environmental Pollution and Waste Management Agency (AKEPWA)		The compilation, transport, processing, recycling or disposal and monitoring of waste materials.
20	Akwa Ibom State Ministry of Lands and Urban Development		Acquire value and allocate public real property for public projects and gazettes such acquisitions by the State with the Ministry
21	Akwa Ibom State Ministry of Local Government Affairs		• Coordinating the activities of Local Government Councils; • Resolving Local Government and Communal Boundary Disputes • Maintenance of Law and Order in Local Government Areas in collaboration with

			Law Enforcement Agencies

2.2 World Bank Safeguard Policies Triggered by NEWMAP Projects

The World Bank Environmental and Social Safeguard Policies are cornerstones of the Bank's support to sustainable poverty reduction. The main objective of these policies is to prevent and mitigate undue harms to people and their respective environments in the developmental processes. These policies also provide guidelines for the Bank and borrower staffs in the identification, preparation, and implementation of programs and projects. Table 2.2 provides the World Bank policies triggered by NEWMAP and those triggered by the specific project site.

Table 2.2: Triggered Safeguard Policies

Safeguard Policies	Triggered by NEWMAP		Triggered by St. Luke's Hospital Anua gully erosion Site		Applicability to Project	How project address policy requirements
	Yes	No	Yes	No		
Environmental Assessment (OP/BP 4.01)	[x]	[ ]	[x]	[ ]	Civil works with site-specific impacts. Construction of concrete open-channels, with restricted water flow in drainage channels to reduce the peak flow rates, flooding and sediment transport. Slope reduction and terracing will require acquisition of land and resources which will lead to economic and potentially physical displacement.	ESMF prepared for NEWMAP and site specific mitigation measures developed in the ESMP.

Natural Habitats (Op/BP 4.04)	[x]	[ ]	[x]	[ ]	Civil works with site specific impacts in creating Buffer Zone along the gully route. The intervention activities outlined require the significant conversion of areas of natural habitats and vegetation.	ESMF prepared for NEWMAP and site specific mitigation measures developed in the ESMP
Pest Management (OP 4.09)	[x]	[ ]	[ ]	[x]	There is no likelihood use of pesticide during project implementation and operation	NA
Physical Cultural Resources (OP/BP 4.11)	[x]	[ ]	[x]	[ ]	Civil works, including construction of concrete channels and slope reduction, will most likely not be able to avoid all cultural resources such as residential buildings, churches and hotels.	ESMF prepared for NEWMAP and site specific mitigation measures developed in the ESMP
Involuntary Resettlement (OP/BP 4.12)	[x]	[ ]	[x]	[ ]	Restriction of access to sources of livelihood. The demolition of structures. The proposed intervention will take place in a populated residential areas, with sparse farming.	RPF prepared for NEWMAP and a standalone RAP spells out site specific issues to be addressed and how
Indigenous People (OP/BP 4.36)	[ ]	[x]	[ ]	[x]	The people in the area are by the World Bank not considered as indigenous people	NA

Forests(OP/BP 4.10)	[x]	[ ]	[x]	[ ]	Civil works will extend to vegetated area.	ESMF prepared for NEWMAP and site specific mitigation measures developed in the ESMP
Safety of Dams (OP/BP 4.37)	[x]	[ ]	[ ]	[x]	NA	NA
Projects in Disputed Areas (OP/BP 7.60)	[ ]	[x]	[ ]	[x]	NA	NA
Project on International Waterways (OP/BP 7.50)	[x]	[x]	[ ]	[x]	Water will not be sourced from international waterway and the catchment area does not discharge into such.	NA

NB: where there is a gap of conflict between the National law and world Bank OP 4.12, the higher standard shall prevail.

In addition, the Safeguards Policy on Labor and Working Conditions (ESS2) from the Revised World Bank Environmental and Safeguards Policy (2016) is also triggered. The provision has thus:

> ***ESS2: Labor and Working Conditions*** is the World Bank's first proposal to introduce a set of operational policy requirements for labor and working conditions in investment projects. The standard prohibits child and forced labor and supports freedom of association and collective bargaining. Taking into account the nature of different types of projects, workers, and suppliers, it includes proportional requirements for community labor projects, the provision of a grievance mechanism for project workers, and requirements relating to occupational health and safety.

2.3 International Conventions and Agreements

Several international regulations, protocols, treaties and conventions have been signed by the World Community aimed at halting environmental degradation and thus protecting human health against possible adverse effects. Nigeria subscribes to a number of these International Regulations and Conventions relating to Environmental Protection. Table 2.3 shows some of the International Conventions, Agreements and Protocols to which Nigeria is signatory and are applicable to the Akwa Ibom State NEWMAP in the St. Luke's Hospital, Anua Gully Erosion Site.

Table 2.3: International Conventions, Agreements and Protocols to which Nigeria is signatory and applicable to the Akwa Ibom State NEWMAP in the St. Luke's Hospital gully erosion site

International conventions, agreements and protocols	Applicable to NEWMAP		Applicable to St. Luke's Hospital gully erosion site		Applicability to project due to	How project address issues raised
	Yes	No	Yes	No		
Both the Vienna Convention for the protection of the Ozone Layer and the Montreal Protocol for control of substances that deplete the ozone layer	[x]	[ ]	[x]	[ ]	Civil works will extend to forest area. There will be reduction in tree taxonomy and biomass leading to reduction in carbon sink and release of ODS gasses.	ESMF prepared for NEWMAP and site specific mitigation measures developed in the ESMP. Provision of vegetation measures following construction of the engineering measures.
Basel Convention on the prevention of trans-boundary movement of hazardous wastes and their disposal.	[]	[x]	[ ]	[x]	ESMF and ESMP do not identify the use and/or generation of hazardous waste in the project lifecycle.	NA
Convention on the prevention of the international trade in endangered species (CITES)	[x]	[ ]	[ ]	[x]	No endangered species(s) of any kind has been identified in the project area.	NA
Convention on Biodiversity	[x]	[ ]	[x]	[ ]	Civil works may extend to vegetated area. This will disturb biodiversity in the area	ESMF prepared for NEWMAP and site specific mitigation measures developed in the ESMP. Safeguard measures incorporated into the design of project

Convention on Climate Change	[x]	[ ]	[x]	[ ]	Proposed activities will result in environmental modification and air pollution which may increase the ambient temperature, thus contributing to global warming	ESMF prepared for NEWMAP and site specific mitigation measures developed in the ESMP. Safeguard measures incorporated into the design of project
Convention on desertification	[x]	[ ]	[x]	[ ]	Proposed activity may result in loss of vegetation	Safeguard measures incorporated into the design of project
Convention on Persistent Organic Pollutants.	[ ]	[x]	[ ]	[x]	No organic pollutant will be used for activities designed for the proposed project during its lifecycle.	NA
World Health Organization (WHO) Health and Safety Component of EIA, 1987.	[x]	[ ]	[x]	[ ]	Proposed activities may be injurious to man and the environment	ESMF prepared for NEWMAP and site specific mitigation measures developed in the ESMP.

2.4 Institutional Framework

NEWMAP activities involve many federal and state ministries, departments and agencies (MDAs), local governments, communities, and the civil societies. This is so because effective implementation of projects requires inter-ministerial and inter-state coordination, collaboration, and information sharing. Thus, each component, sub-component and activity is to be implemented through relevant federal and state MDAs. The various MDAs include those responsible for planning economy and finance, works, agriculture, water resources, forests, transport, power, emergency response, as well as, those focused on climate and hydrological information or watershed basin regulation. The investments for St. Luke's Hospital gully erosion site in Uyo, Akwa Ibom State is being made through the Akwa Ibom

State NEWMAP. However, the Akwa Ibom State Government has the primary responsibility for land management and land allocations with regards to the project site.

The Federal Ministry of Environment (FMEnv) is the lead implementing agency for NEWMAP. The Federal Project Management Unit (FPMU), headed by a Federal Coordinator and hosted by FMEnv is responsible for the overall coordination of NEWMAP activities. The Akwa Ibom State Project Management Unit (AKS-SPMU) is headed by the State Project Coordinator (SPC) and hosted by the Akwa Ibom State Ministry of Environment (AKSME). The SPC is responsible for the coordination of NEWMAP activities in Akwa Ibom State, and is directly responsible for coordinating intervention activities of the St. Luke's Hospital Gully Erosion Site, including the implementation of this ESMP. Both the federal and state levels coordinating units have environmental officers responsible for the mainstreaming of environmental issues into the NEWMAP. The Akwa Ibom State Environmental Officer is directly responsible for coordinating the implementation of the St. Luke's Hospital Gully Erosion Site ESMP on behalf of the State Project Coordinator. At the community level, the St. Luke's Hospital Gully Erosion Site Monitoring Committee will effectively participate in ensuring full compliance with approved standards during project implementation, including civil work activities.

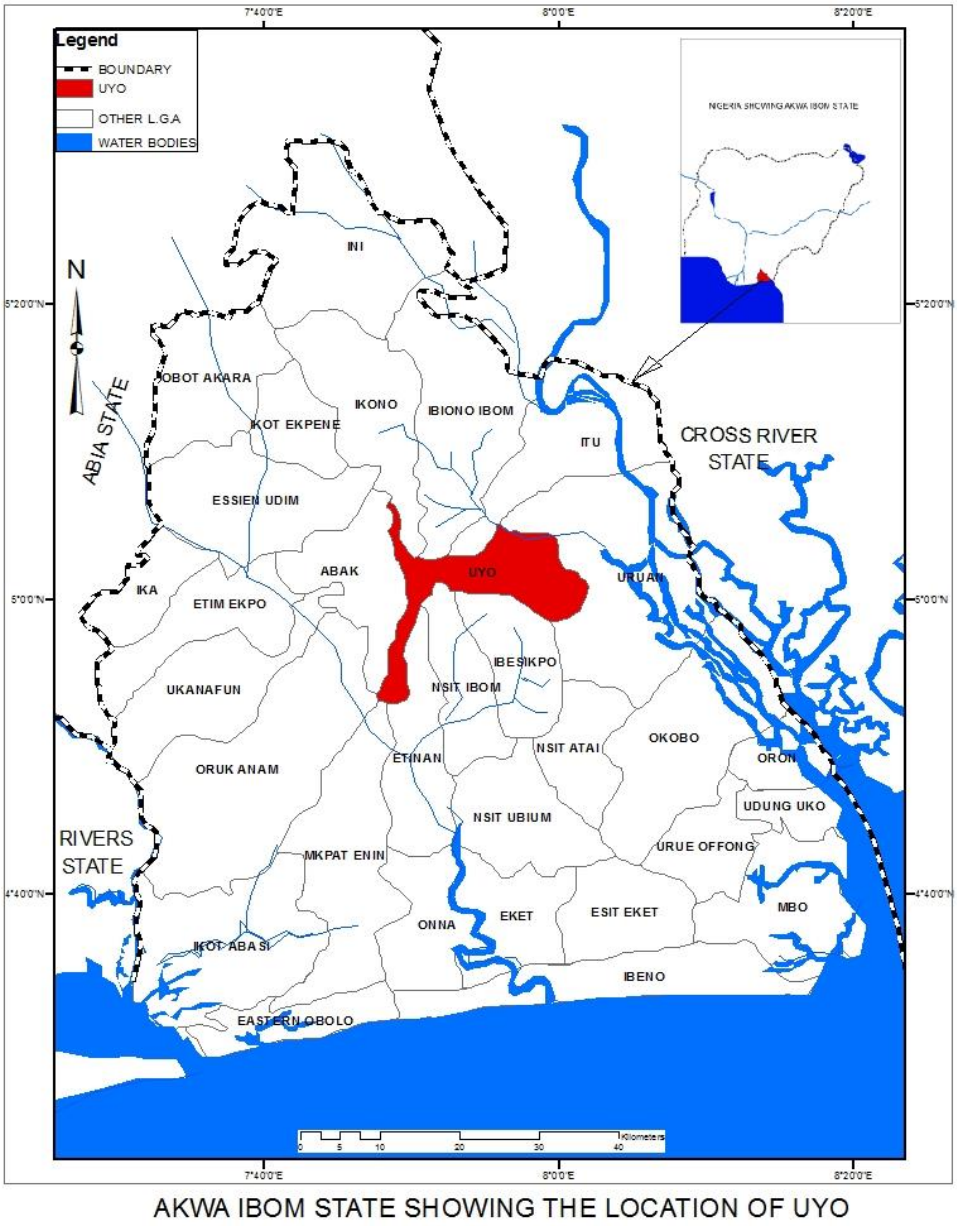
CHAPTER THREE
3 BIOPHYSICAL ENVIRONMENT

3.1 Project Area Description

3.1.1 Location and Extent

Akwa Ibom State is one of the 36 states that make up Nigeria (Fig. 3.1) and is found in the south-south geo-political region of the country. Uyo is the capital of Akwa Ibom State and is located in the Central Senatorial District of the State. Uyo Local Government Area, which is the host of the St. Luke's Hospital gully erosion site, is located between latitudes $4^{0}32^{1}$ and $5^{0}38^{1}$ north of the equator and longitudes $7^{0}25^{1}$and $8^{0}25^{1}$ east of the Greenwich meridian. It bounded to the north by Itu, Ibiono Ibom and Ikono Local Government Areas; to the east by Uruan LGA; to the south by Ibesikpo Asutan, Nsit Ibom and Etinan LGAs; to the south-west corner by Oruk Anam and Mkpat Enin LGAs; and to the west by Abak LGA (Fig. 3.2).

Figure 3.1: Map of Nigeria showing Akwa Ibom State



AKWA IBOM STATE SHOWING THE LOCATION OF UYO

Figure 3.2: Map of Akwa Ibom State showing Uyo Local Government Area

St. Luke's Hospital Gully Erosion site is located within Uyo metropolis in Akwa Ibom State. In strict trigonometrical sense, it is found at the intersection between latitude 5.031348North and longitude 7.958886East. The project is located in Offot Clan and occupies the rear end of St. Luke's Hospital east boundary with the School of Nursing and Midwifery (Fig. 3.3 and Plate 3.1).

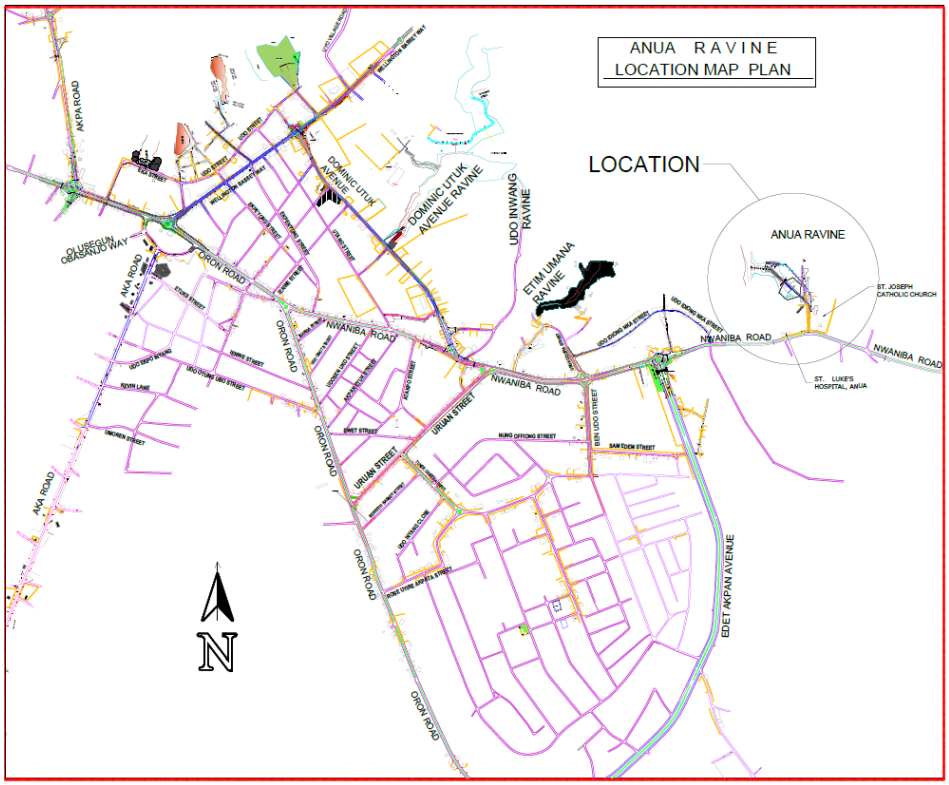


Figure 3.3: Map of Uyo showing the Study Area: Anua Ravine

(Source: NEWMAP Engineering Design)

Plate 3.1: St. Luke's hospital, Anua Gully Erosion Area of Influence

3.1.2 Project's Area of Influence

A panoramic view of the project's area of influence can be seen in Plates 3.1. The project's area of influence or catchment area covers a large section of Uyo metropolis, especially along the Nwaniba Road and adjoining streets (Plate 3.1). As shown in the photograph, the head-stream of the Anua gully erosion is largely occupied by physical structures but the middle and downstream are covered with vegetation. St. Luke's Hospital and Etim Umana gullies share the same basin downstream (Plate 3.4). The major landmarks found within the catchment area are: The St. Luke's Hospital, The School of Nursing and Midwifery, St. Joseph's Primary School and St. Joseph's Catholic Church. There are numerous residential and business buildings situated away from these four major establishments (Plate 3.1). The erosion has already consumed a large portion of the land belonging to St. Luke's Hospital and the School of Nursing and Midwifery. The St. Joseph's Catholic Church old worship hall at the foreground of Plate 3.1 has not been spared either, as the walls of the building have cracked in many places. Former remedial civil works to arrest the rampaging gully erosion was largely unsuccessful as the underground drainage structures can be seen thrown about the ravine (Plate 3.3).

Plate 3.2: Active gullying threatening economic trees and buildings

Plate 3.3: Previous Remedial Civil Works at St. Luke's Hospital Anua Gully Erosion Site Collapsing into the gully.

Plate 3.4: Satellite imagery of St. Luke's Hospital Anua Gully Erosion Catchment Area

Plate 3.5: Several buildings are at risk of collapsing into gully channel

Plate 3.6: Earth road and buildings at risk of collapsing

The extent of damage and risk created by the St. Luke's Hospital gully erosion can further be appreciated by the images in Plates 3.5 and 3.6.

3.2 The Traditional Setting of St Luke's Hospital gully erosion Site

Just like Etim Umana, St. Luke's Hospital gully area is in Offot Clan Council of Uyo Local Government Area (LGA). Anua is the main landlord of the gully area, although there are two other villages within the catchment area of the ravine. These are Ikot Oku Idio Offot and Ekpri Nsukara Offot villages. Ikot Oku Idio Offot village is located in the far downstream part of the ravine, while Ekpri Nsukara Offot village is located adjacent to the far upstream part of Anua ravine. The village Head of Anua village is called Eteidung Aniebet Akpan. Anua village is under Offot Clan Council, whose Clan Head is Etebom Sylvaanus Okon. The Clan Head, together with the village Heads, make up the Clan Council, and they are the custodians of the traditions and norms of the people.

3.3 Physical Environment

The physical environment plays a major part in the smooth functioning of society and economies. Thus, a major component of the present study is the creation of baseline information on the current status of the physical environment. The baseline information is essential because, understanding which segment of the environment is vulnerable to civil works intervention is a prerequisite to identifying and managing environmental risks. To develop effective erosion controls, it is necessary to obtain information on the erosion potential of the site where civil works will take place. Erosion potential in humid tropical regions is influenced by the type and structure of the soil (i.e. the erodibility), the amount and intensity of rainfall (i.e. climate parameters), vegetative cover, topography and the nature of land clearing (deforestation). Thus, this chapter seeks to present the most current status of the environment with respect to physical, chemical, and biological parameters of the environment. Against this baseline, environmental impacts arising from the construction and use of the proposed gully erosion control structures at St. Luke's Hospital, Anua, can be assessed and monitored. Also, concerns raised during stakeholders meetings by individuals and groups living around the gully site are addressed, since erosion is an environmental problem that has caused severe hardship to people and economies in the affected area.

3.3.1 Environmental Parameters

During project initiation and planning, there is the need to obtain specific information on a number of site attributes such as geo-physical land features, vegetation and wildlife. For the present study, baseline data and information were generated on the following environmental parameters:

- Climate and Meteorology
- Air Quality
- Ambient Noise Level
- Geology
- Hydrogeology
- Geomorphology
- Surface Water characteristics
- Groundwater characteristics
- Soil Studies
- Vegetation
- Wildlife

3.3.2 Climate and Meteorology

Weather and climate are important components of the physical environment because they influence the day to day functioning of humans and their economic systems, as well as, helping to shape and maintain the physical environment. Micro-climate is the climate of a small area, for instance, the climate of a ravine, the climate of a football field, the climate of a farm or group of farms, and so on. The micro-climate of an area is very important because it directly affects the biotic and abiotic components of the immediate environment. Accordingly, any modification of the micro-climate can significantly disrupt the smooth functioning of the ecosystem. Therefore, climatic and meteorological baseline studies are essential in any environmental assessment study because they are an integral part of the physical environment, which could easily be altered in the course of civil works intervention, as the proposed St. Luke's Hospital, Anua gully erosion control project. There is no doubt that the on-going climate change phenomenon has affected many of the climatic characteristics that were familiar to the people of Uyo, which they were able to adapt. Emerging climate trends therefore require regular assessment of the state of the climate and meteorology.

3.3.2.1 The Climate of Uyo

On the basis of its geographical location, Uyo, and indeed St. Luke's Hospital, Anua gully area, can be said to experience the tropical rainy climatic type, which receives abundant rainfall with very high temperatures. The tropical rainy climate is the product of the interplay between the Tropical Maritime (mT) air-mass and the Tropical Continental (cT) air-mass. The imaginary line which separates these two air masses is called the Inter-Tropical Continental Zone (ITCZ) or the Inter-Tropical Discontinuity (ITD). While the mT air-mass originates from the Atlantic Ocean and brings with it wet and humid conditions to the study region, the cT air-mass originates from the Sahara desert and carries with it dry and dusty conditions. Due to the proximity of Uyo to the Atlantic sea coast, the area receives more wet conditions from the south-westerly winds (which is the driving force for the mT air-mass) than dry conditions from the north-easterly winds (which is the driving force for the cT air-mass) in a year. Thus, the rainy season in Uyo lasts for about seven months from April to October, while the dry season occupies the five months from November to March. The weather in the study area is hot and humid throughout the year. It is oftentimes very sunny in the dry season, even though the rainy season also have many days of bright sunshine. Winds are fairly consistent and mild, except during squalls associated with

thunderstorms at the beginning of the wet season (Ekpoh, 1994; Udosen, 2008; Ekpoh, 2015). The import of this climatic condition is that, with a land area of 115 km^2 (44 sq mi) and a population of over half a million (2015 estimate), Uyo has had more than its fair share of the "twin evils" of flooding and erosion in recent times, despite serious efforts by successive state and federal governments to address the issue. The near intractable nature of the problem may be due to factors such as topography, massive urbanization, inappropriate and inadequate drainage networks and climate change.

3.3.2.2 Climatic Characteristics of the Study Region

This study relied heavily on climatic data sourced from the Meteorological station, University of Uyo, as well as, the Meteorological data obtained from Nigerian Meteorological Agency (NIMET), Oshodi, Lagos. The data include rainfall, temperature, wind, relative humidity, and sunshine hours. Some of the climatic characteristics were however measured in-situ, such as rainfall intensity and runoff.

3.3.2.2.1 Rainfall

The coastal areas of Akwa Ibom State, which are located close to the Atlantic sea coast, receive the highest amounts of rainfall with annual totals of between 2800 – 3000mm of rainfall. These rainfall amounts decrease gradually hinterland, with Uyo having a mean annual rainfall of about 2,500mm (Ekpoh, 2015). A station-rainfall-analysis was performed for Uyo in Akwa Ibom State using a 30-year data from 1985 to 2014 and decadal values for three decades (Ekpoh, 2015). The result showed that the mean annual rainfall receipt during the 2005-2014 decade was 22 percent above the 30-year mean (Table3.1 and Fig.3.3). From the figure, the 30-year mean rainfall from 1985 to 2014 was 2493.57mm (approximately 2500mm). The mean rainfalls for the first two decades of the study were 2243.23mm and 2195.32mm, indicating a drop of 10.04% and 11.96% from the 30-year mean respectively. However, the third decade mean was 3042.17mm, which showed a 22% increase in rainfall over the 30-year mean. The standard deviation and the coefficient of variation also varied substantially between the first two decades and the third decade (Table 3.1). Also, a close examination of Fig. 3.2 shows that annual rainfall in Uyo maintained a steady pattern during the first twenty years of the study from 1985 to 2004. However, during the last decade of the study from 2005 to 2014, the rainfall pattern shifted abruptly over the 3000mm mark and has virtually remained in that region since then, except for 2009 when it dropped below the 3000mm mark. In the same

vein, a 5-year running mean for the climate period 1985-2014 showed that the running mean shifted from an average of about 2200mm to a new mean of 3000mm (Fig. 3.4). The 5-year running mean (red line) presented a more graphic picture of the shift as the trend showed a firm pattern from 1985 up to 1998 when the trend experienced a steady rise to a peak in 2004, and a further climb to a climax in 2012. The implication of the emerging rainfall pattern for Uyo is that, the rainfall has established a new mean around 3000mm during the last 10 years as against the long-term mean of 2,500mm (Table 3.1). Besides these shifts, individual extreme rainfall events have become very common in recent years. For instance, the University of Uyo Meteorological Station recorded a 171.7mm rainfall on 27th August, 2015, which created flood chaos in Uyo. The extreme rainfall was more than half of the expected mean monthly rainfall of 300mm for August in Uyo (Table 3.1). These recent rainfall characteristics in Uyo in terms of amount and intensity, which are likely to be fallouts from the current climate change, will continue to have serious implications for flood and erosion problems and grave consequences for the residents of the state capital. A comprehensive annual rainfall data for 1977 to 2015 is presented in Table A5.1 (Annex 5).

Table 3.1: Station Rainfall Analysis for Uyo using 30-year data and decadal values

Decade	Mean	Standard Deviation	Coefficient of Variability	Skewness	Kurtosis
1985-1994	2243.23	232.77	10.38	0.74	0.29
1995-2004	2195.32	305.92	13.93	1.76	3.99
2005-2014	3042.17	493.35	16.22	-0.89	2.59
1985-2014 Long-term	2493.57	526.75	21.12	0.85	-0.19

Source: University of Uyo Meteorological Station

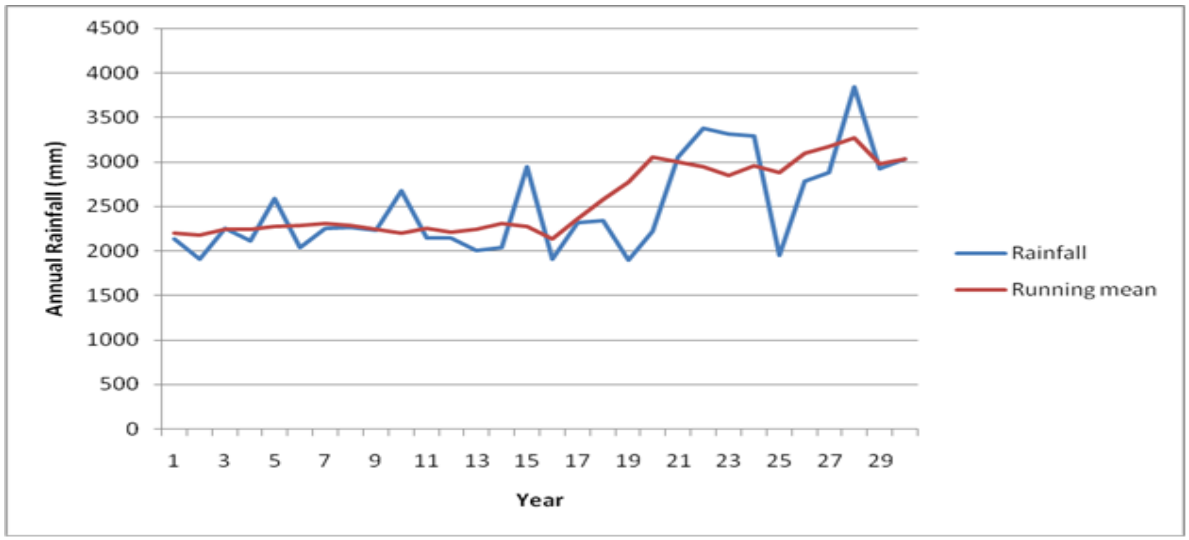


Figure 3.4: Annual Rainfall and 5-Year Running Mean for Uyo, Akwa Ibom State (1985-2014).

3.3.2.2.2 Seasonal Rainfall Pattern and runoff rate.

The monthly mean rainfall distribution in Uyo is presented in Table 3.2, January and December have the lowest rainfall (16.5mm and 18.1 mm respectively). There is increasing amount of rainfall from January until the peak is reached around August or September 351 mm and 347.7mm respectively (Fig. 3.5). On the whole, no month is rainless, but five months from November to March produce 13.47 percent of total annual rainfall. The remaining seven months from April to October account for 86.53percent of the total annual rainfall. This is the wet season.

Table 3.2: Mean monthly rainfall (mm) (1977 - 2003)

Month	Amount
January	1 6.53
February	38.30
March	139.6
April	206.3
May	273.9
June	269.0
July	344.3
August	351.3
September	347.78
October	256.27
November	108.8
December	18.1
Total	**(2370)**

Source: Uniuyo Met Station

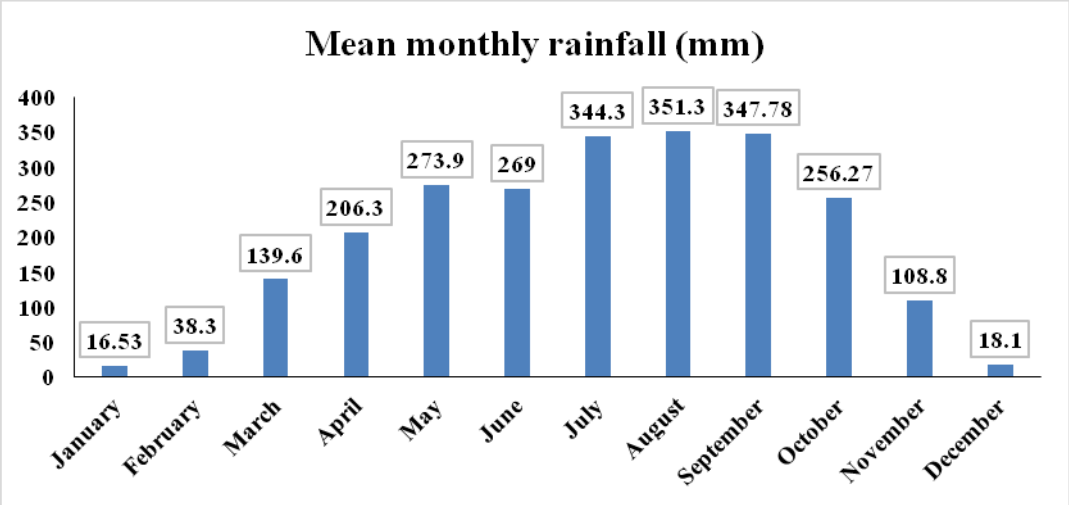


Figure 3.5: Monthly Rainfall Distribution in the study area

Table 3.3 indicates that severe flooding is expected in the months of April to October. At the project site, rainfall is mainly convectional and storms of more than 50mm contribute a total of 45.9 percent of annual rainfall, while storms of more than 25.4mm accounts for a total of 58.7 percent of annual rainfall. In some wet years the contribution of rainstorms of more than 100mm could be above 80 percent [as in 1977[84.1%] and 1979[80.8%]. As with other tropical rainy climate, rainfall intensity in the study area is quite high. Rainfall Intensity (RI) is obtained by dividing the amount of rainfall over the duration or period of fall, i.e. I = A/D. Table 3.3 shows the frequency of rainstorms intensity greater than 50 mm and 100 mm in the study area. The same data is presented graphically in Fig. 3.5

In natural catchments, and amount of rainfall that falls is either intercepted by vegetation, infiltrates into the soil, moves over the earth surface as overland flow, or is lost through evaporation and evapotranspiration. For a rainfall of a given duration and intensity, the proportion which becomes runoff depends mainly on the cover of vegetation or cover crop, the soil infiltration rate, water content and storage capacity, and the slope of the land. There are two functional methods for estimating runoff rate: The Rational Formula and the Cook's Method. The Rational formula for estimating runoff is expressed as follow: Q = CIA/360

Where: Q = Runoff rate (m3/s)

C = Runoff coefficient (between 0 and 1)

I = Rainfall intensity (mm/hr), and

A = Area of the catchment (ha)

Table 3.3: Frequency of occurrence of intense rainstorms in the study area

Month	Rainstorms >50mm	Percentage	Rainstorms >100mm
JAN	0	-	0
FEB	2	1.94	0
MAR	5	4.85	0
APR	6	5.83	1
MAY	14	13.6	1
JUN	17	16.5	6
JUL	14	13.6	2
AUG	10	9.7	1
SEP	16	15.5	3
OCT	15	14.6	2
NOV	3	2.9	1
DEC	1	0.97	0

Source: Udosen, 2008

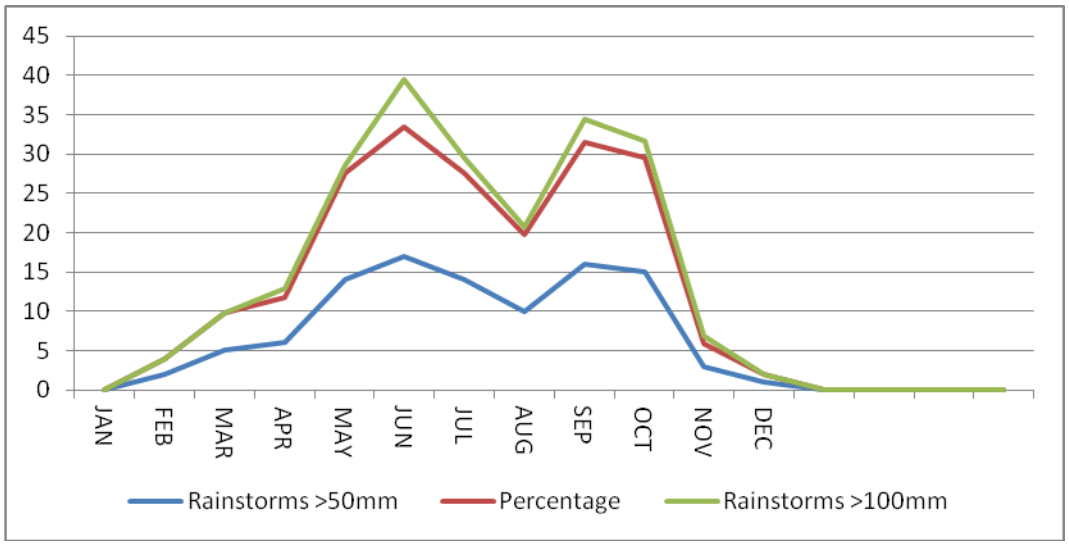


Figure 3.6: Frequency of Occurrence of Intense Rainstorms in the Project Area (Udosen. 2008)

3.3.2.2.3 Air Temperature

As with other tropical locations, monthly variation in mean air temperature in the study area is very small as temperature is relatively high and steady throughout the year. The mean monthly temperature in Uyo is presented in Table A5.2 (Annex 5). The hottest months are March and February with 28.5^{0}C while the coolest months are August (25.4^{0}C) and September with 25.7^{0}C. The range of temperature between maximum and minimum values is quite small for the study area and the mean value is 3.10C, a value that is below the 50C range, the maximum range for all humid tropical climates (Fig. 3.7).

During the fieldwork, the recorded temperatures were 25.0^0C – 27^0C[recorded in the morning hours on May 3rd, 2017] The higher monthly values could be as a result of the global phenomenon called Climate Change which is characterized by high temperatures caused by the phenomenon of global warming. Fig. 3.7 shows the mean monthly maximum temperature for Uyo recorded over a period of ten years [2000-2009]. The temperature values range from about 24ºC to 29.4ºC.

