ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN FOR IKOT ANWATIM EROSION GULLY SITE, CALABAR, CROSS RIVER STATE (UNDER THE NIGERIA EROSION AND WATERSHED MANAGEMENT PROJECT: NEWMAP)

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter One

Chapter Three

Chapter Four

LIST OF PLATES

ACRONYMS

CASHES	COMMUNITY AFFAIRS SAFETY HEALTH AND ENVIRONMENT
CBD	CENTRAL BUSINESS DISTRICT
CFU	COLONY FORMING UNITS
CLO	COMMUNITY LIASON OFFICER
CO	CARBON MONOXIDE
CRS	CROSS RIVER STATE
CSW	COMMECIAL SEX WORKER
CVD	CARDIOVASCCULAR DISEASE
DO	DISSOLVED OXYGEN
ESMP	ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN
FMC	FOREST MANAGEMENT COMMITTEE
FMENv.	FEDERAL MINISTRY OF ENVIRONMENT
HSE	HEALTH SAFETY AND ENVIRONMENT
HUB	HYDROCARBON UTILIZING BACTERIA
HUF	HYDROCARBON UTILIZING FUNGI
IUCN	INTERNATIONAL UNION FOR THE CONSERVATION OF NATURE
JHA	JOB HAZARD ANALYSIS
NEWMAP	NIGERIA EROSION AND WATERSHED MANAGEMENT PROJECT
NO_X	NITROGEN OXIDES
PAPs	PROJECT AFFECTED PERSONS
PMU	PROJECT MANAGEMENT UNIT
PPE	PERSONAL PROTECTIVE EQUIPMENT
PTW	PERMIT TO WORK
SAR	SODIUM ADSORPTION RATIO
SO_X	SULPHUR OXIDES
SPM	SUSPENDED PARTICULATE MATTER
STI	SEXUALLY TRANSMITTED INFECTIONS
TDS	TOTAL DISSOLVED SOLIDS
TSS	TOTAL SUSPENDED SOLIDS
THB	TOTAL HETEROTROPHIC BACTERIA
THF	TOTAL HETEROTROPHIC FUNGI
TOC	TOTAL ORGANIC CARBON
VOC	VOLATILE ORGANIC COMPOUNDS

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EXECUTIVE SUMMARY

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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 is an 8-year multi-sectoral and multi-scale program that on the one hand targets seven Southeastern States with acute gully erosion (Abia, Anambra, Cross River, Ebonyi, Edo, Enugu and Imo), while laying the foundation for scaling out to other southern and northern states nationwide. It is envisaged that the project will promote improved vegetative land management practices and ultimately contribute to retaining or increasing forest cover and carbon storage, while also preventing or reducing erosion impacts through activities such as watershed scale planning, establishing vegetation corridors/set asides, and afforestation or natural regeneration measures. This report presents the Environmental and Social Management Plan (ESMP) for the proposed NEWMAP gully erosion control works at the Ikot Anwatim gully complex in Calabar, Cross River State. The ESMP was developed using baseline data generated during a single season (wet) data gathering exercise, March-April 2014. The ESMP will be utilized by the CRS NEWMAP project monitoring unit (PMU) and her commissioned contractors and will form the basis of site-specific management plans that will be prepared by the contractors as part of their construction methodology.

The Ikot Anwatim gully complex has a main gully, with five major fingers. These gullies pass through large expanse of building areas, settlements and farmlands, through undulating terrain and steep hills to the swamp forests of the Calabar River. The gullies are adversely affecting livelihood in some major communities of Calabar Municipality, namely Ikot Anwatim, Ikot Ansa, Ekorinim, Esuk Utan, Ikot Akpanam and Kasuk. The gully complex is so close to the major Murtala Muhammed Highway in Calabar and no action scenario could mean the washing away of part of the road and the consequent disruption of traffic into Calabar. Also, limited rock-fill to stabilize the gully faces only but excluding reclamation (civil works), with tree planting and re-vegetation of gully site, will still leave the gullies too close to human habitation and traffic, with its safety implications. An option incorporating civil works to reclaim the gullies, with tree planting and re-vegetation of gully sites is preferred as it will restore much of the gullies, improve communication and provide access link roads between parts of the community separated by gully erosion, in addition to enhancing community livelihood options.

Intervention works at the proposed Ikot Anwatim gully erosion project site will involve the structural component of slope stabilization (earthworks to control erosion nick

points), along with the re-vegetation component. The engineering solution includes borrowing specified material to fill gully heads to return the eroded faces to their original position. The major activities will include site clearance and excavations and civil works (construction of permanent project facilities, including stone revetment to reclaim and protect exposed soil surface to stop scouring action of flow velocity. The project design allows for storm waters to be properly channeled, with provision for stilling basins and check dams and rip rap at the outfall. This will dissipate detrimental hydraulic energy of flow before *intentional routing* to the swamp forests (- project end point). The 'co-social benefits' of the project will include the assurance of human safety in the area and that future land use will be practicable.

The sites for the NEWMAP Ikot Anwatim gully complex intervention project are typically low in biodiversity value (poor species composition and an absence or rarity of trees of timber value) and with low carbon value, although in ecological context these areas fall under the "partially modified lowland rainforest" ecozone. The sites include sizable secondary and tertiary forests, mixed vegetation, and the traditional multi-storey cropping dominant throughout Nigeria's Niger Delta. Poor ecosystem/resource management has led to uncontrolled land clearing/overexploitation, which in combination with the increasing storm water runoff from properties on the upper watershed has contributed to the acceleration of slope erosion and landslide activity.

The air basin in the project area is generally clear and free of particulate matter and visible pollutants. Oxides of sulphur and carbon from domestic and vehicular sources were below harmful levels. Generally, vegetation, farm crops, ornamental flowers, etc did not show evidence of stress from air pollution. Discussions with community members also suggested the absence of significant incidence of air borne related diseases in proposed project area.

The NEWMAP Ikot Anwatim gully complex intervention project area lies within the eastern margin of the Niger delta sedimentary basin. The rocks are mainly sandstones, shales, sands and gravel which belong to the Benin Formation and range in age from Holocene to Recent. The area is made up of upper and lower aquifers. The local groundwater flow is south wards. The concentrations of most ions and heavy metals in groundwater are within the limits of FMEnv/WHO.

The soil is moderately acidic with sand fractions (-sand, sandy loam and loamy sand texture). Organic carbon contents suggested soils of medium nutrient status. Mean heavy metal contents for both surface and subsurface soils were within tolerable limits in the project site and thus the soils were free of heavy metal toxicity.

The water within the project area is slightly acidic to neutral. Biological Oxygen Demand (BOD) values were above the recommended permissible limits of FEPA/FMEnv, WHO and EEC regulatory standards. These indicated the presence of organic contaminants in the surface waters and thus water that is not fit for human consumption.

Public interest in the project is high because of the elimination of the threat to lives and property caused by gully activities. The project is likely to engender socio-economic transformation coupled with its impacts on surrounding communities during the construction phase (e.g. noise, dust, emissions etc) and through the influx of workforce and re-vegetation activities. Other impacts will be on relief/hydrology and wildlife. Environmental management guidelines, with performance indicators for environmental components and responsible parties for auditing/monitoring have been built into this ESMP document. Also built into this report are general environmental management conditions for contracts/civil works.

NEWMAP incorporates an integrated biodiversity program designed to address threats (habitat conversion), problems (unsustainable use practices) and opportunities (new enterprises). The typology of activities expected as part of investment in soil erosion management includes promoting alternative income-generating activities to replace those that will be rendered unproductive and the participation and capacity development of indigenous and local communities in the management of the restored areas. Potential livelihood options include snail farming, bee keeping, piggery, poultry, fish farming, propagation of Afang (*Gnetum africanum*) and other leafy vegetables (landraces) and in vegetative propagation (grafting and budding) of important economic tree species.

CRS NEWMAP has developed this Environmental and Social Management Plan (ESMP) to identify the environmental and social management and mitigation actions required to implement project activities in the Ikot Anwatim gully complex area in accordance with the World Bank's Performance Standards and the requirements of applicable Nigerian legislation and environmental policies. The application of measures embedded in this ESMP and other provisions incorporated herewith will ensure that the policies of the Federal Government of Nigeria and the World Bank on environmental and social safeguards assessment are met and all subprojects undertaken are environmentally and socially sound and sustainable.

The projected cost for implementation of the ESMP over the different project phases (inclusive of operation and maintenance for a two-year period) is four million, five hundred thousand Naira (₦4,500,000).

CHAPTER ONE

INTRODUCTION

1.0 Project Background

Gullies are a specific form of severe erosion typically caused by concentrated water flow on erosive soils. Concentrated water flow may begin as minor sheet flow, produce rills, and eventually result in major gully formation. Gullies can have major impacts on an area by taking land out of production and by lowering the groundwater table, as well as being a major source of sediment. Once formed, gullies typically grow with time and will continue down-cutting until resistant material is reached. They also expand laterally as they deepen. Gullies often form at the outlet of culverts or cross-drains due to the concentrated flows and relatively fast water velocities.

Usually the land use surface in urban/peri-urban basins includes roofs, streets and other impervious surfaces. Runoff flows through these surfaces to natural or built up drainage channels and storm sewers. It changes the hydrologic cycle, increasing the overland flow and decreasing the groundwater flow. Under these circumstances the peak discharge increases. In addition, the washed impervious surfaces during rainy days increase the pollution load in the environment and to downstream water bodies. In Nigeria and as in most developing countries source control of urban drainage using structural or physical methods (e.g. detention and retention ponds, permeable surfaces, infiltration trenches etc) are inadequate/do not exist and the impacts are transferred directly to downstream areas. In some cases, these measures have worked whilst in other cases they have generated secondary problems. Also, when no reliable urban plan and regulation exists, people might occupy the flood plains because these areas have a flat topography and generally have lower costs. The non-structural method always employed to solve flood problems at present is just to allow for days of dissipation of flood waters.

The problem of controlling erosion by structural means is compounded by widespread deforestation. Erosion control can in some instances be promoted by restoring vegetation and instituting efficient methods of watershed and soil management. Any long-term solution to the problem of erosion/floods must undoubtedly go further than simply using structural controls. That reafforestation is required - and for many reasons other than just erosion/flood control - is generally accepted by both governments and international agencies.

1.1 Principles in urban drainage

On the basis of reliable experience from many developed countries some main principles in urban drainage management have been developed, which are:

- Urban drainage control scenarios/evaluation should be done in the whole basin and not only in specific flow sections. It should also take into account future city developments;
- The control measures should not transfer impacts to downstream reaches. Priority should be given to source control measures;
- Any long-term solution to the problem of erosion/floods must undoubtedly go further than simply using structural controls. Biotechnical methods offer a combination of physical structure along with vegetative measures for physical protection as well as additional long-term root support and aesthetics.

The urban drainage practices in most of the developing world do not fulfill these principles, the main causes being the following:

- Urban development in the developing countries' cities occurs unpredictably.
- Urbanization in periurban areas is usually developed without taking into account the city regulations. Such urbanization entails *Unregulated developments with* private land owners selling land without the basic infra-structure. There is also the *Invasion of public areas* (such as public green areas). Such developments

become consolidated with the connection of water and electricity approved by the public administration.

- Lack of appropriate garbage collection and disposal decreases the water quality and the capacity of the urban drainage network. Where system drainage exists it is filled with garbage and sediments.
- There is no prevention program for risk area occupation and no requirements are in place for the development of such areas.

1.2 Project Development Overview for the Nigeria erosion and watershed management project (NEWMAP)

Nigeria, with an estimated population of 173.6 m (NPC 2013), occupies an area of 923,770 sq. km and is the largest country in tropical West Africa. Nigeria is confronted by major environmental problems among which are: deforestation, drought and desertification, soil and coastal erosion, water pollution, oil pollution, loss of biodiversity, flooding, urban decay and industrial pollution. Deforestation appears to be an inevitable consequence of 'development'. Soil deprived of the forest litter rapidly loses its structure, becoming very vulnerable to erosion by wind and water. The country faces severe problems of soil erosion - both sheet and gully erosion, largely due to unsustainable development practices. Erosion and degraded watershed have devastating effects on many peoples' lives and destroys essential infrastructure for economic development and poverty alleviation.