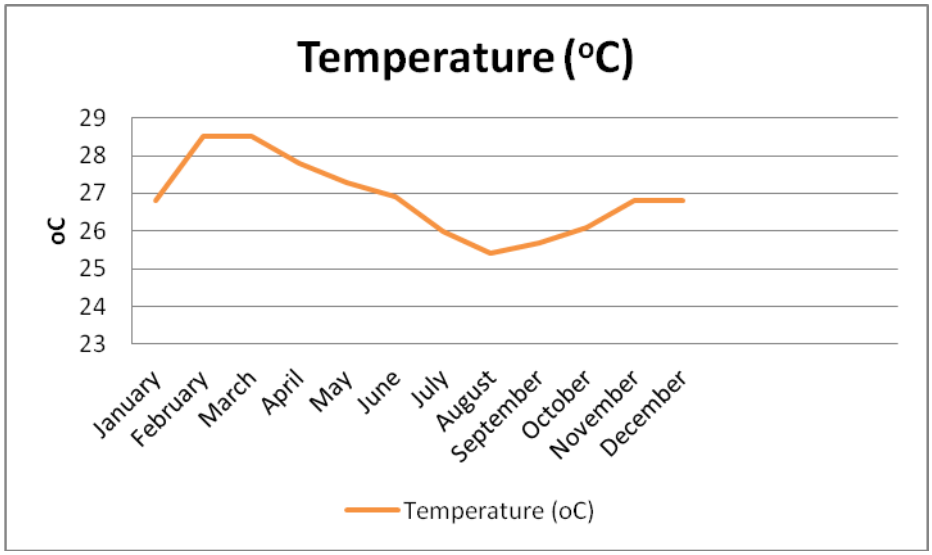


Figure 3.7: Mean Maximum Monthly temperature values (2000-2009)

It is quite evident in Fig. 3.8 that the mean monthly minimum temperature varies, the highest value of 27.7ºC was recorded in the month of March while the least value occurred in August (25.3ºC). Generally, low values are associated with the beginning of the year (January and February) as well as in the months of July to September

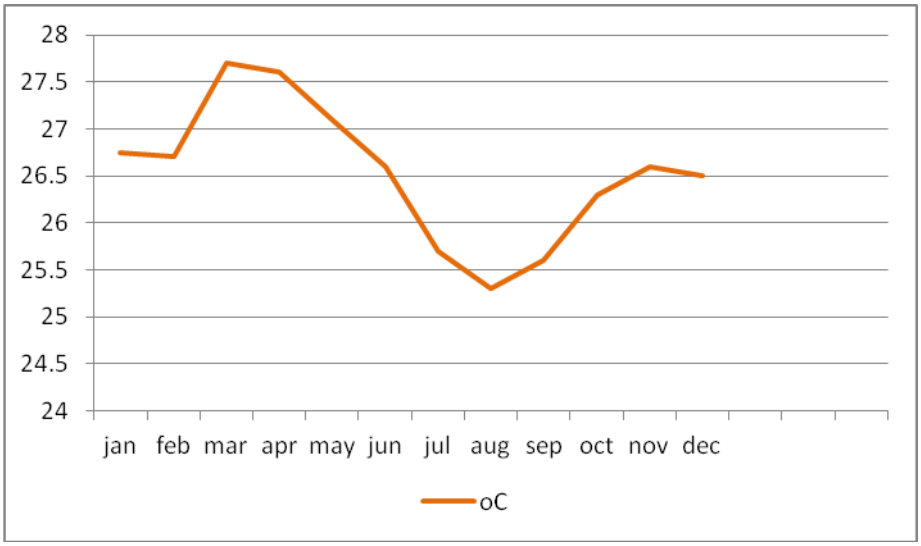


Figure 3.8: Mean monthly minimum temperature values (2000-2009)

3.3.2.2.4 Sunshine in Uyo

Uyo, the study area, receives adequate sunshine especially during the dry season months from November to March. The rainy season, although usually cloudy with overcast skies, also has many days of bright sunshine hours per day. Table 3.4 presents the distribution of sunshine duration in hours per day. Again, the period of shortest sunshine duration coincides with the period of heavy rainfall, high humidity and cloudiness. This comprises the months of July, August, September and October

Table 3.4: Sunshine hours/day (1984-1990)

Month	Average (Hours/Day)
January	3.35
February	3.48
March	3.72
April	4.10
May	4.05
June	2.80
July	1.90
August	2.04

September	2.30
October	2.70
November	3.86
December	4.3

Source: University of Uyo Met. Station (1984-1990)

3.3.2.2.5 Winds

The most prevalent winds in the study area are the southwest and the northeast winds. The south west wind has greater influence in the study area because of the proximity of the study area to the source region of the southwest wind, which is in the Atlantic Ocean. The wind blows all throughout the year, although its dominance is strongest during the rainy months from April to October. The Northeast trade winds similarly blow throughout the year but with greater influence in northern Nigeria, which is closer to its source region in the Sahara desert. In the study region, the influence of the northeast winds is felt most during December and January months, a period known as the Harmattan, because of it is characterized by dry, dusty, stuffy atmospheric conditions.

The percentage of calm wind (speed 0.0-0.2m/s) is higher particularly during the dry season. Apart from the calm periods, wind speed of 0.5-3.0m/s considered as light breeze are more dominant, while wind speed in excess of 5.5/ms occasionally occurs, especially during the onset of heavy rainfall or thundering activities. During the dry season, the winds are fairly well distributed in the directions North (N), North West (NW), and South (S), South West (SW); but during the rainy season, the wind direction for Uyo is dominantly South (S), South West (SW).

3.3.2.2.6 Evaporation

High evaporation are characteristic of all tropical regions because of their proximity to the Equator. Evaporation in the study area is generally high due to the location of the area in the Tropical Equatorial belt, with its associated high values of insolation and temperatures. Usually, annual evaporation values vary from about 1300mm to about 1800mm. For instance, relatively higher evaporation occurs during December and January months when the study area is under the influence of the tropical continental air-mass, than in the rainy season when evaporation rates are significantly lower than relative humidity values.

The Thornthwaite's water balance was computed using rainfall and evaporation data from the University of Uyo Meteorological station. The typical water balance computed for Uyo shows that the annual rainfall is in excess of the potential evaporation (Fig.3.9). Annual evaporation is 1350.1mm, while the computed annual water surplus is 1529.7mm. The implication of this high rainfall excess over evaporation is the availability of water for ground water recharge. Usually, groundwater level is recharged from the month of June, prior to the excess water from the previous rainy season, which is utilized by plants between the months of January and March. In the study area, water table stabilizes during the peak of the wet season-June –September.

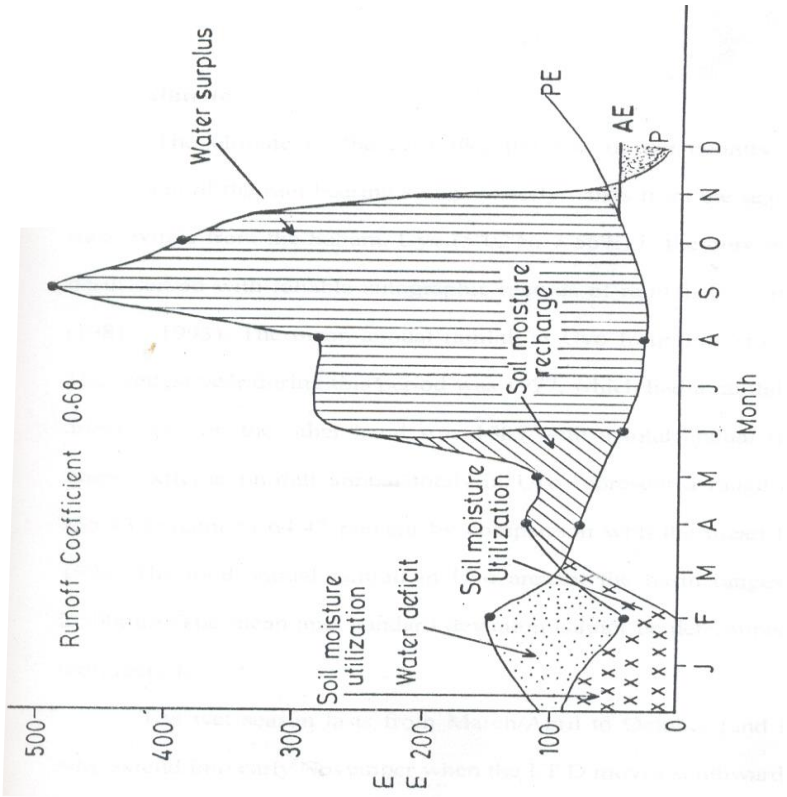


Figure 3.9: Water Balance for Uyo watershed
Source: Udosen, (2008)

3.3.3 Air Quality

Air is an important element of the physical environment because life in planet earth would be impossible without fresh, good-quality air. The air quality components computed both in the field and in the laboratory were: Carbon Monoxide (CO), Hydrogen Sulphide (H_2S), Sulphur Dioxide (SO_2), Nitrogen Oxide (NO_2), Suspended Particulate Matter (SPM), Methane (CH_4),

Volatile Organic Carbon (VOC) and Total Hydrocarbons. The standard air quality instruments for computing these air components are presented in Table A5.3. The coordinates of the air quality (AQ) sampling points are presented in Table 3.5.

Table 3.5: The Location of Sampling Points for some Environmental Parameters

Northings	Eastings	Elevation (m)	Parameter
05º 02' 016"	007º 57' 437"	40	Air Quality & Soil
05º 02' 056"	007º 57' 503"	57	Air Quality & Soil
05º 02' 076"	007º 57' 818"	30	Air Quality &Soil
05º 01' 853"	007º 57' 531"	64	Air Quality & Soil
05º 01' 923"	007º 57' 523"	60	Air Quality & Soil
05 º 01' 836"	007º 57' 445"	62	Soil
05º 01' 755"	007º 57' 431"	64	Soil

Table 3.6 shows the measurements of the various air components in St. Luke's Hospital, Anua project area. The values of the different air components were measured at one hourly interval of 6 hours at 5 sampling points. The results, which are presented in Table 3.6, show that most air quality components were within the Federal Ministry of Environment (FMEnv) permissible limits. For instance, the mean concentrations of NO_2, SO_2 and H_2S were less than 1 ppm in the air of the study area. The range, in terms of recorded values between the lowest and the highest values were equally low (Table 3.6). For instance, NO_2 had a range of 0 – 0.11 ppm; SO_2 had a range of 0 – 0.001; H_2S had 0 - Trace and NH_3 was not even evident in the air of St. Luke's Hospital, Anua gully. Furthermore, all the values recorded for SPM, THC, VOC and RAD were lower than the FMEnv regulatory limits (Table 3.6).

Table 3.6: Ambient Air Quality Measurements at St Luke's hospital, Anua Gully Area

S/N	Air Quality Component	Range	Mean	FMEnv standard	Remarks
1	SPM (mg/m^3)	0.021-0.043	0.03	0.25	Within FMEnv limits
2	NO_2 (ppm)	<001-003	0.001	0.04 -0.06	Within FMEnv limits
3	SO_2 (ppm)	<0.001-0.002	Trace	0.830	Within FMEnv limits
4	H_2S (ppm)	<0.1-0.1	0	0.03	Within FMEnv limits
5	CH_4 % LEL	-	0	NS	No trace in the air
6	CO (ppm)	2.5-8.6	3.9	10	Within FMEnv limits
7	THC (mg/m3)		Trace	1.60	Within FMEnv limits
8	VOC (ppm)	<0.01-0.03	1.0	3.2	Within FMEnv limits
9	Rad. mR/hr	0-0.04	0.02	NS	Insignificant to pose any

					danger
10	NH_3 ppm	_	0	NS	Not present in the air

Fieldwork, May, 2017. NS = Not supplied

3.3.4 Ambient Noise Level

Just like air quality, ambient noise level is another in-situ parameter of the physical environment. The level of noise in the study area was measured with a noise meter called Casella Digital Sound Survey Meter, Model CEL-231. Measurement was done by directing the noise meter towards the direction of the prevailing wind and the reading recorded from the meter in decibel dB(A). The ambient noise level recorded in the Anua gully erosion project area ranged 55.4 dB(A) to 60.7 dB(A), with a mean value of 57.5 dB(A). The values obtained were below the Federal Ministry of Environment recommended standard of 90 dB(A) for 8 hours exposure (Table 3.7). The inference that could be drawn from these readings is that the project area of Anua gully erosion is devoid of activities that produce loud noise, which could be detrimental to human health and comfort, as well as, environmental health.

Table 3.7: Ambient Noise Levels for St Luke's Hospital Project Area

Sample Point	**Latitude (Northings)**	**Longitude (Eastings)**	**Noise Level dB(A)**
ANL 1	05° 02' 056"	007° 57' 503"	60.7
ANL 2	05° 02' 076"	007° 57' 818"	55.4
ANL 3	05° 01' 853"	007° 57' 531"	55.9
ANL 4	05° 01' 923"	007° 57' 523"	58.7
ANL 5	05° 01' 836"	007° 57' 445"	56.6
Mean			57.5
FMEnv Limit			90

Fieldwork, May, 2017

3.3.5 Geology

Published geological map of the Geological survey of Nigeria indicates that Akwa Ibom State consists of stratigraphical units ranging from Maastrichtian to Plaistocene. Four main units are recognized, of which three units belong to the Coastal Plain Sands and the Beach Ridge Complex, while the remaining one belongs to the Shale Fancies to the north-east of the State

(Prtters, et al., 1988; Usoro, 2010). Table 3.8 presents the Geological units in Akwa Ibom State, and showing particularly, the stratigraphical relations.

Table 3.8: Geological Units of Akwa Ibom State

Geological Period	Geological Epoch	Geological Formation
Quaternary	Recent	Alluviun Beach Ridges
	Pliocene – Plaistocene	Coastal Plain Sands Benin Formation
Tertiary	Middle Eocene	Bende Ameki Group
	Early Eocene	Imo Clay Shale Group

Source: Petters et al., (1988) and Usoro (2010)

3.3.5.1 Surface Geological Mapping

Surface geological mapping was achieved by using available maps and data. In addition, visual bearing and spacing methods were used in the field. This was possible with the aid of a Compass-Clinometer and an Abney Level instrument, which were uses to conduct traverses of the surface morphometry through contouring. In strict geomorphic terms, surface expressions of the topography or physical morphometry of the landscape are largely influenced by the internal geology.

The sub surface geological data acquisition involved the inspection of gully valley side sections, available records and existing boreholes in the area. The study area is underlain by one main geological formation, the Coastal Plains Sands, which is also known as Benin Formation (Fig. 3.10). The Benin Formation range in age from Oligocene to Recent, and is about 2100 m thick. It is composed largely of poorly consolidated sands and sandstones as exposed in the roadside cuttings around Uyo and on the eroded slopes of St. Luke's Hospital, Anua gully site. The coarse and sand fractions contain rounded grits and the beds colour are stained deep brown to reddish brown by oxides of iron. The light brown to brown varieties are common in the study area.

The oxides and hydrous oxides of iron and aluminium in both crystalline and amorphous forms are among the major components of the local soils. The presence of amorphous iron and aluminium oxides may modify certain soil properties such as surface charge swelling and aggregate formation. More intense leaching is responsible for such surface charge swelling and aggregate formation. More intense and protracted leaching of parent rocks under the

conditions of wet and dry seasons have also resulted in further enrichment of sesquioxides compounds, giving free iron oxide and Kaolinite in clays (Petters, et al, 1988; Udosen, 2008).

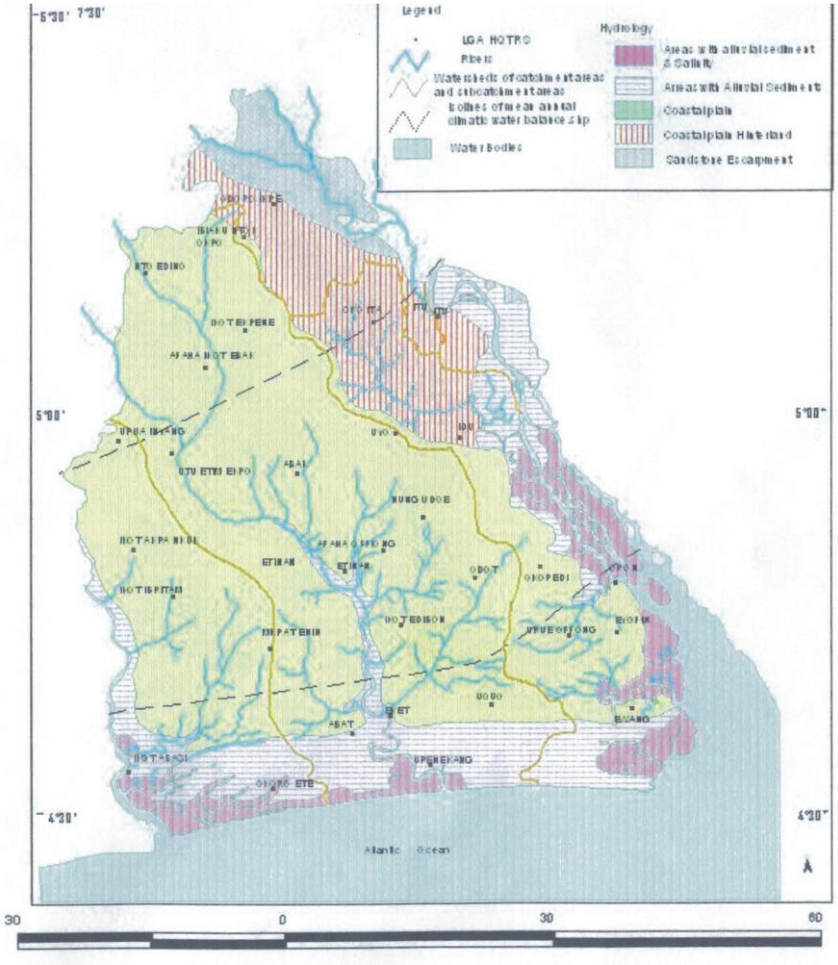


Figure 3.10: Geological Map of Akwa Ibom State (Petters, 1989)

Table 3.9: A Typical Lithological Sequence at St. Luke's Hospital Gully Erosion Site

Lithological Section	Thickness (m)
Topsoil/ soil migratory layer	0.8
Red earth with lenses of clay	5.4
Sands, Ferruginous, Pebbly	4.7
Sandstones, Ferruginized	4.2
Sand, Pebbly, Ferruginised	3.6
Mottled clay layer	2.8
Pallid Zone (whitish colour with red stains)	1.1

Total depth	22.6

Fieldwork, May, 2017

Vertical section of the lithologic sequence in most places within the St. Luke's, Anua gully erosion site averages 20m thick. A typical section at Anua ravine consists of the lithologic sequence presented in Table 3.9. The red earth is found beneath the topsoil. The pebbles are unconsolidated, nearly even grained and cemented by red earth. This is succeeded by the mottled clay layer which is whitish in colour, with red stains. This thick deposit of impervious clay (from 3m – 10m deep) deflects percolating water and may provoke rapid mass movement of overlying regolith on cut slopes or in deep gullies channels of more than 21m, particularly on fairly steep valley slopes.

3.3.6 Hydrogeology

A comprehensive study on the hydrogeology of Akwa Ibom State, fucussing on such parameters as the static water level, ground water flow direction, thickness of aquifer, yield drawdown, specific yield, transmissivity and hydraulic conductivity is presented in the definitive and pioneering work of Petters et al., (1988). The hydrogeology presented in this section relied heavily on that work, in conjunction with findings from other baseline studies. Also, existing boreholes and available reports were used for hydrogeological studies.

Generally, the groundwater movement in the study area is south-eastwards and is sea-bound, as shown in Figure 3.11. From geological surveys, the static water level increases from about 13m at Eket to over 38m around Uyo LGA (Table 3.10). The lithology of the study area, which is more than 80 percent sand and sandstones is very favourable for the storage and extraction of groundwater.

The Coastal Plain Sands are the main aquifer in the study area and is characterized by unconfined aquifer. The deposit of clay at a depth of 3-10m (mentioned earlier) may disturb the vertical and lateral continuity of the aquifer. This may produce artesian aquifers, especially around Etinan, in the south-east of Uyo. The total thickness of the aquifer may be up to 500m and water in this aquifer occurs essentially under phreatic conditions. This condition presupposes that groundwater around Uyo is not prone to salt water intrusion. The hydraulic conductivity varied between 3.80 and 6.50m/day while the transmissivity ranged from 875.00 - 175.00m^2/day, with a mean value of 1193.38 m^2/day. The median and mean

values of the specific yield are 12.75 and 12.65 m^3/hr/m. The aquifer parameters suggest that an active groundwater system underlies the area. The morphometric properties of streams in the Ikpa River basin indicates that the average basin relief is 79m while the mean stream channel slope is 3^0 (Table 3.10)

Table 3.10: Hydrogeologic Data around Uyo and Environs

Location	Static Water Level	Total Depth	Local government area
Uyo	38.7	130	UYO
Nung Ukana Ibesikpo	18.2	196	Ibesikpo Asutan
Eket	15.0	79.9	Eket
Ibeno	1.23	17.5	Ibeno
Ntiat Itam	51.0	123	Itu
Ikot Udo Ibiono	55.2	152.7	Ibiono

SOURCE: Petters, (1989)

Table 3.11: Morphometric Properties of the stream in Ikpa River and environs

STREAM ORDER	STREAM LENGTH (km)	BASIN RELIEF (m)	RELIEF RATIO	STREAM CHANNEL SLOPE (1^o}
1^{st} order	1.6 km	79m	0.0494	3^o

SOURCE: Computed from Uyo Sheet1995/1-4. Scale 1:2500

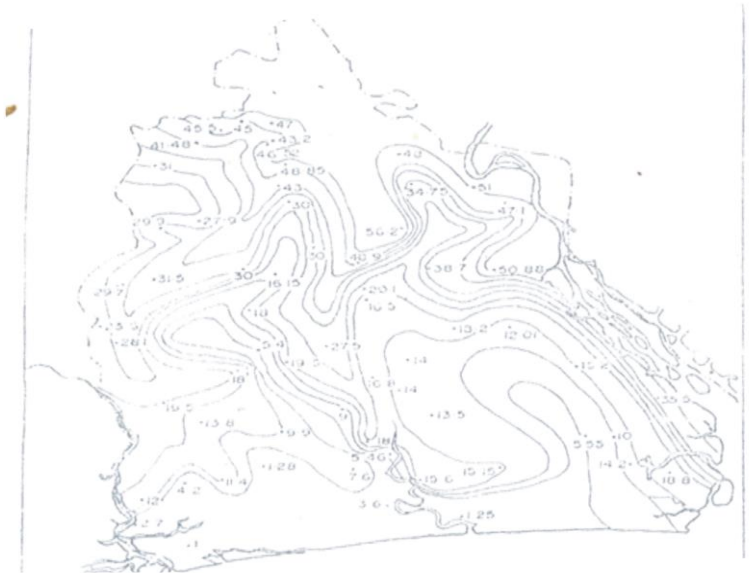


Figure 3.11: Static Water Level in Akwa Ibom State (Petters, 1989)

The value of total thickness of the aquifer in Uyo area is 130m; equally, the static water level decreases towards the coastal settlements viz; Ikot Udo Ibiono [55.2m] ;Uyo[38.7m]; Nung Ukana Ibesikpo[18.2m; Eket town(15.0m) and Ibeno(11.23m) respectively. Thus, the direction of flow of groundwater is southwards towards the coast (Fig. 3.11).

The static water table and total depth of groundwater in selected stations is shown in Table 3.10. Statewide, the depth to static water level ranges between 3m along the coast to 60m at Itu LGA, while the mean aquifer discharge, transmissivity, hydraulic conductivity and storability are about 1573.82m^2/d, 569.52m^2/d, 36.54m/d and 0.02 to 0.03 respectively [Murat,1970]. The main ground water flow direction of the area is south-eastward which is toward the coast. The main source of groundwater recharge in the study area is direct infiltration by rainfall.

3.3.7 Geomorphology

Geomorphologically speaking, Uyo can be described as having a topography of "level to gently undulating" sandy plains in the central and southern parts of the city, but a steeply undulating terrain to the north and north-eat sections, where the basins of Ikpa River and its tributaries dominate the landscape. Most of the basins are dry and only have running water during the rainy season, which are largely runoff from their catchment areas. This is why such streams are called "ephemeral streams", because they flow during the rainy season and dry-up during the dry season. Their sources have absolutely no link with the water table.

Anua ravine was one such dry basin until flood water was channeled from Nwaniba Road and environs through a buried gutter into the ravine head (Plates 3.2 and 3.3). Today, a once greenish Anua ravine has become an erosion devastated amphi-theatre. The main trunk of the Ikpa River is a subsequent river (i.e. 2nd Order river) being a subordinate of the Cross River, which it empties into (Table 3.11). The head-waters of the numerous tributaries of the Ikpa River emerge from ravines of which the best known in those days was the Eka Street/UNIUYO Ravine. Today, that spectacular gully site has been stabilized and it stands as evidence of the success that can be achieved in gully erosion stabilization and restoration through a combination of civil works and biological measures.

Whenever it rains, water gushes out from the buried gutter, together with uncontrolled runoff from the numerous asphalted surfaces around the ravine, cascades into the ravine, causing enormous damage. Thus, the valley slopes are perpetually unstable due to the tractive force on exposed and unstable slopes.

Both free-flowing and channeled run-off from the paved urban roads, streets and other concrete surfaces within the catchment area of the Anua ravine have contributed immensely to the rapid expansion of the ravine both at the gully head, main ravine and sides.

3.3.8 Surface Water Hydrology

St. Luke's Hospital, Anua ravine is a dry valley and does not have any stream within its channel. However, within the catchment of Ikpa River, there are numerous tributaries and the Ikpa River itself. So, surface water hydrology involved water samples from Ikpa River and some of its tributaries, together with storm-water runoff. Thus, the study involved a detailed characterization of all the physical and chemical properties of these water sources which the people depend on such as rain water and borehole water. The methods of the physico-chemical analysis of the water samples are summarized and presented in Annex 6

3.3.9 Surface Water Quality Analysis

The water samples were collected from two sources, a stream outside the study area and storm runoff within the gully channel. The results of physic-chemical analysis of the surface

water samples from the two sources are presented in Table 3.12. It shows the values of each parameter, together with WHO recommended standards. The physicochemical parameters considered in the analyses include ordour, colour, pH, temperature, turbidity, dissolved oxygen (DO), electrical conductivity (EC), total suspended solids (TSS), total dissolved solids (TDS) and biological oxygen demand (BOD); among others.

Water samples from streams were tasteless and odourless, but the storm water or runoff that flows through Anua ravine was dirty and had foul odour. In general, stream water should be less turbid (compared with river or sea water). The turbidity values are 80.2 and 207.3 NTU for stream and storm water respectively. Turbidity in the area may be caused by the washing of unconsolidated topsoil into the storm water, surface runoff from the built-up area and solid waste dumped around the ravine. Therefore, stream water in the area should be treated with lime before consumption.

Table 3.12: Physico-Chemical Analysis of Surface Water Samples

Parameter	Storm water	Stream water	WHO Std	FMEnv Limit
P^H Colour Odour	9.7 Dirty Foul Odour	6.81 Clear Odourless	6.5-8.5 Clear Odourless	6.5 – 8.5 Clear Odourless
Temperature(^{O}c)	26.5	25.1	27-28	-
pH	4.38	5.9	6.5-8.5	6.5-8.5
Turbidity(NTU)	207.3	80.2	5.0	-
Conductivity (µS/cm)	35.7	32.8	250	-
TDS (mg/l)	200	40	500	-
TSS (mg/l)	21.4	0.14	13	30
DO (mg/l)	7.8	5.0	1.0-5.0	-
BOD_1	3.13	0.91	-	-
Nitrate (mg/l)	2.31	1.01	10.0	20
Nitrite (mg/l)	0.003	0.001	<1.0	-
Ammonia (mg/l)	0.011	0.001	-	-
Sulphate (mg/l)	124.1	21.0	42-45	250
Phosphate (mg/l)	0.09	0.17	3.50	<5
Calcium (mg/l)	5.86	1.66	50-150	-
Potassium (mg/l)	1.01	0.23	150	-

Magnesium (mg/l)	2.35	0.11	75	-
Sodium (mg/l)	5.72	2.12	200	-
Oil and grease (mg/l)	ND	ND	ND	10
Zinc (mg/l)	6.03	0.02	-	0.1
Total iron (mg/l)	5.29	0.21	0.36	20
Chromium (mg/l)	0.01	<0.01	0.01	<1.0
Manganese(mg/l)	0.24	Trace	-	200
Cobolt (mg/l)	0.78	Trace	-	-
Copper (mg/l)	1.53	<0.01	1.50	3.0
Lead (mg/l)	0.03	<0.01	0.01	<1.0
Nickel (mg/l)	0.391	<0.01	-	<1.0
THC (mg/l)	31.51	10.31	0.01	0.01

SOURCE: (Fieldwork, May, 2017)

As shown in Table 3.12, the overall assessment of the stream water quality indicates that the concentration of the trace metals were lower than FMEnv/WHO limits. The physico-chemical analyses of the stream water sample from Ikpa river tributary indicate a moderately low water quality for human consumption. Storm water is generally characterized by pH in the range outside FMEnv/WHO permissible limits. The stream water is slightly turbid with total suspended particulate matter within WHO permissible limit. Dissolved Oxygen (DO) in stream water samples was low with a value of 5.0 mg/l, while the corresponding value for storm water was 7.8 mg/l. The value of TSS in the storm water was reasonably high (21.4 mg/l) and this could be explained in terms of the high organic matter load in storm water. THC level was similarly high (31.51 mg/l) in the storm water, signifying low hydrocarbon supply.

The concentration of cations and anions are also low, and are within recommended FMEnv/WHO limits. The tributary of Ikpa River, where the sample was collected, can be said to be a source of fresh water, with the dominant ions being Na, Mg, and K. The concentrations of trace metals (Cu, Cr, Zn, Pb, Ni, etc) were low throughout the study period and classify the stream water as mildly polluted.

3.3.10 Ground Water Quality Analysis

Three boreholes from the study area were selected for ground water quality analysis. The physico-chemical characteristics of the ground water samples and their heavy metal concentration are presented in Table 3.13. The mean temperature of the borehole water samples was 25.9^0c. This value is within the WHO and FMENV range of 25.0^0c – 35.0^0c. A

mean pH of 6.2 was recorded and this falls below the WHO, FMENV range of 6.50 – 8.50. The Electrical Conductivity (EC) of the borehole water had a mean value of 102 µscm^{-1}. These are however below that stipulated by WHO- 4000µscm^{-1}. Generally, borehole water is considered to be less polluted because of the nature of their occurrence, deep down in the rock aquifer. From Laboratory analysis, the results indicated the pH values of the three boreholes sampled were within FMEnv limits. Turbidity levels of the three boreholes were also very low and within FMEnv/WHO limits. In comparison to surface streams, borehole water is more potable in terms of turbidity levels. Dissolved Oxygen (DO) values had moderate values that were below the FMEnv/WHO limits. Ammonia, Sulpur Dioxide, Nitrous Oxide, Potassium, Sodium and Calcium all had low values that were below FMEnv limits. Mean value for oil and grease was 0.013 and THC was 0.023. TDS had a mean value of 22.3. Based on these low levels of chemical concentrations, borehole waters can be said to be less polluted and good for drinking.

All the metals analyzed in the ground water samples exhibited low concentration compared with those of the corresponding surface water and the WHO standards. It can therefore be said that the metal concentrations in the ground water do not pose any serious threat to water quality in the area.

Table 3.13: Physico-chemical and Heavy metals Concentrations in Borehole Water

Parameter	SBH1	SBH2	SBH3	Mean	FMEnv Limit
pH	6.1	6.2	6.3	6.2	6.5 – 8.5
Temp (^oC)	26.1	26.2	25.3	25.9	35^0C
Turbidity (NTU)	0.03	0.04	0.002	0.003	10.0
TDS (mg/l)	22.1	22.7	22.2	22.3	500
TSS (mg/l)	0.024	0.024	0.022	0.023	30
DO (mg/l)	0.34	0.36	0.41	0.37	>7.5
Na (mg	0.83	0.84	0.92	0.86	
BOD (mg/l)	0.71	0.72	0.70	0.71	1.0
K (mg/l)	1.01	0.98	1.01	1.0	
Ca (mg/l)	6.22	6.32	5.93	6.16	
Mg (mg/l)	4.35	4.37	4.28	4.33	
Cl (mg/l)	2.30	2.20	2.30	2.27	250
Sulphate (mg/l)	0.05	002	0.02	0.03	250
Nitrate (mg/l),	<0.001	0.002	0.001	0.001	20
EC (µscm^{-1})	102	104	100	102	NS
Oil and grease (mg/l)	<0.001	0.01	0.03	0.013	10
Ag (mg/l)	0.001	0.001	<0.001	<0.001	<1.0
Cd (mg/l)	0.001	0.001	0.001	0.001	0.01

Cr (mg/l)	0.031	0.027	0.031	0.03	0.01
Pb (mg/l)	0.001	0.001	0.001	0.001	0.1
V (mg/l)	0.01	0.01	0.001	0.001	-
Cu (mg/l)	0.22	0.23	0.21	0.22	3.0
Zn (mg/l)	0.021	0.020	0.022	0.021	0.1
Mn (mg/l)	0.001	0.001	0.001	0.001	200
Fe (mg/l)	0.23	0.23	0.26	0.24	0.3
Ni (mg/l)	0.001	0.001	0.001	0.001	<1.0
THC (mg/l)	ND	ND	ND	ND	-

Source: Fieldwork, May 2017

3.3.11 Soil Studies

Soil is largely a product of the type and nature of bedrock (i.e. the geology), together with the vegetation, climate and topographic expressions of the landscape. It is composed of small particles, which are products of weathering of massive rocks of different mineralogy. Soil consists of four major components, air (25%), water (25%), organic matter (5%) and mineral (45%). Soil particles vary in size, shape and composition. However, three categories of soil particles have been established and they are sand, silt and clay. Table 3.14 shows the soil separates and the textural class.

Table 3.14: Soil Separates and Textural Class

Textural class	Sand (%)	Silt (%)	Clay (%)
Loam	39	37	24
Loamy sand	82	10	8
Silty clay loam	13	52	35

A total of ten (10) soil samples were collected from the topsoil and subsoil within the study area. The coordinates of the sample points are presented in Table A5.4 (Annex 5). Sample collection at each location was done using the graduate Dutch-type tubular auger (Netherlands model), and conical soil – sampling trowel. Other soil properties such as depth, structure, nature of layer boundaries, and presence of mottles or buried organic matter deposits were assessed manually and by visual observations. The soil samples were taken at two essential depths of 0-15cm for surface soil, and 15-30cm for subsurface soil. The soils were analyzed in FMEnv approved laboratories in Uyo. Adequate care was taken to ensure quality control and quality assurance in the collection, storage, transmission and analyses of

field samples. The result of the physico-chemical analysis of the soils in the project area is presented in Table 3.15.

3.3.11.1 Physico-Chemical Characteristics of the Soils

In order to identify the physical and chemical components of a soil so as to establish a baseline, soils occupying any particular landscape must be properly analyzed. The soil properties analyzed in the present study included: colour, texture, aggregate stability, pore spaces, bulk density and soil water content. The loosely-packed, friable and unconsolidated soils of the Coastal Plain Sands are usually highly deficient in minerals that are amenable to deep chemical weathering of the humid tropics.

Table 3.15: Physical Characteristics of Soils within St. Luke's Anua gully eosion Area

Parameter	Surface Soil		Subsurface Soil		Maximum Limit
	Range	Mean	Range	Mean	
Sand (%)	61.4 – 70.4	66.4	54.3 – 74.9	63.2	NL
Silt (%)	20.0 – 24.6	21.1	11.1 – 19.0	19.4	NL
Clay (%)	11.5 – 14.1	12.5	7.2 – 18.2	17.4	NL
Texture	s, ls, sl		s, ls, sl		NL
Bulk density (MgM^{-3})	0.93 – 1.26	1.14	1.0 – 1.21	1.0	<1.40 – 1.60^{++++}
Pore spaces (%)	50 – 60	55	-	-	NL
Aggregate stability (mm)	4.11 – 5.98	5.72	-	-	NL

Key: + = Miller & Donahue, 1995; s = sand; sl = sandy loam; ls = loamy sand; scl = sandy clay loam (Fieldwork, 2007)

3.3.11.1.1 The Surface Soil

Organic matter (humus), manganese and iron are the primary colouring agents in soil. Red soils contain oxidized iron; yellow soils contain hydrated iron; and gray soils indicate chemical reduction of iron, and/or manganese due to wetness and lack of oxygen. The dark soil colour from organic matter at the soil surface helps in the absorption of heat from sunlight to warm the soil. The colour of the topsoil in the study area is generally dark,

grayish-brown, which corresponds to 10YR/3/2 in the Munsell colour chart. The dark colour could be due to long periods of application of compost and household waste as manure on farmlands. The soils are deep and are mainly sandy clay on topsoil and sandy clay loam on subsoil (Tables 3.15 & 3.16). The results of the soil analysis show that the surface soils of the area contain high proportion of coarse sand (mean value 66.4%), a sizable proportion of silt fraction (mean value 21.2 %) and low clay content (mean value 12.5%). The mean value for bulk density of 1.14 g/cm^3 for topsoil.

Pore space refers to the volume of soil voids that can be filled by water and/or air. It is inversely related to bulk density, and is calculated as a percentage of the soil volume:

$$\frac{\text{Bulk density}}{\text{Particle density}} X\ 100 = \%\ Solid\ State$$

100% - % solid space = Percent Pore Space

Compaction decreases porosity or pore space as bulk density increases. In the study area, porosity of the soils ranged from 50 to 60, and the mean percentage porosity was found to be 55 percent.

Soil structure refers to the arrangement of soil separates into units called aggregates. Aggregates are separated by planes of weakness and are dominated by clay particles. Aggregates are important in a soil because they influence bulk density and pore size. Tillage, falling raindrops and compaction are implicated in the destruction of aggregates. The structural aggregate stability of soils refers to the resistance of soil aggregates to manipulation. Thus, the aggregate stability of soils exert tremendous influence on soil erosion, infiltration, retention and movement of water, as well as, the proliferation of roots in the soils (Udoh, 2010). In Anua ravine area, the aggregate stability of soils ranged from 4.16 to 5.98 mm, with a mean of 5.72 (Table 3.16), with the implication that aggregate stability is low and the soils are easily eroded. The data for both surface and subsurface analyses are presented in Table 3.16.

3.3.11.1.2 The Subsurface Soil

As noted above, the corresponding physical characteristics of the subsurface soils are also shown in Table 3.16. From the values in the table, it is evident that the subsurface soils have higher clay fractions, while the silt and sand fractions are lower. The mean values for the texture of sub surface soils are: sand (63.2%), silt (19.4%) and clay (17.4%). This result is

expected due to the fact that soil erosion on farmlands involves the progressive removal of clay and silt and in-washing of clay as a result of illuviation process. In all the samples, the clay content was low (in comparison with other particles) and were kaolinitic (with low water and nutrient holding capacities). They are therefore susceptible to erosion once the vegetal cover is removed. The high percentage of sand fraction in this study area suggests that the soils may likely disintegrate on quick wetting. Usually, coarse textured soils with low activity clay and low organic matter content especially in the surface horizons are generally unstable to raindrop impact and slake on quick wetting (Brady, 1996).

Soil weight is oftentimes expressed on a soil volume basis rather than use a particle size. Bulk density is thus defined as the dry weight of a soil per unit volume of soil. In the study area, bulk density values are highly variable and the range is from 1.0 to 1.21gcm^{-3} for subsurface soil, with a mean value of 1.0 g/cm^3. Coarse textured soils generally have higher bulk density values than fine textured soils because, in the absence of cementing agents, soil particles tend to coagulate, thus reducing the soil volume. Tillage can increase bulk density if it breaks down aggregates and allows soil separates to pack more tightly. Adding organic material decreases the bulk density because organic material has lower bulk density (Babalola, et al., 2007). Bulk density value is 1.0g/cm^3 for sub-surface soil.

3.3.11.2 Soil Chemistry

The chemical reactions control the adsorption and release of plant nutrients and many other chemicals in the environment. Clay particles are the active portion of a soil, because chemical reactions occur at their surface. The results of the chemical analyses of the soils of the study area are presented in Table 3.16.

The pH values show mild acidity, which may be partly due to acid rain which is prevalent in the area, on account of gas flaring in the coastal areas and urban air pollution. Thus, the soil of the study area is moderately acid (pH range 5.1 – 5.8), with a mean value of 5.2. Electrical conductivity values range from 51.01 – 58.21 dSm^{-1}, and has a mean value 54.62 dSm^{-1}. The concentrations of Ca, Mg, Na, and K recorded in the soils of the study area were within the natural occurrence levels for tropical soils of the coastal plains origin. The results further show a relatively high concentration of total organic carbon, exchangeable carbon, organic matter content, and essential nutrients.

Table 3.16: Chemical Characteristics of Soils within St. Luke's Hospital gully erosion site

Parameters	Mean	Range
pH	5.2	5.1-5.8
Ammonia (g/kg)	0.010	0.005-0.041
Sulphate (g/kg)	45.0	36.1-71.2
Phosphate (g/kg)	11.13	6.81- 21.3
Total organic compound (g/kg)	31.2	28.5-36.9
Oil and grease (g/lg)	0.02	<0.01-0.6
EC (dSm^{-1})	54.62	51.01 – 58.21
Nitrate (mg/kg)	18.24	12.08 – 30.20
Organic matter content (%)	2.34	2.20-4.20
AV.P	49.9	6.94 – 102.52
Ca (g/kg)	17.9	15.60 - 22.15
Mg (g/kg)	14.97	13.12 -17.2
Na (g/kg)	90.6	51.03 – 100.9
K (g/kg)	45.8	38.06 – 65.20
ECEC	2.34	1.11 – 3.87
BS [%]	52.2	34.5 – 66.2
Cobolt (g/kg)	0.45	0.11 – 0.71
Zinc (g/kg)	13.2	11.73 – 21.7
Total iron (g/kg)	21.79	7.64 – 30.5
Lead (g/kg)	1.67	1.28 – 2.26
Chromium (g/kg)	18.44	11.2 – 26.3
Cadmium (g/kg)	2.35	1.71 – 4.36
Copper (g/kg)	8.87	2.1 – 12.5
Nickel (g/kg)	1.44	1.06 – 2.49
THC (ppmC)	<0.001	<0.001 – 0.001
Vanadium (g/kg)	0.0015	0.001 – 0.002

Source: Fieldwork, 2017

Among the anions, Sulphate was the most visible in terms of its concentration in the soils of Anua ravine. Nitrate and Phosphate recorded the least concentrations. The mean concentrations of Sulphate, Nitrate and Phosphorus in the soils of the study area were 45, 18.24 and 11.13 g/kg respectively.

3.3.11.2.1 Heavy Metals

Generally, the concentrations of the heavy metals in the soil were low and within normal range reported for such soils. Iron (Fe), Zinc (Zn), Chromium (Cr), Lead (Pb), Cadmium (CD), Nikel (Ni), Vanadium (V), Copper (Cu) and Manganese (Mn) were all found to be generally low in concentrations and do not pose any threat to the environment of the project area.

3.3.11.3 Soil Microbiology

Soil Microbiology refers to the study of microscopic organisms, such as bacteria, viruses, archaea, fungi and protozoa in the soil. Typically, organic material in the soil is derived from the decomposition of plant, animal and microbial matter, which creates richer nutrient in the soil. Soil micro-organisms are important in cycling the biologically important elements such as Nitrogen, Carbon, Sulphur and Phosphorus. Within the soil profile, heterotrophs are richer in the surface soils than the sub-surface. This is explained by higher amount of nutrient, especially organic carbon, Nitrogen, Sulphur and Phosphorus in the top soil. Soil bacteria are also involved in controlling the availability of some key metals such as iron and manganese that are necessary trace elements for living cells. They are also involved in the degradation and the detoxification of complex and toxic organic compounds in the soil, such as pesticides, herbicides and petroleum hydrocarbon. However some soil microbial flora are pathogenic to man and animals, for instance *Clostridium tetani*, an obligate soil anaerobe is responsible for tetanus disease in man.

Many types of fungi can be found in soil but the specific genera will vary with the type of soil and with its physical and chemical properties. Some soil fungi are free living, while others live in symbiotic relationship with plant roots. Species of the following genera such as *Candida, Aspergillus, Penicillum, Rhizopus,* and *Mucoor* are common in soil. Some of these fungi are good hydrocarbon utilizers and are capable of degrading and metabolizing complex and toxic organic compounds in the soil such as Cellulose, Legnin, Herbicides and Pesticides.

The primary environmental conditions that affect the density and composition of the bacterial and fungal flora of the soil include moisture, temperature, acidity, organic matter and inorganic nutrient supply. Moisture and availability of oxygen are intimately interrelated. Wet soils are unfavorable for most bacteria because the pore spaces in the soil are filled up with water, thus diminishing the amount of air in the soil. The major effect of wetness is to

reduce oxygen in the soil which will subsequently reduce the soil aerobic microflora. Continued water logging of the soil changes the flora from one consisting primarily of aerobes to one consisting mostly of anaerobic species.

Highly acidic or alkaline conditions generally inhibit the growth of common bacteria. However, many species of fungi can multiply over broad pH ranges from alkaline to acidic. Therefore, since most bacteria do not multiply in highly acidic environment, the fungi will dominate the soil population in areas of low pH. Temperature influences the rate of biochemical processes through its effect on the rates of enzyme reactions. The bulk of soil bacteria in the study area are mesophiles (bacteria that grow best at temperatures from 20-50^{0}C). True psychrophiles (bacteria that grow below 20^{0}C) are rare or absent in the study area. Generally, soil is a natural habitat for the proliferation of various kinds of micro-organisms.

3.3.11.4 Soil Infiltration Rates

Soil acts as a sponge, by taking up water and retaining it. Movement of water into soil is called **infiltration**, while the downward movement of water within the soil is called **percolation, permeability or hydraulic conductivity.** Pore spaces in soil is the conduit that allows water to infiltrate or percolate. Low infiltration rates lead to ponding on nearly flat terrains, and runoff on sloping surfaces. Table 3.17 shows a classification of infiltration or permeability rates.

Infiltration rate of a soil is useful both in terms of the physical processes operating within the drainage basin and as a quantitative index for the description of soil characteristics. Measurement of infiltration rates are usually expressed as depths of water entry into the soil during a given time (cm/hr), and a special derivative is the term infiltration capacity defined as the maximum rate at which rainfall can be absorbed by a soil in a given condition (Udosen, 2008).

Table 3.17: Infiltration/Permeability Classification

Infiltration/Permeability Class	Infiltration Rates (inches/hour)
Very rapid	>10
Rapid	5 – 10
Moderately rapid	2.5 – 5

Moderate	0.8 – 2.5
Moderately slow	0.2 – 0.8
Slow	0.05 – 0.2
Very slow	<0.05

In this baseline study, double ring infiltro-meter was used in determining the infiltration rates in the study area. The maintenance of a high level of soil organic matter is crucial for erosion studies because organic matter is not only important in increasing the nutrient status of the soils but it also binds the loose sand particles together, a useful mechanism in checking soil erosion.

Soil structure is the most vulnerable physical property of the soil to deteriorate when vegetation cover is destroyed. The soil structure at the study area is mainly fine granular to medium granular. Structurally, unstable soils are readily slaked and tend to form a semi-permeable surface crust, which leads to concentration of runoff on slopes. In this study, soils of the Coastal Plains Sands are found to be susceptible to dispersion by raindrop impact and to crust formation. The mean final infiltration rates (using a single ring infiltrometer) of the bare and crusted surface, sparsely vegetated and forested/grass covered surfaces are 6.8 mmhr $^{-1}$, 35.9 mmhr $^{-1}$ and 122.8 mmhr $^{-1}$ respectively [Udosen,2008, Udoh, 2010].

3.3.11.5 Soil Erodibility

Soil erodibility is a function of soil structure, soil texture, organic constituents, mineralogic and chemical characteristics (Jackson, 1962). In this study, the clay content for topsoil ranged from 11.5- 14.1% (mean = 12.5%). For meaningful interpretation of clay ratio, a minimum of 10% clay is required (Brady, 1996). The mean sand/silt/clay ratio for topsoil and subsoil was approximately 7:2:1, and for the sub-surface soil, the ratio was approximately 6:2:2.

The result of a pilot survey carried out at the study area shows that the K-factor for eroded soils in area ranges from 0.20 to 0.36 with a mean value of 0.22 and coefficient of variation of 24.2%. The narrow range of variation of the K-factor for eroded soils is due to the low organic matter content, low infiltration rate and weak soil structure, which limit soil resistance to erosive agents. The values of K-factor for eroded soils recorded compares favourably with those reported by Niger Techno (1979) for the deep porous 'red soils' (0.25), but are by far lower than those of the reddish brown and brown soils, which they put at 0.41 and 0.43 respectively in different parts of eastern Nigeria. The K-factor for un-eroded soils

(under thick vegetation cover) ranges from 0.02 to 0.18 (mean value = 0.06). These seemingly structural stability derives from the loosely-packed sandstone formation of recent geologic age, which has undergone intense chemical alterations and leaching, even under dense vegetation cover. The topsoil is thoroughly leached by infiltrating water, giving rise to non-cohesive earth materials. The unconfined compression test confirms that soils formed on the Coastal Plains Sands are loose and incoherent even beneath compacted surfaces and values for compacted surfaces range from 0.87Nmm^{-2} to 6.97Nmm^{-2}, with an average of 3.49Nmm^{-2}. On the other hand, impact stress of intense tropical rains are as high as 10Nmm^{-2}. This impact stress is far in excess of the strength of the soils. This probably accounts for the breakdown of soil aggregates during tropical rainstorm. Soil penetrometer readings range from 2.40 x 10^2 Kpa to 25.62 x 10^2 Kpa for eroded soils in the study area. The critical shear strength of the soil averaged 12.76 x 10^2 Kpa (Udosen, 2008).

3.3.12 Vegetation

The vegetation of the study area falls within the tropical lowland rainforest, although human activities, in the form of urbanization, farming, lumbering, firewood harvesting, bush burning, etc, have affected both the vegetation structure and species abundance. Today, the vegetation of the study area can best be described as mosaic of derived bushes and farmland. In terms of ecology, St. Luke's Hospital, Anua gully site exhibits low species composition largely due to the influence of human activities. There is high population density and intensive built-up area in the gully head area, (Plate 3.1), resulting in serious human disturbance of the ecosystem in terms of buildings, asphalted surfaces, unpaved and paved roads, bush paths, farmlands, numerous residential houses, business establishments, churches, schools and the St. Luke's Hospital itself.

3.3.12.1 Field methods

The survey method employed during the vegetation study was the stratified random transect sampling. In this method, areas of uniform vegetation and landform were selected and transects of variable lengths and breadths laid subjectively on them, as a consequence of the topographic expressions of the landscape. In each of the transects, plant species were identified and recorded along 10m x 10m quadrats. Besides species identification, information were also collected on habitat type, vegetation structure and species abundance. Unidentified plants were collected for mounting and identification in the University of Calabar herbarium. Physical observation of plants for signs of health defect was also carried

out. Suspected diseased plants were collected in polyethylene bags and taken to the laboratory for examination and analysis.

3.3.12.2 Species Abundance

A little over one hundred plant species were recorded in the Anua Ravine Area. The species belong to 38 families and 82 genera. Common species frequently encountered during the survey were: *Aspiliaafricana, Cyperus sp. Colocasiaesculentus, Clitoriaternatea and Paspalum sp.* The families with high number of species include: *Poacea* (14) *Fabacea* (12), *Cyparacea* (10), *Asteraceae* (7), *Commelinaceae* (6), *Malvaceae* (5), and *Amaranhaceae* (5). Over half of the families (20) were identified as single species. No endangered plant species was identified during the survey. Important food plants encountered during the survey were: Plantain, banana, mango, paw-paw, oranges, guava, pineapple, maize, pepper, okra, cassava, cocoyam, yam, waterleaf and pumpkin. Tree crops found in the area include: oil palm tree, raffia palm tree, coconut, local apple tree, African pear tree, avocado pear tree and African oil bean. A comprehensive list of plants identified during the survey is presented in Table 3.18.

Table 3.18: List of Plant Species identified in the study area

Plant species trees / shrubs	Common Name	Abundance	Uses
Bambusa Vulgaris	Bamboo	Abundant	Staking of yams, Fencing
Musanga Cecropoides	Umbrella tree	Abundant	Roof rafters
Elaeis guineensis	Oil palm	Abundant	Source of palm oil and kernel
Mangifera India	Mango	Rare	Produce edible mango fruit
Dracaena arborea	Dragon tree	Common	Boundary Marking
Albizia Zygia	Albizia	‘’	
Citrus Sp	Orange	Common	Produces sweet edible orange fruit
Alstonia boonei	Stool wood	‘’	Material for wood – carving
Raphia hookeri	Palm wine tree	rare	Source of palm wine &

			thatch material
Dacryodes edulis	African pear	Common	Produces edible pear
Tecuna grandis	Teak	Rare	Durable timber of maturity
Anthocleistaa vogelii	Cabbage tree	''	Leaf used for tying
Manniophyton folrum	Gassonut	''	Root and bark are medicinal
Fiscus exasperata	Sand paper tree	''	Goat fooder and cure for belly ache
Alchornea cordifolia	Christmas bush	''	Leaf produces tannin
Cocus nucifera	Coconut tree	''	Produces edible coconut
Gmelina arborea	Gmelina	Common	Fuel wood and in paper production
Hevea brasiliensis	Rubber	Rare	Produces latex for industrial use
Canaga odorata	Queen of the night	Rare	Air Freshener
Manihot esculentus	Cassava	Abundant	
Cleistopholis patens		''	
Chrysophyllum albidum	Star apple	Common	
Ganaga odorata			
Loncho carpus cyanescens	African indigo		
Allophylus africanum			
Saccharum officinarum	Sugar cane	Common	Stem is sweet and edible
Musa para disiaca	Plantain	Abundant	Food item
Carica papaya	Paw Paw	Common	-do-
Colocasia sp	Cocoyam	Common	-do-
Herbs / Weeds			
Nephrolepis biserrata	Sword fern		
Kyllinga erecta	Sedge		
Costus afer	Bush cane	Common	Extract used for treating insect bites
Aspillia Africana	Wild sunflower		Treatment of cough
Sida acuta	Broom weed		
Ageratum conyzoides	Goat weed		
Pteridium aquilinum	Bracken fern		
Saggitifolius			Soil cover
Sellaginella myosurus	Slender club moss		Used to form lead-carrying pad
Dissotis sp	Chickweed		
Smilax anceps	West African Sassapilla		Thorny creeper

Lycopodium cernuum			
Eleusine indica	Bull grass		
Sporobolus pyramidalis	Cat's tail		
Panicum maximum	Guinea grass		
Ipomoea involucrata	Morning glory		Extract used for treating jaundice
Mariscus sp			
Desmodium sp	Mat's weed		
Triumfetta cordifolia	Chinese burweed		Rope weaving
Chloromolaena odorota	Awolowo or siam weed	Abundant	Medicinal
Cyperus			
Palisota hiersuta	Goat's knee		Goat's fodder
Eurphorbia hirta	Asthma plant		
Digitaria horizontalis			
Emilia practessima			
Cnestis practessima			
Talinum triangulare	Water Leaf		Fodder, edible vegetable

SOURCE : Fieldwork, May 2017

3.3.12.3 Wildlife

In spite of the massive urban activities at the gully head of St. Luke's Hospital gully erosion site, wildlife was observed to exist and flourish in the ravine environment.

Standard line track technique was employed in the wildlife survey. This was complemented by participatory rural appraisal interviews, together with intensive search for tracks, droppings and calls of different animals.

The identified wildlife resources range from reptiles, birds and small mammals (mostly rodents). Birds were the most conspicuous form of vertebrate within the area alongside other purely terrestrial wildlife species such as *Thryonomys swiderianus* (grass cutter), *Antherurus africanus* (Brush-tailed porcupine), *Cricetomys gamianus* (giant rat), *Protoxerus strangeri* (Squirrels). Most of the aves (birds) sighted belong to the family *Falconidae,* which includes hawks and Kites. Reptiles present in the area included *Agama agama* (red neck Lizards), *Mabuya affinis* (Lizards). Others include *Bitis gabonica, Python sabae, Dendropsis jamesonii* (Snakes). Diverse forms insects were also observed in the vegetation area. Antelopes and

Pangolins were mentioned as being present by a key informant, who is a hunter. The summary of wildlife species available in the study area is presented in Table 3.19.

Table 3.19: List of wildlife species available in the study area

S/N	Common name	Zoological name	Habitat	Mode of identification	Remarks/ Conservation Status
1	Grass cutter	*Thryononys swinderianus*	Forest ground & farm land	DS, KII	Abundant
2	Porcupine	*Erethizon dorsatum*	Forest ground	KII, FP	Rare
2	African palm squirrel	*Expixerus epii*	Forest ground & arboreal	DS, HB	Highly abundant
3	Ground squirrel	*Xerus sp.*	Forest ground & arboreal	DS, HB	Highly abundant
4	Giant rat	*Cricetomys gambianus*	Forest soil and ground	DS, HB	Abundant
5	Common rat	*Raltus rattus*	Forest ground and farmland	DS, HB,KII,FS	Highly abundant
6	Large land snail	*Archatina marginatus*	Forest ground	DS	Highly abundant
7	Antelope	*Disambiguation*	Forest ground	KII	Rare
8	Python	*Python sebae*	Forest ground	HB, QE	Less abundant
9	Viper	*Bittis ganaoneica*	Forest ground and soil	HB, QE	Less abundant
10	Lizard	*Agama agama*	Forest ground and	DS, QE	Highly

			farmlands		abundant
11	Common African Toad	*Bufo regularis*	Forest ground	DS	Abundant
12	Millipedes	*Sprostraptus lassiniensis*	Forest ground	DS, QE	Abundant
13	Praying mantis	*Polyspilota aeruginosa*	Farmlands	QE	Less abundant
14	The earthworm	*Hypercodrilus africanus*	Forest soil	DS, HB,QE	Highly abundant
15	Small land snails	*Archachitina sp.*	Forest ground	DS,QE	Abundant

Key to identification

DS	=	Direct sighting	HS	=	Habitat Site
FP	=	Foot Prints	KII	=	Key Informant's Information (Hunter)
FS	=	Feeding Site	NFS	=	Nature of Faecal Sample
C/S	=	Call/Song	SM	=	Smell

CHAPTER FOUR

4 SOCIO−ECONOMIC CHARACTERISTICS OF THE STUDY AREA

This section focuses on the socio−economic characteristics of the communities surrounding the St. Luke's Hospital gully erosion site. The study identifies and analyses several socio−economic features and variables that may be adversely affected by the proposed NEWMAP gully erosion intervention project. To achieve the socio-economic component of the ESMP, primary data were generated and gotten during field studies in the communities in the month of May, 2017. Published and unpublished records of government Ministries, Departments and Agencies, together with census publications, were the sources of secondary data. The socio−economic survey adopted a combination of several data collection techniques to achieve the objectives the study.

Table 4.1: Questionnaire administration and public consultation

Categories of Stakeholders sampled	questionnaire Administered	Questionnaire Returned	FGD	KII	Community meeting
Key stakeholders	20	20		3	2
Other members of the community	180	155	3		
Total	200	175	3	3	2

Source: Field Survey, 2017.

4.1 Age of respondents

Most of the respondents (34.7%) are found in the age brackets of 36−45years and this is by far larger than other single age bracket apart from 26−35 and 46−55 age brackets (Fig 4.1). The combined age brackets of 26−35, 36−45 and 46−55 constitute a very significant proportion of respondents about 81.7%. Anua community thus has very virile active population.

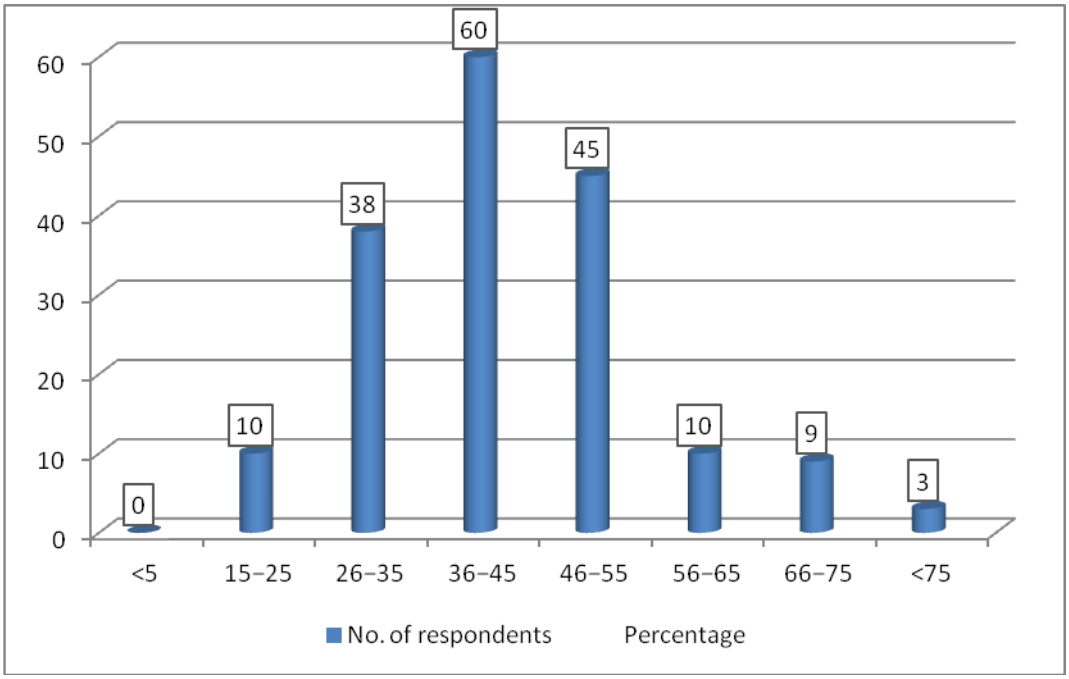


Figure 4.1: Age of respondent

Source: Field Survey, 2017.

4.2 Gender of respondents

Figure 4.2 represents the gender components of respondents. Majority of the respondents are males with a population share of 57.14% over females 42.86%.

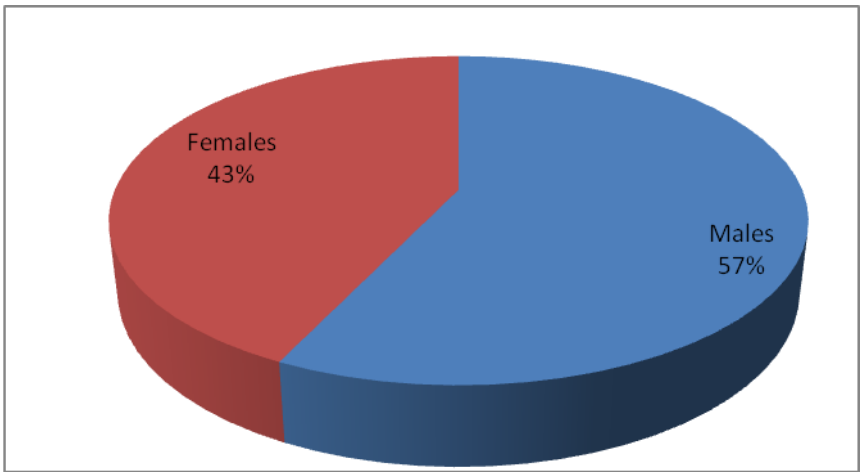


Figure 4.2: Percentage distribution of respondents by gender

Source: Field Survey, 2017.

4.3 Educational attainment

Table 4.2 contains statistics on the education status of respondents. It shows that only 2.86% of the respondents lack formal education and only 8% of the respondents have attended

primary school (through with 5.7% completing primary education with certificates and 2.29% without certificate). This means that a significant number of, or virtually all, the respondents have had formal education with certificates (40%). Over 38% of respondents have had tertiary education of different cadres (including holders of National Certificates of Education NCE; Ordinary Diploma OND; Higher National Diploma HND and Bachelors of Science Degree or equivalent). This is a highly educated community.

Table 4.2: Distribution of respondents by education

Status	No. of respondents	Percentage
No formal education	5	2.86
Primary education		
Certificated	10	5.71
Non−certificated	4	2.29
Secondary education		
Certificated	70	40.00
Non certificated	19	10.86
Tertiary education		
NCE/OND−equivalence	31	17.71
HND/B.Sc/BA	22	12.57
M.Sc/MA	14	8.00
PhD	0	0
Total	175	100

Source: Field Survey, 2017.

4.4 The ethnic composition

Anua, the study area, is in the heartland of Ibibio ethnic group of Nigeria. As indicated in Fig 4.3 Ibibio people are the majority of residents 84.0%, while other ethnic groups form the remaining 16%−Annang, 5.7%; Efik, 4.6; Yoruba, 1.2%; Igbo, 4.00; and Ijaw, 0.57%.

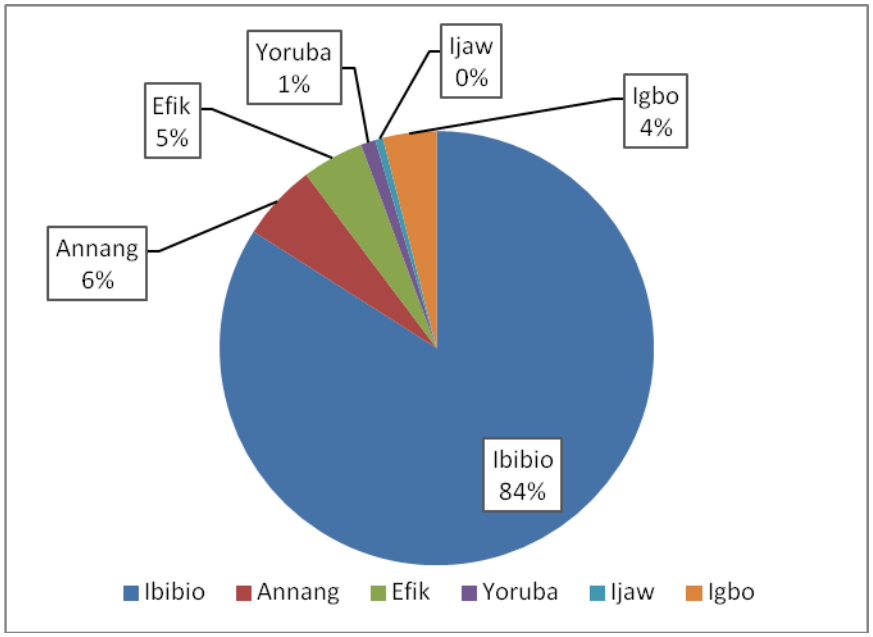


Figure 4.3: Percentage of respondent by ethnic groups

Source: Field Survey, 2017.

4.5 People, History, Culture, and Religion

The study area is within the jurisdiction of Uyo Capital Territory. The communities around the gully erosion site are part and parcel of indigenous ethnic group of Ibibio who migrated from the Cameroun through the Benue valley and established and settled in Ibibio village near Arochukwu. The struggle with their Igbo neighbour resulted in Ibibio War which led to their eventual migration to join with the Ibibio group who had earlier left Ibibio village and settled in the present day Ikono in Akwa Ibom State. Among other achievements and traditions Ibibio people founded some societies which were/are "Ekong" "Ekpo Nyoho" and "Ekpe" among the menfolk. These societies were used for the enforcement of laws and regulations in Ibibio-land. Among the womenfolk "Ebre" and "Iban Isong" societies were focused on the maintenance of decency and decorum in the society including the treatment of womanhood with dignity and respect by members of the communities. "Ngugho" (fattening) was established as a way or means of making the right of passage of girls to womanhood including also the grooming of girls for future home−building.

These observances and societies have virtually disappeared in many parts of Ibibio-land as Christianity has become a way of life for overwhelming majority of Ibibio people and modern government today with its many institutions has taken over the governance including the maintenance of law and order in the society. However, Ekpe, Ekpo Nyoho and Ekong,

masquerades and other traditional/ancestral ensembles are for ceremonial displays and parades during important events in the communities such as the coronations of high chiefs and paramount rules, reception of dignitaries and festivals like Easter, Christmas and New Year.

The people of the communities (Anua and Ikot Oku Idio) around the gully site "Akwa Abasi Ibom", the Supreme Being (the Almighty God). Christian religion is central and is deeply established and entrenched in Anua society. Traditional shrines are hard to come by in the study area. Like, in many other Ibibio communities, there are several churches of various denominations including the old established orthodox churches, and relatively recent Pentecostal, Evangelical and Revival churches. Christian religion observances are commonly observed and kept annually, Easter and Christmas being the most outstanding. Traditional weekly calendars based on periodic market days in Ibibio-land have been virtually replaced by Christendom's own. During the field survey all the respondents claim Christianity as their religion and there were no evidences or artifacts of other known religions in the study area.

4.5.1 Shrines

During one of the consultation meetings, a traditional worshiper from Ikot Oko Idio Offot suggested that the gully problem could be as a result of not appeasing the gods of their forefathers due to their ancient ways being over-taken by Christianity. This suggests that some of the people in the study area still have some belief in the efficacy of deities to afflict people and the land. Particularly, during one of the consultation, one of the elders Chief Effiong Ekpeyong Essien (said to be the Chief Priest of Anua) opined that *Eka Anua*, *Ukana Offot*, and *Afia Anua* which are the gods of the three streams (*Eteghedi*, *Idim Itiat* and *Idim Ndom*) of Anua community need to be relocated for the construction to proceed.

4.5.2 Taboos

There are no dietary taboos, but there are social taboos such as sleeping with another man's wife is totally forbidden and in the ancient times used to carry instant death penalty, without appeal. Homosexuality, stealing and sorcery are also seriously abhorred by the St. Luke's Hospital gully erosion site Community.

4.6 Traditional governance

Like any other traditional society, the people of Anua in particular and Uyo in general have a traditional (setting) framework for governance and discharging responsibilities, though this arrangement is highly modernized and structured by the government. The traditional governance framework takes hierarchical structural pattern as shown in Fig 4.4. At the rather broad based grassroots level of governance are the family heads, youth leaders, women leaders and CDC leaders and over them at next level are the village heads who are superintended over by the Clan Heads, who themselves are answerable to the Paramount Ruler. In other words, at the apex of the hierarchical structure of governance is the paramount. Ruler, who superintends, over all council meetings, whose membership include clan heads, village heads and other respected and distinguished traditional title holders including women.

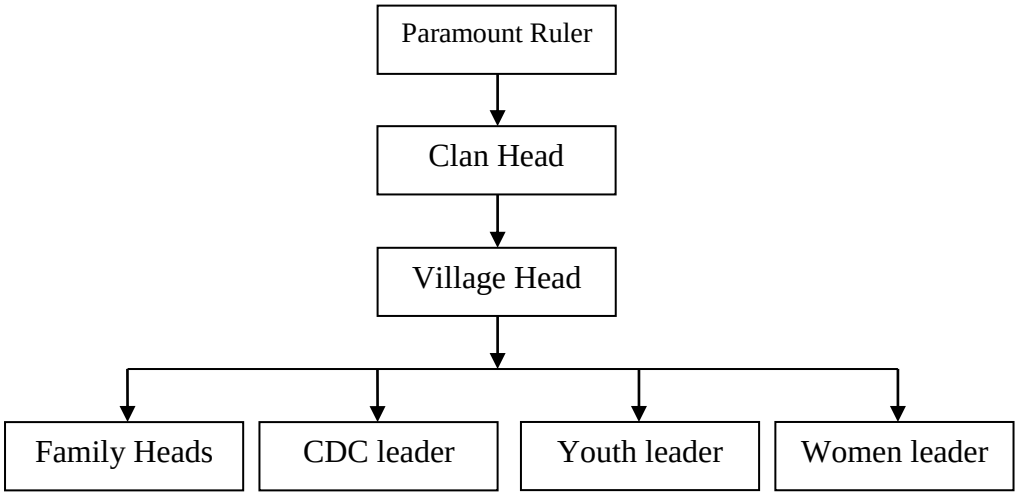


Figure 4.4: Hierarchical Structure of Traditional Institution in the study area
Source: Field Survey, 2017.

4.7 Residents' status: indigenes and migrants/tenants

The residents of the study are of different categories: the indigenes and migrants/tenants the indigenes are the majority of residents (57.14%) and the remaining people (45.1%) are migrants and/or tenants who occupy houses on rent and/or owning their residences in the study area (Table 4.3) these migrants and/or tenants are from other parts of Ibibio-land in the main and very few Igbo, Yoruba, Annang and Efik from other parts of Nigeria. The indigenes occupy their own houses and/or ancestral houses.

Table 4.3: Indigenes and migrants/tenants

Category	No. of respondents	Percentage
Indigenes	100	57.14
Migrants/tenants	75	42.86
Total	175	100.00

Source: Field Survey, 2017.

4.8 Distribution of respondents by duration of residency

A simple majority of residents of Anua community have spent at least 15 years living there. Table 4.4 shows that over 58% of respondents have lived in the study area for a period of not less than 16 years. They have stayed in the study area long enough to be aware of the pre−gully development and now at least to be able to articulate their perceived differences of the situation in terms of gully development process, the causes and the consequences that have adversely affected the socio−economic conditions of the study area. Yet almost 51% of this category of residents (16−20, 21−25, 26−30, 31−46 and 40+ age brackets) are indigenes who were born and bred in the study area of the total 75 migrants about 41% have lived in the study area for less than five years while the rest, about 59%, have lived for upward of 6−25 years. Generally speaking, the majority of both indigenes and tenants/migrants have live long enough to be well appreciative of the gully development and its attendant consequences on the socio−economic life of the people.

Table 4.4: Distribution of respondents by duration of residency

Years (period)	Indigenes	Migrants/tenants	Total	Percentage
<5	0	31	31	17.7
6−10	0	24	24	13.7
11−15	11	7	18	10.3
16−20	14	4	18	10.3
21−25	39	9	48	27.4
26−30	28	0	28	16.0
31−40	6	0	6	3.4
40+	2	0	2	1.1
Total	100	75	175	100.00

Source: Field Survey, 2017.