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 will take a comprehensive watershed management approach (with an investment focus on gully erosion prevention and rehabilitation). It is envisaged that the project will promote improved vegetative land management practices and ultimately contribute to retaining or increasing forest cover and carbon storage, while also preventing or reducing erosion impacts through activities such as watershed scale

planning, establishing vegetation corridors/set asides, and afforestation or natural regeneration measures.

The investment in erosion and watershed management (Component One of NEWMAP) activities involve sub-projects each of which may 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. Such works trigger the Environmental Impact Assessment (EIA) Act of the Federal Government of Nigeria and the World Bank's environmental and social safeguards policies (OP/BP 4.01, Environmental Assessment and OP/BP 4.12, Involuntary Resettlement etc), which must be applied to any project with potential adverse environmental and or social impacts.

This report presents the Environmental and Social Management Plan (ESMP) for the proposed NEWMAP gully erosion control works at the Ikot Anwatim gully complex in Calabar, Cross River State. It describes the procedures and arrangements for addressing safeguard issues (adverse environmental and social impacts that need to be anticipated, avoided and mitigated or reduced to acceptable levels). The ESMP will be utilized by the contractors commissioned by Cross River State (CRS) NEWMAP for the project and will form the basis of site-specific management plans that will be prepared by the contractors as part of their construction methodology prior to works commencing. The ESMP will ensure that the policies of the Federal Government of Nigeria and the World Bank on environmental and social safeguards assessment are met and all subprojects undertaken are environmentally and socially sound and sustainable.

1.3 Project Area

The Ikot Anwatim gully erosion complex in Calabar falls within the Niger Delta environment. The entire area is characterized by high water tables with soils fully saturated to ground surface for almost nine months of the year. During the rainy season, the area is flooded and runoff is expected to be large. It is important to point

out that Calabar, like many urban centres in Nigeria, is affected by unplanned urbanisation. Although there is a laid out master plan, expansion and development of residential, business and industrial activities go on without strict adherence to the city masterplan. The consequences of such 'undirected and unplanned' urbanisation is manifest in the city's environment. Rapid runoff has caused soil erosion/gullies as well as sediment deposition problems in downstream areas.

The Ikot Anwatim gully complex is one of the prioritized erosion sites for NEWMAP intervention in the Cross River State (Fig. 1.1). The gully complex is located in Calabar Municipality (Fig. 1.2). Calabar is located between Latitudes 4° 78' and 5° 09' N and Longitudes 8° 15' and 8° 26' E and lies between the valleys of two rivers: the Great Qua River on the eastern side, and the Calabar River on the west (Fig. 1.3). The Ikot Anwatim gully complex has a main gully, with five major fingers. These gullies pass through large expanse of building areas, settlements and farmlands, through undulating terrain and steep hills to the Calabar River (Fig. 1.4). The main gully starts from the discharge points of the existing concrete culverts on the Murtala Muhammed Highway and runs westwards into the fresh water swamp of the Calabar River. The entire area has developed into deep ravines which are adversely affecting livelihood in five major communities of Calabar Municipality, namely: Ikot Anwatim, Ikot Ansa, Ekorinim, Esuk Utan, Ikot Akpanam and Kasuk. Many dwellings and roads have been lost due to these active gullies. The gully also threatens power transmission Pylons and the Murtala Mohammed Highway, which is the main access road to Calabar town.

The gully complex has caused damage to private and commercial property, public infrastructure and the ecosystem (e.g. loss of biodiversity, spawning grounds for fish and other wildlife habitats) and continually endangering the lives of humans.

Fig. 1.1 : Location of Cross River State on Political Map of Nigeria

Fig. 1.2. Location of Calabar (arrowed) in political map of Cross River State.

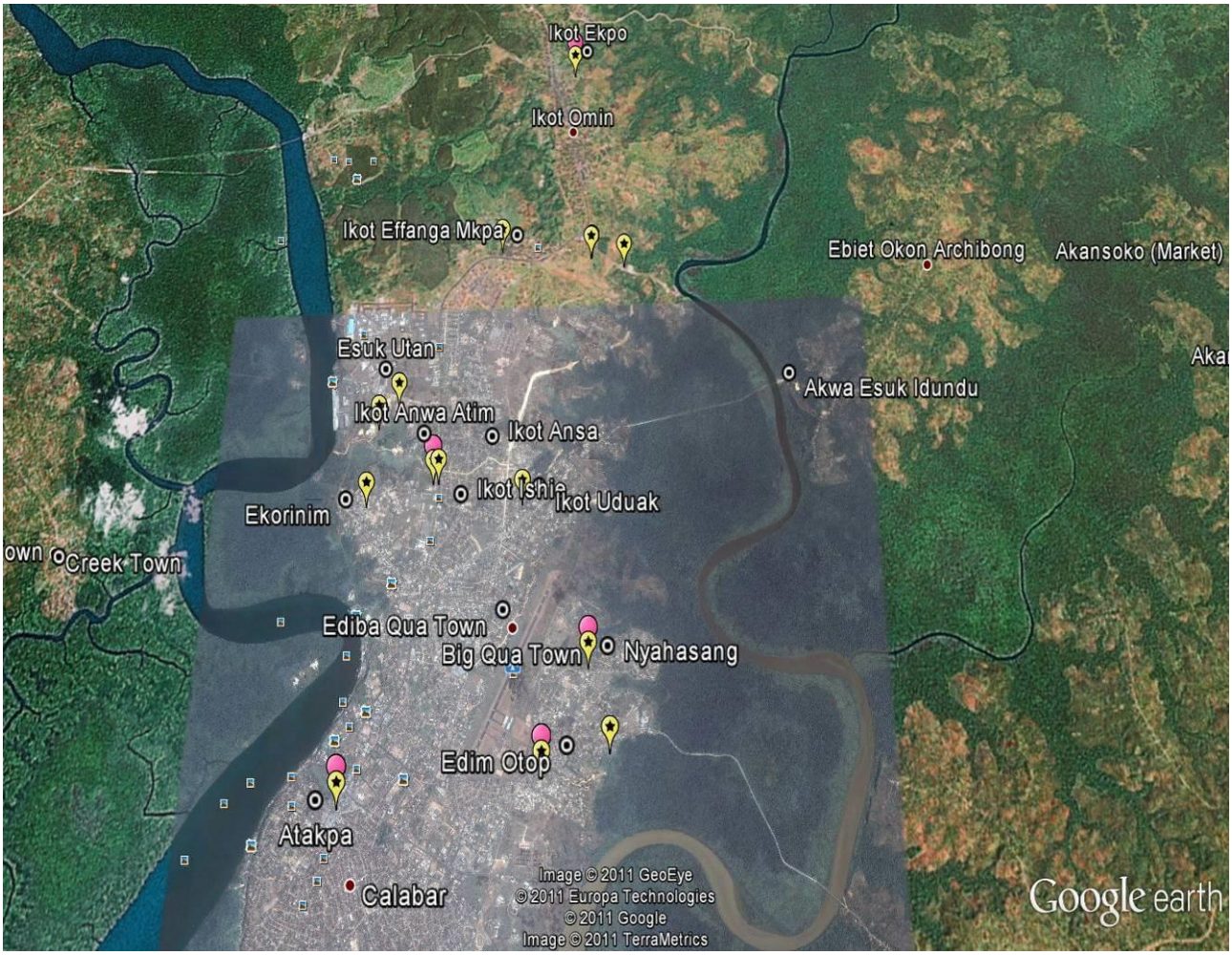


Fig. 1.3: Satellite imagery showing locations (yellow dots) of priority erosion sites in Calabar. Ikot Anwatim gully complex site can be seen (yellow/pink dot on the lower top left flank of map) close to Calabar River. Calabar lies between the valleys of two rivers: the Great Qua River (East) and the Calabar River (West).

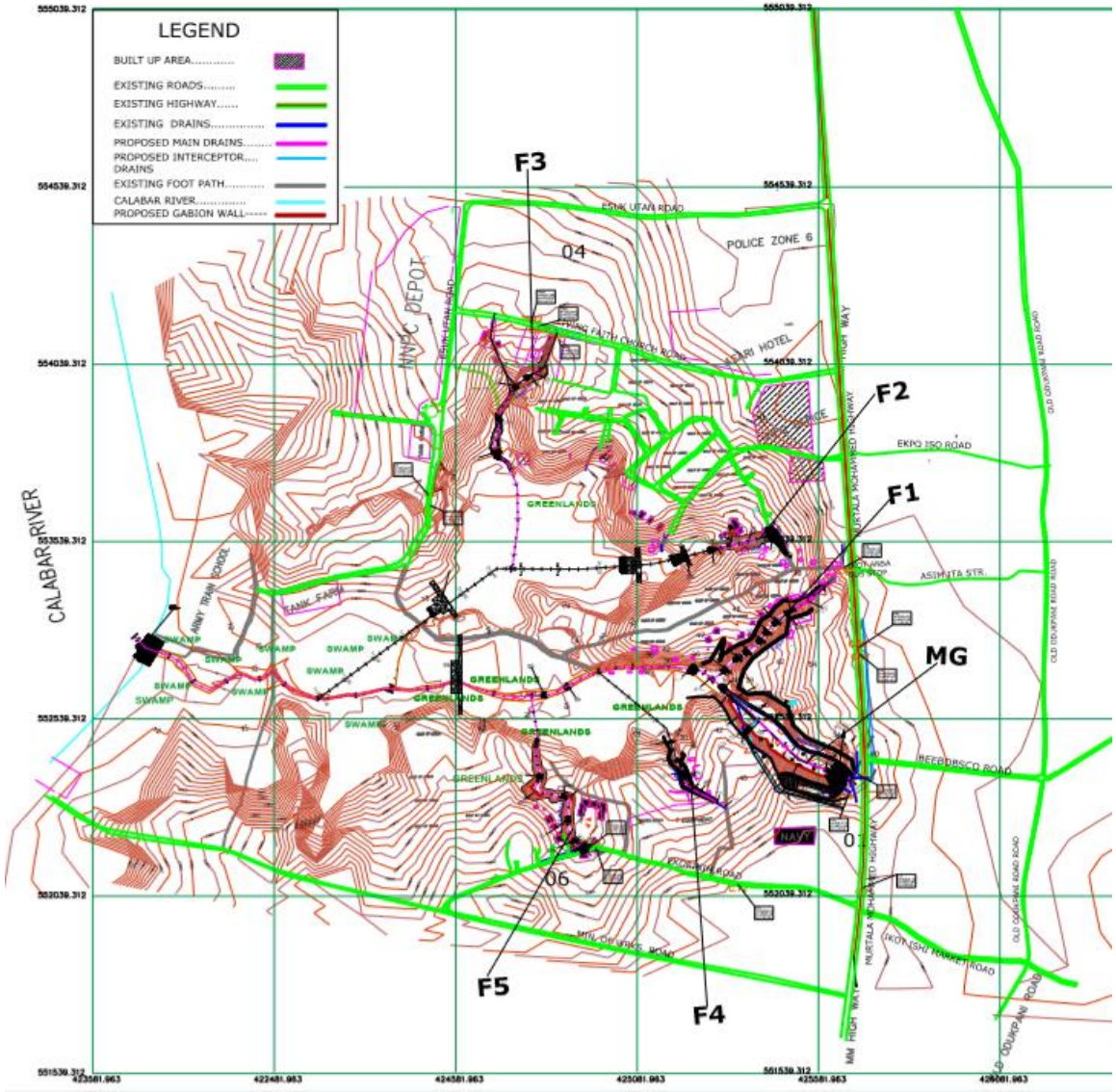


Fig. 1.4:Layout of main gully (MG) and gully fingers (F1-F5) within Ikot Anwatim (CRS NEWMAP Engineering Report, 2013)

Main Gully Erosion Site (Bebobsco)

The gully is located adjacent to the Murtala Muhammad highway and is about 3 km from the U.J. Esuene stadium. It extends about 2.3 km through undulating terrain into the Calabar River, with an average width of 170 m and average depth of about 12 m. Previous intervention works to control the gully by the Government of Cross River State included construction of drainage channels and a stilling basin on the gully bed, re-profiling and revegetation of the sides of the gully. These efforts proved largely unsuccessful as the structures suffered severe damage during one year of operation (see Plate 1.1A&B). A review (for CRS NEWMAP by Rabiona Engineering Ltd, 2013) of the palliative works suggests that the drainage channel lacked energy dissipation structures such as stilling basin along the conveyance channel. The gully bed is uneven and without vegetation. There is lack of collector drains from sides of the gully and the drainage channel is located towards the right-hand-side of the gully (from the highway end), making it impossible to receive run-off from the left-hand-side of the gully. Furthermore, there is lack of vegetation on the poorly terraced slopes and the concrete of the drainage channel has been severely damaged at the steps, rendering it very vulnerable and prone to further detrimental damage. This ESMP study is based on the design by Rabiona Engineering Ltd (2013), which was commissioned by CRS NEWMAP to carry out a study and re-design the intervention works to be in line with the recommendations of the World Bank and FAO experts on the Ikot Anwatim gully complex project.

Plate 1.1A

Plate 1.1B

Plate 1.1 A, B: Main gully erosion site of Ikot Anwatim gully complex (Bebobsco). Gully aggravated by concentrated runoff from drainage pipes and surface drainage channels on Murtala Muhammed Highway). Local and State government efforts at containing gully erosion (above) have proved largely unsuccessful.

Gully Finger No. 1 (Ikot Ansa Bus Stop)

This gully is adjacent to the main gully and begins a few metres behind the Ikot Ansa bus stop and empties into the main gully. The gully is about 401 m long. The average width is 30m while maximum depth is about 18 m. The origin of this gully is traceable to the failure of a channel conveying run-off from Ikot Ansa area. The failure and settlement of the channel at various sections along the longitudinal alignment of the drain and failure of the side slope (due to the topography and erodable nature of the soils in these areas) are major factors responsible for this gully. Also the poor end treatment of the drain is responsible for the erosion activities of the water emptying into the gully downstream. A number of buildings and lands have been destroyed by the gully, with persisting danger and fears to the Ikot Anwatim community. If no action is taken to check the gully erosion, lives and more property may be washed away.

Gully Finger No. 2 (Ikot Anwatim Village) – New gully finger

This gully is traceable to the earth road used by those engaged in hauling sand from down the Sand Beach. It is a new erosion finger of about 500 m long, 50 m width and 9 m deep. It is as a result of unchanneled concentrated water from the sides of the earth road, linking Ikot Anwatim and the Sand Beach (Plate 1.2). If nothing is done, the Ikot Anwatim village itself will be threatened and more useful land will be lost.

Plate 1.2: Gully head at Ikot Anwatim village (Gully Finger No. 2).

Gully Finger No. 3 (Winners Chapel)

This gully finger is located behind Winner's Chapel Church, Ekorinim and stretches into the main gully. It is about 650 m long, 30 m wide and 9 m deep. This gully is as a result of the failures around the sides and terminus of a previously treated gully. The slopes of the channel have failed and nearby lands have been eroded. If nothing is done the nearby church and other adjoining property may be consumed by the expanding gully (Plate 1.3).

Plate 1.3: Winner's Chapel Church (a gully [Gully Finger No. 3] runs behind the church to the right hand side).

Gully Finger No. 4 (Green Valley)

This gully finger is located behind Green Valley Hotel and threatens residential houses around the area. The gully is about 520 m long, 10 m wide and 8 m deep. This gully lies nearly parallel to the main gully head and terminates after the first left turn of the main gully. The main cause of the gully is poorly discharged run-off from the road into steep slopes of weak soil (Plate 1.4).

Plate 1.4: Gully finger behind Green Valley Hotel (Gully Finger No. 4).

Gully Finger No. 5 (Ekorinim II)

This gully finger is located right in the middle of Ekorinim II and lies beside a primary school with great threat to the school. The gully is about 550 m long, 25 m wide and 8 m deep. The gully has cut off the main asphalted access road to Ekorinim II. The gully is caused by uncontrolled discharges from a culvert and side drainage channels on Ekorinim II road (Plate 1.5). If action is not taken urgently several buildings will be consumed by this gully.

Plate 1.5: Command area of gully site at Ekorinim II (Gully Finger No. 5). The road has been severed and water pipelines exposed).

Table 1.1: Summary of key features of the gullies in Ikot Anwatim

S/No.	Name	Total Length (m)	Maximum Depth (m)	Average Depth (m)	Average Width (m)
1	Main Gully (Bebobsco)	2213	21	12	170
2	Gully Finger No.1 (Ikot Ansa Bus Stop)	401	18	15	30
3	Gully Finger No. 2 (Ikot Anwatim)	500	13	9	50
4	Gully Finger No. 3 (Winners Chapel)	638	14	9	30
5	Gully Finger No. 4 (Green Valley)	514	11	8	10
6	Gully Finger No. 5 (EkorinimII)	549	12	8	25

1.4 The Rationale For The ESMP

The development of an Environmental and Social Management Plan (ESMP) includes establishing an environmental and social impact assessment (if none exists) and management process framework that incorporates the following elements:

- Regulatory policies;
- Identification of risks and impacts;
- stakeholder consultation/engagement
- Management programs that includes emergency preparedness and response;
- Monitoring and review.

This Environmental and Social Management Plan (ESMP) is developed to identify the environmental and social management and mitigation actions required to implement project activities at the Ikot Anwatim gully site, in accordance with the requirements of the World Bank and applicable Nigerian national legislation. This ESMP provides an overview of the environmental and social baseline conditions in the Ikot Anwatim gully complex project area, summarizes the potential impacts associated with the project activities at the proposed gully intervention site and sets out the management measures required to mitigate any potential impacts. There has been no previous baseline study conducted in the area. Consequently, the potential impacts and

associated mitigation measures and management procedures presented in this ESMP are based on the baseline information and assessments established through literature research and a single season field data gathering/laboratory analysis in March-April 2014 (- corresponding to the wet season). The established baseline conditions and stakeholder/community concerns have been incorporated into this document (See Chapters 3 and 4). Also presented in the ESMP are the management procedures to be used for community engagement, dissemination of project information and grievance management.

The benefits envisaged in conducting this ESMP include:

- The management of environmental and social performance throughout the life of the project.
- Protection of the environment and minimizing adverse social impacts via consultative process; and
- Lower overall project cost in the long term (reduced probability of environmental disasters, costly clean–up, host communities interference, etc.);
- Effective community engagement, opportunity for enhanced public confidence and good public relations and
- Support for displaced persons in their efforts to restore their livelihoods and living standards and compensation for any loss of livelihood or assets;

This ESMP will be utilized by the CRS NEWMAP project monitoring unit (PMU) and her commissioned contractors and will form the basis of site-specific management plans that will be prepared by the contractors. All contractors and subcontractors shall comply with the ESMP requirements as applicable to the tasks they are employed to undertake. It is recognized that practical implementation of many of the measures may rest with contractors and subcontractors and consequently CRS NEWMAP PMU will require a robust review/audit mechanism, as described in this ESMP, to ensure that it is executed on her behalf. This ESMP should be regarded as a live document that should be

reviewed and updated as new technologies and regulatory regimes emerge and impacts become apparent during the project life.

1.5 Methodology For The ESMP Preparation

The main approach for preparing the Environmental and Social Management Plan (ESMP) is highlighted in Fig 1.5. Research and review of literature on the project was undertaken in the following areas:

- Climate and meteorology
- Land use
- Biodiversity, including wildlife resources
- Vegetation and habitats

Literature sources included but not limited to the following:

- State and Federal Government publications
- Journal articles and dissertations
- World Bank documents.

Consultation for ESMP Preparation

Stakeholder consultation was carried out (in March-April 2014) with necessary government agencies, parastatals and the CRS NEWMAP project management unit (PMU). Consultation included interactions with the following:

- Cross River State Ministry of Environment
- The host communities (Ikot Anwatim, Ikot Ansa, Ikot Ishie, Ekorinim, Esuk Utan, Ikot Akpanam and Kasuk)
- CRS NEWMAP Team Members
- Other key stakeholders (Forestry Commission etc.)

The list of some of the persons met during consultation is presented as Annexure 1.

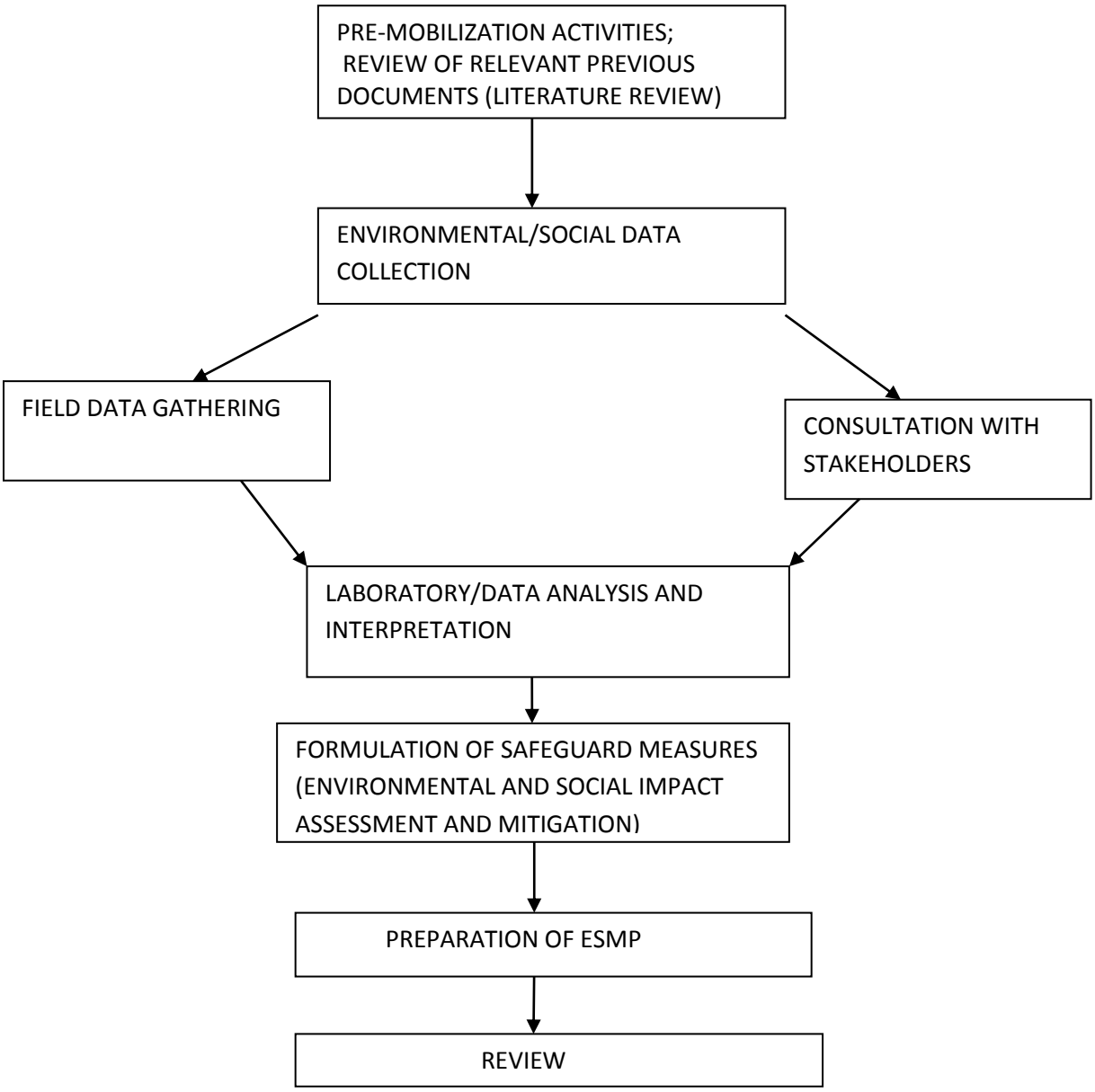


Fig 1.5: ESMP Design and Implementation Plan

1.6 Overview of the proposed gully erosion intervention project (Summary of Key Works)

The proposed Ikot Anwatim gully erosion intervention project will involve the structural component of slope stabilization (earthworks to control erosion nick points), along with the re-vegetation component. The engineering solution includes using imported material to partially reclaim gullies in order to return eroded faces to their original position. The 'co-social benefits' of the intervention project will include the assurance of

human safety in the area and that future land use will be practicable. The design of proposed intervention works at the Ikot Anwatim gully complex includes different components which are presented below for each gully finger.