4.9 Occupation of respondents

Like many urban communities in Akwa Ibom State, a large majority of people are self−employed in the study area and smaller numbers work in private establishments and civil/public services. Table Fig 4.5 shows that over 60% of respondents are self−employed, followed by those working in private establishments, 16.0%; and in the civil/public service, 14.86%, and others house-help, nannies, and so on) 8.57 percent. The self−employed are mainly small (petty) retail traders (34.3%); a small number of very small−holding farmers (16.0) and the artisans producing such items as cane−related products and tricycle (Keke Napep) repairers (10.2%) (Table 4.5). A large majority of the traders and artisans are underemployed and are yet to realize their full potentials as part of active productive population of the society. Field group discussions revealed that the youths are yet to be fully mobilized for the working of the economy of the society, in spite of their qualifications and skill acquisition efforts. They lack sponsors and access to credit facilities for self−actualization, which could have helped them to become effectively engaged in productive ventures. Even the farmers within the community face many constraints such as lack of access to seeds and seedlings, fertilizers, land, technical knowledge of soil and weather, and so on.

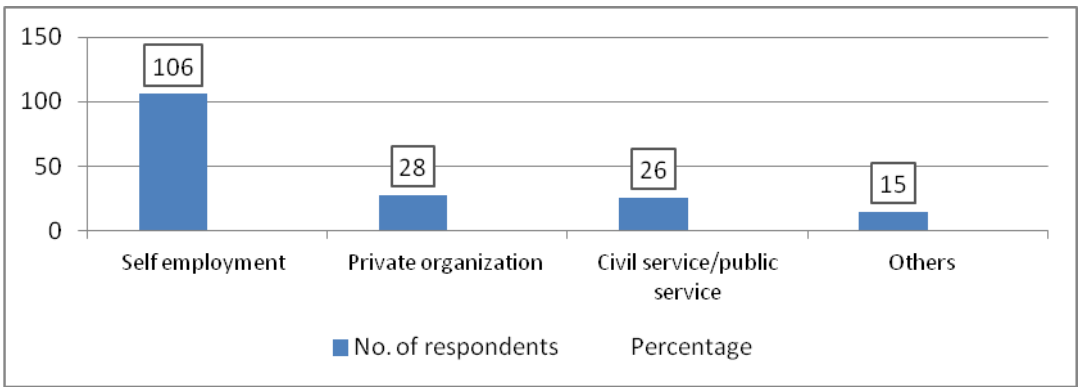


Figure 4.5: Distribution of occupation by major groups
Source: Field Survey, 2017.

Table 4.5: Occupation of respondents by category

Category	No. of respondents	Percentage
Public/civil service	26	14.9
Farming	28	16.0
Trading	60	34.3
Teaching	7	4.0
Technician	5	2.0
Artisan	18	10.2

Others	31	17.7
Total	175	100.00

Source: Field Survey, 2017.

4.10 Income distribution

Table 4.6 gives statistics on the monthly income distribution of respondents in the study area. The monthly income bracket of ₦61001- ₦70,000 has the highest concentration of respondents (34.3%). And only a very marginal proportion of the respondents (2.3%) are within the monthly income bracket of ≥₦70,000. In other words, vast majority of respondents, about 63.4%, earn below ₦60,000 as a monthly income and in this category over 40% of the respondents earn between ₦10,000 and ₦30,000. In all, majority of people in the community earn an average of ₦10,000 and ₦30,000. In all, majority of the people in the community earn an average of ₦1,000 a day, which is a little above two dollars ($2) a day, just above the poverty line especially in this period of economic recession in Nigeria. It tells about low living standards in the study area.

Table 4.6: Distribution of respondents by income

Income	Frequency	Percentage
≤ 10,000	7	4.0
10001−19000	17	9.7
19001−29000	21	12.00
29001−30,000	33	18.90
30,001−40000	13	7.40
40001−50,000	8	4.6
50,001−60,000	12	6.7
61001−70,000	60	34.3
≥ 70,000	4	23
Total	175	100.00

Source: Field Survey, 2017.

4.11 Modes of savings

There are several modes of savings in an economy. However, the most dominant mode of saving in the study area is the bank. Overwhelming majority (94.3%) of respondents do their savings in banks, while very marginal proportions of the respondents save in "Osusu" ("etibe") (1.7%) and cooperatives (1.1%) (Fig 4.6). About or almost 3.0% of the people do not make savings because of poor or lack of income. Group discussion on the issue shows a general apathy of people towards savings in financial house, other than banks. This

development is attributed to prevalence of low earnings and high costs of living which do not promote savings.

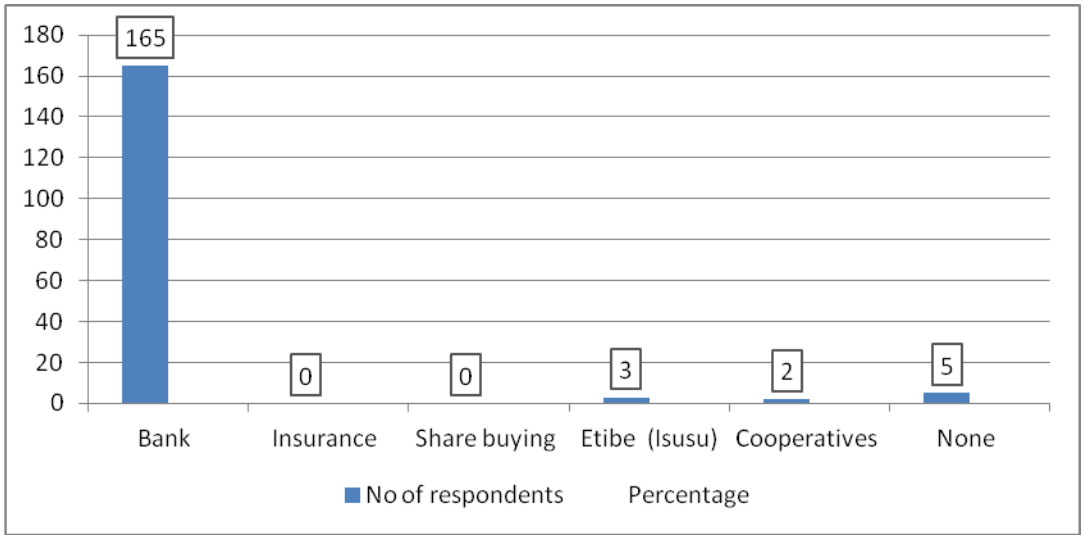


Figure 4.6: Modes of savings

Source: Field Survey, 2017.

4.12 Settlement pattern and housing

Anua community is part of Uyo capital territory administration. Like most parts of Uyo urban, the settlement is mostly nucleated while maintaining some degree of linearity as homes/buildings are built along major roads and streets. The nucleated pattern of settlement is a clear indication of urban land scarcity in the face of heightened population increase in the last 20−25 years. This development certainly coincided with the making of Uyo the capital of Akwa Ibom State in 1987−about three decades ago, a development that has brought about significant population growth, housing development and thus enhanced need/demand for urban space to accommodate increased socio−economic the activities in Uyo urban, including the study area. Houses in the study area are built of cement block walls and metal roofing sheets.

4.13 Marital Status

Most people in the study area are married. As shown in Fig 4.7 over 62% of respondents are married, while 33.1 percent remain as single, and 2.3% as widowed, 1.1% as widowers and another 1.1% as separated. There is no case of divorce. These statistics give a representative of stable society as far as marriage is concerned and remains pivotal to the continuity of human race. This may also give a clue to what the present and future size of the family/household and the growth pattern of the population will look like in the study area.

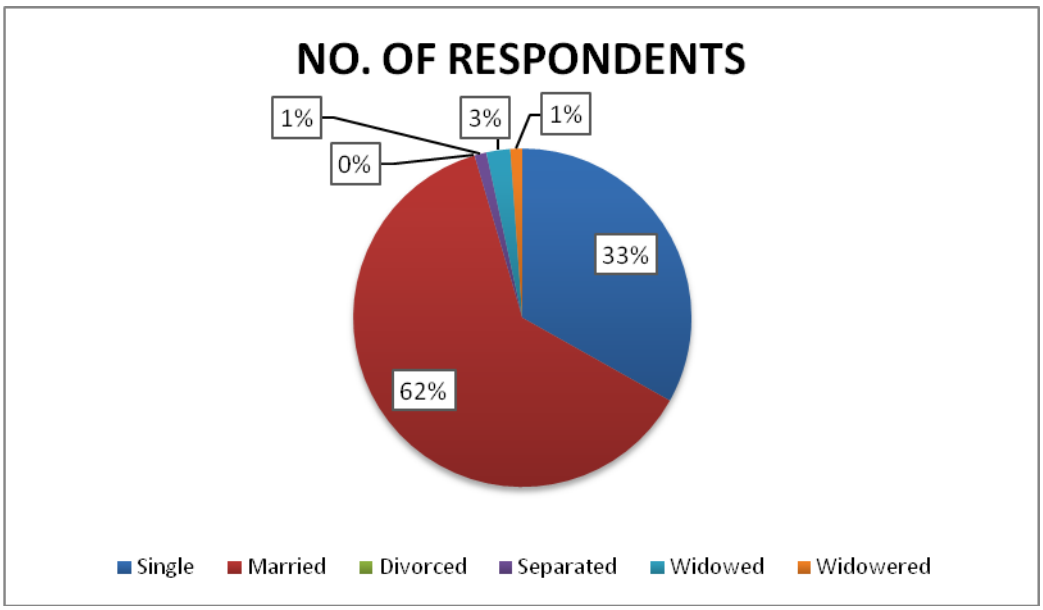


Figure 4.7: Marital status
Source: Field Survey, 2017.

4.14 Family/household size

The family/household size gives an indication of the dependency level of the people. Fig 4.8 shows a higher concentration of respondents (28.6%) in the family/household size of 5-6 category. In addition to this, family/household categories of 6−7 and >7 have added enormously to the state of the community population dependency (37%), making a whopping 65.8% of the respondents, having a family size of 5-7 and over.

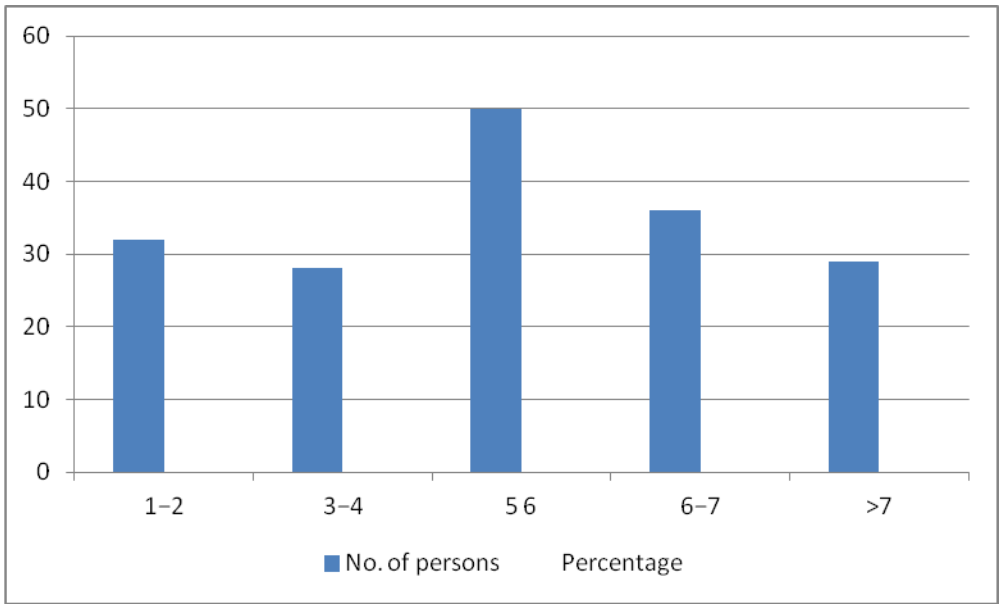


Figure 4.8: Family/household size
Source: Field Survey, 2017.

4.14.1 Distribution of respondents by number of children (male−female)

Table 4.7 contains statistics on the distribution of respondents by children, males and females. The category of 3-4 children has the highest concentration of children (41.1%), 95-males and 136 females, adding up to 226 children. This category is followed by the categories of 5-6 children (17%) and 7-8 children (12.6%). On the down side of age the number of children, (in the category 1-2 children has a share of 10% of respondents with a total number of 22 childern-14 males and 8 females compared to a much higher children dependency in category of >8 children having 42 childern-18males and 24 females though the respondents in the later category constitutes a little less than 3.0%. Again, while the least category of children 1-2 has only 10% of the respondents the respondents in the higher categories of 5-6, 7-8 and >8 constitute over 32% of the total respondents. The enumeration shows high ratio of the dependency in the family/household in the study area. The table shows lower male children than female children with the mean figures of 1.56 and 1.94 giving an average of 3.5 children per family/household. However, about 16% of the respondents have no children and if this proportion is excluded from the enumeration, household/family with children have higher ratio of dependency with slightly lower mean male children (1.86) than mean female children (2.31) up to average of four children per family.

Table 4.7: Distribution of respondents by number of children (male−female)

Category	No. of children			Total	
	Male	Female	Total	Frequency (No. of respondents)	Percentage
1−2	16	17	33	18	6.67
2−4	90	136	226	72	42.78
5−6	87	82	169	30	13.33
6−7	89	89	153	22	13.33
>7	24	24	42	5	23.89
None	0	0	0	28	0.00
Total	273	339	612	175	100.00
Mean	**1.56**	**1.94**	**3.50**		
Mean*	**1.86**	**2.31**	**4.17**		

Mean* Role excluding household/family without children

Source: Field Survey, 2017.

4.14.2 Distribution of respondents by number of other dependents

As Africans the Ibibio people, in the main, believe in and uphold the value of family extension system. Many people in the community have many dependents other than their children to cater for their needs−ranging from food, shelter, health, clothing, education to training and skill acquisition. Table 4.8 gives male-female ratio dependency of 1.67:1.89 thus giving and average of 3.6 adult dependents per family/household. There are more female dependents per family/household in the study area. These figures (ratios) are higher if 39 respondents without dependents are not part of the enumeration: male−female ratio 2.15:2.43 and a total adult dependency of 4.6 in the community. Considering average number of dependent children and adult together a typical family/household is shouldering high dependency burden (of not less than 7) in the study area. This means that the adverse social and environmental consequences caused by the gully erosion in the study area have had significant impact on the socio−economic circumstances of the community, especially for those households with large number of persons who are directly and/or indirectly dependent on these families/households.

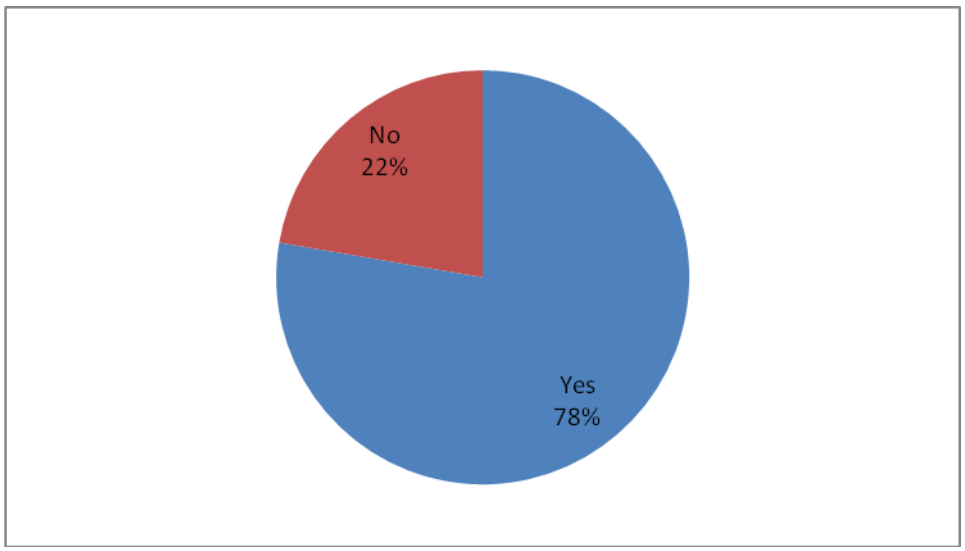


Figure 4.9: Percentage distribution of respondents by non−children dependents
Source: Field Survey, 2017.

Table 4.8: Distribution of respondents' non−children dependents by gender

Dependent class	No. of respondents	Percentage	Male	Female	Total
1−2	60	34.3	46	54	100
3−4	40	22.9	90	90	180
5−6	8	4.6	41	40	81
>6	28	16.0	116	146	262
None	39	22.3	0	0	0
Total	175	100	293	330	633
Mean			**1.67**	**1.89**	**3.56**

Mean*			**2.15**	**2.43**	**4.58**

Note* Excluding respondents without dependents
Source: Field Survey, 2017.

4.14.3 The issue of child labour

The issue of child labour is a general malaise in the developing world society. However, almost all the respondents in Anua community loath child labour. A very marginal proportion of the respondents (2.3%) have used child labour occasionally for street trading when they do not have enough market for their perishable commodities such as bananas and plantains. Group discussion shows that poverty accounts for child labour among people who engage under−age children in any socio-economic activity.

4.15 Conflict settlement

Administered questionnaire and group discussion have not established any conflict of communal dimension occurring in the study area in the contemporary times. However, as expected in any human community there may exist some misunderstandings between individuals, families or groups, which are adjudicated either in formal courts, traditional rulers' courts and churches, depending on the nature of the cases for disposition and the kinds of people involved.

4.16 Awareness of gully erosion

Both the focus group discussions and the administration of questionnaire point to the gully development as a major concern of the people of the community. Hence, all the respondents indicated their awareness of the gully problem (100%).

4.16.1 Respondents' perception of causes of Anua gully erosion

It is the overwhelming perception of the respondents that the drainage channeling of water from the city (Nwaniba section of Uyo city) into the valley is the main cause of the awful gully erosion development in Anua. Fig 4.10 shows that while over 91% of respondents consider the drainage channelization into the ravine as the main factor, three other factors has been identified as contributing to the development of the gully and they come very far behind drainage channeling. They include rain runoff (17.1%) from the gully's community, farming in the past 17.1% and sand mining 5.7%.

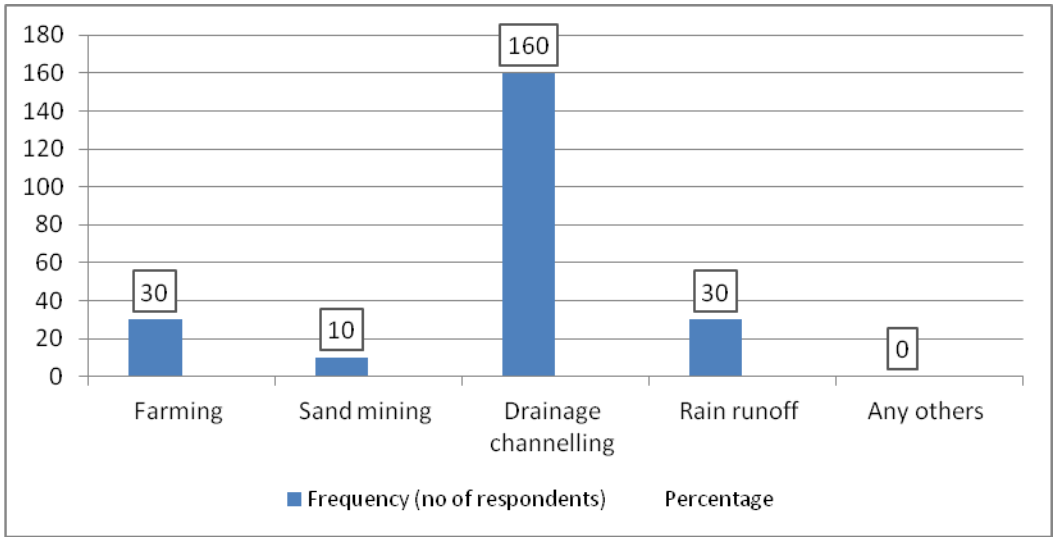


Figure 4.10: Respondents' perception of causes of St. Luke's Hospital, Anua gully erosion
Source: Field Survey, 2017.

4.17 Perceived losses of, and threats to, property and other things by respondents

Some possessions including property have been lost to, and/or threatened by, the ever−advancing gully erosion. Four percent of respondents have had this terrible experience while the remaining 90% have not as indicated in Figure 4.11.

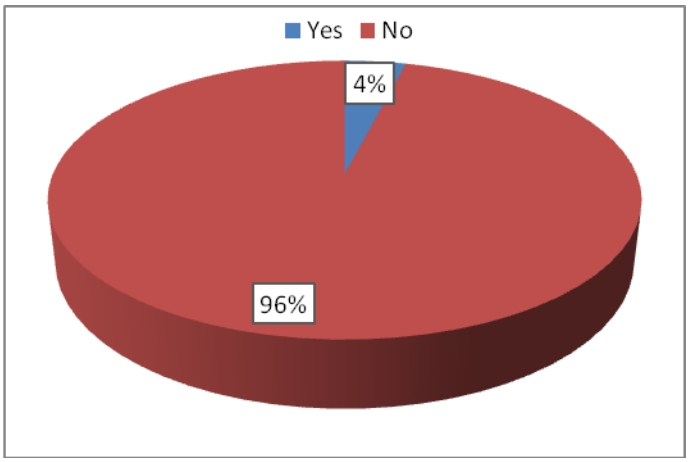


Figure 4.11: Distribution of respondents by losses of or threats to, property and other things

Source: Field Survey, 2017.

The community generally are deeply concerned of actual and potential threats posed by gully erosion. Items of things lost or threatened include property hospital, farmlands and tree crops. Most frequently mentioned lost and/or threatened items of their include farmlands (for

vegetables and food crops) (4.42%), and tree crops (28.6%), which are related agriculturally, property and titled land/forested land 85.7%.

Also, the respondents expressed their awareness of actual losses sustained by others within the community due to the gully development. Such losses include: properties, farmlands, tree crop, community prized land, and the highly threatened St Luke Hospital gully erosion site. Table 4.9 has statistics on the awareness of types of losses incurred by members of the community based on the perception of the respondents. Most of the identified losses to the ravine include farmland (68.6%), tree crops (34.3%), ancestral/community land (34.3%) and title land/forested land (22.9%). Over 90% of the respondents are concerned about the fate of St Luke Hospital which is at the verge of being consumed by the gully and in particular, the recently renovated Dr. Ward's Administrative Complex, classrooms and hostels of the School of Nursing and Midwifery, the worship hall of St. Joseph's Catholic Church and a connecting road between the hospital and the school of nursing and midwifery (Plate 3.1).

Table 4.9: Respondents' perceived losses sustained by community members

Item	Frequency
Farmland (vegetables, food crops)	120
Tree crops	60
Title land/forested land	40
Ancestral land/community land	60
Don't know	30

Source: Field Survey, 2017.

4.18 Respondents' awareness of NEWMAP

Almost everybody is aware of the NEWMAP and what it stands for concerning the arresting of the highly rampaging Anua erosion gully. The concern about the gully development is such that any issues or phenomena that seem to be related to the gully site readily catch the attention of the community members. Figure 4.12 illustrates the enormous concern of the populace: an overwhelming majority of the people being aware of the coming of World Bank, through NEWMAP and its agents, for the intervention project that seeks to find solution(s) to the ever growing Anua gully erosion problem.

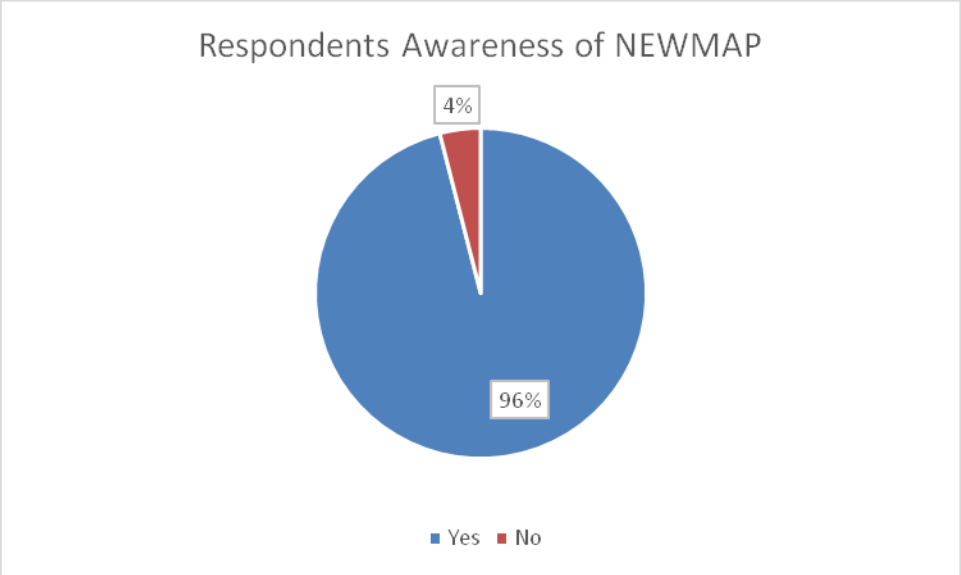


Figure 4.12: Respondents' awareness of NEWMAP
Source: Field Survey, 2017.

4.19 Respondents' perception of valuables to be protected

The dire consequences of gully development are such that the community members are worried and anxious about the disappearing fabrics of the socio−economic life of the community. To this extent they identify some features and things that should be rescued or protected from further ruination by the expanding gully (Table 4.10). They consider these features as the most valuables that should be protected and preserved through intervention of government and such other agencies/institutions as the World Bank (NEWMAP). These include farmlands (68.6%), economic trees (34.9%) medical/health facility (St Luke Hospital) (98.3%), ancestral land (34.3%) and titled/forested land (24%).

Table 4.10 : Respondents' perception of valuables to be protected

Valuable	No. of respondents (Frequency)	Percentage of total respondents that selected the option
Economic trees	61	34.9
Farm land	120	68.6
Hospital (St Luke Hospital)	172	98.3
Ancestral Land	60	34.3
Title/forested land	42	24.0

Source: Field Survey, 2017.

4.20 Health and general quality of life

4.20.1 Common health challenges

Several diseases have been identified in the study area by the respondents and the discussion group. Table 4.11 presents an array of the perceived diseases suffered by members of the community. The people perceive malaria (pre−eminently), typhoid fever, cough, catarrh, skin diseases and high blood pressure as main prevalent diseases in the community. These are followed by dysentery/cholera, heart disease, hepatitis, stroke, cancer, HIV/AIDS, tuberculosis, diphtheria and others. Like in several humid tropical environment, malaria is the commonest disease, which affect all categories of people, both adult and children in the study area. However, they perceive measles, diarrhea, febrile convulsion, skin disease, cough and catarrh and diphtheria as being the common sickness among children particularly under the age of five, while high blood pressure, heart disease, stroke, typhoid fever, hepatitis, diabetes, cancer are common diseases among adults.

Table 4.11: Common health challenges

Illness/diseases	Number of respondent that selected the option	Percentage of respondents that selected the option
Malaria	160	91.4
Typhoid fever	96	54.9
Skin diseases	59	33.7
Catarrh and cough	62	35.4
High blood pressure	50	28.6
Abdominal/digestive diseases	50	28.6
Hepatitis	25	14.3
Heart disease	20	11.4
Stroke	15	1.7
Cancer	10	5.7
HIV/AIDS	12	6.9
Tuberculosis	11	6.3
Diphtheria	26	14.9
Others	36	20.6

Source: Field Survey, 2017.

4.20.2 Environmentally related factors of health

The respondents have identified several environmental factors, which they perceive as adversely affecting health of the community members in general. They are indicated in Table 4.12 to include, among others, flood/poor drainage, lack of safe drinking water, polluted storm−water caused by erosion development, poor sanitary condition, poverty, poor nutrition and stress.

Table 4.12: Perceived environmental factors in disease causation

Factors	Number of respondents that selected the option	Percentage of respondents that selected the option
Flood/poor drainage/gully pools/mosquito bites	162	92.6
Poor sanitary/hygienic condition	98	56.0
Lack of safe domestic water	92	52.6
Polluted borehole water	80	45.7
Poverty: unaffordability of health care, etc	70	40.0
Poor nutrition	60	34.3
Hard work/stress	50	28.6
Poor electricity/lack of basic infrastructure	30	17.1
Landslide/slumping: Destruction and threat to property and other belongings	0	0
Drugs/tobacco abuse	14	8.0
Promiscuity	8	4.6
Bad road	20	11.4
High noise	3	1.7
Bad weather	7	4.0

Source: Field Survey, 2017.

Much of water supply for the community is from private commercial boreholes. Water from these boreholes cannot be said to be safe for domestic use since it is usually not given proper treatment before dispensation and consumption, nor the depth of the boreholes certified by any regulatory authorities, to ascertain that they do not extract water from infiltration runoff. Oftentimes, the location of the boreholes is in very close proximity of within 3−10metres to septic tanks as against World Health Organization (WHO) required standard of 30−40metres. The survey reveals that typhoid fever and diarrheal disease (cholera and dysentery) are some of the common health challenges in the study area. Also, field survey shows that many gutters are not built for smooth flow of waste water and run−off water could stand

permanently for weeks and months, thus becoming breeding pools for mosquitoes (including female anopheles) and amphibians, with their characteristic guttural noise at night.

Part of the measures of health status is the sanitary state of the immediate surroundings of houses. Houses in the study area are generally in close proximity to each other. Several of these houses, for lack of space, are far short of sufficient and proper drainage systems. Even where there are gutters and natural drains they are often clogged with solid wastes.

4.20.3 Health knowledge, behaviour, attitude and practice

Only 3.86 percent of respondents do not have formal education, while almost 8% have primary education, 50.86% secondary education and 37% with tertiary education. Expectedly, with sampled population of high literacy of this kind, there should not only be high degree of awareness but also positive tendency towards health related issues in the study area. The respondents are well aware of public health challenges, which according to them, include tuberculosis, malaria, typhoid fever, hepatitis, HIV/AIDS and other sexually transmitted infections. This sound knowledge is enhanced by pervasiveness and commonplace of media enlightenment today in Uyo and its environs in particular and the world in general.

Also, the people are not only well aware of the dangers, causes and transmission of HIV/AIDS and other sexually transmitted infections, they practice safe sex/protected sex and keep to one's only spouse. This finding is based on focus group discussion. Married respondents are monogamous. Behaviourally, over 79% of the respondents go to conventional health facilities for care, while 12% seek alternative herbal/traditional outlet for care, though the latter also attend conventional health care outlet. To this extent, self−medication and buying−over−the−counter without physician's prescription is considerably reduced in the study area. Still, some people are into using food supplements for their health care even though they complained of high cost of obtaining such drugs. There are two pharmaceutical outlets and over five patent medicine stores in the study area. Based on focus group discussion, the health seeking behaviour of the people could be said to be "satisfactory" (i.e. 3) in grade point of 1−2−3−4−5. They claim to be handling any signs and symptoms disease with prompt visitation to health−care delivery facility within 1−3 days of disease occurrence/development.

4.14.1 Lifestyle

Certain life styles have adverse effect on health. These include the use of tobacco and alcohol, substance abuse (hard drugs), sexual misbehaviour and so on. However, an insignificant number of respondents in the study area do smoke cigarettes (4.0%), and over 28.5% do take alcohol sparingly, but they all give indication of their sound knowledge (awareness of) health risks associated with these indulgences. However, group discussions indicate that some youths in the study area are into the use of hemp and other hard drugs. Also, both the focus group discussions and questionnaire give an indication that the people understand the need for self−restraint and the need to practice protected sex in order to promote good health and healthy living. These two sources also indicate the need to enforce the law regarding the use of hard drugs in the study area and the establishment of rehabilitation centres for the abusers of alcohol and drugs. In general, there has been no outbreak of any deadly disease of epidemic proportion in the study area.

4.14.2 Respondents' awareness of health care facilities

There are some health care facilities near and within the study area including private clinics and a hospital, St Luke Hospital, which has been a long established hospital serving the people in the study area, Akwa Ibom State and beyond. All of respondents are aware of the St. Luke Hospital and over 85% have turned to hospital for their health care needs in last 3−5years. Referral cases are sent to University of Uyo Teaching Hospital, Uyo. Table 4.13 shows the preference of healthcare provider by the people of the study area. Hospital, Chemists and Church are very popular among the people in seeking healthcare.

Table 4.13: Patronage of Different Types of Health Service Providers in the Study Area

Health Care Provider	Anua Offot	Ikot Oku Idio Offot
Hospitals/Health Centres	53	21
Chemists/Drug Peddlers	71	45
Traditional Birth Attendants	17	11
Herbalists/Traditional Medicine Practitioners	12	36
Churches/Spiritual Healing Homes	37	24

4.20.4 Nutrition

The residents of the study area are civil servants, traders, farmers, artisans and self−employed and they have common social−demographic characteristics. They share common opinions regarding their staple food variants/items, comprising cassava (garri, foo−foo and tapioca), yam, rice, plantain, beans, a wide variety of vegetables and fruits, like orange, pineapples, mango, pear and "udara". The main sources of animal protein are fish, crayfish, goat, eggs, snail, chicken, pigs and bush meat.

4.20.5 The study area economy

The economy of study area is dominated by private sector. Over 60% of respondents are self−employed and about 16% work in private establishments. There are many sources of income, which are expected from an urban/semi−urban economy. Retail trading is the main occupation of the people (34.3%), while most other people are into farming (16.0%), civil service (14.99%) and artisans (10.2%), as well as a variety of services. Some of the people are engaged in teaching (4%), in both public and private schools; and still some work as middle−to top−level technicians in private organizations (2.9%). Some others are engaged in such activities as sand quarrying, fishing, babysitting, nanny, street cleaning, transportation, recreation/relaxation services, and so on (17.7%). A wide variety of crops are cultivated in the study area as contained in Tables 4.14 and 4.15.

Table 4.14: Food crops grown in the study area and frequencies mentioned by respondents

S/N	Food crops	Number of respondents that selected the option	Percentage of respondents that selected the option
1	Cassava	148	84.6
2	Yam	76	43.4
3	Water yam	62	35.4
4	Coco yam	42	24.0
5	Plantain	120	68.6
6	Banana	93	53.1
7	Maize	114	65.1
8	Fluted pumpkin	95	54.3
9	Melon	56	32.0
10	Water leaf	101	57.7
11	Bitter leaf	56	32.0

	(etidot)		
12	Afang	60	34.3
13	Editan	22	12.6
14	Atama	43	24.6
15	Etikene	7	4.0
16	Okro	68	38.9
17	Spinach	51	29.1
18	Garden egg	28	16.0
19	Scent leaf (ntong)	31	17.7
20	Ikoh	29	16.6
21	Utasi	16	9.1
22	Pepper	17	9.7
23	Ginger	16	9.1

Source: Field Survey, 2017.

Table 4.15: Fruit/tree crops grown in the study area and frequencies mentioned by respondents

S/N	Tree crop/fruit	Number of respondents that selected the option	Percentage of respondents that selected the option
1	Orange	108	61.7
2	Mango	107	61.1
3	Avocados	60	34.3
4	African pear	67	38.3
5	Paw paw	75	42.9
6	Coconut palm	48	27.4
7	Guava	38	21.7
8	Udara	38	21.7
9	Pineapple	51	29.1
10	Sugar cane	8	4.6

Source: Field Survey, 2017.

4.20.6 Disposal of human waste

Water closet and pit latrines/toilets are the main means of disposing human waste (excreta) in the study area. Figure 4.13 shows that a vast majority of respondents (79.4%) make use of water closet, and far smaller number of respondents (20.6%) make use of pit latrines/toilets.

However, poor water supply in terms of availability and affordability limits the use of water closet. Nevertheless, there was no sufficient evidence to show that some community members defecate in surrounding bushes, open drains and gully sites. The main issue that may compromise human health is the proliferation of boreholes without keeping to the WHO location requirement regarding pit toilet and septic tanks. Untreated borehole water exposes the people to health and environmental hazards, as well as the risk of contracting water−borne and skin diseases. The dire situation requires government intervention to improve on the peoples' quality of life. However, the environmental hygiene and waste management in the study area can be described as "fairly good".