1.6.1 MAIN GULLY (MG)

The key works related to the project at the main gully include the following components:

i. Demolition of existing concrete catch-pit and interceptor drainage channels;
ii. Existing main channel to be cut off from taking any discharge from the gully head and its outlet connected to the new channel;
iii. Earth filling and compaction using imported material to partially reclaim part of the gully head including slope batter at side walls;
iv. As the left hand side of the gully is facing great threat from uncontrolled runoff from high elevation around the Navy hospital, it is necessary to demolish and reconstruct the existing failed interceptor drain with adequate provision for energy dissipation. Provision of reinforced concrete interceptor drain (1.0 m x 1.0 m) across the left hand side of the gully to capture direct run-off into the gully, including connection with catch-pits, chute channels and main drainage channel at the gully bed. All joints shall be provided with water-stop to prevent leakage into the supporting ground and fill.
v. Provision of interlocking blocks for slope protection at the gully head around the chute channel;
vi. Provision of gabion structure at the toes of steep slope;
vii. Provision of 6.0 m long x 6.0 m wide x 4 m deep catch-pit at the outlet of the culvert on the highway to control discharges from existing road side drains and culvert. Trash rack shall be provided at the entrance point of drainage channel upstream to prevent debris from entering into the catch pit. Provision has been made in the management plan to clean the trash rack of debris monthly during rainy seasons.

viii. A reinforced concrete chute channel of about 70 m length, 4.0 m width and depth of 2.0 m to connect the catch-pit from gully head with the 1st stilling basin situated 19 m lower on the gully bed.

ix. The discharge from the 1st stilling basin (18 m length by 4.0 m width and 6.5 m) shall be conveyed to the 2nd stilling basin (10 m length by 4.0 m width and 5.5 m depth) using a 325 m long x 3 m wide x 2 m deep reinforced concrete channel.

x. A 3rd stilling basin of dimension 6.0m length x 1.5m width x 4.0m height shall be provided at the main gully bed to dissipate hydraulic energy from the interceptor chute channel before discharging into the main channel.

xi. Riprap for erosion control downstream of stilling basins;

xii. Reno/gabion mattress drainage channel at gully bed;

xiii. Provision of a check dam downstream of gully to stabilize the gully: The remaining stretch of the gully after dissipation of detrimental hydraulic energy of flow through the stilling basins upstream shall be stabilized using a gabion check dam of 2 m height. The remaining section of the gully has bed slope of less than 1% and so does not require further check dams. The edges of the gabion check dam shall be extended to key into the side walls of the gully by at least 1 m. Gabion has the advantage of flexibility in adjusting to earth movements as well as low cost compared with rigid concrete structures.

xiv. Provision for stone pitching of critical sections to avoid scour around existing culverts;

xv. Re-vegetation with local/domesticated grasses and trees;

xvi. Demolition of 2 nos. existing buildings and other similar structures within the limit of construction works; Compensation for demolished buildings and other underground structures;

xvii. Provision for the relocation of service lines such as water pipelines, electric poles, etc.; and

xviii. Provision for temporary access road during construction.

1.6.2 GULLY FINGER 1 (F 1; Ikot Ansa bus stop)

The key works related to the project in gully finger no. 1 at Ikot Ansa bus stop include the following components:

i. Demolition of existing concrete drainage channels;
ii. Earth filling and compaction of the fill to partially reclaim part of the gully head including slope batter at side walls;
iii. Provision of gabion structure at the toes of steep slope;
iv. A 4.0 m x 3.0 m x 3.0 m catch-pit shall be provided to collect flow from the outlet of the existing drain into the chute channel.
v. A reinforced concrete chute channel of about 110 m length, 4.0 m width and depth of 2.0 m connects the catch-pit from gully head with the stilling basin situated 21.72 m lower on the gully bed.
vi. A reinforced concrete stilling basin of 18 m length x 4 m width x 6.5 m depth shall be provided on the gully bed for hydraulic energy dissipation;
vii. Geotextile filter protection of all structures as shown on design drawings;
viii. Riprap for energy dissipation downstream of stilling basin;
ix. There shall be five check dams of 2 m height to stabilize the gully downstream of the stilling basin. The 1st check dam shall be located 35m from the stilling basin.
x. Re-vegetation with local/domesticated grasses and trees;
xi. Demolition of 6 nos. existing buildings and other similar structures within the limit of construction works;
xii. Compensation for demolished buildings and other underground structures;
xiii. Provision for the relocation of service lines such as water pipelines, electric poles, etc.; and
xiv. Provision for temporary access road during construction.

1.6.3 GULLY FINGER 2 (F 2)

The key works related to the project in gully finger no. 2 at Ikot Anwatim village include the following components:

i. Demolition of existing concrete drainage channels;
ii. Earth filling and compaction of the fill to partially reclaim part of the gully head including slope batter at side walls;
iii. Provision of 0.6 m x 0.6 m drain on both sides of the reclaimed road up to head of gully finger;
iv. Provision of 1.5 m x 1.5 m box culvert on reclaimed road to discharge water from the road;
v. Provision for stone pitching on culvert inlets and outlets including critical sections to prevent scour;
vi. Provision of 2 No. 3.0 m x 3.0 m x 3 m catch-pits at the outlet of culvert on the road, and at outlet of existing drainage channel to receive flows into the chute channel;
vii. Provision of 1.5 m x 1.5 m chute channel on filled slope up to stilling basin at the gully bed;
viii. Provision of a stilling basin (6 m length x 1.5 m width x 4 m depth) at the gully bed for hydraulic energy dissipation;
ix. Geotextile filter protection of all structures as shown on design drawings;
x. Riprap for energy dissipation downstream of stilling basin;
xi. There shall be five check dams of 2 m height to stabilize the gully downstream of the stilling basin. The 1st check dam shall be located 67m from the stilling basin.
xii. Re-vegetation with local/domesticated grasses and trees;
xiii. Materials testing for quality control during construction;
xiv. Provision for topographic surveys;
xv. Demolition of 6 nos. existing buildings and other similar structures within the limit of construction works;

xvi. Compensation for demolished buildings and other underground structures;
xvii. Provision for the relocation of service lines such as water pipelines, electric poles, etc.; and
xviii. Provision for temporary access road during construction.

1.6.4 GULLY FINGER 3 (F 3)

The key works related to the project in gully finger no. 3 at Winners Chapel, Ekorinim include the following components:

i. Demolition of existing concrete drainage channels;
ii. Earth filling and compaction of the fill to partially reclaim the gully head including slope batter at side walls;
iii. Provision of a 3.0 m x 3.0 m x 3.0 m catch-pit at the outlet of existing drains to receive flows into the chute channel;
iv. A reinforced concrete chute channel of about 20 m length, 2.0 m width and depth of 1.5 m to connect the catch-pit from gully head with the stilling basin situated 8.57 m lower on the gully bed.
v. Provision of stilling basin (8 m length x 2 m width x 4.5 m) at the gully bed for hydraulic energy dissipation;
vi. Geotextile filter protection of all structures as shown on design drawings;
vii. Riprap for energy dissipation downstream of stilling basin and to check discharge from existing drain;
viii. There shall be four check dams of 2 m height to stabilize the gully downstream of the stilling basin. The 1st check dam shall be located 120 m from the stilling basin.
ix. Re-vegetation with local/domesticated grasses and trees;
x. Materials testing for quality control during construction;
xi. Provision for topographic surveys;
xii. Provision for the relocation of service lines such as water pipelines, electric poles, etc.;

xiii. Provision for temporary access road during construction.

1.6.5 GULLY FINGER 4 (F 4)

The key works related to the project in gully finger no. 4 at Green Valley Hotel include the following components:

i. Demolition of 1 no. existing buildings within the limit of construction;
ii. Earth trimming/filling and compaction of the fill to partially reclaim the gully head including slope batter at side walls;
iii. Construction of 3.0 m x 3.0 m catch-pit to receive flow from existing drainage channel upstream and connect to chute channel;
iv. Provision of a reinforced concrete chute channel of about 89 m length, 1.5 m width and depth of 1.7 m to connect the catch-pit from gully head with the stilling basin situated 17.92 m lower on the gully bed.
v. Provision of stilling basin (15 m length x 1.5 m width x 5.5 m) at the gully bed for hydraulic energy dissipation;
vi. Geotextile filter protection of all structures as shown on design drawings;
vii. Riprap for energy dissipation downstream of stilling basin and to check discharge from existing drain;
viii. There shall be four check dams of 2 m height to stabilize the gully downstream of the stilling basin. The 1st check dam shall be located 35 m from the stilling basin.
ix. Re-vegetation with local/domesticated grasses and trees;
x. Materials testing for quality control during construction;
xi. Provision for topographic surveys;
xii. Provision for the relocation of service lines such as water pipelines, electric poles, etc.;
xiii. Provision for temporary access road during construction.

1.6.6 GULLY FINGER 5 (F 5)

The key works related to the project in gully finger no. 5 at Ekorinim II include the following components:

i. Demolition of 4 nos. existing buildings within the limit of construction;
ii. Demolition of existing failed culverts and drainage structures;
iii. Excavation of unsuitable materials underlying the failed road within the limits of the gully head and disposal or reuse for vegetation works after gully stabilization; The excavated pits shall be backfilled with borrowed materials.
iv. Provision of 1.5 m x 1.5 m box culvert across the road to discharge water from road side drains;
v. Reinstatement Of The Road**:** Since erosion has cut off the road (see Plate 1.5), the road subgrade and pavement structures made up of 150 mm thick compacted laterite sub base and 150 mm thick compacted stone base shall be reinstated for about 80 m length. The existing 7.3 m width of road shall be retained. The road shall be finished with 40 mm thick asphaltic wearing course over MC1 bitumen primed layer. The affected road side reinforced concrete drains of 0.6 m x 0.6 m shall be reinstated.
vi. Construction of 3.0 m length x 3.0 m width x 3.0 m catch-pit to receive flows from culvert and road side drainage channels into the chute channel;
vii. Provision of a reinforced concrete chute channel of about 18 m length, 2 m width and depth of 1.7 m to connect the catch-pit from gully head with the stilling basin situated 11.48 m lower on the gully bed
viii. Provision of stilling basin (8 m length x 2 m width x 4.5 m depth) at the gully bed for hydraulic energy dissipation;
ix. Geotextile filter protection of all structures as shown on design drawings;
x. Riprap for energy dissipation downstream of stilling basin and to check discharge from existing drain;

xi. There shall be four check dams of 2 m height to stabilize the gully downstream of the stilling basin. The 1st check dam shall be located 85 m from the stilling basin.
xii. Re-vegetation with local/domesticated grasses and trees;
xiii. Materials testing for quality control during construction;
xiv. Provision for topographic surveys;
xv. Provision for the relocation of service lines such as water pipelines, electric poles, etc.;
xvi. Provision for temporary access road during construction.

General considerations in project design:

Owing to the location of the design structures (i.e. in an urbanized area), and the interconnectivity of various hydraulic structures (such as culverts from roads, chute channels from gully head catch-pits and stilling basins), and to avoid the detrimental consequences of an eventual collapse, 100-year return period discharges were adopted for design.

Filling under channel chutes shall be made with imported fill material and compacted to 100% standard proctor or 98% modified proctor in layers of 100 mm maximum for manual compaction, and 250 mm for mechanical compaction to limit settlement in the fill material. Significant settlement under chute channels could result in cracks and other damages. For these reasons, channels will be divided in successive stretches of 10m length each, with settlement and expansion joints placed between them and provided with a water-stop along the base and wing walls. This will prevent cracking in the event of severe settlements in the supporting fill, while ensuring perfect water tightness due to the presence of the water-stop joint. The expansion joints will be provided at 20m intervals with water stop and bituminous fill, while settlement joints (closed joints) will be at 10m distance between successive expansion joints with water-stop but without bituminous fill.

Gabion and Reno Mattress

Gabions and Reno Mattress will be used to stabilize the side slopes in areas affected or not affected by filling/cut. Gabions of varying sizes shall be used to stabilize slopes where the angle of inclination is very high. Reno mattress shall be used as apron for the gabion works. Geotextile shall be placed before the installation of the gabions and Reno-mattress. These shall be used where applicable in areas of cut or fill to protect drainage channels e.g. in open concrete drains to prevent further embankments failure.

Re-vegetation with local/domestic grass and trees: To maintain the reclaimed part of the gully from further degradation, improved vegetation and ground cover is proposed by planting of grass, shrubs, economic tress like guava, mangos, gmelina, Indian bamboo, etc and forest friendly trees that have long tap roots etc. This area shall be demarcated and reserved as green (protected) area after rehabilitation. The participation and capacity development of indigenous and local communities in the management of the restored areas will be promoted.

Construction Materials

Fill and other construction materials will be obtained from government approved borrow pits around Calabar, Akpabuyo and Odukpani. Rock source for gabions and rockfill are available in many quarries at Akamkpa Local government Area of Cross River State, located about 20Km from the project site. The rock type is predominantly granite. Concrete Aggregates – River sand for fine aggregate is available within the project site and most areas in Calabar. The contractor shall provide on-site confirmation tests on all materials used.

1.7 Indicative Timeline for Project Phases

NEWMAP is an 8-year multi-sectoral and multi-scale program. Project activities can be categorized under the pre-construction, construction and the operation and maintenance phases. These are described briefly, with indicative timelines as follows:

Pre- Construction Phase

Major activities in the first two years of the project (from project approval in May 2012) include stakeholders' consultations and undertaking studies for the development of site specific environmental management plans (ESMP), resettlement action plans (RAP) and engineering designs for proposed construction of remediation works for the approved gully erosion sites. Consequently, identification of potential project affected persons (PAPs), issues of relocation/compensation/income restoration assessment and selection of contractors for project works are to be addressed during this phase of project activities.

Construction Phase

The major activities of the third year will be the mobilization of equipment and personnel to site, site clearance and excavations and civil works (construction of permanent project facilities). It is expected that civil works will be completed within 12 months of awarding the contract.

The proposed civil work activities include stone revetment to reclaim and protect and reinforcement of exposed soil surface to stop scouring action of flow velocity. The project envisages 5- 15m offset from the gully edge as the main zone of impact and only assets within this zone are considered as affected, using a census cut-off date of November 26, 2013. After this date, no persons are eligible for resettlement benefits. Details are provided in the RAP, which identifies about 322 persons as potentially project affected persons (PAPs) for the gully complex area.

Various temporary construction-related components of the project will include staging areas, worker camps and lay down areas. Borrow areas are located some kilometers away from the project area. The exact areas to be occupied by the camp and the number of workers required are yet to be defined. However, the construction phase employment will be in the order of 180- 300 persons, on the basis of the assumption that work will go on simultaneously in all gully sites. The staging areas/worker camps are expected to be small in size as community members have expressed their willingness to rent out property for use by construction workers. Any construction

related staging/lay down areas/worker camps would be restored to their original condition upon completion of construction activities.

Operation/Maintenance Phase

At the end of the 3rd year to the 1st half of the fourth year, it is expected that all permanent project facilities will be operational. Once operational, maintenance of drainage channels, catch pits and impact basins etc. is expected to commence by the fourth year. The re-vegetation component (with local/domestic grass and trees) and forest/watershed management will be among the major activities in the fourth and subsequent years following completion of civil works. NEWMAP incorporates an integrated biodiversity program designed to address threats (habitat conversion), problems (unsustainable use practices) and opportunities. The opportunities include promoting alternative income-generating activities to replace those that are no longer productive and capacity development of indigenous and local community in the management of the restored areas. These complementary livelihood initiatives and provision of financial capital and/or materials for take-off will ensure sustainability beyond the 8-year lifespan of NEWMAP.

1.8 Project Alternatives

Alternative 1: "No Action"

A 'No Action" scenario in Ikot Anwatim gully complex area will spell doom and a return to the devastating and life threatening effects of 'runaway' gullies. Since the upper watershed of the gully complex is so close to the major highway in Calabar (Murtala Muhammed Highway), no action could mean the washing away of part of the road and the consequent disruption of activities in Calabar municipality. The NNPC petroleum storage depot that borders the lower watershed will also be threatened. The gully erosion intervention project under Nigeria Erosion and Watershed Management Project (NEWMAP) is, therefore, a much welcome development. The project development overview for NEWMAP has been discussed in Chapter One of this document. Other alternatives considered on the basis of project cost estimates were:

Alternative 2: This excludes reclamation (civil works) but rock-fill to stabilize the gully faces only, with tree planting and re-vegetation of gully site. This alternative will still leave the gully too close to human traffic and activities in Calabar municipality, with its safety implications. The option was therefore rejected.

Alternative 3: Filling and compaction using imported fill material to partially reclaim the gullies in order to return eroded faces to their original position. The main gully extends close to the main highway into Calabar (Murtala Muhammed Highway) and also within limits of heavily built-up areas along the highway, necessitating the option of filling for partial reclamation (civil works), with tree planting and re-vegetation of gully site.

Alternative 3 is the preferred option as this will improve communication within the municipality because it shall ensure maintenance of Murtala Muhammed Highway and public infrastructure in the area, in addition to enhancing livelihood options in communities in the Ikot Anwatim gully complex area.

Implementation of the project (post construction period)

Conservation set asides are essential along erosion prone areas. Successful project execution will lead to the establishment of vegetation corridors (habitat strips) which could serve as indigenous community conserved areas. That is, these habitat strips should have the status of protected areas that should be managed through community-based forest management committees (FMCs) (IUCN revised Category IV, 1994). Such an arrangement will help integrate people's livelihoods through community involvement in development and management of the project. Other potential benefits will be in the area of eco-tourism, forestry, agro-forestry, wildlife products and ecosystem services.

1.9 Structure Of The Report

The ESMP outlines the environmental and social management processes and procedures applicable to the project and includes the topics which are common to all environmental and social disciplines. Supporting documents are provided as appendices.

The ESMP is structured as follows:

Chapter 1 – Introduction;

Chapter 2 – Institutional and Legal Framework for Environmental Management;

Chapter 3 – Biophysical Environment (Description of the area of influence and environmental baseline conditions).

Chapter 4 – Socio-Economic Characteristics and Consultation with Stakeholders;

Chapter 5 – Assessment of Potential Adverse Impacts;

Chapter 6 – Environmental and Social Management Plan;

Chapter 7 – Summary, Recommendations and Conclusion;

Annexures

CHAPTER TWO

INSTITUTIONAL AND LEGAL FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT

Preparation and implementation of the proposed remediation works at the Ikot Anwatim gully erosion complex area is grounded on both Nigerian national legislation and World Bank operational safeguards policies. Policies and operational procedures relevant to the proposed project are discussed in this chapter. Compliance to applicable legislations and operational procedures will be maintained throughout project's life cycle.

2.1 NATIONAL LEGAL AND ADMINISTRATIVE INSTRUMENTS

The Environmental Impact Assessment Act No. 86 of 1992 of the Federal Government of Nigeria.

The Environmental Impact Assessment Act (Act No. 86 of 1992) makes EIA mandatory for all major public and private projects in Nigeria. The Federal Environmental Protection Agency (FEPA) (now Federal Ministry of Environment, FMENV) was set up by decree 58 of 1988, (currently section 1 of the Federal Environmental Protection Act cap 131 Law of the Federation of Nigeria 1990).

National Environmental Protection (Management of Solid Hazardous Wastes) Regulation (S.1.15) 1991

This regulation spells out the requirements for groundwater protection, surface impoundment, land treatment, waste piles, landfills, incinerators, etc. It also describes the hazardous chemical products and dangerous waste constituents.

The Endangered Species (Control of International trade and Traffic) Decree No. 11, 1985; Endangered species Decree CAP 108 LFN 1990

This Decree stipulates that the hunting, capture of, or trade in the animal species listed in its Schedule 1 (endangered species) has been absolutely prohibited. The Decree also stipulates that the hunting, capture, trade in, or unapproved dealing with an animal

species listed in its Schedule 2 (threatened species) was permitted only if the individual possessed a license issued under the Decree.

2.2 Cross River State Ministry of Environment Edict

Environmental issues are not only regulated by Federal Acts and Decrees but also by State edicts, International Conventions that are ratified by both the Federal and State Governments. The EIA Decree No.86 of 1992 also recommended the setting up of State Environmental Agencies to participate in regulating the consequences of project development on their environment. The provisions of section 24 of the FEPA Decree 58 of 1988 and chapter 131 of the laws of the Federation of Nigeria ensured the establishment of the Cross River State Environmental Protection Agency (CRSEPA), now the Ministry of Environment. Among other things the Ministry shall cooperate with the Federal Ministry of Environment, State Environmental Protection Bodies, Federal and State Ministries, Local Government Council, Statutory bodies and Research agencies on matters and facilities relating to environmental protection.

2.3 THE WORLD BANK SAFEGUARD POLICIES

The World Bank's Operational Policies (OP) includes guidance on Environmental Assessment requirements. The Bank's Safeguard Policies are meant to ensure that operations of the Bank do not lead to adverse impacts or cause any harm. The Safeguard Policies are lumped into Environment, Rural Development, Social Development and International Law.

In order to ensure that project affected persons will not be impoverished, proposed remediation works at the Ikot Anwatim gully erosion complex area trigger The World Bank's Policy on Involuntary Resettlement (OP/BP 4.12). Project activities and resettlement may also lead to the loss of some livelihood practices. The resettlement action plan (RAP) for CRS NEWMAP is the subject of a separate study which addresses a number of complexities on how to deal with already degraded and destroyed assets, immediately vulnerable sites, as well as those persons that will need to be relocated due to project activities and physical investment.

The following policies are relevant for consideration under the ESMP preparation for the gully erosion intervention project:

Environmental Assessment (OP 4.01)

The OP 4.01 requires among others that screening for potential impacts is carried out early, in order to determine the level of EA to assess and mitigate potential adverse impacts. The EA ensures that appropriate levels of environmental and social assessment are carried out as part of project design, including public consultation process, especially for Category A and B projects. The OP 4.01 is applicable to all components of Bank financed projects, even for co-financed components.

OP/BP 4.12 Involuntary Resettlement

The Policy on Involuntary Resettlement is intended to assist displaced people arising from development projects, in order not to impoverish any affected people within the area of influence of projects. An action plan that at least restores the standard of living must be instituted, in cases where resettlement is inevitable or loss of assets and impacts on livelihood occurs. Public consultation of "re-settlers" as well as the host communities is significant for the successful resettlement process and implementation of the action plan, in order to incorporate appropriate choices.

OP/BP 4.04
Natural Habitats

This policy recognizes that the conservation of natural habitats is essential to safeguard their unique biodiversity and to maintain environmental services and products for human society and for long-term sustainable development. The Bank therefore supports the protection, management, and restoration of natural habitats in its project financing, as well as policy dialogue and economic and sector work. This policy is triggered by any project (including any sub-project under a sector investment or financial intermediary) with the potential to cause significant conversion, loss or degradation of natural habitats whether directly (through construction) or indirectly (through human activities induced by the project). This policy is triggered by the re-vegetation component of the gully erosion intervention project.

OP 4.09 Pest Management

The objective of this policy is to (i) promote the use of biological or environmental control and reduce reliance on synthetic chemical pesticides; and (ii) strengthen the capacity of the country's regulatory framework and institutions to promote and support safe, effective and environmentally sound pest management. The policy is triggered as there is likelihood of pesticide application in the re-vegetation component of project design

OP 4.36 Forests

The objective of this policy is to assist borrower to harness the potential forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development and protect the vital local and global environmental services and values of forests. This policy is triggered as the gully erosion intervention project may bring about changes in the management protection and utilization of forests resources.

OP 7.50 Projects in International Waters

This policy is triggered if (a) any river, canal, lake or similar body of water that forms a boundary between, or any river or body of surface water that flows through two or more states, whether Bank members or not; (b) any tributary or other body of surface water that is a component of any waterway described under (a); and (c) any bay, gulf strait, or channel bounded by two or more states, or if within one state recognized as a necessary channel of communication between the open sea and other states, and any river flowing into such waters. Calabar is an important catchment area for rivers (Calabar River, Cross River and Great Kwa River) emptying into the Atlantic Ocean. Calabar has a sea port, with ferry services operating to the Republics of Cameroon and Equatorial Guinea etc.

Bank's Policy on Disclosure

The Bank's policy on disclosure requires that all the people residing in the given areas of a project have the right to be informed of the proposed development project in their

respective areas. Prior to project appraisal therefore, the summary of the study of the development action along with other relevant information should be disclosed to or at the level of the Bank and the project area.

The World Bank and Nigeria's EA requirements and operational procedures were harmonized as far as possible, which makes this ESMP responsive to the objectives of good practice, in the following respects:

- Early consideration of environmental and social issues (starting at the screening stage);
- Identification and early consultation with stakeholders;
- Prevention of adverse impacts through the consideration of feasible alternatives;
- Incorporation of mitigation measures into planning and (engineering) design.