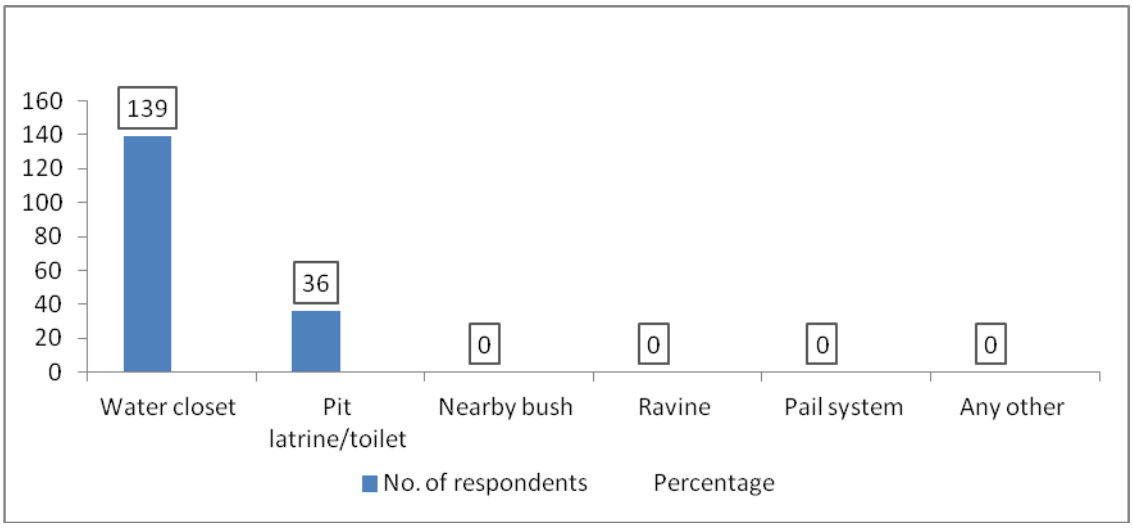


Figure 4.13: Distribution of respondents' by human waste disposal methods

Source: Field Survey, 2017.

4.20.7 General waste disposal

Fig 4.14 shows that 88.6% of respondents utilize Uyo Capital City facilities for the disposal of their wastes. Only 5.7%, 3.4% and 2.3% of respondents disposed of their wastes by burning, burying and bush respectively.

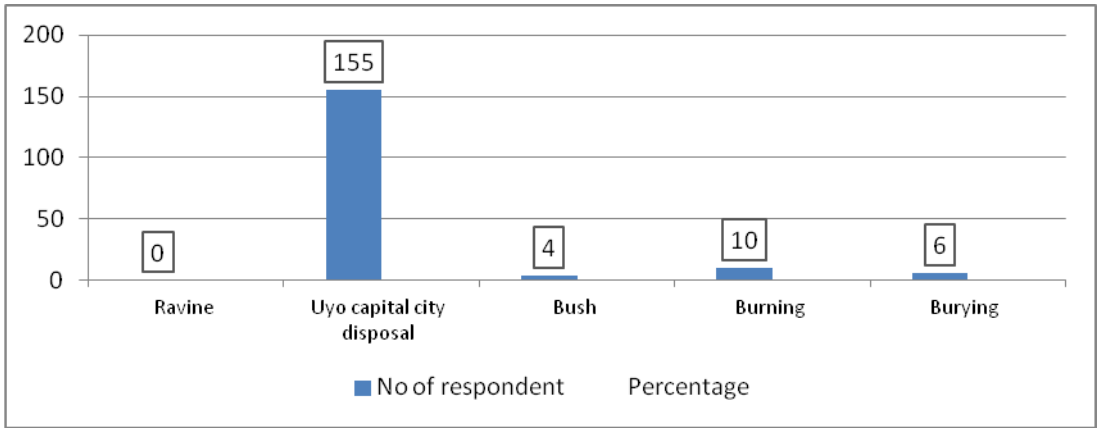


Figure 4.14: Distribution of respondents by waste disposal facility
Source: Field Survey, 2017.

4.20.8 Recreational activities

Many people in the community are engaged in one form of recreational engagements or the other for their social, physical and psychological wellbeing. Figure 4.15 gives statistics on the main recreational activities of respondents. Sit−out (40.6%) and walking (37.1%) are the most outstanding recreational activities, followed by jogging (11.4%) and football (13.1%), dancing/singing (5.1%) and swimming (4.6%).

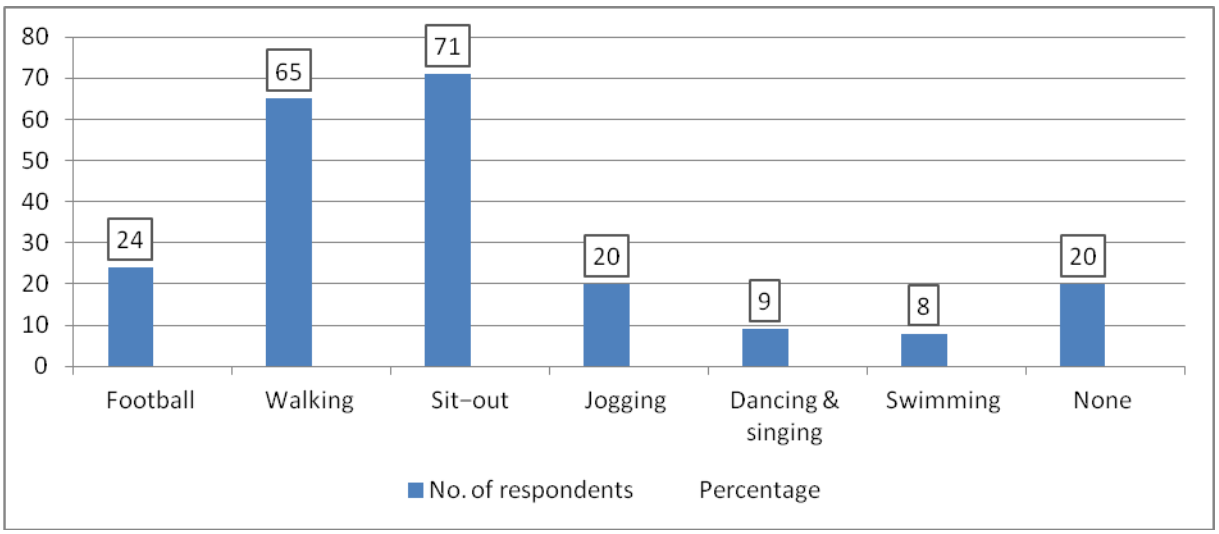


Figure 4.15: Distribution of respondents by recreational activity
Source: Field Survey, 2017.

4.21 Infrastructure

The section identifies and assesses available infrastructural facilities in the study area, covering education, health, transportation, communication, and so on.

4.21.1 Health infrastructure

There are some health care facilities near and within the study area including private clinics and a hospital. A notable healthcare facility is the St Luke Hospital, Anua. Referral cases are usually sent to University of Uyo Teaching Hospital, Uyo, located about 10 kilometres away.

4.21.2 Road transportation and telecommunication

Main roads linking the community to other parts of the city of Uyo are tarred or asphalted. Also, some main streets within the study area are tarred, though some have developed potholes with clogged open gutters spilling out waters during the rains. Several of the streets are not tarred and are broken deep in places. Traffic flows are impeded by the bad nature of many of the roads. Tricycles, motor cycles, cars, mini−buses and trucks form the main transit systems conveying goods and people. Cars are the most dominant means of transportation in the study area. Like most Nigerian cities including Uyo capital city, there are no provisions for non−motorized vehicles such as hand push trucks, bicycles and wheel chairs. Similarly, there are no separate provisions for walking and jogging. Internal road networks do not carry pedestrian walkways. Telecommunication services are provided by private firms, such as MTN, GLO, Airtel and Etisalat.

4.21.3 Energy/power infrastructure

The main power infrastructure is the linkage of the study area with national grid for the supply of electricity by Power Holding Company of Nigeria (PHCN). However, the supply of electricity could at best be described as erratic, a failure, or awfully unpredictable, taking the forms of outright "black out", "a brown out" or sometimes alternating under−capacity voltage and over−capacity voltage at varying patterns of path time (days, months) and space in the study area and Uyo city in general. Power infrastructure is a national malaise, creating a general despondency among the populace regarding the awful unreliability of national grid electricity supply, with losses to businesses and homes. Many of the respondents (60.9%) claim ownership of generators of varying capacities for domestic, commercial and/or industrial needs. These add enormously to the cost of running businesses and/or homes, besides the fact that generators are a major source of environmental pollution (noise and air pollution). Lanterns are commonly used for lighting in the community during power outages.

4.14.3 Educational infrastructure

There are some notable educational facilities is the study area, ranging from kindergarten/primary schools to secondary schools. People in the study area embrace available higher institutions (including Uyo City Polytechnic, the University of Uyo and Akwa Ibom State University) which are within the Uyo Capital City. Some of the schools, in particular secondary schools, are said to be seriously lacking in such important areas as teaching staff, libraries and laboratories (FGD). There is a long standing school of nursing and midwifery located within the precinct of St Luke Hospital and is being threatened by the advancing gully. It needs urgent intervention.

4.14.4 Water infrastructure

Boreholes form the main water sources for the community. Both the focus group discussion and questionnaire show that due to the highly unreliable nature of public water supply, individuals and organizations have made commercial boreholes to be their main source of domestic water supply and also for commercial purposes (investment). Hence, borehole is the most frequently mentioned source of water supply (80.0%) among other sources, followed by public pipe borne water (23.4%) and rains (20.0%) (Table 4.16). The worrisome aspect of the borehole business is the general lack of quality control in terms of ground depth, location in relation to other incompatible land use types, such as septic tanks and cemetery, together with the fact that there is absolutely no treatment agenda put in place before dispensation and consumption of borehole water. Similarly, harvested rain water is hardly free of impurities including parasites, dust, soot and obnoxious substances from many sources, ranging from local gully dust, generators and vehicular emissions to industrial emissions and gas flaring from relatively far−off places known for persistent gas flaring and large scale industrial operations, among other human activities. In other words, water from both boreholes and rainfall are not treated and are therefore, the main media for transmitting disease−causing agents to the people. Of course, the community has such common diseases as skin rashes and irritation, typhoid fever, cough, catarrh, dysentery and diarrheal disease.

Table 4.16: Water sources

Source	Frequency	Percentage
Public potable water	41	23.4
Rainfall	35	20.0
Spring	4	2.3
Boreholes	140	80.0
Tanker service	0	0

Source: Field Survey, 2017.

4.22 Health and general needs of the community

A combination of focus group discussions, questionnaire survey and interviews give clear indication of high level of awareness of the people concerning challenges facing the study area. Their expectations tally with the findings of the socio−economic team. They are in agreement demanding an immediate stop to ravine encroachment, of course, with sustainable measures put in place for their livelihood. These and other needs are as summarized in Table 4.17.

Table 4.17: Health and general needs of the community

S/N	Priority need	Rank
1	Gully control	10
2	Safe drinking water	10
3	Schools	8
4	Employment	9
5	Electricity	7
6	Good drainage	8
7	Hospital/health/medical/personnel	8
8	Recreational facilities	4
9	Good road	6

Ranking: 1−4 pressing need; 5−7 very pressing need ; 8−10 extremely pressing need
Source: Field Survey, 2017.

4.15 Solution to the problems of erosion in Anua gully erosion site

The community members are agreed on one point that the gully development and its attendant consequences are such that it requires urgent high level government intervention and perhaps in partnership with any international agencies of repute. It is at this level that solving the problem could best be attempted and guaranteed in terms of technical expertise, finance, thoroughness, commitment, choice of operating firms, work quality control, supervision and monitoring, and so on. They seem to identify certain aspects of development that should be emphasized at the intervention to include proper channelization works involving the immediate community and part of Uyo capital city drainage systems, culminating in the building of consequent main stepwise drain (gutter) to Ikpa river.

CHAPTER FIVE

5 ASSESSMENT OF POTENTIAL ADVERSE IMPACTS AND ANALYSIS OF ALTERNATIVES

5.1 Methods and Techniques used in Assessing and Analysing the Environmental and Social Impacts of the Proposed Project.

There is no doubt that various components of the biophysical and social environments of the St. Luke's Hospital gully area would be impacted by the proposed NEWMAP intervention project. The environmental and social impacts of the proposed St. Luke's Hospital gully erosion control and stabilization measures will be both negative and positive. Understanding what types of impacts and which segments of the environment are vulnerable is a prerequisite to identifying and managing environmental risks. Thus, the ultimate goal of an ESMP study is the provide information on how to avoid or minimize identified negative impacts, while domesticating and encouraging the positive ones.

There are different approaches to the prediction and evaluation of impacts. Some of them include: the Five Step Tool (5ST), the Hazard Effect Management Project (HEMP) and the ISO 14001. These are very useful approaches in the assessment and analysis of environmental problems. However, this study adopted the Five Step Tool (5ST) because it provides a high level of explanation and details and is easy to operationalize, even with minimal data set.

For the identification and rating of key issues and impacts that are likely to occur during the phases of the gully erosion control and stabilization project and the significance of the associated impacts, a five step tool (5ST) was adopted. The tool is sequentially ordered so as to rate the impacts of the various activities of the project (Fig. 5.1). Table 5.1 shows the probability of occurrence, consequence severity, likelihood ranking and risk matrix methodology. Table 5.2 shows the actual levels of potential positive and negative environmental and social impacts for the St. Luke's Hospital, Anua Gully Erosion Site

Risk is a possibility of loss resulting from a threat, insecurity incidence or event. Risk is inherent in almost all aspects of life. The essence of risk is dependent on the potentials of threats. A **threat** is a product of intention and capability of an adversary, both man-made and

natural, to undertake an action that would be detrimental to an asset. Risk cannot be totally eliminated from the environment, but with careful planning, it can be minimized and managed. Risk is a systematic and analytical process to consider the likelihood to which a threat will endanger an asset, individual, or function. Thus, Risk is best understood as the product of the consequence of an event and the probability of the event occurring; Risk= Consequence x Probability. In order to manage risk, it must first be identified, measured, and evaluated.

5.2 Impact Evaluation Model

The identified impacts were classified into four levels of severity:- Low, Medium, High and Extreme, and the Five Step Tool (5ST) impact evaluation model was followed sequentially in order to rate the impacts (Fig. 5.1).

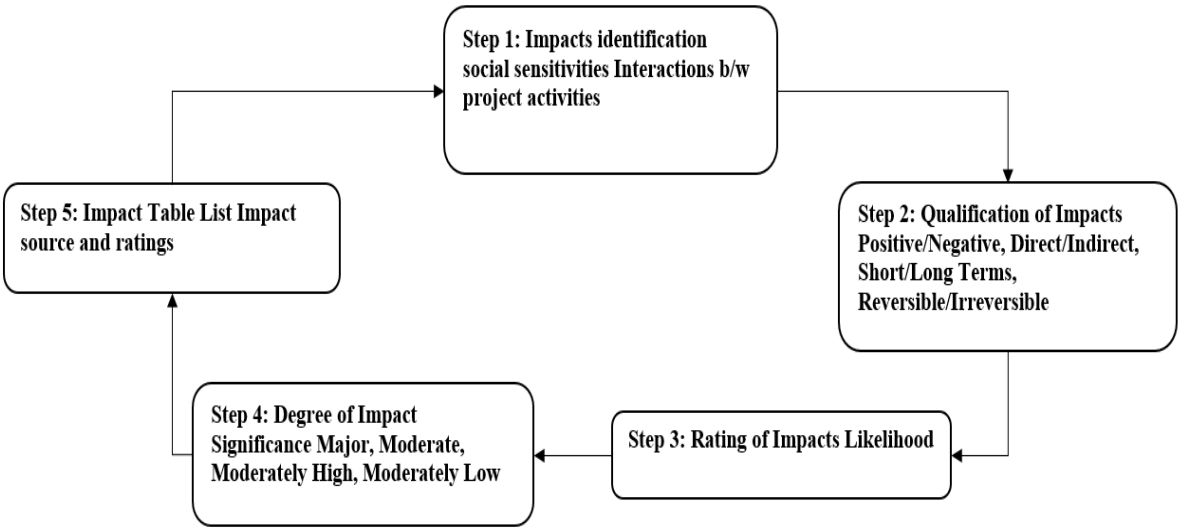


Figure 5.1: Five step tool for impact rating

5.2.1 Step 1: Identification of potential impacts

Expected impacts were determined based on anticipated interaction between project activities and major environmental and social sensitivities. The environmental and social sensitivities likely to be affected by project activities include the following:

(a)Environmental Components

- micro-climate
- air quality
- Noise level
- Surface water
- Ground water
- Soil
- Topography and Landscape
- Terrestrial Habitats

(b)Social Components

- Air quality
- Noise level
- Economic activities
- Employment
- Public health
- Occupational health and safety
- Land Use
- Transport and traffic
- Leisure and social activities
- Community affairs and Grievance redress
- Power and Water supplies

5.2.2 Steps 2: Qualification of Impacts

Impacts can be qualified on the basis of whether they are: positive or negative; short-term or long-term, reversible or irreversible; direct or indirect (Fig. 5.1).

5.2.3 Step 3: Rating of Impacts

This stage involves evaluation of the impact to determine whether or not it is significant. Two criteria are used in evaluating the significance of impact, and they are:

- Likelihood of occurrence – This is an assessment of the probability of the effect occurring.
- Potential Consequence – This is the actual result and scale that an effect might have. The application of each of the two criteria is described in Table 5.1

Table 5.1: Likelihood of Occurrence of Impact

Impact Probability	Likelihood	Frequency
High probability (80-100%)	A very likely impact	Very frequent impacts
Medium high probability (60 – 80%)	A likely impact	Frequent impacts
Medium probability (40 – 60%)	A possible impact	Occasional impacts
Medium low probability (20 – 40%)	An unlikely impact	Few impacts
Low probability (0-20%)	A very unlikely impact	Rare impacts

The magnitude of the potential changes to the physical and social environment caused by the impact of an activity or hazard, and the level of sensitivity of the receiving environment determine the potential impacts of the activity (Table 5.2)

Table 5.2: Potential Consequence Classification Matrix

	Magnitude of Effect		
Receptor Sensitivity	**Low change**	**Medium change**	**High Change**
Low receptor sensitivity	Trivial effect	Slight effect	Substantial effect
Medium receptor sensitivity	Slight effect	Substantial effect	Big effect
High receptor sensitivity	Substantial effect	Big effect	Massive effect

The rating of the potential consequences of an impact and its effects are presented in Table 5.3

Table 5.3: Potential consequences of an impact

Potential Consequences	Effects
Extreme consequence	A massive effect
Great consequence	A big effect
Considerable consequence	A substantial effect

Little consequence	A slight effect
Hardly any consequence	A trivial effect

5.2.4 Step 4: Degree of Significance

The characteristics used in the 5ST model to determine the degree of significance and ratings of an impact are presented in Table 5.4.

Table 5.4: Degree of Significance of an impact

Impact Significance	**Impact Ratings**
Major significance	Major impact
Moderate significance	Moderate impact
Minor significance	Minor impact
Negligible significance	Negligible impact

5.2.5 Step 5: Impact Assessment Matrix

The final stage of the 5ST model is the development of an impact assessment matrix or impact table. Table 5.5 shows the impact assessment matrix that is developed for this study. From the matrix, greater attention was paid to major and moderate impacts in the development of mitigation measures. Good engineering practices, environmental health and safety should be able to address low or negligible impacts. The positive impacts shall be monitored and enhanced whenever it is expedient to do so, in order to maximize the benefits.

Table 5.5: Impact Assessment Matrix

	Potential Consequences		
Likelihood	Positive		Negative

			Hardly any	Little	Considerable	Great	Extreme
High			Moderate	Moderate	Major	Major	Major
Medium			Minor	Moderate	Moderate	Major	Major
Medium			Minor	Minor	Moderate	Moderate	Major
Medium			Negligible	Minor	Minor	Moderate	Moderate
Low			Negligible	Negligible	Minor	Minor	Moderate

5.3 Associated and Potential Impacts Determination

The results of the evaluation of the interaction between the proposed activities at St. Luke's Hospital gully erosion site and their potential impacts on environmental and social sensitivities are presented in subsequent sections of this chapter. The identified negative impacts were rated as minor, moderate, major and extreme/ low, medium, high and extreme. Beneficial or positive impacts arising from the project were simply rated as positive. Thus, no further classification was conducted on the beneficial impacts

5.4 Potential Impacts of the Proposed St. Luke's Hospital Gully Erosion Intervention Project.

The identified potential impacts that could result from NEWMAP intervention in St. Luke's Hospital, Anua gully erosion site were evaluated qualitatively and categorized as "adverse" (meaning, the impact or event would produce negative effects on the biophysical and /or socio-economic environments) or "beneficial" (meaning, the impact or event would produce positive effects on the biophysical and/or socio-economic environments). The significance or otherwise of any impact or event was evaluated on the basis of risk and frequency of impact in conjunction with the rating of importance of affected environmental component which was the outcome of rigorous stakeholders consultation.

5.4.1 Negative (Adverse) Impacts of the Proposed Project Activities

For the proposed St. Luke's Hospital, Anua project, potential negative impacts have been categorized on the basis of what should be anticipated during the pre-construction phase, the construction phase and the operational phase. This categorization is to facilitate the implementation of the mitigation measures that are outlined in the Environmental and Social Management Plan (ESMP).

5.4.1.1 Pre-Construction Phase (Potential Negative Impacts)

5.4.1.1.1 Displacement of Landed Properties

The proposed intervention will lead to displacement of landed properties at the risk of the gully erosion, particularly for people living along the corridor of the gully erosion site.

5.4.1.1.2 Disruption of Livelihoods Sources

Livelihood sources such as slope cultivation, economic trees (palms, oranges, pears), sand mining, would be affected.

5.4.1.1.3 Mass movement of people into the Project Area:

With the current economic recession in Nigeria, people are just looking for where things is happening, in terms of job opportunities. When civil works commence at the St. Luke's Hospital gully erosion site, there will be influx of people (the good, the bad and the ugly) into the area in search of opportunities. The extent to which the influx becomes a positive or negative impact will be determined by the effectiveness of the ESPM. Without effective ESPM implementation, the overall impact could be substantially negative.

5.4.1.1.4 Continuous Storm Water Menace and Accelerated Slope Failures

Prior to commencement of construction work at the St. Luke's Hospital gully erosion site, storm water has continued to wreak havoc on the gully sides through slope wash, landslides and slumping, collapsing structures and destroying land, together with their economic trees and vegetation.

5.4.1.2 Construction Phase (Potential Negative Impacts)

A decisive requirement at the construction phase is the creation of buffer zone and right of way. Vegetation will be cleared from the gully erosion site, large drains will be constructed and other related constructions will be carried out. From the activities during the construction phase, the environment will be disturbed and altered. Broadly speaking, the key potential negative impacts are:

5.4.1.2.1 Potential Impacts on Flora

Plants are immobile objects and that makes them most vulnerable in case of hazardous event. Civil works in St. Luke's Hospital gully erosion site will definitely lead to the destruction of many plants irrespective of size and extent of living footprints.

5.4.1.2.2 Potential Impacts on Fauna

Birds and climbing animals as well as life forms such as soil micro-organisms of the project area will also be affected. Animals in high densities that have built adaptation mechanisms and those living naturally in the area will be directly and indirectly displaced from their natural habitats.

5.4.1.2.3 Potential Impact on Biodiversity and Loss of Habitat

The level of civil work anticipated at the construction site will have significant effects on the general biodiversity in terms of plant and animal species, through loss or damage of habitat. Nonetheless, the cleared vegetation will be recovered by planting small trees and plants. The construction works will not harm any major bird or animal migration routes.

5.4.1.2.4 Potential Impact on Geomorphological Features

Every landscape has its unique character and form. Civil works that will involve massive land excavation and landscape re-ordering may negatively impact on the initial features of the pre-construction landscape.

5.4.1.2.5 Potential Impact on the Micro-Climate

The micro-climate is the climate of a small place, e.g a valley, a mountain top, etc. Construction work in St. Luke's Hospital gully site may increase the ambient air temperature due to heat emissions from trucks, machines and equipment. This may cause an inversion of the valley temperature and a possible modification of the weather and climate.

5.4.1.2.6 Environmental degradation from Site Camp Construction

The construction of site camps often involve land clearance and soil excavation. These could stimulate further land degradation if the site camp is not properly located and construction properly handled.

5.4.1.2.7 Potential Impact on Ambient Noise Level

During Civil works, localized noise would be generated from trucks, machines and equipment that may exceed acceptable noise levels. Increased influx and increase in the

number of people within the project site may also translate into increased noise levels. Thus, the once serene hospital and nursing school environment may become rather busy and noisy.

5.4.1.2.8 Problem of vibration and earth shaking

Heavy duty vehicles do cause vibration when they move. A large number of such vehicles moving in the construction site will create significant impact on the earth surface through vibration. Also, earth moving machines and equipment working at the project site will cause significant vibrations within the project area. This may cause fear in the minds of the residents, or even lead to collapse of some structures with faulty foundations at the crest of the ravine.

5.4.1.2.9 Potential Impact on Air Quality

Air pollution is a serious problem as it causes the deaths of numerous people yearly due to respiratory illnesses such as asthma, bronchitis, cough and catarrh. Emissions from construction trucks, machines and equipment are likely to impact the air quality of the immediate locality negatively. This may lead to sudden increase in respiratory illnesses in the area during the civil works. Dust particles and other potentially injurious particulate matter will be released into the atmospheric environment. This could cause problems such as reduced visibility, respiratory tract infections and general discomfort. These problems would afflict the residents in the immediate vicinity of the project area and the magnitude of the problem could be traced periodically from hospital records or through routine field surveys.

5.4.1.2.10 Potential Impacts on Water and Water Resources

Acid rain is a phenomenon that is associated with emission of noxious gases into the atmosphere. Construction work that involves the use of trucks, earth moving equipment, machines and generators, all of which combust fossil fuels, will surely emit noxious gases into the atmosphere, leading to the formation of acid rain. This will impact not only the quality of the local rainfall, but also the surface streams and wells within the project area. Furthermore, oils, sludge and chemicals from construction trucks, machines and equipment can infiltrate the local water table and pollute the underground water. Other sources of

pollutants include: wastewater containing high suspended solids; oil residues and industrial fluids from washing of plant and vehicles that would spill into nearby water body and seep into groundwater; spill of fuel oil around fuel storage tanks that would seep into groundwater and nearby stream and waste oil, grease and de-greasing solvents from vehicle and plant servicing.

5.4.1.2.11 Contamination of the Soil

Just like water resources, the soil and its resources within the project area are likely to be contaminated from construction waste water, oils, sludge and chemicals. The soil micro-organisms and other soil constituents might be negatively impacted.

5.4.1.2.12 Disruption to Communication Routes

Roads within the right-of-way of the project may temporarily be closed during construction work for easy movement of trucks and machines, and also to avoid accidents. Bush paths within the gully area may also be closed to the public. These closures will definitely impact on the ease of movement and convenience of the residents in particular, and the travelling public in general. The impact on vehicular movement will naturally be confined to increased journey time and other costs associated with travelling delays, particularly during morning and afternoon peak periods. During this period, the majority of cases will only cause minor inconveniences.

5.4.1.2.13 Over-Stretching of Public Infrastructure and Utilities

The increased influx of people into St. Luke's Hospital project area may lead to over-stretching of public infrastructure and utilities such as roads, accommodation, health centres, schools, water supplies and electricity. Roads in the project area might become crowded; house rents might rise in response to increased demand for residential and business homes; health centres and schools might be over-subscribed; water and electricity supplies may become unstable due to increased demand.

5.4.1.2.14 Disruption of Public Utilities

Underground cables, pipes and other underground installations may be damaged during excavation works, leading to disruption of electrical, phone and water supply services.

5.4.1.2.15 Disruption of Public Peace and Safety

One characteristic of over-crowding is restiveness. The attraction of people to the project area in search of livelihood opportunities will lead to over-crowding of the Anua village, and indeed Offot Clan, which already is relatively crowded. In such a situation, restiveness in the form of quarrelling, fighting and "urban vagabonds" may become more frequent. Crimes such as stealing, prostitution, armed robbery and kidnapping might also intensify in the area.

5.4.1.2.16 Construction Site Hazards

Generally construction sites are inherently hazardous and unsafe for both the project workers and the general public. The hazards and risks in construction sites are many and varies from mechanical failure, through equipment malfunctioning, to construction site fumes. For ravine site construction, where many of the valley slopes have become unstable due to basement undercutting by runoff, the probability of unforeseen slope failure is ever present.

5.4.1.2.17 Cultural Impacts

Erosion control works may cause damage to landed properties, historical, archeological and cultural sites. Normally, Resettlement Action Plan (RAP) should take care of this aspect of the intervention, but most people have a strong attachment to place (Topophilia) and will resist resettlement despite being at the risk of the gully erosion engulfing him and his property. Graves and other artifacts within the project-right-of-way may be relocated or destroyed.

5.4.1.2.18 Impact on Community Life

Some of the recreational activities of the project workforce will likely cause negative impacts on the immediate community of the project. Abuse of alcohol among the workforce may affect the local population negatively through increased teenage pregnancies and increase in the number of out-of-school children. There will also be an increased risk for the spread of sexually transmitted diseases (STDs), including HIV and /AIDS.

5.4.1.2.19 Health Issues

Air, water and noise pollution observed earlier might result to increased health challenges among the workers at the project site and the residents of layouts adjoining he project site. Incidents of respiratory tract infections may be more frequent. Ponding of runoff as a result of construction work may encourage mosquito breeding and increases the risk of malaria illness.

5.4.1.2.20 Gender Issues

Women are home-makers, and for most poor women in urban suburbs, they bear the brunt of providing food for their families through illegal farming of every available land, be they marginal or protected lands. As a result, the St. Luke's Hospital gully stabilization right-of-way will consume many of such illegal farms during construction. This will bring misery and despondency to many such women and their families.

5.4.1.3 Operational Phase (Potential Negative Impacts)

During the operational phase, there are a number of events that will impact on the environment. For instance, storm runoff that will flow through the project area will bring with it sediments and debris that may cause rapid sedimentation and even clogging of runoff channels. Operational phase could also witness issues such as, air pollution, water pollution, noise pollution, traffic congestion, occupational health and safety issues among others.

5.4.1.3.1 Silting/Clogging of Drainage Channels

Due to high temperatures and rainfall all year round, rates of chemical weathering in the humid tropics are very high, with abundance of clay and silt materials in runoff. The habit of disposing waste in runoff waters is also very common among urban residents of third world

countries. Therefore, St. Luke's Hospital erosion control project will continue to receive volumes of runoff that contain large quantities of soil sediments and house-hold waste. These may create the problems of sedimentation and channel clogging during the operational phase.

5.4.1.3.2 Air Quality

The operational phase of the St. Luke's Hospital, Anua project will surely create some air quality issues. With the expected enhanced aesthetics of the ravine area due to NEWMAP intervention, a once risky and abhorred area of Uyo will become a celebrated masterpiece in landscape architecture. This will lead to increased traffic to the area by fun seekers and nature lovers. The increased traffic will also translate to air quality problem.

5.4.1.3.3 Increased Noise Level

As with air quality, the operation phase of the project will attract a heavy traffic due to the beauty and awe of the new landscape in the ravine environment. Increase in the number of vehicles visiting the site as well as site maintenance trucks and vehicles will likely increase the noise level in the area during operational phase. Also, the design of the main runoff evacuation channel provides for break of slopes and speed bumps to reduce the velocity of runoff along the channel. These obstructions usually generate sounds that may add to the noise level of the area.

5.4.1.3.4 Water Quality Issues

Water quality issues should be minimal during the operational phase because most of the construction phase pollutant sources would have been evacuated from site and remediation actions undertaken. However, the project site will continue to receive large volumes of polluted runoff and waste water from the catchment area which could pollute surface streams and even infiltrate the water table at the final reception zone.

5.4.1.3.5 Structural Failure and Safety Issues

Possible design fault or sabotage could lead to structural damage of erosion facilities, creating safety issues. Maintenance workers and other contract staff might be exposed to accidents at this stage.

5.4.1.3.6 Intruders to the Project Site

Sand miners, firewood hawkers and free-lance farmers may venture into the project area during the operational phase to practice their trade. Such activities could cause a disruption of the erosion stabilization work.

5.4.1.3.7 Menace of Post Construction Solid Waste

There will be solid wastes generated from the operations of the gully stabilization works. Such wastes will include topsoil overburden, unused lateritic and sea sand soils, pieces of metals, wooden planks, cement packages and stone debris. These wastes usually cause eye-sore and they destroy the aesthetics of the environment.

5.4.2 Positive Social Impacts of the Proposed Project Activities

5.4.2.1 Positive Social Impacts of the Proposed Project Activities

Just like the negative impacts, the treatment of positive impacts will be made in phases to cover, the pre-construction, construction and operational phases of the project. The potential positive impacts of the project include the following:

5.4.2.1.1 Rehabilitation of degraded lands and their conversion into productive land

With the proposed intervention in St. Luke's Hospital gully erosion site, a once degraded land will be restored. The land will be properly managed and monitored for proper and effective utilization.

5.4.2.1.2 Public Safety

The proposed project will restore hope in a people that have become hopeless due to the nightmare of gully erosion. The feeling of insecurity due to constant threat from gully erosion will be eliminated. This is specifically with respect to safety of properties and human lives, which have been hitherto at the risk of the gully erosion. Safety of lives particularly during the epic gully erosion in rainy season will be reduced and the potential landed properties at the risk will diminish. As gathered from the field study, restriction of movement of schoolchildren whenever it rains as a result of high current of floodwaters running through the gully will also be reduced.

5.4.2.1.3 Employment Opportunities

As part of creating good corporate image, the construction firm should be encouraged to create significant temporary employment for construction workers, equipment maintenance and support staff, in which the local folks may be given priority. Indeed, the bulk of the unskilled labour should first be sourced within the host communities before looking out.

5.4.2.1.4 Increase in the Value of Structural and Landed Properties

With the proposed restoration work at the St. Luke's Hospital gully erosion site, the surrounding layouts to the hospital will enjoy a sigh of relief, because the seasonal problem of perennial flooding would have come to an end. They will build houses and live in them, and those who left the area due to incessant flood problems would return. The prices of structural and landed properties will rise.

5.4.2.2 Positive Environmental Impacts of the Proposed Project Activities

5.4.2.2.1 Reversal of Gully erosion Activities in the Area

The gully erosion in St. Luke's Hospital was initiated by the channeling of flood water from Nwainba Road and environs to St. Luke's Hospital Ravine, which was largely forested and stable. Gully erosion is a critical issue in Uyo as a whole because the phenomenon has caused untold hardships to the people and community, through destruction of lives and property, ravaging of the landscape and farmlands, loss of crops, and creating fear and insecurity among the residents of Anua village and Ikot Oku Idio, who suffer from backwater flooding. The proposed project will bring the activities of gully erosion to a halt, control flooding in the catchment area and take away the burdens of the people. The Hospital Management, the School of Nursing and Midwifery Management, and the St. Joseph's Catholic Church Priest and members will be the front-line beneficiaries of the project.

5.4.2.2.2 Rehabilitation of degraded lands (Gully erosion Affected Lands) and their conversion into productive land

The proposed NEWMAP intervention, through a combination of civil works and biological measures will recreate the landscape and change the story of St. Luke's Hospital, Anua, Uyo for the better. Patronage will revive, because people have become scared of the massive flooding that usually happen in the area every season.

5.4.2.2.3 *Reducing disaster risks in the project area*

The risk of gully erosion disaster and massive flooding will be greatly reduced. People will have more confidence to go about their businesses even during heavy rainfall while the fear of exposure to disaster will be removed.

Table 5.6: Potential positive and negative environmental and social impacts of the proposed intervention at St. Luke's Hospital gully erosion site.

	Activities	Potential impacts	Impact level			
A	**Pre-construction phase**		**Low**	**Medium**	**High**	**Extreme**
1	Mobilization of equipment and other materials to site	Air quality deterioration from release of dusts and emissions from vehicles transporting equipment to site	X			
		Noise and vibration from movement of heavy duty vehicles	X			
		Traffic congestion and increased risk of road traffic accidents and injuries as a result of movement of heavy equipment	X			
B	**Construction stage**					
1	Site clearing and land acquisition for right of way	Removal of flora and fauna	X			
		Air quality deterioration from release of dusts and gaseous emission from exposed soil surfaces and vehicles	X			
		Employment of local labour for construction activities resulting in improved livelihood and welfare		X		
		Noise and vibration from the use of machineries and motorized equipment		X		
		Generation of vegetal wastes from site clearing activities	X			
2	Installation of equipment and structures (Site offices, utilities, workshops, etc)	Generation of construction wastes	X			
		Noise and vibration from the use of machineries and motorized equipment during construction of site structures		X		
		Air quality deterioration from release of cement dusts, and toxic fumes from equipment and machineries used during building and welding of site structures	X			

3	Earthworks – excavation, grading, and compaction	Noise and vibration from the use of machineries and vehicles during excavation, burrowing, backfilling and compaction activities		X		
		Air quality deterioration from dusts generated during excavation, burrowing, filling, backfilling and compaction activities		X		
		Disruption of public utility services from damage to existing underground public utility cables and pipes during excavation works			X	
4.	All civil engineering	Noise and vibration from the use of machineries and motorized equipment		X		
		Contamination of surface and underground water from waste water and spillages of oil and other petroleum products through leakages and improper handling	X			
		Waste generation from cement and concrete works such as cement bags and metal scraps	X			
		Deterioration of air quality from release of cement dusts and toxic fumes during construction structures	X			
		Employment of local labour for construction activities resulting in improved livelihood and welfare	X			
		Occupational accidents and injuries from the use of machineries and equipment	X			
C	Operation and maintenance phase					
1	Maintenance and operation	Creation of employment by training locals as maintenance officers		X		
		Waste generation from de-silting and other maintenance works	X			
		Occupational accidents and injuries as a result of falling and tripping during routine maintenance	X			
		Reduced mortality/morbidity from water related diseases		X		

5.5 Analysis of alternatives

In the context of the ESMP, the analysis of the project alternatives refers to a comparison of possible alternatives to be considered with respect to the proposed project at St. Luke's Hospital, Anua Gully Erosion site. One of the stated alternatives is prescribed due to its outstanding merits over the others. The choice centers on the fundamentals of meeting with the threshold of criteria concerning all considered environmental and social variables that are paramount to the project (i.e. Applicable or Relevant and Appropriate Requirements (ARAR)).