2.4 International Best Practices

Ideal best practices are driven by commitment to optimize conservation benefits alongside economic development. It might involve working backwards to remedy the impacts that have already occurred. Therefore, best practices provide options of repair, restoration, reinstatement and compensation of wildlife habitat values and the processes that sustain bioresources. These practices require co-operation between regulatory agencies and community groups. It is possible that additional sources of funding can be accessible when such multi-stakeholder groups are formed. For example, in Australia the state governments set the general conditions for projects based on Environmental Impact Assessment and community consultation processes, and companies are allowed flexibility as to how they can meet these conditions. Rehabilitation arrangements are considered at the development proposal stage. Also, the 'polluter pays' principle applies.

The main elements of World Bank Safeguard policies and other international legal and administrative instruments and protocols that are applicable to CRS NEWMAP are summarized and presented in Annexure 2.

CHAPTER THREE

ENVIRONMENTAL BASELINE OVERVIEW (BIOPHYSICAL ENVIRONMENT)

This chapter provides an overview of the baseline (biophysical) environmental conditions at the proposed Ikot Anwatim gully complex intervention project area. The acquisition of baseline information will ensure the establishment of structures for effective adoption of mitigation and management measures. The proposed gully erosion intervention project area has peri-urban to urban setting, incorporating several high density built up areas around the Murtala Muhammed Highway and Ekorinim at the upper watershed. Businesses in these areas include occasional government buildings, schools, Christian religious structures and banks. The major roads are tarred and with street lighting. The lower watershed level is swampy (flood plain), with much human interference (farming, sand mining etc) and borders with the Nigerian National Petroleum Company (NNPC) petroleum products storage depot (Plate 3.1).

Plate 3.1: NNPC petroleum products storage depot (background) and lower watershed of gully complex area (foreground).

The Command area of gully at the main gully and all gully fingers is mix of residential housing, homestead farms and small forest groves. The gullies in the sub-watersheds are active and about 175 (main only) hectares. The most critical of the causes of gully erosion in most parts of the Ikot Anwatim gully complex is concentrated run-off coming

from abruptly terminated drainage channels from dwellings and road sides. This is in combination with unhealthy landuse practices (including sand mining downstream of main gully) and the non-availability of drainage channels to check the overland flow from the entire catchment area and subsequent control of the discharge into Calabar River. The situation is enhanced by highly erosion susceptible soils and the undulating topography of the area which increases the velocity of surface run-off. Urban runoff is a major cause of flooding, the inundation of land or property in a built-up environment caused by rainfall overwhelming the capacity of drainage systems.

The environmental baseline conditions of the project area are summarized in the sections that follow. The baseline was conducted using a single season data gathering exercise carried out in March-April 2014 (corresponding to the wet season). The details of the methodologies adopted for data acquisition for each of the environmental components and the impact indicators are described in Annexure 5A of this ESMP document.

3.1 Air Quality Assessment/Meteorology

The fundamental climatic factor (which affects the hydrology) is rainfall. Calabar falls within the sub-equatorial climate belt with a mean annual precipitation of just under 3000 mm (Table 3.1). Characteristically, Calabar is visited by two seasonal winds, the Northeast harmattan wind of the dry season and the Southwest warm wind of the wet season. The dry season starts from November to March, while the rainy season usually begins from April to October (Fig. 3.1). The relative humidity is usually within the average of 70 to 80 percent throughout the year except for the short dry period of harmattan while the monthly average temperature is between 26^{o}C and 28^{o}C. A summary of the ambient air quality of the project area during the wet season in comparison with Federal Ministry of Environment Standards for air pollution control in Nigeria is presented in Table 3.1. The wettest month in the area is July with an average of 462.0mm followed by August (422.9mm) while the driest month being January with average value of 27.9mm followed by December (31.7mm). The Total Annual Rainfall ranges between 2109.5mm and 4168.7mm.

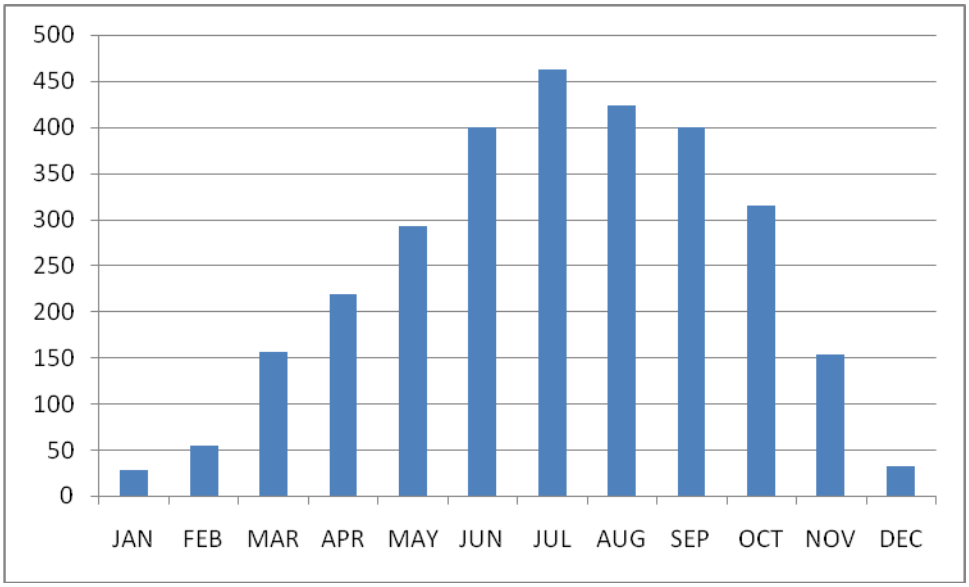


Fig. 3.1: Average Monthly Rainfall Distribution in Calabar (1970-2013) (Source: Calabar NIMET station)

Table 3.1: Mean Ambient Air Quality in the Ikot Anwatim Study Area (April 2014)

S/N	Parameter	Mean	FMENV. Limit	Remarks
1	Haz-Dust (spm) (mg/m^3)	0.10	0.25	Haz-Dust Concentration in the ambient air is within Fed. Min. of Env. limits.
2	H_2S (ppm)	0.30	8.00	H_2S concentration within FMENV. Limits
3	NO_2 (ppm)	0.10	0.04 - 0.06	Higher than FMENV. Limits probably from industrial/vehicular sources in the area.
4	SO_2 (ppm)	0.1	260	SO_2 concentration within FMENV. Limit
5	NH_3 (ppm)	1.0	10.00	
6	CO (ppm)	1.0	10.00	CO concentration in the Project area is within FMENV. Limits
7	FL (LEL)	0.20	-	-
8	HCN (ppm)	(<1.0)	-	-
9	THC (mg/m^3)	0.12	160	Within FMENV. Limits
10	VOC/CH4 (%)	2.0	-	
11	Radiation (cpm)	22	32**	Ionization level is within the normal background radiation.
12	Noise dB(A)	60	90	Within FMENV. Limits.

** Natural Background Limit; **LEGEND:** FMENV = Federal Ministry of Environment;
cpm = count per minute.

The dominant wind direction and wind speed greatly affects propagation and distribution of gaseous pollutants. Air temperature and wind speed determine the speed with which gaseous pollutants are propagated and distributed. The concentration of hazardous dust was higher than FMENv. permissible limits probably due to the high

volume of vehicular movement. The levels may be even higher during the construction phase due to operations of construction machines and vehicular transport by heavy duty trucks/trailers that will convey materials to and from project site.

The mean concentrations of pollutant gases measured in the Ikot Anwatim gully erosion intervention project area are also shown in Table 3.1. Mean values of Hydrogen Sulphide (H_2S), Sulphur (IV) Oxide (SO_2), Ammonia (NH_3), Carbon monoxide (CO) and flammable gases were within limits approved by the FMENV. The slightly higher values for NO_2 may be attributed to vehicular and industrial sources in the vicinity of the project area. Ionization radiation had a mean of 22 cpm and was within the natural background level of less than 32 cpm.

All the parameters investigated had low values, indicating that the present ambient air quality of the Ikot Anwatim gully complex intervention project Area meets the World Health Organization (WHO) (2000) Guidelines, the European Commission Directives (1999/30/EC) on ambient air quality and FEPA Guidelines (1991). However, it is important to note that sampling was carried out in April (wet season) and low values may partly be ascribed to scavenging by rain water.

Environmental Occupational Noise Assessment

The major sources of noise were from vehicular traffic. The noise levels were lower than 90dB (A), which is the limit set by Federal Environmental Protection Agency (FEPA) and Industrial occupational and Health Act (OSHA) of 1990 (EPA, 1974, 78) which permits noise level of 90dB (A) for a continuous daily exposure of 8 hours. Above this level hearing impairment could develop. The results of environmental baseline study of noise levels at the proposed Ikot Anwatim gully complex intervention project area show that mean noise levels were lower than the permissible limits of the FMEnv (Table 3.1 above).

The baseline situation of the air basin in the proposed project area indicates that:

1. The mean concentrations of suspended particulate matter (spm) in the ambient air were low. These values are within the FMEnv. and World

Health Organization standards for ambient air and constitute no health hazard to inhabitants of the area.

2. The volatile organic carbon (VOC/CH_4) and total hydrocarbons (THC) in the ambient air were also lower than FMEnv. guidelines, therefore the air is unpolluted by these parameters.

3. The mean concentrations of the selected gaseous air pollutants (CO, H_2S, NO_2, NH_3 and SO_2 etc) show lower levels than FMEnv. guidelines, and classify the air basin around the study area as unpolluted.

Therefore, the atmosphere in all the communities is generally clear and free of particulate matter and visible pollutants.

3.2 Geological Setting

The study area is situated within the Niger Delta basin. The Niger Delta consists of three formations. These formations include Akata (oldest), Agbada and Benin (youngest). The present study area is underlain by the Benin Formation. The Benin Formation range in age from Oligocene to recent and is about 2100 m thick. The materials of the basin consist of medium- to coarse sandstones, sands, shales and gravel (Webber & Daukoru, 1975). Overlying the Benin Formation are Quaternary deposits of 40-50 m thick. The geology mapping of Calabar and the local lithology are presented as Fig. 3.2 and 3.3 respectively.