5.5.1 No-Action Alternative

The assumption underlying this alternative is based on the impression that there will be no alteration to the existing condition at the St. Luke's Hospital gully erosion site. In specific terms, the prevailing gully erosion area will be left untouched, unaddressed and without any civil works or any engineering construction works. The gully expansion at St. Luke's Hospital, Anua will be left to persist without any attempt at addressing the environmental challenge it poses. Consequently, the conditions at the gully erosion site and the seasonal inundation of its watershed will worsen and this may result in the destruction of houses, farmlands, roads and road infrastructures, public facilities, educational facilities etc. The situation may aggravate to the extent of damaging existing road infrastructure such as Nwaniba Road, which connects Uyo with the Five-Star, Ibom Meridien Hotel. With the no-action alternative, annual loss of farm produce, impaired access, unsafe status of lives and properties will increase; and thus, gully erosion will persist unchecked and uncontrolled. Other environmental and social unfavourable impacts such as reduction of existing road capacity, exposure to risk and dangers from the high currents of floodwaters, high cost of transportation, destruction of soil, exposure of flora and fauna to devastating imprints of erosion, loss of land and landed properties, and likely surface and groundwater pollution, will be strengthened. Basically, the current conditions will be left without any remedial efforts. Due to these numerous effects, the no-action alternative is not recommended for this project.

5.5.2 Delayed-Action Alternative

It is noted that the earlier action adopts a delayed tactics, which resulted into further damages and degradation of the watershed. Inflation and other economic forces may cause monumental changes in the cost of materials thereby increasing the financial burden of the rehabilitation.

5.5.3 Right-Away Action Alternative

The right-away actions ensure an immediate attention to address the issues and benefit from both short-term and long-term effectiveness.

5.5.4 Use of Civil Works, Bioengineering and Technological Methods

For the anticipated rehabilitation of gully erosion induced damage at St. Luke's Hospital gully erosion site, all elements of the watershed together with environmental and social components should be considered. This approach will ensure that relevant components of the natural and human environments under the threat and risk of destruction, such as soil, public infrastructure, social and community infrastructures and facilities will be secured in the affected communities.

The procedure for the rehabilitation works and associated enhancements will involve intensive civil works across the broad spectrum of the affected and high-risk areas. Consequently, construction works, bioengineering and technological approaches will be adopted in restoring and enhancing affected areas as envisioned according to the goals of the NEWMAP. Adverse impacts of these activities will be highly reduced in such a way that the benefits will outweigh the demerits as necessary.

5.5.4.1 Use of Civil Works

The civil works will be concentrated at the areas closest to the erosion site and will ensure negligible adverse impacts on livelihood. The adverse impacts will be largely reversible, indirect and short term. The merit of the Civil Works totally outweighs the no-action option even though the cost implication of the former would be much more than for the latter.

5.5.4.2 Bioengineering

The merit of the Bioengineering totally outweighs the no-action option even though the cost implication of the former would be much more than for the latter.

5.5.4.3 Technological Methods

The combination of the Bioengineering and Technological Alternative outweigh the No-Action Alternative and it is, thus, recommended. The two alternatives are presented in Table 5.3. As shown in Table 5.3, it can be summarized that the Civil Work, bioengineering and technological alternative will provide the solution that NEWMAP sought while the No-Action alternative will undoubtedly aggravate the problem being experienced in the area.

Table 5.7: Appraisal of the 'No Action' Alternative and use of other lines of action

Criteria	No action	Delayed action	Right away action	Biological works alone	Civil works alone	The civil works (Biological & the construction of Hard Structures
General safeguard of environment and human health (general protection mechanisms)	This will not benefit the concerned stakeholders and community residents considering the observed level of destruction the gully erosion has had on the area. Private properties and public infrastructures have been severely affected and this has led to loss of lives and landed	This will not benefit the concerned stakeholders and community residents. The damage may become catastrophic and the level of human and material losses may be well beyond repair.	This will be the right step to safeguard the environment and human wellbeing from further degradation	The remediation of the biological life forms will lead to improvement of life; properties will be secured, lives saved, resources recovered, transportation facilities enhanced and general restoration of livelihood. It will benefit the project affected people and the residents.	The implementation of this proposed project will lead to improvement of life. Properties will be secured, lives saved, resources recovered, transportation facilities enhanced and general restoration of livelihood. It will benefit the project affected people and the residents.	The rehabilitation of degraded environment coupled with remediation of the biological life form will lead to improvement of life. Properties will be secured, lives saved, resources recovered, transportation facilities enhanced and general restoration of livelihood. It will benefit the project affected people and the residents.

	properties, land degradation, loss of agricultural fields and produce, etc., adopting this alternative will not benefit project affected people and the environment in general					
Short-term usefulness	No-action alternative does not add any specific input to the stated criteria	Delayed action will contribute nothing to short-term usefulness	This will be immediate derivable benefits and a sustained long term benefit will be achieved.	The timeline for the biological works is long term. Nevertheless, the benefits derivable are still better than a No-Action and delayed-action alternatives.	The timeline for the civil works is long term. Nevertheless, the benefits derivable are still better than a No-Action and delayed-action alternatives.	The timeline for the civil and biological works are long term. Nevertheless, the benefits derivable are still better than a No-Action and delayed-action alternatives.
Long term effectiveness and permanence	This option does not meet the long-time effectiveness and	Already incurred damages may obliterate the	This option perfectively meets both the long-term and	The biological works alone will provide long-term effectiveness for the watershed but may	The civil works alone will provide long-term effectiveness for the watershed but may not be	The combination of civil and biological works will provide long-term effectiveness for the watershed

	permanence criteria	gains from long-term effectiveness	short-term effectiveness and permanence criteria	not be sustainable without the civil works	sustainable without the biological works	

CHAPTER SIX

6 STAKEHOLDER'S CONSULTATIONS

6.1 Public Consultations

Public consultation for the NEWMAP involves the process of informing the communities on the rationale for undertaking the Erosion and Watershed Management project in their environment. Consultation is essential because it creates the opportunity and avenue for communities and Project Affected Persons (PAPs) to interact with the project proponents and contribute input and feedback information toward the overall strengthening and domestication of the project.

In the case of St. Luke's Hospital gully erosion site, to capture and address issues and concerns of every stakeholder to this project, wide reaching consultations were conducted. The principal objective of the public consultations was to acquire and disseminate information, identify and address legislative, community, and environmental concerns associated with the NEWMAP intervention project at the St. Luke's Hospital gully erosion site.

Initial consultation started with community leaders and stakeholders in Uyo Local Government Council being informed of the proposed gully erosion intervention project by NEWMAP Project Management Unit (PMU). Subsequently, Stakeholder consultations were carried out in March 2017 the Management Staff of St. Luke's Hospital, the two Principals of School of Nursing and Midwifery, a representative of the Priest of St. Joseph's Catholic Church, the Head Teacher of St. joseph's Primary School, Anua Village Head, Youth and Women leaders of Anua Village, Ekpri Nsukara Village and Ikot Oko Idio Offot Village, together with some members of their communities. Consultations also included interactions with the following: Government Agencies and Parastatals such as the AKS-NEWMAP PMU; Akwa Ibom State Ministry of Environment; AKS-NEWMAP Team Members; Consultants; Project Engineer; Anua Community, and other key stakeholders (Plates 6.1-6.8). Consultants interacted with community members and discussed the project in details, including their fears and expectations on the project. Issues of resettlement for persons who might be affected by the project are discussed in another report (Resettlement action Plan) for AKS NEWMAP.

6.2 Objectives of Consultation

- Facilitate communications and mutual understanding between the various stakeholders and the project proponent;
- Gain support and buy-in from all relevant stakeholders
- Comply with mandatory statutory requirements
- Create awareness in the communities of the proposed project to avoid conflicts in the course of project execution through misunderstanding of the project,
- Identify issues relevant to the proposed project that might affect existing social, economic and environmental stability;
- Mobilize host communities to express their collective concerns regarding the perceived negative impacts of the proposed project;
- Obtain local and traditional knowledge that may be useful to the project
- Obtain first-hand information on the social, political and economic conditions of the community, and
- Sensitize the people on possible resettlement as a result of the project.

Some of the photos taken at consultation sessions are presented as Plates 6.1 - 6.8, while the list of participants at those meetings are presented in Annex 2.

Plate 6.1: Paramount Ruler of Uyo with Chiefs

Plate 6.2: Plate 6.2: Village Heads during the meeting

Plate 6.3: The Chairman Uyo LGA pledging solidarity

Plate 6.4: Cross-section of the audience at meeting

Plate 6.5: Cross Section of Anua Community

Plate 6.6: Plate. 6.6: Cross Section of Anua Community

Plate 6.7: Newmap Team/Consultant during the

Plate 6.8:AKS-SPC addressing Anua gathering

meeting

6.3 Identification and involvement of key stakeholders

AKS-NEWMAP initiated an early consultation process with all the relevant parties, so as to ensure that all the issues of concern are addressed prior to start-up of project. The identified stakeholders are:

- World Bank
- Akwa Ibom State Ministry of Environment
- Other Ministries represented in the Akwa Ibom State NEWMAP Steering Committtee
- Representatives of Community leaders and youths in proposed project area
- Representatives of community based organizations (CBOs) and Non-governmental organizations (NGOs) in the project area.

Continued Stakeholder Consultation must be undertaken during all phases of the project. It is recommended that a Stakeholder Forum be established including directly affected parties, representatives from the local community and other identified persons. The forum will serve to communicate project progress, material changes to the project, grievances received and corrective action taken. The appropriateness and effectiveness of methods of stakeholder engagement should be reviewed on a regular basis and existing methods revised and alternative methods implemented as required.

6.4 Stakeholders Issues

Community participation is considered to be a fundamental tool for managing a two-way communication between the SPMU and the public, aimed at building and improving decision making by actively involving relevant stakeholders. Basically, the stated needs of the Community can be grouped into several main issues including improved road networks to assist the transport of people and goods, educational facilities and training opportunities both in the formal and informal sectors, up-grading of health care services and facilities, job opportunities from government, enhanced economic activities through market facilities and access to capital. Youth groups are more concerned with employment and training since they are largely the ones with limited alternatives. Also, women are more concerned with trading/markets due to their roles and responsibilities as mothers and homemakers.

6.5 Fears and Expectations

6.5.1 Fears

The fears expressed by community members are many and varied and include the following:

- The main fear expressed by the people was about a possible delay in the commencement of construction works due to the onset of the 2017 rainy season, which will bring more flooding to the catchment area and more misery to the residents of the basin area.
- Fears were also expressed on ensuring timely payment of compensation for project affected houses and economic trees.
- Just like in Etim Umana community, the St. Luke's Hospital gully erosion site community members expressed concern over the environmental and social hazards (e.g. road obstruction, noise and dust, etc) that might be associated with project works, but noted that such temporary difficulties do not bother them because the project benefits far out-weigh them.

6.5.2 Expectations

The people have certain expectations from the State and Federal Government of Nigeria and the World Bank. The under-listed were generally considered the priority needs in the community as determined by the socio-economic surveys:

- Control of perennial flooding in Anua and Ekpri Nsukara villages as well as averting any adverse effect of the construction in Ikot Oku Idio community
- Asphalting of internal roads within the community
- Provision of pipe-borne water for the people
- Up-grading of the public schools in the communities
- Provision of street lights
- The people were forward looking over the issue of compensation for land taken up by project
- They have great expectations concerning the prospect of youths employment during intervention works at the gully site
- Scholarships for children
- Formation of erosion site committees with membership drawn from the communities.

The NEWMAP erosion control project is a development that the people are enthusiastically waiting for and they are very expectant of the benefits that the project will bring to the people. The project is expected to rescue many structures that are at the tipping point of being swallowed, and they include houses, economic trees, useful land, lives and property. This project therefore is expected to have both short and long term benefits to the host community, Akwa Ibom State and the Nigerian nation.

6.6 Grievance Mechanism

From survey results, the occurrence of conflict within or between communities in the project area is relatively uncommon. The project may increase the frequency of many social vices in the host communities among which are drug abuse, robberies, prostitution, teenage pregnancy, etc. In general, there are potentially several areas of social impact some of which are mitigated through Corporate Social Responsibility efforts. There will be the need for AKS-NEWMAP to also establish a Grievance Resolution Mechanism with adequate representation of all relevant stakeholders, whereby the concerns of the local population and other stakeholders regarding the project can be addressed. A grievance mechanism will be adopted, and grievances can be submitted in one of the following ways:

- Using existing grievance mechanism channels. The grievance/complaint is made directly or through Chiefs to the Clan Head/Ward Chairman or Councilor (representing the political party in power) (via letter/note or verbally). These officers can settle intra-/inter community complaints within their zones and/or, if the need arises, take responsibility for reporting the issue to AKS-NEWMAP PMU;
- By submitting the grievance directly to AKS-NEWMAP PMU (either verbally or via letter/note); and
- By submitting the grievance to the principal contractor who will then be responsible for informing AKS-NEWMAP PMU.

CHAPTER SEVEN

7 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

7.1 Mitigation Measures

In Chapter Five of this report, some of the impacts that the proposed St. Lukes Hospital, Anua gully erosion control and stabilization project may cause on environmental and social attributes of the project area were identified. Again, the main goal of ESMP study is to provide measures that will reduce or where possible eliminate perceived impacts. This chapter therefore, presents a set of mitigation measures for the identified negative impacts. It is the conviction of this study that these measures, if properly adhered to, and meticulously implemented, will eliminate or at least minimize most of the potential negative impacts, while at the same time enhancing the positive impacts.

In designing an Environmental and Social Management Plan (ESMP) for identified potential impacts of the proposed St. Luke's Hospital gully erosion control project, due cognizance of FMEnv guidelines for Urban Infrastructural Development (UID), the training and experience of members of the multi-disciplinary team that conducted the study, relevant literature and the views of relevant stakeholders gathered during site visits and consultations, were taken into consideration. Thus, the mitigation measures proposed for possible impacts that may arise from specific project activities are from well informed sources. Again, the presentation is in phases.

7.1.1 Pre-Construction Phase

During this phase, the mitigation measures required are those that will mitigate identified potential adverse impacts of the project prior to the commencement of civil works. Two critical issues that are important during this phase are: land/property acquisition and community perception of the project. Even before site clearance, it is critical to settle all land and property acquisition issues, particularly those within the project corridor. This will cover the legally binding right-of-way for civil construction works to commence. Of course, this aspect of the project is provided for by the Resettlement Action Plan (RAP). It is also very important to manage the divergent perceptions of the host communities about the authenticity of the project. In order to resolve such misconceptions or ill-feelings caused by previous

experiences, there are relevant steps to be taken as mitigation measures to checkmate any doubt about the legitimacy and authenticity of the project. These measures are shown in Table 7.1.

During site clearance, the following measures should be observed:

- As much as possible, site clearing should be done sparingly, clearing only the really necessary sites so as to minimize further erosion activities and possible climate modification that may result. The project site is already built-up and will involve very little deforestation.
- Adequate care should be taken during site clearance and preparation to ensure that foreign vegetation/species are not introduced to the project environment.
- Areas that are cleared but will not be used should be promptly re-vegetated using fast growing plant species.
- Care should be taken to prevent mechanical damage to plants not marked for clearing, to avoid predisposing such plants to secondary pathogenic infection.
- Solid wastes such as felled trees, plants and debris generated from clearing activities should be gathered together and disposed at approved disposal sites.
- Areas to be cleared should first of all be sprayed with water so as to reduce dust generation during clearing activities.
- Movement of heavy machines to be employed for site clearing activities should be carefully planned and controlled so as to ensure that areas not marked for clearance are not destroyed.
- Construction site wastes should be collected and disposed at approved disposal sites
- For good corporate image of the project and peaceful co-existence, priority should be given to the host community during employment of unskilled labour that would be required during the site clearing activities. This will foster good relationship between the project proponent and the host community.
- Site clearing activities should only commence when there is absolute certainty that the project is ready to commence construction activities. This is necessary so as to minimize the possibility of erosion and/or flooding due to undue exposure of the project site after clearing activities.
- Equipment to be used during site clearing activities shall be carefully selected. Very old equipment faulty equipment shall be discouraged so as to reduce the attendant

impacts on the environment such as noise pollution and vehicular emissions due to vehicular emissions.

- Site clearing activities should be carefully planned so as to ensure that the host community are not exposed to avoidable stress. In this regard there should be interaction with the host community to determine the period of the day that is most convenient for clearing activities.

7.1.2 Construction Phase

Civil works is expected to create various environmental and social impacts. Also, such impacts are expected to traverse different aspects of the environmental and socio-cultural components of the project area. As required, several governmental MDAs (State Ministries, Departments and Agencies) will be involved in mitigation process. Tables 7.2 - 7.5 present the mitigation measures to various impacts during construction phase. Specifically, air quality issues, noise and vibration, water quality issues, traffic and transportation, health and safety issues are considered. For each of these, the specific mitigation measures are designed to separately curb the identified adverse impacts. Besides these items, the following suggestions are also made as general measures to ensure safe and quality engineering practice during civil works:

- Good engineering practice should be adopted during construction and installations so as to reduce the various environmental impacts that may arise from the operations. Thus, there will be need for adequate quality control and assurance measures.
- Since the location of the project is in the humid tropics, construction activities should be carefully planned and executed to take advantage of the available dry months as possible.
- Construction activities that would result in noise pollution such as excavation, backfilling, and compaction should be carried out during the day time, so as to minimize impact of sleeplessness on the host community.
- As suggested during the pre-construction phase, unskilled and semi-skilled labour should be sourced from the host community first, before looking elsewhere. This is necessary not only to foster a good relationship between the project proponent and the host community but also to reduce influx of people from outside the community, thereby reducing the strain on public utilities in the area.

- As much as it is practicable, effort should be made to ensure that construction activities do not ground the economic activities of the host community to a halt.
- Solid wastes generated from construction activities such as different packaging materials, excess construction materials, scrap metals; etc shall be collected regularly and disposed properly in accordance with regulatory agencies stipulations.

7.1.3 Operation and Maintenance Phase

During the operation phase, air quality issues, noise and vibration, water quality issues, traffic and transportation, health and safety issues will re-surface. For each of these, the specific mitigation measures are designed to separately curb the identified adverse impacts (see Table 6.6). Other general instructions for optimal operation of installed facilities include:

- Provision of spill mitigation equipment, in case of extreme event rainfall.
- Regular de-silting of drainage channels to avoid blockage of underground drains.
- Strict enforcement of health and safety rules around the project site.
- Training of health and safety personnel for good environmental housekeeping practices around the project site.
- Regular drills on emergency procedures to provide a plan of action in case of failure of underground drains.
- Strict enforcement of "No Dumping of Wastes" in drainage channels.

Table 7.1: Mitigation Measures for Pre-construction Phase

S/n	Project Activities	Potential environmental and social impact	Mitigation measures	Responsibility
1	Land acquisition for the intervention project	Conflict from the members of the community to vacate areas allocated for the project	The RAP should outline the framework for mitigation measures.	St. Luke's Hospital gully erosion site committee and community associations and RAP implication committee
	Public awareness	Pessimistic community perception can disrupt the proposed project activities	1. Proper awareness/ sanitization of the host community on the project	AKS NEWMAP-PMU

Table 7.2: Mitigation measures for the environmental impacts in the construction phase

S/n	Proposed project activities	Potential environmental and social impact	Mitigation measures	Responsibility
1	Excavating, filling scooping of earth material and other related activities	Channel/Ravine Bank Failure	1. Heavy duty machinery and filling material should be about 30m away from the channel 2. Vibration induced machines should be avoided 3. The overhand should be lowered before using excavator with a boom of at least 25 meters	Site engineer and/or contractor
2		Overburden material cave in	1. Heavy duty machinery and filling material should be about 30m away from the channel 2. Machines that can cause vibration should be avoided 3. Use manual efforts to reduce overburden 4. Ensure filling materials are compacted.	Site engineer and/or contractor
3		Mudflow	1. Possibly limit civil work to dry season 2. proper re-channelization of runoff before actual work 3. temporary shoulder must be hydrologic-ally stable to avoid being washed away 4. temporary ballast and wicker work should be put in place	Site engineer and/or contractor
4		Soil impacts on activities such as excavation, grading, leveling, compaction, etc.	1. Erosion control measures should be implemented. 2. Planting of trees should be encouraged 3. Localized environmental designs that took into consideration the terrain and biophysical database of the	Site engineer and/or contractor

			environment should be implemented by the contractor and site engineer	
5		In situ waste management	1. Designated sites should be selected for waste management 2. Measures to ensure waste is properly handled should be encouraged 3. Cover of waste collection materials 4. Construction waste could be recycled and reuse, this option should be prioritized.	Site engineer and/or contractor
6		Land use conflicts	1. RAP report should be properly followed. 2. World Bank safeguard policy should be implemented based on the land use issues.	Site engineer; AKS ministry of Land and Survey
7		Channelization of flood waters	1. Ensure free flow of storm water in drains to ease construction activities. 2. Where necessary, diverting water to safe environment could be utilized 3. Watershed and bioengineering techniques should be implemented.	Site engineer and/or contractor
8		Topographic alterations and other civil works for remediation purposes	1. The construction works should be done according to local relief and hydrology 2. Old drainage system should be maintained and new ones prioritized. 3. Ensure that site-specific plans are designed with respect	Site engineer and/or contractor

			to local topography.	
9		Air quality issues (Dust)	1. Use of breathing protection masks and routing water sprinkling to curtail dust 2. Use of dust suppression method to minimize airborne particulate matter 3. Provide PPE as necessary 4. Reduce travel distances by planning constructions campsites close to work areas. 5. International standards for exhaust emission should be adequately complied with.	Site engineer and/or contractor
10		Water quality concerns	1. Mobile toilet facilities should be provided near the site and away from streams. It should be properly maintained based on municipal sewage collection and treatment regulations 2. Ensure provision of proper storage facilities to avoid leakage into the water supply systems. 3. Development and implementation of proper waste management plans (WMPs)	Site engineer and/or contractor
11		Noise level nuisance	If possible, construction activities should be limited to day time	Site engineer and/or contractor
12		Increased siltation and runoff	Ensure stipulated water flow and safe environment designs are adhered to and the high flow of water during rain should be controlled using the stipulated construction guidelines on	Site engineer and/or contractor

			pollution (the Management of Solid and Hazardous Wastes. Regulations 1991)	

Table 7.3: Mitigation Measures for the biological impact in the construction Phase

S/n	Proposed Project Activities	Environmental and social impact	Mitigation measures	Responsibility
1	Clearing of forest	Impact on flora and fauna	1. Identify site of special scientific interest. 2 Co-operate with relevant MDAs at both federal and state levels such as the federal Department of Livestock, privately owned wildlife conservation parks, Zoos and Zoological department of Universities, for the housing of possible animals that may be relocated in this phase. 3. Department of forestry of the State Ministries of Environment and Natural resources; and Agriculture.	Site engineer and/or contractor
2		Impact on wildlife	Ensure that all the necessary World Bank safeguard polices on wild animals and their related habitats are addressed and strictly adhered to such policies include OP 4.04 and OP 4.36 on Natural Resources and forestry respectively.	Site engineer and/or contractor

Table 7.4: Mitigation measures for the environmental impacts in the construction phase

S/n	Proposed project activities	Potential environmental and social impact	Mitigation measures	Responsibility
1	Mobility of machineries and materials	Traffic and transportation impact	The contractor shall liaise with state transportation and traffic maintenance agency as well as Federal Government agencies such as the Federal Road safety commission (FRSC) throughout the construction phase to ensure that traffic safety is maintained and ensured during the period	Site engineer and/or contractor
2		Accidents and Road crashes	1. All workers shall be sensitized and monitored on the need to keep the first rule of civil and construction works which is "safety First". 2. Contractor shall conduct a risk – based assessment of all construction tasks and provide appropriate safety measures	Site engineer and/or contractor
3		Employment opportunities	1. Ensure that individuals from the project community are given priority to improve any socioeconomic rife from local youths. 2. The campsite for workers should be located remotely away from the community to enhance the progress the civil work	Site engineer and/or contractor
4		Human displacement	1. World Bank OP 4.12 should be applied for this issue	Site engineer and/or

			on the affected areas 2. All issues of resettlement / compensation are being addressed in RAP	contractor
5		Aesthetics	1. Proper use of engineering practice should be adopted with the best available construction technology which recognizes the need to keep local aesthetics and an engineering expert in the field of aesthetics should be employed as part of the team	Site engineer and/or contractor

Table 7.5: Mitigation measures for the environmental impacts in the construction phase

S/n	Proposed project activities	Potential environmental and social impact	Mitigation measures	Responsibility
1	Sexual activities	HIV/AIDS AND STDs	1. HIV/AIDs and STD awareness programme should be prioritized 2. Other activities should include treating other sexually transmitted diseases, distributing condoms, and providing counseling, screening, and support services for employees 3. Medical examinations on general health issues should be performed on new employees and repeated regularly	Site engineer and/or contractor

			throughout the term of employment. 4. Workers should be prohibited from patronizing prostitutes and the use of alcohol and drugs.	
2	Domestic water usage	Water – borne diseases	Good sanitation, including hygienic water supply and proper waste disposal, should be maintained at the operations area and residential accommodations throughout the phases of the project.	Site engineer and/or contractor
3	Malaria	Malaria issues	Government programmes to improve existing medical and healthcare services in the local communities should be supported as much as possible. This includes mosquito control programmes such as the distribution of insecticide treated nets to affected community members.	Site engineer and/or contractor

Table 7.6: Mitigation Measures for Operation Phase

S/N	Proposed Project Activities	Environmental and Social Impacts	Mitigation measures	Responsibility
1	General maintenance operations	General maintenance operations	1. Maintenance operations shall be designed according to environmental safety guidelines of the department of Environmental Engineering and Ecology of Ministry of Environment and Natural Resources and Federal Ministry of Environment.	Site Engineer and/or Contractor

2	Air quality	Air quality Issues	1. Periodic checks on ambient air quality; vehicles roadworthiness should be prioritized and regular checks on the nature of the road should be conducted with respect to air quality parameters.	Site Engineer and/or Contractor
3	Noise and vibration	Noise and vibration Issues	Speed limits signboards shall be placed at strategic locations along the major roads for the use of motorists and other road users. The local road transportation officials should be empowered to checkmate the activities of careless motorists.	Site Engineer and/or Contractor
4	Water quality	Water Quality issues	Ensure waste dumps are not situated close to the project area to avoid water pollution cases. Wastewater and sewage should be channeled according to safety guidelines.	Site Engineer and/or Contractor
5	Traffic and transport	Traffic and transportation Issues	Ensure free flow of traffic by ensuring that traffic officials are strategically positioned at specific junctions to provide appropriate directions and guidelines to enhance free flow of traffic within the project area.	Site Engineer and/or Contractor
6	Health and Safety	Health and safety Issues	Maintenance workers are expected to imbibe the workplace safety rules via proper sensitization procedures prior to maintenance works. Ensure that workers utilize safety tools such as safety boots, safety helmets, and other essential safety wears on-site; First aid tools are provided for minor injuries which are to be treated prior to being forwarded to a medical center for proper treatment; Health, Safety	Site Engineer and/or Contractor

			and Environment (HSE) Officer should be available prior to and during work operations.	
7	Sand Mining in rehabilitated channel.	Sand Mining in rehabilitated channel issues.	1. Ensure Sand Mining is not done in the rehabilitated channel	Site Engineer and/or Contractor

7.2 Monitoring: Project Implementation and Mitigation Measures

7.2.1 Pre-Construction Phase

At this phase, measures are provided to ensure that activities that needed to be done for the smooth running of the project is done before proper civil works commence. Table 7.7 shows monitoring activities for pre-construction phase.

7.2.2 Construction Phase

As mentioned in the section on mitigation measures, civil works are anticipated to have various environmental and social impacts; such potential impacts are expected to traverse different aspects of the environmental and socio-cultural components of the project area. The mitigation measures for the identified impacts have been stated. Therefore, both project implementation and mitigation measures implementation need to be monitored. Tables 7.8 - 7.11 shows monitoring for both project implementation and mitigation measures to various impacts during construction phase.

7.2.3 Operation and Maintenance Phase

Table 7.12 shows the monitoring activities for environmental and social issues identified and for which mitigation measures have been proffered.

Table 7.7: Monitoring for Pre-construction Phase

s/n	Project Implementation Activities	Potential Environmental and Social Impact	Monitoring		Monitoring Indicators	Frequency	Responsibility	
			Project Implementation	Mitigation Measures			Monitoring project implementation	Monitoring mitigation measures
1	Land acquisition for the intervention project	Conflict from the members of the community to vacate areas allocated for the project	As indicated in the RAP report	As indicated in the RAP report	As indicated in the RAP report	All issues should be settled before the starting of civil works	Akwa Ibom State NEWMAP-PMU	St. Luke's Hospital, Anua Gully Erosion Site Committee and Community Associations & RAP Implementation committee
2	Public Awareness	Pessimistic Community perception can	Before commencement of the civil	Proper awareness/sensitization of the host	1. Number of public awareness	Periodically during the pre-	1. Community Based	Akwa Ibom State NEWMAP-

		disrupt the proposed project activities. Perception of the community members on the competence of contractors	Works and during civil works.	community on the project and the competence of contractors	campaign, 2. Number of adverts placed in the media 3. Complaints made by the project affected community members	construction , construction and Operational phases.	Organizations 2. AKS Gully Erosion Site Committee and Community Associations. 3. AKS NEWMAP focal NGO.	PMU
3	Clearing of Forest	Impact on flora and fauna	Before commencement of the civil Works	1. 1.Identify design right of way. 2. Restrict clearance to the right of way	1. Area cleared outside the gully erosion remediation corridor. 2. Extent of area	Daily during clearance for installation and along the right of way.	Site Engineer and/or Contractor	AKS NEWMAP-PMU; AKS Ministry of Environment; NESREA

					cleared for installation			

Table 7.8: Monitoring for the Project Implementation and Mitigation Measures for the Environmental Impacts in the Construction Phase

s/n	Proposed project activities	Potential Environmental and Social Impact	Monitoring		Monitoring Indicators	Frequency	Responsibility	
			Project Implementation	Mitigation Measures			Monitoring project implementation	Monitoring mitigation measures
1	Excavating, filling, scooping of earth material and other Related activities	Channel / Ravine Bank Failure	1. Sighting 2. Visual Observation During implementation of civil works	1. Sighting 2. Visual Observation. 3. Distance measurements using tape rule.	1.Distance of heavy duty machines from the channel during civil works 2 Overhead position of excavator with boom of at least 25	Every day during the construction phase	Site Engineer and/or Contractor	AKS NEWMAP; AKS State Ministry of , Environment

					meters. 3. Vibration level of machinery during civil works.			
2		Overburden material cave in	1. Sighting 2.Visual Observation During implementation of civil works	1. Sighting 2.Visual Observation. 3. Distance measurements using tape rule.	1.Location of heavy duty machines during civil works 2 Overhead position of excavator with boom of at least 25 meters. 3. Vibration level of machinery during civil works.	Every day during the construction phase	Site Engineer and/or Contractor	AKS NEWMAP; AKS Ministry of Environment
3		Mudflow	1. Sighting 2. Visual Observation	1. Sighting 2. Visual Observation	1. Number of solid waste disposal bins and cabins available. 2. Physical presence of objects, rocks, etc.	Every day during the construction phase	Site Engineer and/or Contractor	AKS NEWMAP; AKS State Ministry of

					deposited along the courses of rivers. 3.Runoff paths are re-channelized before construction			Environment
4		Soil impacts on activities such as excavating, grading, leveling, compacting etc.	Visual estimate during and after implementation of civil works	Visual estimate during and after implementation of civil works	1. Number of trees planted. 2. Area of vegetated lawns created 2.Number of Community complaints on soil/land degradation	Every day during the construction phase	Site Engineer and/or Contractor	AKS NEWMAP; AKS Ministry of Environment
5		In situ waste management	Visual estimate during and after implementation of civil works	Visual estimate during and after implementation of civil works	1. Availability of waste management plan for the entire project cycle 2. Number of waste bins available.	Every day during the construction phase	Site Engineer and/or Contractor	AKS NEWMAP; AKS Ministry of

					3. Availability of designated waste disposal vehicle. 2. System in place to manage degradable waste 3. Number of complaints received from the community members over the improper waste disposal 4. Cleanliness of the specific work sites			Environment
6		Land use Conflicts	As stated in the RAP report	1. RAP report should be properly followed. 2. World Bank safeguard	As stated in the RAP report	Three months before actual construction	Akwa Ibom State Ministry of Lands and Survey	AKS NEWMAP-PMU

				policy should be implemented based on the land use issues.				
7		Channelization of flood waters	1. Sighting 2. Visual Observation.	1. Sighting 2. Visual Observation.	1.Number of flow obstruction material identified along the channel 2. Direction of flow during civil work.	This should be set before the start of civil works on the gully erosion site.	Site Engineer and/or Contractor	AKS NEWMAP-PMU; AKS Ministry of Environment
8		Topographic alterations and other civil works for remediation purposes	Visual Estimate/ Observation during implementation of civil works	Visual Estimate/ Observation	1. Height of bank stabilization to the local relief 2. Depth and area extent of excavation. 3. Number and area extent of cut and fill	Before actual civil work on the gully erosion site	Site Engineer and/or Contractor	AKS NEWMAP-PMU; AKS Ministry of Environment

					4. Terraced areas (extent)			
9		Air Quality Issues (Dust)	In-Situ Measurement during implementation of civil works	1. In-Situ Measurement 2.Visual Observation 3. Water sprinkle records.	1. Suspended Particulates (TSP, PM10, or smaller), SO2, NOx, CO, THC 2. Number of time water is sprinkle on daily bases during construction 3. Level of airborne particulate matter during construction 4. Number of PPE provided 5. Number of time routine maintenance was done on equipment and machinery. Number	Daily checks for adherence to safety concerns	Site Engineer and/or Contractor	AKS NEWMAP-PMU; AKS Ministry of Environment

					of community complaints received.			
10		Water Quality Concerns	In-Situ/ Laboratory Measurements •Visual Observation	In-Situ Measurements •Visual Observation	1. Number of mobile toilets provided 2. Type of storage facility provided 3. Regular cleaning of workshop for maintenance. 4 Water Quality (pH, TDS, TSS, BOD, COD, Turbidity, THC, heavy metals) measurement	Weekly during the construction phase of the project	Site Engineer and/or Contractor	AKS NEWMAP-PMU; AKS Ministry of Environment
11		Air Quality (Noise)	In-Situ Measurement; Complaint register	In-Situ Measurement; Complaint register	1. Noise level in dB. 2. Number of complaints received	□ Daily during the construction	Site Engineer	AKS NEWMAP-PMU; AKS Ministry

			. Maintenance records •Visual Observation	•Visual Observation	from the community 3. Number of time heavy duties were maintained	exercises		of Environment
12		Increased Siltation and runoff	In-Situ Measurement •Visual Observation	In-Situ Measurement •Visual Observation	1.water level in channels during construction 2. Physical presence of objects, rock, debris, etc. deposited along the courses of rivers 3. Number of acceptable erosion control measures	Weekly and more frequently during wet season	Site Engineer and/or Contractor	AKS NEWMAP-PMU

Table 7.9: Monitoring for the Project Implementation and Mitigation Measures for the Biological Impacts in the Construction Phase

s/n	Proposed project activities	Potential Environmental and Social Impact	Monitoring		Monitoring Indicators	Frequency	Responsibility	
			Project Implementation	Mitigation Measures			Monitoring project implementation	Monitoring mitigation measures
1	Clearing of Forest	Impact on flora and fauna	Visual Observation Visual Estimate of Cover	Visual Observation Visual Estimate of Cover	1. Area cleared outside the gully erosion remediation corridor. 2. Extent of area cleared for installation. 3. Number of trees planted and area extent of lawns developed	Daily during construction phase	Site Engineer and/or Contractor	AKS NEWMAP-PMU; AKS Ministry of Environment; NESREA
2		Impact on Wildlife	Visual Observation Visual Estimate 1. of Cover	Visual Observation Visual Estimate	1. Number and extent of protected/conserved area developed	Daily during construction	Site Engineer and/or Contractor	Contractor; AKS NEWMAP-PMU;

				2. of Cover	2. Number of tree planted	phase		Federal NEWMAP and other relevant Ministries

Table 7.10: Monitoring for the Project Implementation and Mitigation Measures for the Socioeconomic Impacts during Construction Phase

s/n	Proposed project activities	Potential Environmental and Social Impact	Monitoring		Monitoring Indicators	Frequency	Responsibility	
			Project Implementation	Mitigation Measures			Monitoring project implementation	Monitoring mitigation measures
1	Machineries and materials	Traffic and Transportation Impacts	Visual Observation	Visual Observation Complaint Register	1. Number of road signs and traffic officials present.	Every day during the construction phase	Site Engineer and/or the Contractor	AKS NEWMAP-PMU; AKS Ministry of

					2. Number of community complaints received on traffic issues			Transport
2		Accidents and Road Crashes	Visual Inspection Incident Reports	Visual Inspection	1. Number of road signs on the corridor of movement. 2. Number of traffic officials present during construction. 3.. Number of sensitization and awareness campaigns conducted 3. Number of Complaints made by the project	Every day during the construction phase	Site Engineer and/or the Contractor	AKS NEWMAP-PMU; AKS Ministries of Transport and Environment

					affected community members			
3		Employment Opportunities	Employment records	Employment records	1. Availability of a functional unit monitoring compliance status 2. Availability of staff-job descriptions, recruitments and engagement. 3. Number of local people employed as both skilled and unskilled workers.	Every day during the construction phase	Site Engineer and/or Contractor	AKS NEWMAP-PMU; AKS Ministries of Labour and Environment
4		Human displacement	As spelt out in the RAP report	As spelt out in the RAP report	1. No. of PAPs 2. Amount of compensation	As spelt out in the RAP report	Site Engineer and/or Contractor	AKS NEWMAP-PMU

					paid 3. No. of PAPs (requiring involuntary resettlement)			AKS Ministry of Land survey
5		Aesthetics	Visual Inspection	Visual Inspection	1. 1. Number of ornamental trees planted 2. 2. Areal extent of gardens and parks provided.	Regularly during the construction phase	Site Engineer and/or Contractor	AKS NEWMAP-PMU AKS Ministry of Lands and Surveys

Table 7.11: Monitoring for the Project Implementation and Mitigation Measures for the Public Health Impacts in the Construction Phase

s/n	Proposed project activities	Potential Environmental and Social Impact	Monitoring		Monitoring Indicators	Frequency	Responsibility	
			Project Implementation	Mitigation Measures			Monitoring project	Monitoring mitigation

							implementation	**measures**
1	Sexual Activities	HIV/AIDS and STDs	Visual Inspection Incident Report	Visual Inspection Incident Report	1. Number of HIV/AIDS and STDs awareness provided (training & awareness) 2. Preventive measures introduced 3. No. of community complaints received. 4. No. of people affected by HIV and or STD	Constantly during the construction phase on weekly basis.	Site Engineer and/or Contractor	AKS NEWMAP-PMU; AKS Ministry of Health
2	Domestic Water Usage	Water-borne diseases	Visual Inspection Incident Report	Visual Inspection Incident Report	1. Availability of waste management plan for perusal by the contractor	Daily during the civil work activities	Site Engineer and/or Contractor	AKS NEWMAP-PMU; AKS Ministry of Health

					2. System in practice to manage waste and water borne diseases 3. Cleanliness of the specific work sites			
3	Malaria	Malaria Issues	Visual Inspection Incident Report	Visual Inspection Incident Report	1. Number of health awareness campaign provided (training & awareness) 2. Preventive measures introduced 3. Number of complaints received from Community 4. No. of workers	Regularly right through the construction phase	Site Engineer and/or Contractor	AKS NEWMAP-PMU; AKS Ministry of Health

					affected by malaria & other vector/water borne diseases from hospital records.			