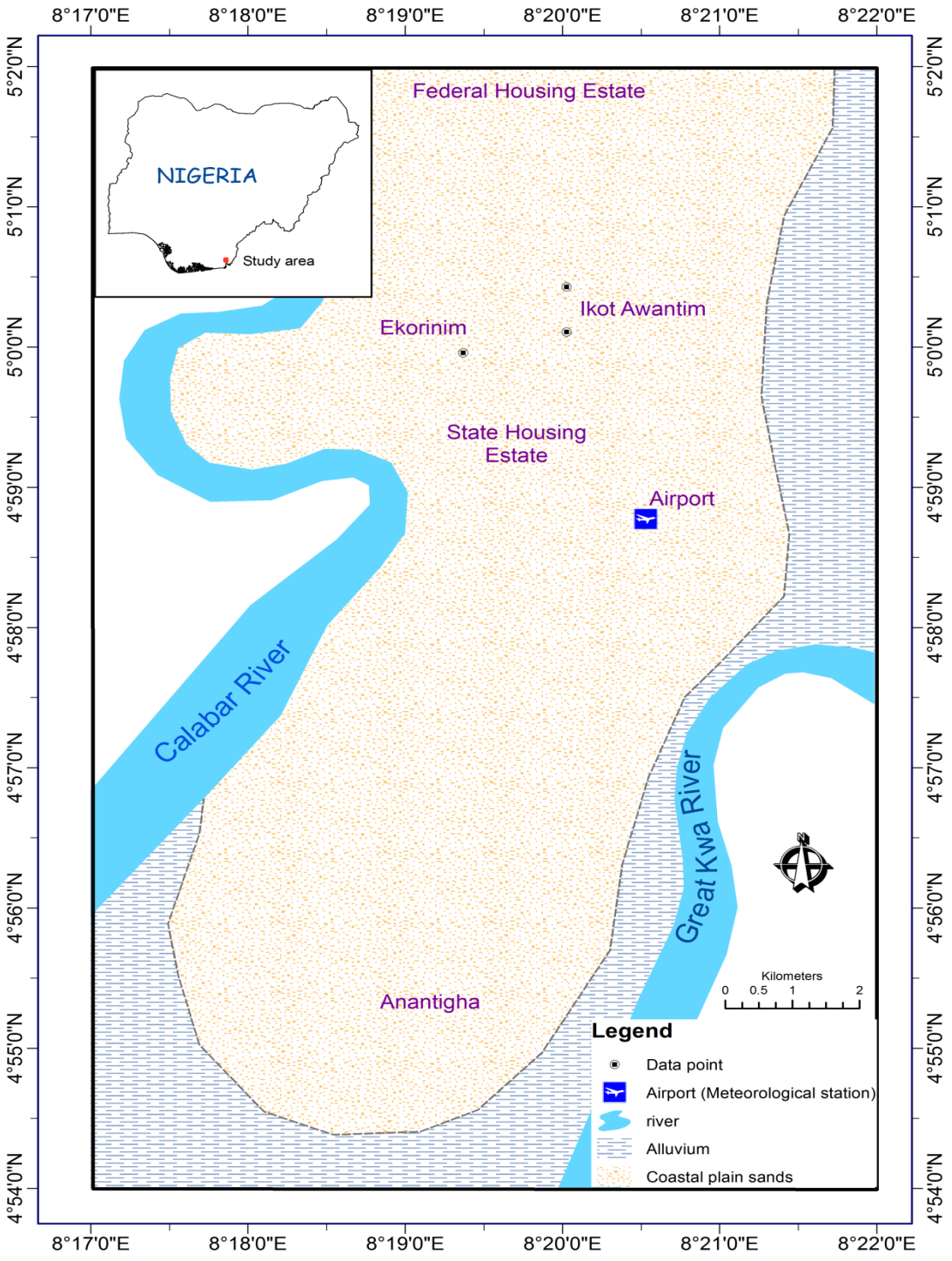


Fig. 3.2: Geology map of Calabar, including the sampled locations

3.2.1 Hydrogeology

The main water-bearing unit is the Benin aquifer. The aquifer is composed of unconsolidated and loose sediments; predominantly gravel, sand, silt and clay of Tertiary to recent age (Figure 3.3). The sands comprise more than 80% of the aquifer materials. These sands are largely medium- coarse grained, moderately sorted, subangular to subrounded.

Edet and Okereke (2002) divided the Benin Formation in Calabar area into two major water bearing units: the upper gravelly and the lower sandy groundwater aquifers. The upper aquifer has mean thickness of 52.7m and average static water level of about 35.0m. The aquifer is highly exploited in the southern and south central parts of the area. The aquifer comprises of gravels and medium-coarse grained sands with minor intercalations of fine grained sands, silts and clays. The hydraulic conductivity and transmissivity for the upper aquifer are the range 110.5 – 214.7m/day and 275.8 – 14400m^2/day.

The lower sandy aquifer extends from a depth of 30m in the southern part of the area to more than 100m in the north and hence exploited by deep boreholes compared to the upper aquifer that is exploited by hand dug wells and shallow boreholes (<60m). The depth to water level here is >60m. The lower aquifer is composed of fine to medium grained sands, silts, clay and lignite. The hydraulic conductivity and transmissivity values are 61.2 – 73.2m/day and 1200-2928m/day.

3.2.2 Groundwater levels and flow direction

The average depth to static water level, SWL (level where the water pressure equals the atmospheric pressure) with respect to sea level at the study site varies from 18 to 26 m for wet and dry seasons. A general overview of the spatial aspects of the groundwater flow is shown on the contour map of the potentiometric surface (Figure 3.3). The local groundwater flow is from the north towards the south (Figure 3.4).

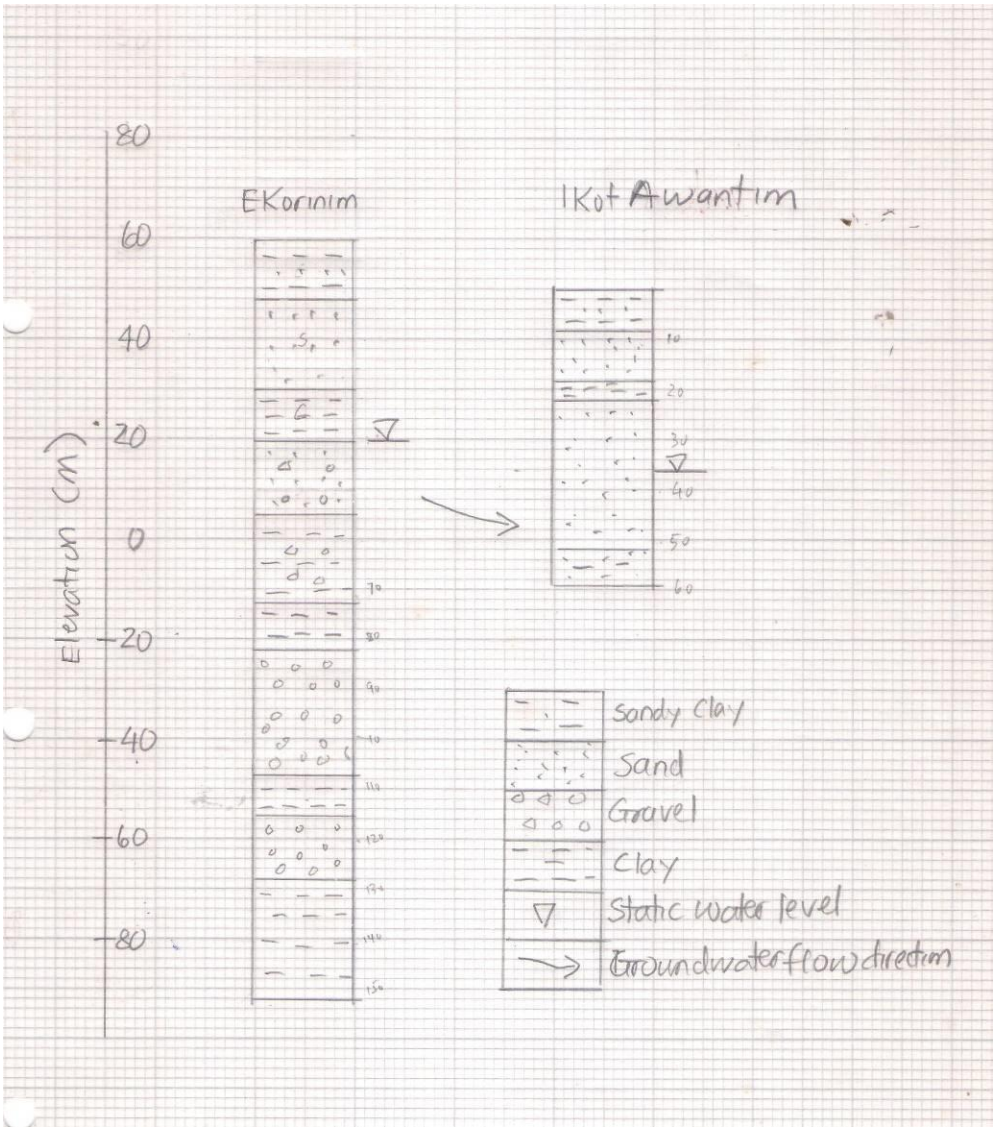


Figure 3.3: Geologic cross section Ekorinim-Ikot Awantim

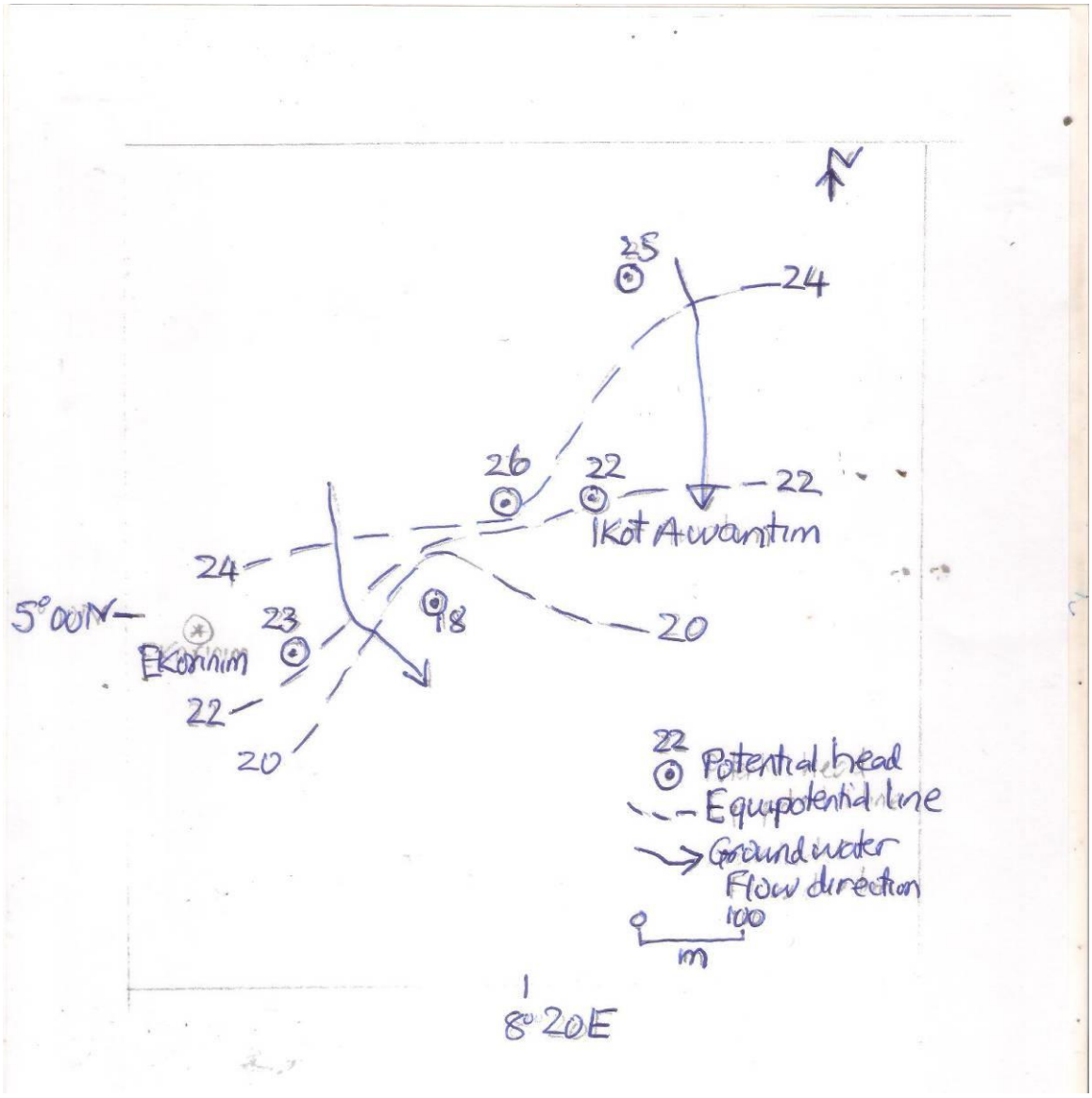


Figure 3.4: Groundwater flow map for Ekorinim-Ikot Awantim based on average wet and dry seasons measurements.

3.2.3 Groundwater Quality: The physical, chemical, biological and heavy metals contents of the groundwater samples wet and dry seasons are presented in Table 3.2. The distribution of ground water sampling points is shown in Fig. 3.5. The appearance of the groundwater samples for both wet and dry seasons is clear. The colour of the water samples was 5.0 in both seasons. This value is lower than the WHO (1993) maximum limit of 20.0 for drinking and domestic purposes. The data for other physicochemical parameters and heavy metals content show that all the parameters considered were within the limits for drinking, domestic, agricultural and industrial use. However, the biological parameters values were higher than the WHO standard of 0 CFU/ml for both total and faecal coliform and were suggestive of faecal pollution.