Table 7.12: Monitoring for Operation Phase

s/n	Proposed project activities	Potential Environmental and Social Impact	Monitoring		Monitoring Indicators	Frequency	Responsibility	
			Project Implementation	Mitigation Measures			Monitoring project implementation	Monitoring mitigation measures
1	General maintenance operations	General maintenance operations	Visual Inspection Maintenance reports	Visual Inspection Maintenance reports	1. Number of maintenance conducted per Year.	Quarterly: during the operation phase of the project	Environmental Officer, AKS PMU and Environmental officer; AKS Ministry of	AKS Ministries of Environment, Forestry & Transport

							Environment	
2	Air quality	Air quality Issues	In-Situ Measurement Complaint register Visual Observation	In-Situ Measurement Complaint register Visual Observation	1. Air quality measurements during Operation. 2. Number of time water is sprinkle on daily bases during dry season 3. Level of airborne particulate matter 4. Number of community complaints	Weekly: throughout the operation phase of the project.	Environmental Officer, AKS PMU and Environmental officer AKS Ministry of Environment	AKS Ministries of Environment & Forestry

					received.			
3	Noise and vibration	Noise and vibration Issues	In-Situ Measurement Complaint register	In-Situ Measurement Complaint register	1. Noise level measurements in d**B** during construction. 2. Number of community complaints received.	Weekly: throughout the operation phase of the project	Environmental Officer, AKS PMU and Environmental officer; AKS Ministry of Environment	AKS Ministries of Environment, Forestry & Transport
4	Water quality	Water Quality issues	.In-Situ Measurement .Visual Sighting Complaint register	Visual Sighting	1. Number of mobile toilet provided 2. Type of storage facility provided. 3. Location of dumpsite.	Weekly: throughout the operation phase	Environmental Officer, AKS PMU and Environmental officer AKS Ministry of Environment	AKS Ministries: Environment, Forestry

5	Traffic and transport	Traffic and transportation Issues	Visual Observation -Complaint Register	Visual Observation -Complaint Register -Training and awareness campaign records	1. Number of traffic wardens available 2.Number of awareness campaigns conducted on safety and driving issues 3. No. of complaints received from the Community	Daily: for traffic officers and Quarterly: for awareness campaign. throughout the operation phase	AKS Relevant Ministries: Transport/ Works/ Infrastructure	AKS Relevant Ministries: Transport/ Works/ Infrastructure
6	Safety	Health and safety Issues	Visual Inspection -Incident Reports	Visual Inspection -Incident Reports -Safety talk records and reports	1. No. of complaints about pollution due to operations 2. Number of workers with PPEs	Quarterly throughout the operation phase of the project	Site Engineer and/or Contractor	AKS Relevant Ministries: Transport/ Works/ Infrastructure

					3. Number of FRSC and police present in the area. 4. Number of safety talk and awareness conducted.			
7	Sand Mining in rehabilitated channel.	Sand Mining in rehabilitated channel issues.	Visual sighting	Visual sighting	Number of truckloads of sand evacuated from the channel.	Weekly	Environmental Officer, AKs PMU and Environmental officer; AKS Ministries: Environment	AKS Relevant Ministries: Transport/ Works/ Infrastructure

7.3 Institutional Arrangements: Responsibilities and Accountabilities

Roles and responsibilities and adequate institutional arrangements are vital to the efficient execution of the environmental and social safeguard measures outlined in the present ESMP. Thus, details of institutional arrangements and the roles and responsibilities of the diverse institutions in the implementation of the ESMP are discussed as follows.

7.3.1 Pre-Construction Phase

7.3.1.1 Key Agencies

Main Agencies with major roles in the implementation of the ESMP during the pre-construction phase are:

- The Federal NEWMAP-PMU;
- The Akwa Ibom State NEWMAP-PMU;
- Akwa Ibom State Ministries, Departments and Agencies (Health and Environment, Information, Land, Finance, Physical Planning and Urban Development, and Agriculture);
- Community Based Organisations;
- The St. Luke's Hospital gully erosion site committee; and
- The World Bank.

7.3.1.2 Role of the Involved Agencies

The key duty for monitoring the ESMP lies with the AKS-NEWMAP and the Ministry of Environment while the implementation of/and reporting on the ESMP lies with the Contractor. At the initial stage, ground works and preparatory meetings and consultations are being conducted with the St. Luke's Hospital gully erosion site committee and Community Associations, Community Based Organizations (CBOs), as well as, members of the concerned communities in the area. The Contractor must liaise with the Akwa Ibom State NEWMAP-PMU on issues raised in order to strike a balance in responding to the issues to meet international safeguard polices of the World Bank. These concerns would be communicated to the appropriate Akwa Ibom State Ministries with their respective departments and agencies (MDAs) for prompt action on issues raised.

7.3.1.3 Reporting and Follow-Up

St. Luke's Hospital gully erosion site committee and Community Associations through its secretary should forward the details of the meetings held to the Akwa Ibom State NEWMAP-

PMU. This is to enhance a feedback, reporting and follow-up mechanisms for the issues raised and the respective means of their implementations. Any issues raised should be forwarded together with the contributions of the Akwa Ibom State NEWMAP who would have reviewed the comments within the scope of the project and their suitability to World Bank needs. The Contractor must ensure that the observed comments and notes are implemented strictly as agreed and the feedback relayed to the Akwa Ibom State NEWMAP-PMU. This process continues through a chain of reporting-feedback, follow-up and response mechanism until the pre-construction phase is completed.

7.3.2 Construction Phase

7.3.2.1 Key Agencies

Major Agencies with roles in the implementation of the ESMP during construction works are:

- The Engineer/monitoring firm;
- The Contractor (with specific relevant specialists);
- Akwa Ibom State NEWMAP-PMU;
- Federal NEWMAP-PMU;
- Akwa Ibom State Ministries, Departments and Agencies (Works and Infrastructure, Health and Environment, Agriculture and Forestry);
- Environmental Officers of the Federal NEWMAP-PMU;
- Environmental Officers of Akwa Ibom State NEWMAP-PMU;
- Federal Ministry of Environment (FMEnv), NESREA; and
- World Bank.

In addition to the key agencies, the Akwa Ibom State Government through the MDAs will also have a role in general oversight of ESMP implementation.

7.3.2.2 Role of Concerned Agencies

The key responsibility for monitoring and reporting on the implementation of the ESMP lies with the site Engineer and contractors. Through its Environmental and Social Specialist (ESS) the Contractor will be responsible for regular supervision and reporting on ESMP implementation. The Engineer's ESS will have access to a team of experts in different fields (water, soil, social consultant etc.) in order to ensure sufficient capacity to oversee implementation of ESMP.

The implementation of the ESMP will be managed by Akwa Ibom State NEWMAP-PMU through the Environment Officer (EO) that will be primarily responsible for daily inspection and monitoring of ESMP implementation. The Akwa Ibom State Ministries of Works, Health, Environment, Agriculture and Forestry should monitor the ESMP implementation on the fundamentals of the internal mechanisms and policies as established by laws guiding their operations. These institutions may conduct site visits with representatives of Federal NEWMAP-PMU. The reports of the findings should be forwarded to the World Bank.

The Federal Ministry of Environment (FMEnv) and NESREA should also send Environment Officers and officials monitoring the ESMP project under the Federal NEWMAP approved projects, to observe the level of implementation of the provisions of the ESMP compliance. At the local level, the Akwa Ibom State Ministry of Environment can also pay visits to the project site to observe and monitor the level of compliance to the provisions of the ESMP.

7.3.2.3 Reporting and Follow-Up

Follow-up process is duty-based, the Environmental and Social Specialists (ESS) of the Engineer/ Monitoring Firm must prepare, document and report incidents monthly. These are reports that would be submitted to the Akwa Ibom State NEWMAP project coordinator for comments, observations, and recommendations. Afterward, the Akwa Ibom State NEWMAP-PMU would send feedback to the Engineer through the consultant(s)/PMU Environmental Officer or directly when urgent act is required. In core, checking and reporting on the implementation of follow-up action will also be part of the duties of the ESS.

The Contractor and Site Engineer should submit monthly reports on the implementation of the ESMP to the Akwa Ibom State NEWMAP-PMU. The ESS officers who will advise the project management unit should vet the report. In case of any discrepancy on environmental issues, the project coordinator should convene a Project Environmental Management (PEM) meeting to discuss the way forward.

7.3.3 Operational and Maintenance Phase

It should be stated that the mitigation and monitoring activities are not the sole responsibility of the Akwa Ibom State NEWMAP or Federal NEWMAP during the operational phase. The Akwa Ibom State NEWMAP and the Federal NEMWAP as the managing entity of the rehabilitated St. Luke's Hospital, Anua-AKS Gully Erosion site has the responsibility to

consider these measures, and to bring these to the attention of other government agencies especially the state ministry of health and environment for proper action.

7.3.3.1 Key Agencies

At the operational phase, the main institutions, which Akwa Ibom State NEWMAP will collaborate with include:

- Akwa Ibom State Ministry of Environment;
- Akwa Ibom State Ministry of Health
- Akwa Ibom State Ministry of Agriculture &Forestry;
- Akwa Ibom State Ministry of Transport;
- Akwa Ibom State Ministry of Works; and
- The Nigerian Police Force.

Also the Local government administrative council should have a role in general oversight of ESMP implementation and in ESMP up-dating during the operational phase.

7.3.3.2 Role of Concerned Agencies

The duties of the institutions that have a role in the process of the operation of the AKS Gully Erosion monitoring are stated as follows.

- The Monitoring and Supervision Unit of the Akwa Ibom State Ministry of Environment should conduct constant visits to the site to check and confirm that the gully erosion site is operated and maintained. Monitoring activities should be conducted within the legal and administrative capacity of the Ministry of Environment, through their respective departments and agencies.
- Akwa Ibom State Department of Forestry should conduct constant inspections for compliance with afforestation plans, which should be in concordance with international standards.
- The Ministry of Transport should check the nature of vehicular traffic and road transportation pattern in the area with respect to transportation safety and vehicular controls.
- The Ministry of Works will conduct normal checks on the nature of infrastructure given, within the duration of the project and the period of assessment.
- Police should ensure that crime and criminal activities are reduced to the barest minimum in order to avoid wrong labelling of such events to the proposed project activities.

7.3.3.3 Institutional and Implementation Actions for the ESMP at the Local Level

At this level, NEWMAP ESMF vested the overall implementation of the ESMP on the Site Committee and Community Associations. The AKS Gully Erosion Site Committee and Community Associations has already been constituted by Akwa Ibom State NEWMAP and the committee constituted a critical mass of source of information and community liaison during the field activity for the preparation of this ESMP. The committee has several sub-committees including women wing and environmental sub-committee.

Conversely, considering the various background of the committee members and the need for adequate knowledge on the environmental procedure of the project, the committee and sub-committee members need further capacity building on environmental and social issues on the implementation of the ESMP at all stages of the implementation. Consequently, capacity strengthening and sensitization of the AKS Gully Erosion Site Committee and Community Associations and the Environmental sub-committee members is critical to the successful implementation of this ESMP. The content of the training should include but not limit to (i) Role of community during construction and post contraction (ii) Sustainable practice to ensure gully erosion stabilization and, (iii) Implementation of the ESMP at the local level.

7.4 Training Programmes

The AKS NEWMAP will develop, implement, and track training programmes at PMU and community levels. Table 7.13 describes the institutional capacity-strengthening plan, which should be followed at the PMU and community levels.

Table 7.13: Institutional Capacity-Strengthening Plan

S/N	Capacity Needs	Participants	Subject	Resource Person	Duration	Cost (USS $)
1	Personnel require appreciation of World Bank/ Federal/State environmental policies, as well as, an application of these policies in implementing the	**PMU Training** PC, Environment and safeguards specialist, Project engineer and	In-depth consideration of the mitigation measures proffered by the ESMP. Satellite Image interpretation of the St. Luke's	Remote sensing and environmental science specialist	4 days seminar	40,000

	World Bank support for St. Luke's Hospital gully erosion control.	Social safeguards specialist. The estimated number of participant is ten (10) persons	Hospital gully erosion site watershed imagery for critical assessment of changes overtime			
2	NEWMAP institutional arrangement target audience responsible for site monitoring and liaison between community and the Akwa Ibom State NEWMAP and contractors	**Community** Akwa Ibom Gully Erosion Site Committee and Community Associations' members. The estimated number of participant is Twenty Five (25) persons.	General environmental awareness seminar that will include Ecological and Social Science principles, as it affect Etim Umana Gully Erosion site. Mitigation measures proffered in the ESMP	Remote sensing and environmental science specialist	2 days workshop	20,000
	Total					$60,000

7.5 Implementation Schedule

An implementation schedule gives a clear-cut direction on the timeline for the implementation of the stipulated mitigation measures. It is anticipated that each of the stated measures should be time-based for suitable implementation and appropriate monitoring. Table 7.14 documents the schedule for the mitigation measures with respective time lapse. However, this is not rigid as human circumstances might bring a modification and when such arise, all concern parties must be informed.

7.6 Remediation Plans after Closure/ Decommissioning

The following site remediation measures are made based on environmental sensitivities identified earlier in the study, especially negative (adverse) impacts. The measures include:

- Soils contaminated from accidental oil and/or chemical spills during the construction/operational phase shall be removed for ex-situ or offsite treatment. However, the soil can also be treated using various available in-situ treatment technologies i.e. land farming.
- All equipment and debris shall be removed from the project environment and disposed in an environmentally friendly manner.
- Indigenous plant species that were cut down during site clearing activities for access road/site clearing shall all be replanted.
- The site shall be graded to its original landscape to prevent incidences of erosion.
- A good waste management plan shall be practice. All used chemical containers and any other material shall be properly disposed. For example, reusable or recyclable materials shall be taken back to the manufacturers of the products or sold to local vendors.
- Construction access routes shall be blocked wherever possible, especially where subsequent use by local communities is not appropriate.
- After the restoration measures have been effected, the site shall be photographed and monitored by the proponent's representatives. The aim is to enable the proponent through proper documentation, to effectively monitor the site recovery.

Table 7.14: ESMP Implementation Schedule

s/n	Mitigation measures for:	MITIGATION TIMELINE (MONTHLY)																							
		1ST	2ND	3RD	4TH	5TH	6TH	7TH	8TH	9TH	10TH	11TH	12TH	13TH	14TH	15TH	16TH	17TH	18TH	19TH	20TH	21ST	22ND	23RD	24TH
1	**Pre-construction phase** Community sensitization about the project.																								
	ii. Land Acquisition																								
2	**Construction phase** 1. Environmental impacts																								
	2. Biological impacts																								
	3. Socioeconomic impacts																								
	4. Public health																								
3	**Operation and maintenance phase** Air quality, noise and vibration, water quality, traffic & transportation, and health and safety																								
4	**Decommissioning Phase:** Bioremediation																								

7.7 ESMP Costing and Cost Analysis

The cost analysis illustrated here is structured to ensure that each of the identified mitigation measures is successful and proficiently implemented. It is designed exclusively for each of the activities identified for each of the phases of the St. Luke's Hospital, Anua Gully Erosion Rehabilitation project as shown in Tables 7.5 to 7.6. Hence, it covers the pre-construction, the construction and the operation phases, with mitigation measures as essential. Therefore, the cost is designed for a global spread across the stated measures. Table 7.15 illustrates the details of the ESMP costing for the St. Luke's Hospital Gully Erosion Rehabilitation project, with estimation in U.S. Dollar.

Table 7.15: Cost Analysis of the Proposed Project ESMP Implementation

S/N	**ESMP Activities**	**Cost Estimate ($)**
	Monitoring (Implementation and Mitigation Measures)	
1	***Pre-construction Phase***	6,000
	Construction Phase	
	Environmental Impacts	20.000
	Biological Impacts	10,000
	Socioeconomic Impacts	10,000
	Public Health Impacts	20,000
	Sub-Total	**66,000**
	Operation Phase	20,000
	Total for Monitoring	**86,000**
2	**Institutional Capacity reinforcement Programme**	
	PMU	40.000
	Community	20,000
	Total for Institutional Capacity	**60,000**
	Grand Total	146,000

7.8 ESMP Disclosures

After a review and clearance by the World Bank, the ESMP will be disclosed at the FMEnv, SME and host LGA offices as well as the World Bank Info Shop. The purpose will be to

inform stakeholders about the project activities; impacts anticipated and proposed environmental management actions.

CHAPTER EIGHT

8 SUMMARY, CONCLUSION, AND RECOMMENDATIONS

8.1 Summary

Catastrophic earth's change is usually associated with phenomena such as earthquake and volcanic eruption. However, recent soil erosion and flood problems in Akwa Ibom State can rightly deserve the use of such terms to describe their mode of operation. The problem of accelerated gully erosion in St. Luke's Hospital gully erosion site is a clear case of mishandling of the environment by man, through directing flood waters to Anua ravine without preparation for proper reception. Anua ravine, being an undulating topography, with a soil type that is of the coastal plain sands origin, and experiencing a humid tropical rainy climate, is predisposed to human-activity-triggered gully erosion.

The study outlined the mission and purpose of NEWMAP, together with the main goal of the proposed intervention in the St. Luke's Hospital gully erosion site in Uyo, Akwa Ibom State. In order to ensure that the proposed NEWMAP intervention at St. Luke's Hospital gully erosion site does not compound existing challenging environmental and social conditions in the area, the study set out to conduct baseline studies on biophysical components of the environment, as well as, the current social, economic, and health conditions of the residents of the gully area. In the process, extensive consultations with stakeholders within the project area were held, involving the Paramount Ruler of Uyo, Prominent Chiefs, Village Heads, Heads of Institutions and Establishments, Youth Groups, Women Groups, Community Based Organizations (CBQs), individuals and Anua Community. Biophysical data were collected through field surveys, experimentation and laboratory analysis. Socio-Economic surveys were conducted using multi-disciplinary approaches. Equipped with baseline parameters, the study set out to identify potential environmental and social issues that can arise as a result of the proposed civil and engineering works at and around the project area. Accordingly, a an environmental and social management plan (ESMP) was developed to contain any potential environmental, social and health issues that could arise as a result of the intervention.

8.2 Conclusion

The proposed St. Luke's Hospital gully erosion rehabilitation is a worthy venture and should be pursued for the sake of humanity and environment. The excitement and cooperation shown by host community and all stakeholders are pointers to the fact that the intervention will be a huge success and is highly appreciated.

8.3 Recommendations

A major recommendation of the ESMP was that a combination of civil works and biological measures should be adopted in order not to demolish any structures, since most of the buildings around the gully site (St. Luke's Hospital, School of Nursing, School of Midwifery, and St. Joseph's Catholic Church) are of immense socio-economic importance and great historical significance. Furthermore, construction work should be confined to daytime hours to avoid undue disruption of sleep of patients in the hospital.

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ANNEX 1: ATTENDANCE AT COMMUNITY ENGAGEMENT

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Nigeria Erosion and Watershed Management Project (NEWMAP)

AKWA IBOM STATE PROJECT MANAGEMENT UNIT

Plot 7, G-Line, Ewet Housing Estate, Uyo, Akwa Ibom State

ATTENDANCE SHEET

DESCRIPTION: Engagement with St. Luke's Hospital gully erosion site community

DATE: Friday 31st March, 2017 — Venue: School of Nursing and Midwifery, St. Luke's Hospital, Anua.

SN	NAME	ADDRESS / ORGANIZATION	SEX	PHONE NUMBER	DESIGNATION / POSITION	SIGNATURE
1	PATRICK E. IBANGA	ST. JOSEPHS CATHOLIC CHURCH ANUA	MALE	08023421648	CHURCH CHAIRMAN	
2	COMRADE RICHARD OSCAR	NUN. OF AGRIC (LABOUR LEADER (ANUA)	MALE	08030996743	CHAIRMAN	
3	ANIETI NICHOLAS	ST. JOSEPH CATHOLIC, ANUA	Male	08052337032	Youth President	
4	Imeobong Sampson	Anua village Council	male	08038723571	Youth leader	
5	Abasiaeh Akpan	Anua village Council	male	08066448603	youth leader	
6	Emmanuel S. Udoh	RCCG 34 SANNI OBUN. IK	MALE	08033623660	secretary council	
7	Regina MK Pongonyong	Hand maids of the holy child Jesus	Female	08029521078	Supervisor (Losps)	
8	Ofuekong E. Okon	Ministry of Environment	male	08036042549	Civil Engineer	
9	Aniefie Cletus Sam	Ministry of Environment	Male	08029553121	Technical Engin	
10	Basil, Inierke Leo	St. Joseph catholic church, Anua	male	08137715981	Secretary	
11	PEACE BASSEY	IKOT OKO IDIO OFFOT	Male	07066919370	Youth Leader	
12	Ediong-Innocent	IKOT OKO IDIO OFFOT	Male	07081823770	pastor	
13	Aniefie E. Nicholas		M	07037037447		
14	Marylyn Essang	EROFFOD	F	08187881489	Student	
15	Joseph Victory	EROFFOD	F	08134595422	student	
16	Umoh, Ento Ekpenyong	EROFFOD	F	08029980623	student	
17	Elder Ekpenyong	Udo Expo Mkpa St	M	08037250165	Business	
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Nigeria Erosion and Watershed Management Project (NEWMAP)

AKWA IBOM STATE PROJECT MANAGEMENT UNIT

Plot 7, G-Line, Ewet Housing Estate, Uyo, Akwa Ibom State

The World Bank

ATTENDANCE SHEET

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DATE: Friday 31st March, 2017 Venue: School of Nursing and Midwifery, St. Luke's Hospital, Anua.

SN	NAME	ADDRESS / ORGANIZATION	SEX	PHONE NUMBER	DESIGNATION / POSITION	SIGNATURE
1	Obonwan Veronica P. Odung	Ekpri Nsukara Village	Female	07080528688	Women Leader	[signature]
2	DR Godwin M. Inyang	St Luke Hospital, Anua	M	08023002133	Chief Med Director	[signature]
3	MR. Dominic C. Effiong	St. Luke's Hospital	M	08037469568	Admin. officer	[signature]
4	LINUS E. IBANGA	MANAGEMENT ST LUKES HOSPITAL	M	08033252267	MANAGEMENT STAFF	[signature]
5	MR UWAK M. NSA	ANUA OFFOT	M	08035403620	YORTH PRES	[signature]
6	Rs Philomena Edem	Sch OF NURSING, ANUA - UYO	F	08027658376	V.P. SCH OF NUR. ANUA	[signature]
7	EMMANUEL UKPO	✓ ✓ ✓ ✓	M	08032695067	PRINCIPAL	[signature]
8	MFON AKPAN (MRS)	SCH. OF MIDWIFERY - ANUA-UYO	F	08027022427	VICE PRINCIPAL	[signature]
9	Ekaette Akan (Mrs)	✓ ✓ ✓ - Anua - Uyo	F	08024666717	Principal	[signature]
10	Blessing Akpan (Mr)	✓ ✓ ✓ Anua - uyo	M	08104286855	Youth officer	[signature]
11	Ime-Obong Udo (Mr)	✓ ✓ ✓ Anua - uyo	M	08139015306	Chief Security	[signature]
12	Sebastian Akpan (Mr)	Anua	M	07011114159	Village Council, Anua	[signature]
13	Charles Udoh	41 Abak Rd. Uyo	M	08023308086	Consultant	[signature]
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18	Nathaniel Sebastian Udoh	NO 52 Utuk's Lane Anua - offot uyo	M	08029997448	N Ekang	[signature]
19	Iberedem E. Uko	NEWMAP, AKS	M	08165389141	Asst. to SPC	[signature]
20	Udeme Akpan	AKS NEWMAP	M	08064740389	Mand E	[signature]
21	Uford Ekot	AKS NEWMAP	M	08135487019	SLO	[signature]
22	Abasiama James James	AKS NEWMAP	F	07064765158	PIA	[signature]
23	Aniedi S. Usen	AKS NEWMAP	M	08157852984	ADM OFFR	[signature]
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Nigeria Erosion and Watershed Management Project (NEWMAP)

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The World Bank

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DATE: Friday 31st March, 2017 Venue: School of Nursing and Midwifery, St. Luke's Hospital, Anua.

SN	NAME	ADDRESS / ORGANIZATION	SEX	PHONE NUMBER	DESIGNATION / POSITION	SIGNATURE
1	EAMON A. IBIONG	137 MBAK RD; ANUA.	M	08064696104	CHAIRMAN, ST. Joseph Parish	[signature]
2	ANTHONY G. UWA	29 MBAKRIS ANUA	M	07034915161	CHMN UDO UDO FORUM	[signature]
3	Henry Elijah	90, Ekpenyong St., Uyo	M	08034470518	St. Luke's Hospital	[signature]
4	Julian Ema Ette	17 Mbak Rd - Anua Offot	M	07032785108	17 Mbak Rd Anua	[signature]
5	[illegible] Akpan	245B [illegible] Rd	M	080[illegible]08	Village head Anua Offot	[signature]
6	Gloria Uwak	Ekpri Nkukara, Offot	F	07035691648	-	[signature]
7	UWEM EKAWEM	IDIANE EBON STREET	F	08063629157		[signature]
8	UMOREN, MFON SUNDAY	85, Ikot Ekpene Road, Uyo	M	07066972882		[signature]
9	Akan Oliver	233 Nwaniba Rd, Uyo.	M	08069342728	Indigene of Anua	[signature]
10	JOSEPH DAVID EFFIONG	397 ORON ROAD, UYO	M	08027686921		[signature]
11	UMOREN EFIOKABASI S.	85 Ikot Ekpene Rd, Uyo	M	07085096138		[signature]
12	[illegible] Ambrose	EROFLOOD	M	08161518756	CONSULTANT	[signature]
13	Nsikak Alexander Udo	NEWMAP UYO	M	08083997854	NEWMAP/DRIVER	[signature]
14	DR EDEM ESARA	NEWMAP, Uyo	M	08035404927	CONSULTANT	[signature]
15	Dr UWEMME R. ETUK	NEWMAP UYO	M	0806835[illegible]	CONSULTANT	[signature]
16	ENGR. AKANINYENE HENRY	NEWMAP, UYO	M	08028442176	Project Engineer	[signature]
17	Inyime Robinson	WASIF	M	07065731470	ED	[signature]
18	Inyenobong Usoh	Eroflood Projects, Uyo	F	07067341598		[signature]
19	Mfon Lawrence	NEWMAP-AKS	F	07083020813	CO-NEWMAP	[signature]
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ANNEX 2: SUMMARY OF WORLD BANK ENVIRONMENTAL AND SOCIAL SAFEGUARD POLICIES (10+2)

- Use of Country Systems (OP 4.00). The Bank's environmental and social ("safeguard") policies are designed to avoid, mitigate, or minimize adverse environmental and social impacts of projects supported By the Bank. The Bank encourages its borrowing member countries to adopt and implement systems that meet these objectives while ensuring that development resources are used transparently and efficiently to achieve desired outcomes.
- Environmental Assessment (OP 4.01). Outlines Bank policy and procedure for the environmental Assessment of Bank lending operations. The Bank undertakes environmental screening of each proposed Project to determine the appropriate extent and type of EA process. This environmental process will apply to all sub-projects to be funded.
- Natural Habitats (OP 4.04). The conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long-term sustainable development.
- Pest Management (OP 4.09). The policy supports safe, affective, and environmentally sound pest management. It promotes the use of biological and environmental control methods. An assessment is made of the capacity of the country's regulatory framework and institutions to promote and support safe, effective, and environmentally sound pest management.
- Involuntary Resettlement (OP 4.12). This policy covers direct economic and social impacts that both result from Bank-assisted investment projects, and are caused by (a) the involuntary taking of land resulting in (i) relocation or loss of shelter; (ii) loss of assets or access to assets, or (iii) loss of income sources or means of livelihood, whether or not the affected persons must move to another location; or (b) the involuntary restriction of access to legally designated parks and protected areas resulting in adverse impacts on the livelihoods of the displaced persons. The ESMF and RPF reports discuss the applicability of this policy in detail.
- Indigenous Peoples (OD 4.20). This directive provides guidance to ensure that indigenous peoples benefit from development projects, and to avoid or mitigate adverse effects of Bank-financed development projects on indigenous peoples. Measures to address issues pertaining to indigenous peoples must be based on the informed participation of the indigenous people themselves. Sub-projects that would have negative impacts on indigenous people will not be funded
- Forests (OP 4.36). This policy applies to the following types of Bank-financed investment projects: (a) projects that have or may have impacts on the health and quality of forests; (b) projects that affect the rights and welfare of people and their level of dependence upon or interaction with forests; and (c) projects that aim to bring about changes in the management, protection, or utilization of natural forests or plantations, whether they are publicly, privately, or communally owned. The Bank

does not finance projects that, in its opinion, would involve significant conversion or degradation of critical forest areas or related critical habitats.

- Physical Cultural Properties (OP 4.11). Assist in preserving physical cultural resources and avoiding their destruction or damage. PCR includes resources of archaeological, paleontological, historical, architectural, religious (including graveyards and burial sites), aesthetic, or other cultural significance..
- Safety of Dams (OP 4.37). For the life of any dam, the owner is responsible for ensuring that appropriate measures are taken and sufficient resources provided for the safety to the dam, irrespective of its funding sources or construction status. The Bank distinguishes between small and large dams.
- Projects on International Waterways (O 7.50). The Bank recognizes that the cooperation and good will of riparians is essential for the efficient utilization and protection of international waterways and attaches great importance to riparians making appropriate agreements or arrangement for the entire waterway or any part thereof.
- Disputed Areas (OP/BP/GP 7.60). Project in disputed areas may occur the Bank and its member countries as well as between the borrower and one or more neighbouring countries. Any dispute over an area in which a proposed project is located requires formal procedures at the earliest possible stage.
- Disclosure Policy (OP 17.50).Supports decision making by the Borrower and Bank by allowing the public Access to information on environmental and social aspects of projects. Mandated by six safeguard policies that have specific requirements for disclosure in country (Before project appraisal in local Language and in English) and World Bank INFO-Shop (Before project appraisal in English). Documents can be in draft but must meet WB standards).

ANNEX 3: GENERAL ENVIRONMENTAL MANAGEMENT CONDITIONS FOR CONSTRUCTION CONTRACTS

The Environmental and Social Management Plan (ESMP)

SPECIFIC OBLIGATIONS OF CONTRACTOR:

- The contractor shall familiarize himself with the contents of the ESMP and share same with those who work with him about this Plan.
- He shall prepare his work strategy and plan to fully take into account relevant provisions of the ESMP.
- If the Contractor fails to implement the approved ESMP after written instruction by the Supervising Engineer (SE) to fulfil his obligation within the requested time, the PMU reserves the right to arrange through the SE for execution of the missing action by a third party on account of the Contractor.
- Where it is established that there are persist flouting of the guidelines and other relevant provisions sanction shall be met on the contractor

Sustainability Issues

- The Contractor shall endeavor in its performance of the construction service to ensure that it uses working methods, equipment and materials that will improve the sustainability of delivering the contract requirements, with particular emphasis on the following sustainability objectives:
  - Increased recycled content;
  - Reduced transport distances;
  - Whole life cost considerations;
  - Reduced energy use and CO2 emissions;
  - Waste reduction; and
  - Reducing impact on the community i.e. noise and disruption of traffic).
- The Contractor shall encourage their supply chain to help them meet the sustainability objectives of the project.
- The Contractor shall produce materials sourcing plan for the items covered under the Schedule of Rates

Transport of products and tools to the site

- Delivery of products to the site in concentrated form and then dilution on site
- Use of reusable containers to transport products to the site
- Delivery of products in bulk and outside peak traffic times
- **Disposal of used products or packaging from products**
- Products or packaging taken away for reuse, recycling or appropriate disposal by the contractor

Training of contractor staff

The contractor needs to indicate members of its Staff who are trained on the environmental impact of their work and the environmental policy of the authority on whose project they will be working.

Health and Safety

- Precautions for maintenance of Contractor's personnel H&S
- Appointment of an accident prevention officer at the site and reporting on H&S conditions HIV-AIDS prevention

Prohibitions

- Prohibitions on child labour
- Prohibitions on forced labour.
- Prevent pollution of water bodies and neighbouring environ from wastes arising from construction sites.

Taking Over of Site by Contractor

- The date on which the site is handed over to the Contractor shall be recorded and certified in writing by both the Engineer and the Contractor's Agent. From the date on which the site is taken over, the Contractor shall be responsible for maintaining that portion of road in good condition and for repairing damage of an kind to the road culverts or bridges from whatever cause arising thereof, whether caused by constructional traffic or not.

Contractor Not To Enter Neighbouring Land

- Where it is necessary to enter a neighbouring land during the course of construction or maintenance for the purpose of making temporary road diversions, winning construction or maintenance materials or for any other reason, the landowner or occupier shall first be consulted by the Contractors, and his written permission obtained. In the event of the owner or occupier withholding his permission, full circumstances of the case shall be referred to the Engineer and no further action shall be taken until his instructions are received.
- Under no circumstances is land to be interfered with until the compensation, if any, has been paid by the Contractors.
- When permission has been obtained and work is carried out, care shall be taken to ensure that no unnecessary damage is caused to the land and that all reasonable precautions are taken to prevent soil erosion, and mosquito breeding. On completion of the work, all land shall be left in a tidy condition with the sites of all borrow-pits battered down to a reasonable slope as directed by the Engineer's Representative. All borrow pits shall be adequately drained so as to prevent storm water collecting in them. No compensation will be paid to the Contractors for any delays due to negotiations with the owners of the land. Any costs incurred in complying with the requirements of this Item shall be deemed to be included in the tendered rates and prices.

Notice of Operations

- No important operation, particularly blocking or cutting of any road, water pipe or other services shall be carried out without the consent in writing of the Engineer. The request in writing must be made sufficiently in advance of the time of operation so as to enable him to make such arrangements as may be deemed necessary for its inspection and the provision of all relevant safety precautions.

Weather Conditions

- The Contractor shall be deemed to have taken weather conditions into account when preparing his Tender and he shall not be entitled to extension of time by reason of the occurrence of delays due to weather unless he can show that such conditions could not have been reasonably foreseen.
- **Precautions against Pollution of Streams**
- The Contractor shall take all necessary precautions to secure the efficient protection of all ditches, streams and waterways against pollution.

Copies of orders

- The Contractor and Sub-contractors shall provide the Engineer's Representative with copies of all order, which they may place for the supply of materials or goods required in connection with the Works.

Work during period of maintenance

- After the commencement of the period of maintenance the Contractor shall do nothing, which might endanger the safety of the public, and he shall obey all instructions of the Engineer or other duly authorized person or authority in this regard.

Throughout the Period of Maintenance the Contractor shall notify the Engineer's Representative what work or operations the company intendeds to carry out on the site, and he shall obey any instructions which the Engineer's Representative may give as to times and manner of working, so that any inconvenience to the Public, especially the St. Luke's hospital community, is kept to a minimum.

General

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

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

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

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

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

(e) Prevent and minimize the impacts of quarrying, earth borrowing, piling and building of temporary construction camps and access roads on the biophysical environment

including protected areas and arable lands; local communities and their settlements. In as much as possible restore/rehabilitate all sites to acceptable standards.

(f) Upon discovery of ancient heritage, relics or anything that might or believed to be of archaeological or historical importance during the execution of works, immediately report such findings to the SE so that the appropriate authorities may be expeditiously contacted for fulfilment of the measures aimed at protecting such historical or archaeological resources.

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

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

(i) Ensure that garbage, sanitation and drinking water facilities are provided in construction workers camps.

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

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

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

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

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

Worksite/Campsite Waste Management

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

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

8. Used oil from maintenance shall be collected and disposed properly at designated sites or be re-used or sold for re-use locally.
9. Entry of runoff to the site shall be restricted by constructing diversion channels or holding structures such as banks, drains, dams, etc. to reduce the potential of soil erosion and water pollution.
10. Construction waste shall not be left in stockpiles along the road, but removed and reused or disposed of on a daily basis.
11. If disposal sites for clean spoil are necessary, they shall be located in areas, approved by the SE, of low land use value and where they will not result in material being easily washed into drainage channels.

Whenever possible, spoil materials should be placed in low-lying areas and should be compacted and planted with species indigenous to the locality.

Material Excavation and Deposit

12. The Contractor shall obtain appropriate licenses/permits from relevant authorities to operate quarries or borrow areas.
13. The location of quarries and borrow areas shall be subject to approval by relevant local and national authorities, including traditional authorities if the land on which the quarry or borrow areas fall in traditional land.
14. New extraction sites:
    a) Shall not be located in the vicinity of settlement areas, cultural sites, wetlands or any other valued ecosystem component, or on high or steep ground or in areas of high scenic value, and shall not be located less than 1km from such areas.
    b) Shall not be located adjacent to stream channels wherever possible to avoid siltation of river channels. Where they are located near water sources, borrow pits and perimeter drains shall surround quarry sites.
    c) Shall not be located in archaeological areas. Excavations in the vicinity of such areas shall proceed with great care and shall be done in the presence of government authorities having a mandate for their protection.
    d) Shall not be located in forest reserves. However, where there are no other alternatives, permission shall be obtained from the appropriate authorities and an environmental impact study shall be conducted.
    e) Shall be easily rehabilitated. Areas with minimal vegetation cover such as flat and bare ground, or areas covered with grass only or covered with shrubs less than 1.5m in height, are preferred.
    f) Shall have clearly demarcated and marked boundaries to minimize vegetation clearing.
15. Vegetation clearing shall be restricted to the area required for safe operation of construction work. Vegetation clearing shall not be done more than two months in advance of operations.
16. Stockpile areas shall be located in areas where trees can act as buffers to prevent dust pollution. Perimeter drains shall be built around stockpile areas. Sediment and other pollutant traps shall be located at drainage exits from workings.

17. The Contractor shall deposit any excess material in accordance with the principles of the general conditions, and any applicable EMP, in areas approved by local authorities and/or the SE.
18. Areas for depositing hazardous materials such as contaminated liquid and solid materials shall be approved by the SE and appropriate local and/or national authorities before the commencement of work. Use of existing, approved sites shall be preferred over the establishment of new sites.

Rehabilitation and Soil Erosion Prevention

19. To the extent practicable, the Contractor shall rehabilitate the site progressively so that the rate of rehabilitation is similar to the rate of construction.
20. Always remove and retain topsoil for subsequent rehabilitation. Soils shall not be stripped when they are wet as this can lead to soil compaction and loss of structure.
21. Topsoil shall not be stored in large heaps. Low mounds of no more than 1 to 2m high are recommended.
22. Re-vegetate stockpiles to protect the soil from erosion, discourage weeds and maintain an active population of beneficial soil microbes.
23. Locate stockpiles where they will not be disturbed by future construction activities.
24. To the extent practicable, reinstate natural drainage patterns where they have been altered or impaired.
25. Remove toxic materials and dispose of them in designated sites. Backfill excavated areas with soils or overburden that is free of foreign material that could pollute ground water and soil.t EMP
26. Identify potentially toxic overburden and screen with suitable material to prevent mobilization of toxins.
27. Ensure reshaped land is formed so as to be inherently stable, adequately drained and suitable for the desired long-term land use, and allow natural regeneration of vegetation.
28. Minimize the long-term visual impact by creating landforms that are compatible with the adjacent landscape.
29. Minimize erosion by wind and water both during and after the process of reinstatement.
30. Compacted surfaces shall be deep ripped to relieve compaction unless subsurface conditions dictate otherwise.
31. Re-vegetate with plant species that will control erosion, provide vegetative diversity and, through succession, contribute to a resilient ecosystem. The choice of plant species for rehabilitation shall be done in consultation with local research institutions, forest department and the local people.

Water Resources Management

32. The Contractor shall at all costs avoid conflicting with water demands of local communities.
33. Abstraction of both surface and underground water shall only be done with the consultation of the local community and after obtaining a permit from the relevant Water Authority.

34. Abstraction of water from wetlands shall be avoided. Where necessary, authority has to be obtained from relevant authorities.
35. Temporary damming of streams and rivers shall be done in such a way avoids disrupting water supplies to communities downstream, and maintains the ecological balance of the river system.
36. No construction water containing spoils or site effluent, especially cement and oil, shall be allowed to flow into natural water drainage courses.
37. Wash water from washing out of equipment shall not be discharged into water courses or road drains.
38. Site spoils and temporary stockpiles shall be located away from the drainage system, and surface run off shall be directed away from stockpiles to prevent erosion.

Traffic Management

39. Location of access roads/detours shall be done in consultation with the local community especially in important or sensitive environments. Access roads shall not traverse wetland areas.
40. Upon the completion of civil works, all access roads shall be ripped and rehabilitated.
41. Access roads shall be sprinkled with water at least five times a day in settled areas, and three times in unsettled areas, to suppress dust emissions.

Blasting

42. Blasting activities shall not take place less than 2km from settlement areas, cultural sites, or wetlands without the permission of the SE.
43. Blasting activities shall be done during working hours, and local communities shall be consulted on the proposed blasting times.
44. Noise levels reaching the communities from blasting activities shall not exceed 90 decibels.

Disposal of Unusable Elements

45. Unusable materials and construction elements such as electro-mechanical equipment, pipes, accessories and demolished structures will be disposed of in a manner approved by the SE. The Contractor has to agree with the SE which elements are to be surrendered to the Client's premises, which will be recycled or reused, and which will be disposed of at approved landfill sites.
46. As far as possible, abandoned pipelines shall remain in place. Where for any reason no alternative alignment for the new pipeline is possible, the old pipes shall be safely removed and stored at a safe place to be agreed upon with the SE and the local authorities concerned.
47. AC-pipes as well as broken parts thereof have to be treated as hazardous material and disposed of as specified above.
48. Unsuitable and demolished elements shall be dismantled to a size fitting on ordinary trucks for transport.

Health and Safety

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

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

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

Repair of Private Property

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

53. In cases where compensation for inconveniences, damage of crops etc. are claimed by the owner, the Client has to be informed by the Contractor through the SE. This compensation is in general settled under the responsibility of the Client before signing the Contract. In unforeseeable cases, the respective administrative entities of the Client will take care of compensation.

Contractor's Environment, Health and Safety Management Plan (EHS-MP)

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

- For the Contractor, for internal purposes, to ensure that all measures are in place for adequate EHS management, and as an operational manual for his staff.
- For the Client, supported where necessary by a SE, to ensure that the Contractor is fully prepared for the adequate management of the EHS aspects of the project, and as a basis for monitoring of the Contractor's EHS performance.

55. The Contractor's EHS-MP shall provide at least:

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

56. The Contractor's EHS-MP will be reviewed and approved by the Client before start of the works. This review should demonstrate if the Contractor's EHS-MP covers all of the identified impacts, and has defined appropriate measures to counteract any potential impacts.

EHS Reporting

57. The Contractor shall prepare bi-weekly progress reports to the SE on compliance with these general conditions, the project EMP if any, and his own EHS-MP. An example format for a Contractor EHS report is portrayed in Annex 6. It is expected that the Contractor's reports will include information on:

- EHS management actions/measures taken, including approvals sought from local or national authorities;

- Problems encountered in relation to EHS aspects (incidents, including delays, cost consequences, etc. as a result thereof);
- Lack of compliance with contract requirements on the part of the Contractor;
- Changes of assumptions, conditions, measures, designs and actual works in relation to EHS aspects; and
- Observations, concerns raised and/or decisions taken with regard to EHS management during site meetings.

58. It is advisable that reporting of significant EHS incidents be done "as soon as practicable". Such incident reporting shall therefore be done individually. Also, it is advisable that the Contractor keep his own records on health, safety and welfare of persons, and damage to property. It is advisable to include such records, as well as copies of incident reports, as appendixes to the bi-weekly reports. A sample format for an incident notification is shown below. Details of EHS performance will be reported to the Client through the SE's reports to the Client.

Training of Contractor's Personnel

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

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

Cost of Compliance

60. It is expected that compliance with these conditions is already part of standard good workmanship and state of art as generally required under this Contract. The item "Compliance with Environmental Management Conditions" in the Bill of Quantities covers this cost. No other payments will be made to the Contractor for compliance with any request to avoid and/or mitigate an avoidable EHS impact

ANNEX 4: PICTURES

Arial view of the St. Luke's Hospital gully erosion site

ANNEX 5: SUMMARY OF THE DATABASE OF INFORMATION COLLECTED FOR ESMP

SECTION A: TECHNICAL APPROACH AND METHODOLOGY

A5.1 Field Work and Laboratory Analysis

Field work was undertaken in April-May 2017, during which time baseline data were generated on the following environmental and social conditions.

- Climate and Meteorology
- Air Quality
- Ambient Noise Level
- Geology
- Hydrogeology
- Geomorphology
- Surface Water Characteristics
- Groundwater Characteristics
- Soil
- Vegetation
- Wildlife, and
- Socio-Economic Characteristics
- Community Health

A5.2 Sampling Rationale

The ESMP study adopted the systematic random sampling technique in which the entire St. Luke's Hospital gully erosion site was considered to be the major running transect, with cross transects and sampling quadrats purposively selected at regular intervals to capture any morphological changes in biophysical parameters. A total of 7 sampling points were selected for soil, 5 sampling points for air quality, 5 sampling points for ambient noise level, two sampling points for surface water quality, and 3 sample points for underground water quality.

A5.3 Quality Control/Quality Assurance

All the samples collected on biophysical parameters were analyzed in Federal Ministry of Environment (FMEnv) approved laboratories in Uyo. Adequate quality control/quality assurance measures were observed in the collection, transmission and analyses of field samples. Both in-situ field measurements and subsequent laboratory analyses were performed to the best standards of scientific experimentation.

A5.4 Bio- Physical Baseline Data

a. Climate and Meteorology

Climate, and especially micro-climate, is an important component of the physical environment that influences a lot of activities both in the biotic and abiotic environments. Data for climate and meteorology studies were sourced from the Meteorological Station, University of Uyo; and the Nigerian Meteorological Agency (NIMET), Oshodi, Lagos. In-situ measurements of some parameters such as rainfall intensity and runoff were also done onsite. Standard methods of climatic analysis were used to analyze the data and useful deductions made. Comprehensive rainfall and temperature data for the study area are presented in Tables A5.1 and A5.2.

b. Air Quality

Air quality study was carried out to generate data needed as baseline data for the area. Composite samples of ambient air were measured at least three times and average values determined and recorded. Appropriate quality assurance measures were applied for data gathering, including pre-calibration of all air quality analyzers prior to actual measurement exercise. Details of the air components and their measuring instruments are provided in Table A5.3.

c. Ambient Noise Level

The ambient noise levels were determined using a noise meter called Cassella Digital Sound Survey Meter, Model CEL-231. The meter is suitable for free field and random incidence noise monitoring and provides a clear and unambiguous digital display of the sound level. Measurement was done by directing the noise meter towards the direction of the prevailing wind and reading the recorded value from the meter in decibel.

d. Geology/Hydrogeology/Geomorphology

The general objective of the study was to carry out an assessment and potential impact on the geology, hydrogeological and geomorphological features of the study area in respect of the proposed works at the St. Luke's Hospital, Anua gully erosion site. The following were determined through literature, fieldwork and laboratory analysis:

- Geological formation in a regional context, types and distribution of geologic materials
- Aquifer types and parameters
- Groundwater levels and flow direction
- Groundwater quality to include physical, chemical and heavy metal concentrations
- Geomorphological features of the study area

Surface geological mapping was achieved using available maps, reports and data. In addition, traverses were conducted to determine the slope inclination and geomorphological features. This was aided through the use of an Abney level and compass – clinometer. Subsurface geological studies was undertaken using drill log data from existing reports and literature. Static water level (SWL) measurements were made with water level recorder (Type KLT-Du). This guided the determination of groundwater flow direction.

e. Surface Water Quality

Water sampling and analysis

Surface water samples were collected from two (2) sampling locations. One was storm water from the gully channel, while the other was stream water from a tributary of Ikpa River. The samples were collected with the aid of aseptically certified plastic containers, and were transferred into ice chest, where they were stored at approximately 4^0C, until refrigerated. Samples were analyzed in the laboratory within 5 days of collection. Samples for heavy metals analysis were collected in 20ml polyethylene bottles and preserved by acidifying to pH 2 with nitric acid (HNO_3) until analysis. In-situ measurements were carried out for some parameters in water with the aid of a multi-parameter (Ekjelkamp) reader. These parameters were pH, temperature, dissolved oxygen (DO), salinity, total dissolved solids and conductivity.

f. Groundwater Quality

Groundwater samples for physic-chemical analysis were collected through boreholes (Fig. A6.3) in polyethylene bottles and stored in a cool box at approximately 4^0C before refrigeration. Analysis of the samples was done within 5 days of collection. Samples for heavy metals analysis were collected in 20ml polyethylene bottle and preserved by acidifying to pH 2 with nitric acid (HNO_3) until analysis was carried out. In-situ measurements were carried out for some parameters in water with the aid of a multi-parameter (Ekjelkamp)

reader. These parameters were pH, temperature, dissolved oxygen (DO), salinity, total dissolved solids and electrical conductivity.

g. Soil Studies

A total of 10 soil samples were obtained from the 5 sampling stations for surface and subsurface depth sequence (that is, 0-15 and 15-30cm respectively). The St. Luke's Hospital gully area was divided into 5 sampling stations, following a stratified transect random sampling procedure. Sampling of each location was done using the graduate Dutch-type tubular auger (Netherlands model), and conical soil-sampling trowel. Samples for bulk density and total porosity determinations were collected. These samples were collected by driving a cylindrical metal core samplers of known dimension into the soils to the desired depth and carefully removed to preserve a known volume of sample as it exists in-situ.
The soil samples were transported to the laboratory in labeled polyethylene bags for the analysis of physical and chemical parameters. For quality control assurance, the soils were properly sampled (composite), carefully labeled, stored in a cool place, preserved against hazards, and analyzed in a FMEnv-certified laboratory in Uyo.

Laboratory Analysis of soil samples
The soil samples collected were air-dried (room temperature), ground with wooden roller and sieved via 2mm mesh. Samples for bulk density were placed in an oven at 1050C until constant weight was reached (Tel and Hagarty, 1984; Obi, 2000). The percent total pore space was computed from the bulk density assuming a particle density of 2.65g/cm3. The weight of the oven-dry samples were later taken and recorded accordingly. The bulk densities of the samples were evaluated using the equation:
BD = Wt. of oven dry sample (gm)
Volume of sample (Cm3)

Particle size distribution was determined by Bouyoucos hydrometer method (Gee and Bauder, 1986) using sodium hexa-metaphosphate as a dispersant and the textural classes determined using the textural triangle chart. Aggregate structural stability (water stable aggregate) was determined using the wet sieving method of low (1954) as modified by Reid and Goss (1981). The aggregates were separated into various sizes by sieving the samples through a nest of sieve under water with a 2mm and 0.5mm sieve. The samples were put on the upper sieves and slowly wetted by capillary for 5 minutes. The set of sieves containing the soil samples were then lowered into and out of water for 20 times. The samples in the sieves were then transferred to moisture cans and over-dried to a constant weight and their percentages were determined by a simple calculation.

Soil pH was determined using the routine method of IITA (1979). The method of Walkley and Black (1934) as outlined by Juo (1979) were used in the determination of organic carbon. Available phosphorus was determined by Bray and Kurtz (1945) No. 1 method. Total nitrogen was determined by the micro-Kjeldahl digestion method (Jackson, 1962). Exchangeable bases (Ca+, Mg+, K+ and Na+) were extracted with neutral IM NH_4 OAc, pH 7.0; the potassium and sodium in the extract was by flame photometry while calcium and magnesium was by Versenate EDTA titration method (Jackson, 1962; IITA, 1979). Cation exchange capacity (CEC) was obtained by the summation of exchangeable bases.
Heavy metal contents of the soils were determined by Atomic Absorption Spectrophotometry following digestion of soil samples with a mixture of concentrated nitric acid ($HN0_3$) and hydrogen chloride (HCl) (Barnhisel and Bertsch, 1982)

h. Soil Microbiology

Collection and treatment of Soil samples

The study of microbes is important as they respond readily to changes in the environment and therefore may be used as a sensitivity index of pollution or changes within the environment. Sediment samples were collected with hand trowel and the contents were emptied into a clean cellophane bag, and stored in a cool-box. Twenty surface and sub-surface soil samples were collected (from same locations for soil studies) using hand auger at 0-15cm and 15 -30cm depth for microbiological studies. For the sediment and soil samples 1gm of each were dispensed into a test tube containing 9ml of filtered sterilized water to make a 1:10 dilution subsequent dilutions were made by serial dilution to 10-6 the concentration used for platings.

i. Vegetation

Large arbitrary transects were laid for vegetation analysis due to challenges of topographic expressions. At each sampling transect, plants were identified from 10m x 10m quadrat. Unidentified plants were collected for mounting and identification in the herbarium of the University of Calabar. The plant species were identified using the works of Hutchinson and Dalziel (1963, 1968-72). From each transect, information on habitat, vegetation structure and species abundance were collected and recorded. Habitat data included vegetation description, latitude, longitude and altitude, which were read off directly from the GPS. Tree species diversity was calculated as the Shannon-Wiener (H1) index, while the abundance of herbaceous genera were expressed in qualitative terms such as, dominant, frequent, occasional, or rare (Pryor, 1981). On this basis a species having a wide distribution with many stands, the classification was, common, abundant, and widespread species. Alternatively, a species may have a similarly wide distribution but with very few stands and would be classified as, infrequent, restricted or occasional species. Species of limited geographic distribution and with a few stands can simply classified as rare, because they are vulnerable to elimination as a consequence of their limited extent alone, besides other factors. Some species are equally said to be rare where little is known about their distribution.

Vegetation was also observed for any health defects. Samples of diseased plants were taken from the field in polyethylene bags to the laboratory for analysis. They were examined microscopically and cultured on Agar plates using the surface spreading plate technique. Fungal and bacterial pathogens were identified using such features as cultural morphology and pigmentation.

j. Wildlife

The term wildlife is used in its generally accepted but restricted sense to refer to the vertebrates (animals with backbone). Surveys of wildlife employed the standard line transect sampling technique, complemented by participatory rural appraisal interviews.

A5.5 Socio-Economic Studies

The socio-economic survey adopted a multi-dimensional approach to achieve the objectives of the study. A combination of methods was adopted at varying degrees for the different parameters measured.

(a) Structured Questionnaire
(b) Focus group discussion
(c) Key informants information
(d) Participant observation and estimation.

SECTION B

AKS-NWEMAP: EMSP STUDY FOR ETIM UMANA GULLY EROSION SITE SOCIO-ECONOMIC SURVEY QUESTIONNAIRE (SESQ)

Local stakeholders' survey

1. Location of respondents_____

2. Age: (a) < 15 [ ] (b) 15-25 [ ] (c) 26-35 [ ] (d) 36- 45 [ ]
   (e) 46-55 [ ] (f) 56-65 [ ] (g) 66-75 [ ] (h) 76+ [ ]
3. Gender: (a) Male [ ] (b) Female [ ]
4. Religion_____
5. Ethnic background_____
6. Position in community (a) Paramount ruler [ ] (b) Clan head [ ] (c) Village head [ ] (d) youth leader [ ] (e) women leader [ ] (f) resident[ ] (g) any other please specify_____
7. How long have you lived in this area? (a) <5years [ ] (b) 6-10years[ ] (c)11-15year [ ](d) 16-20 [ ] (e) 21 years and above [ ]
8. Educational attainment of respondents
   (a) No formal education [ ]
   (b) i Primary education with certificate [ ]
   ii Primary education without certificate [ ]
   (c) i Secondary education with certificate [ ]
   ii Secondary education without certificate [ ]
   (d) Tertiary education [ ]
   i Vocational training/skill acquisition [ ]
   ii OND/HND/B.Sc/BA/M.Sc/PhD [ ]
9. Occupation: (a) Self-employed [ ]
   (b) Private organization [ ]
   (c) Civil service/public service [ ]
   (d) No job [ ]
10. Specific main occupation:(a) Teaching [ ] (b) Trading (wholesale/retail) [ ] (c) Tailoring [ ] (d) Farming [ ] (e)Welding [ ]
    (g) Any other (please, specify)_____
11. Subsidiary/secondary engagement(s): (indicate your secondary/part time activity if any ……
12. Income (₦) per month: (a) < 10,000 [ ] (b) 10,000-19,000 [ ]
    (c) 20,000-29,000 [ ] (d) 30,000-39,000 [ ] (e) 40,000-49,000[ ]
    (f) 50,000-59,000 [ ] (g) 60,000 + [ ]

13. Which of the following mode of saving money do you patronize? (a) Bank [ ] (b) Etibe (Isusu) [ ] (c) Cooperative [ ]

14. Martial status: (a) Single [ ] (b) Married [ ] (c) Separated [ ]
(d) Widowed/widower [ ]

15. Household/Family size: (a) 1-2 [ ] (b) 3-4 [ ] (c) 5-6 [ ] (d) 6-7 [ ](e) >7 [ ]

16. Children: Number and Age range (a) 1-2 [ ] (b) 3-4 [ ](c) 5-6 [ ]
(d) 6-7 [ ] (e)>7 [ ] (f) None [ ]

17. Do you have other dependants in your household?
(a) Yes [ ] (b) No [ ]

18. If yes to Q17, please supply the number _____

19. Are you aware of problem of gully erosion?
(a) Yes [ ]
(b) No [ ]

20. What do think are the causes of Etim Umana Gully Erosion?
(a) Farming [ ] (b) sand mining [ ] (c) Draining channeling into the valley [ ]

21. Are there things you have lost or that have been threatened by the erosion problem?
(a) Yes [ ] (b) No [ ]

22. If "yes" in number 21 above, which of the following have been lost or threatened by the erosion problem?
(a) Property (house(s) [ ]
(b) Ancestral homes/grave(s)/tomb(s)/ shrine(s) [ ]
(c) Farm land (food crops/ vegetables) [ ]
(d) Tree crops [ ]
(e) Business place (space) [ ]
(f) Life/lives [ ]
(g) Any other (please, specify) _____

23. Are you are aware NEWMAP is coming? (a) Yes [ ] (b) No [ ]
(c) I don't know [ ]

24. If "yes" (in question number 23) what is /are the most valuable item(s) of property to be protected?
(a) Economic trees [ ]
(b) Farm land (vegetables, food crops) [ ]
(c) House(s)/estate(s) [ ]
(d) Shrine(s) [ ]

(e) Ancestral home(s) [ ]
(f) Graves/cemetery [ ]
(g) School(s) [ ]
(h) Church(es), Mosque(s) [ ]
(i) People [ ]
(j) Road(s) [ ]
(k) Borehole(s) and other sources of water [ ]
(l) Village square/town hall/civic centre [ ]
(m) Health care facility [ ]
(n) Office(s) [ ]
(a) Any other (please, specify) _____

25. In your perception what are common health challenges (illnesses/diseases) you have faced in the study area in the last two years?
(a) Malaria [ ]
(b) Hepatitis [ ]
(c) Typhoid fever [ ]
(d) HIV/AIDS [ ]
(e) Tuberculosis [ ]
(f) Diphtheria [ ]
(g) Cholera/dysentery [ ]
(h) High blood pressure [ ]
(i) Heart disease [ ]
(j) Stroke [ ]
(k) Cancer [ ]
(l) Cough and catarrh [ ]
(m) Skin disease [ ]
(n) Any other (please, specify)_____

26. Name any illnesses/diseases you have suffered from in the last two years
(a)_____
(b) _____
(c) _____
(d) _____

27. What are the environmental (risk) factors of, or hazards to, health in the study area?
(a) Landslides/mudflows/slumping [ ]
(b) Flood/poor drainage, etc-breeding grounds for disease and pathogens [ ]
(c) Lack of safe drinking water [ ]
(d) Polluted water caused by the erosion development [ ]
(e) Inadequate and unaffordable water supply [ ]
(f) Poor nutrition [ ]
(g) Poor sanitary condition(s) [ ]
(h) Poverty [ ]
(i) Illiteracy [ ]

(o) Any other (please, specify) _____

28. Do you see the erosion problem as posing health hazards in terms of (a) physical well-being?
(a) Social well-being? (a) Yes [ ] (b) No [ ] (c) I don't know [ ]
(b) Psychological well-being? (a) Yes [ ] (b) No [ ] (c) I don't know [ ]

29. Is/are there risk(s) of health problems as a result of the project intervention?
(a) Yes [ ]
(b) No [ ]
(c) I don't know [ ]

30. If yes, please list them _____
_____
_____

31. What are the healthcare facilities in the study area (at least within a radius of 1-3 kilometres of your residence)? Please list them_____
_____

32. What are the main recreational activities that you undertake? (a) football [ ] (b) Table Tennis [ ] (c) Walking [ ] (d) Dancing [ ] (e) Swimming [ ] (f) Jogging [ ] (e) Bird watching [ ] (h) Sit-out With Friends [ ] (i) Any other (please specify) _____

33. Lists food and tree/fruit crops including vegetables; produced in the study area
i. Food crops (including vegetables)
(a) _____
(b) _____
(c) _____
(d) _____
(e) _____
(f) _____
(g) _____
(h) any more _____

ii. Fruit/tree crops
(a) _____
(b) _____
(c) _____
(d) _____
(e) _____
(f) _____
(g) _____
(h) any more _____

34. Protein sources

S/N	Protein sources	Regularly (daily)	Occasionally	Rarely	None at all
A	Fish				
B	Crayfish				
C	Goat				
D	Cattle				
E	Chicken				
F	Snail				
G	Pig				
H	Mushroom				
I	Any other specify				

35. Do you indulge in any of the following?
    (a) Smoking (cigarettes) (a) Yes [ ] (b) No [ ]
    (b) Snuffing (a) Yes [ ] (b) No [ ]
    (c) Drinking (alcoholic beverages) (a) Yes [ ] (b) No [ ]
    (d) Coffee/tea (a) Yes [ ] (b) No [ ]

36. Where do you dispose your waste? (a) Into Ravine [ ] (b) I use Uyo Capital Disposal Facilities [ ] (c) Into the bush [ ] (d) I burn them [ ](e) I bury my waste [ ] (f) Any other (please specify) _____

37. How do you dispose of human waste (Excreta)? (a) Water Closet [ ] (b) Pit Latrine [ ] (c) Nearby Bush [ ] (d) In the Ravine [ ](e) Pail system [ ] (f) Any other [ ]

38. What are sources of water supply? (a) Pipe-borne water [ ] (b) Stream [ ] (c) Rainfall [ ] (d) Bore-hole [ ] (e) Tanker services [ ] (f) Any other _____

39. Has your community experience and communal or group conflict in recent times (a) Yes [ ] (b) No [ ]

40. How are such conflicts settled? (a) Court [ ] (b) Church [ ] (c) Use of Traditional Rulers [ ] (d) Government intervention [ ]

41. Do you encourage child Labour in your household? (a) Yes [ ] (b) No [ ]

42. If yes to Q 39, what factors inform your decision? (a) Poverty [ ] (b) No interest in child education [ ] (c) Any other [ ]

43. What do think should be done to solve the problem of erosion in Etim Umana Gully Erosions site?_____
    _____
    _____

44. Name any two diseases you have faced in the last two year? _____

45. Main diseases of children under five years?
    (a) _____
    (b) _____
    (c) _____
    (d) _____
    (e) _____

46. Important need you feel should be taken care of in the community

S/N	**Need**	**Scale** →									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	Gully control										
2	Safe drinking water										
3	Schools										
4	Employment										
5	Electricity										
6	Good drainage										
7	Hospital/health/medical/personnel										
8	Recreational facilities										
9	Good road										
10	Any other										

SECTION C: FIELD DATA

TABLE A5.1: Annual Rainfall in Uyo and their departures from the mean 1977 - 2015

Year	Amount mm	Departure from the mean
1977	3355.8	835.4
1978	3270.7	750.3
1979	3825.2	1304
1980	2867.6	347.2
1981	2422.8	-97.6
1982	2372.5	-147.9
1983	1599.4	-921
1984	1878.7	-641.7
1985	2132.6	-387
1986	1905.2	-615.2
1987	2251.4	-269
1988	2115.0	-405
1989	2588.5	67.6
1990	2038.8	-481.6
1991	2248.1	-272.3
1992	2248.8	-271.6
1993	2230.1	-290.3
1994	2668.7	148.3
1995	2084.9	-435.5
1996	2332.8	-187.6
1997	1921.3	-599.1
1998	2027.8	-492.6
1999	2808.8	288.4
2000	1840.9	-679.5
2001	2317.2	=203.2
2002	2331.5	-188.9
2003	2193.5	-326.9
2004	2221.6	-298.8
2005	3029.9	509.5
2006	3513.7	993.3
2007	2505.5	-14.9
2008	2725.7	205.3
2009	1934.1	-586.3
2010	2782.1	261.7
2011	2879.9	359.5
2012	3837.9	1317.5
2013	2951	430.6

2014	3066.9	546.5
2015	2967.6	447.2
Mean	**2520.4**	**-**

Source: Uniuyo Met. Station, 2016

TABLE A5.2: Mean Monthly Minimum Temperature in Uyo for Ten Years [2000-2009]

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2000	26.9	25.5	28.4	27.8	27.2	26.5	26.2	25.5	25.7	26	26.2	26.9
2001	26.7	27.6	25.2	27.1	26.9	26.8	26.1	25.4	25.7	26.5	27.5	27.3
2002	27.7	25,6	29.3	28.5	27.3	26.9	25	25.7	25.9	26.4	27	27.2
2003	27.4	25.6	28.5	27.4	28.0	27.3	26.1	25.3	26.3	26.1	27	26.6
2004	26	28.4	28.5	28.0	26.7	26.4	25.3	24.6	25.2	26.2	26.5	25
2005	26.5	27.6	25.3	27.8	27.3.	26.5	25.4	25	25.9	26.4	26.6	26.1
2006	26.8	27.9	27.7	25.8	26.6	25	24.8	25.2	25	25.5	26.2	26
2007	26.6	27.7	27.2	27.7	26.9	26.2	25.8	25	24.1	24.9	25.2	25.2
2008	25.5	26.4	27.8	27.6	26.4	27.6	26.9	25.4	25.5	26.6	28.3	28.5
2009	27.4	25.1	29.4	27.9	27.8	27	25.7	25.9	26.9	27.6	25.1	28.2
MEAN	26.75	26.7	27.7	27.6	27.1	26.6	25.7	25.3	25.6	26.3	26.6	26.5

Source: Uniuyo Met. Station, 2016

TABLE A5.3 Air Quality Components and their Measuring Instruments

S/N	**Air Component**	**Measuring Instrument**
1	Suspended Particulate Matter	Digitized Handheld Monitor (Micro-dust Pro)
2	Sulphur Dioxide	Portable Sulphur Dioxide (SO_2)Monitor
3	Carbon Monoxide (CO)	Portable Carbon Monoxide (CO) Monitor
4	Hydrogen Sulphide (H_2S)	Portable Hydrogen Sulphide (H_2S) Monitor
5	Amonia (NH_3)	Portable Amonia (NH_3) Monitor
6	Nitrogen Oxide (NO_2)	Portable Nitrogen Oxide (NO_2) Monotor
7	Volatile Organic Carbon (VOC)	Photo-ionization Detector
8	Total Hydrocarbons (THC)	Ultrasonic Agitator/Spectro-Photometric Meter

ANNEX 6: METHODS OF PHYSICO-CHEMICAL ANALYSIS OF WATER

S/N	Parameters	***Methods***
1.	Temperature (^{O}C)	Thermometer
2.	pH and E^{h}	WTW – pH 90 electronic meter, sensitivity ± 1.0%
3.	Dissolved Oxygen (mg/l)	Measured with Oxyguard Handy MK II electronic meter, sensitivity, ± 1.0%
4.	Electrical Conductivity	WTW LF – 90 conductivity meter, sensitivity ± 1.0%
5.	Turbidity (NTU)	Turbidity was measured spectrophotometrically using formazine standards according to HACH.
6.	Total Suspended solids, TSS (mg/l):	Spectrophotometric determintion according to HACH
7.	Salinity (mg/l)	Measurement by transformation of conductivity values using the "practical salinity scale 1978" (UNESCO, 1981).
8.	Biochemical Oxygen Demand, BOD_5 (mg/l)	BOD_5 was measured as the difference between initial oxygen concentration in sample and concentration after 5 days incubation in DO bottles at $20^{O}C$ (APH, 1989).
9.	Nitrite (mg/l)	All samples for nutrients were filtered at low vacuum through 0.45mm membrane filter. Nitrite was measured

		spectrophotometrically by the diazotisation method (Parsons *et al*, 1984)
10.	Nitrate NO_3 (mg/l)	Nitrate was measured as nitrite after reduction in cadmium reduction systems (Parsons *et al*, 1984).
11.	Phosphate PO_4 (mg/l)	Measured spectrophotometrically by Molybdenum blue method (Parsons *et al*, 1984).
12.	Chloride, Cl (mg/l)	Chloride was measured titrimetrically using silver nitrate and potassium dichromate as indicator (Rodier, 1975).
13.	Sulphate, SO_4 (mg/l)	Measurement was done spectrophotometrically by turbidity using barium chloride (APHA, 1989).
14.	Ca, Mg, K, Na (mg/l)	Measured titrimetrically by complexometric technique using EDTA as titrant (APHA, 1989).
15.	Heavy metal (Cr, Cd, Zn, Pb, As, Mn Cu, Ni and Fe).	-Deter Determination of concentrations using Atomic Absorption Spectrophotometer. AAS model 2380 (precision ± 0.01%. Loring and Rantala, 1992).
15.	Total hydrocarbons (THC)	Extraction with Hexane and determination spectrophotometrically.