3.3 SOIL STUDIES

3.3.1 Physical Characteristics

The distribution of soil sampling points is shown in Fig. 3.6. The physical characteristics of the prescribed soils – surface (0 – 15cm) and subsurface (15 – 30cm) are presented in Annexure 5B (Appendix II) and summarized in Table 3.3. The texture of the soils sampled in the area is dominated by sand, loamy sand and sandy loam in both surface and subsurface soils depending on the *pedogenic* processes of the soil development and local edaphic conditions. Sand fraction varied from 72.46 to 92.46 % with mean values of 87.73% and 81.10% in surface and subsurface soils respectively; silt from 0.04 to 10.94% with means of 3.99% and 6.20% respectively in surface and subsurface soils and clay from 0.06 to 18.60% with means of 7.60% and 12.01% for surface and subsurface soils respectively in all the samples collected from the study area (Table 3.3). Bulk density varied from 0.90 to 1.20MgM^{-3} (mean, 1.04 mg m^{-3}) and its corresponding surface mean value of 61% (range, 55 – 66%) (Table 3.3). The structural aggregate stability of the soils refers to the resistance of soil aggregates to manipulation (Talha *et al.*, 1978; Brady and Weil, 1999). The aggregate stability of soils exerts tremendous influence on soil erosion, infiltration, retention and movement of water and the proliferation of roots in the soils. In the gully erosion area, aggregate stability ranged from 6.96 to 8.16mm with a mean of 8.22mm (Table 3.3). Thus, aggregate stability is low, with soils being easily eroded.

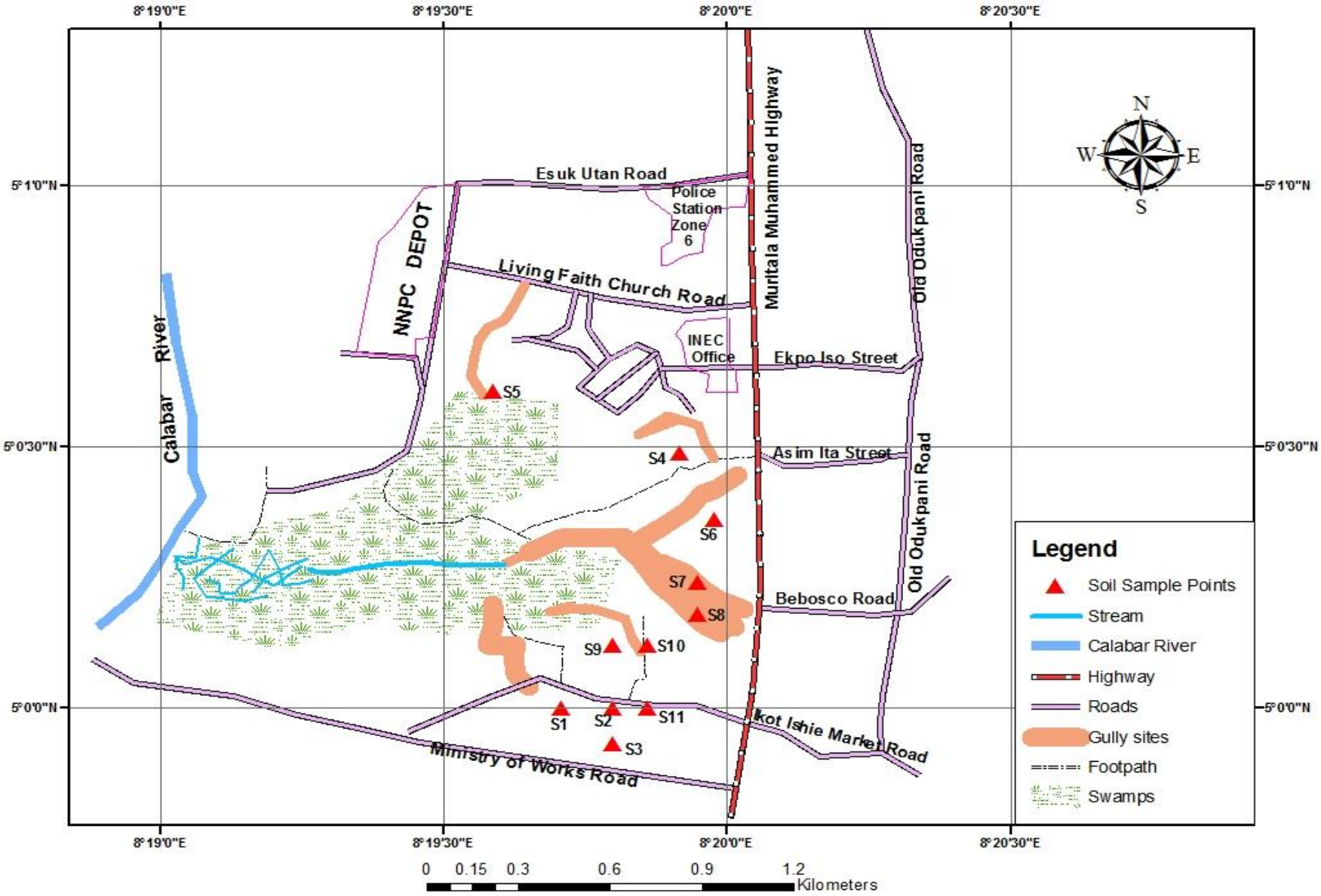


Fig. 3.5: Map Showing Distribution of Soil Sampling Points in the Ikot Anwatim Newmap Project Area

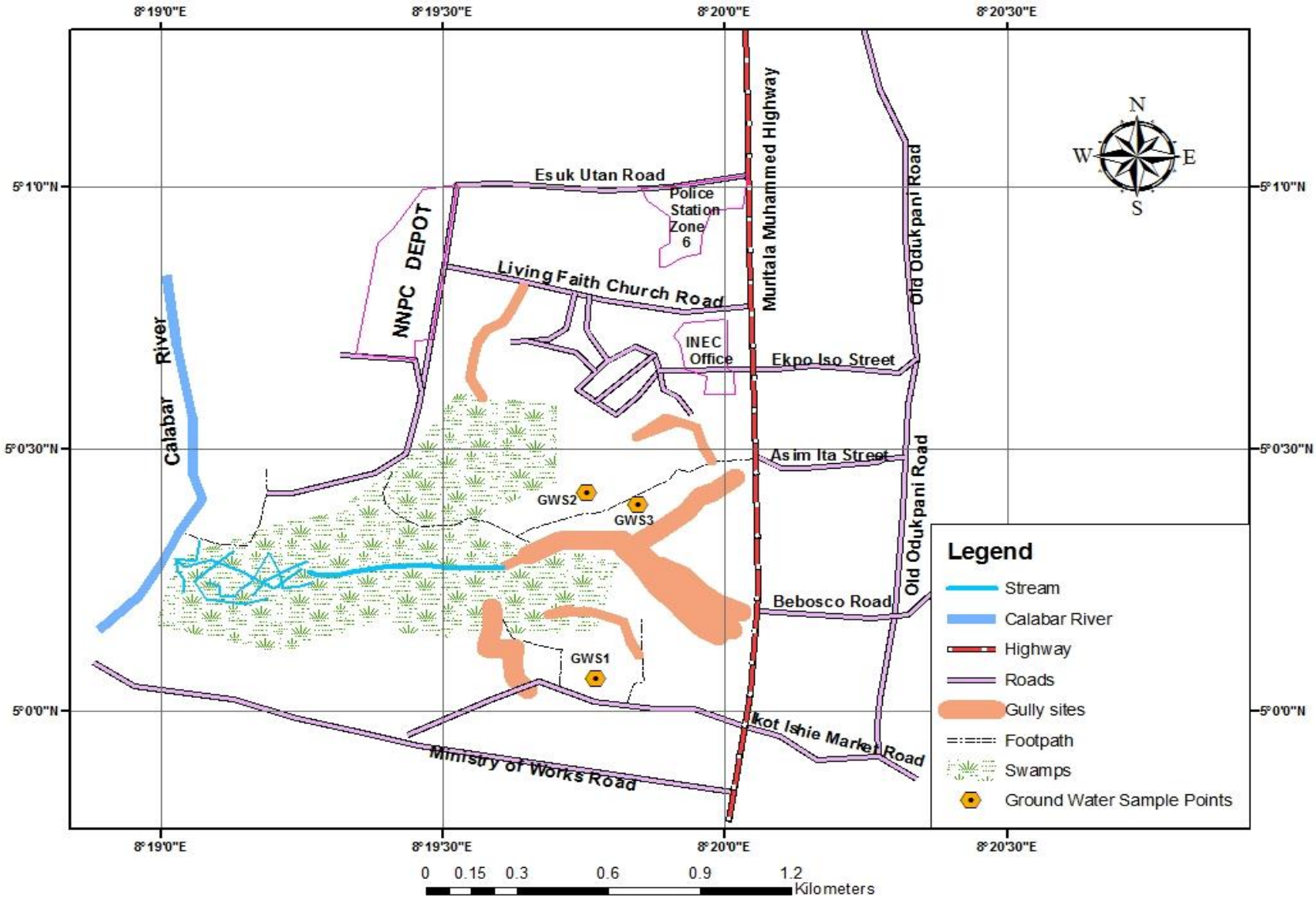


Fig. 3.6: Map Showing Distribution of Ground Water Sampling Points In The Ikot Anwatim Newmap Project Area

Table 3.2 Physicochemical Parameters and Heavy Metal Contents in the Groundwater

Season	Unit	Dry	Wet	WHO
Appearance		Clear	Clear	Clear
Colour		<5.0	5	20
Turbidity	NTU	1.78	1.9	5
TSS	mg/l	ND	0.008	0.1
Temp	^{o}C	27.80	27.10	
EC	µS/cm	257.90	125.60	1400
TDS	mg/l	109.45	91.17	1000
pH		5.54	6.86	6.5-8.5
Eh	mV	115	30	
DO	mg/l	4.30	4.30	5.0min
HT	mg/l	14.46	2.55	75
Alk	mg/l	11.30	45.85	400
SiO_2	mg/l	1.72	7.44	
Na	mg/l	8.14	18.28	200
K	mg/l	1.63	2.11	12
Ca	mg/l	4.84	0.57	50
Mg	mg/l	0.57	0.27	100
NH_4	mg/l	0.3	0.35	0.5
Cl	mg/l	2.90	4.94	250
NO_3	mg/l	13.88	20.81	50
SO_4	mg/l	43.92	0.00	400
HCO_3	mg/l	13.56	55.02	400
Fe	mg/l	0.14	0.15	0.3
Mn	mg/l	0.25	0.27	0.05
Al	mg/l	ND	ND	0.2
Cd	mg/l	ND	ND	0.003
Cu	mg/l	0.02	ND	0.5
Pb	mg/l	ND	ND	0.005
Cr	mg/l	ND	ND	-
Zn	mg/l	0.11	0.23	5
THC	CFU/ml	TNTC	TNTC	3
TCC	CFU/ml	174	90	0
FCC	CFU/ml	140	45	0

3.3.2 Chemical Characteristics

The soil reaction is moderately acid (range, pH 5.0 – 6.6) with pH mean values of 5.6 and 5.8 for surface and subsurface soils respectively (Table 3.3). Electrical conductivity values ranged from 0.074 to 0.293dSm^{-1} with means of 0.210dSm^{-1} and 0.200dSm^{-1} respectively in surface and subsurface soils (Table 3.3).

Organic carbon contents varied from 0.75 to 1.97% with mean values of 1.33% and 0.99% in surface and subsurface soils respectively. Total nitrogen ranged from 0.04 to 0.07% with means of 0.06% and 0.05% respectively in surface and subsurface soils (Table 3.3). Available P varied from 4 – 9 mg Kg^{-1} with mean values of 7 mg Kg^{-1} in both surface and subsurface soils respectively.

Exchangeable bases were as follows: Ca (range, 3.10 – 6.26cmolkg^{-1}) with means of 5.28 cmolkg^{-1} and 5.08cmolkg^{-1}; Mg (range, 1.01 – 2.70cmolkg^{-1}) with mean values of 2.05cmolkg^{-1} and 1.90cmolkg^{-1} ; K (range, 0.04 – 0.18cmolkg^{-1}) with means of 0.08 cmolkg^{-1} and 0.09; Na (range,0.04 – 0.08cmolkg^{-1}) with mean values of 0.07cmolkg^{-1} and 0.06 cmolkg^{-1} in both surface and subsurface soils. The exchangeable acidity values varied from 2.16 to 5.36cmolkg^{-1} with means of 2.16 and 5.36cmolkg^{-1} in surface and subsurface soils respectively (Table 3.3). Effective cation exchange capacity (ECEC) oscillated between 8.76 and 13.36 cmolkg^{-1} with mean values of 11.18 and 10.90cmolkg^{-1} in surface and subsurface soils respectively. The percent base saturation values ranged from 54 to 74 with means of 67 and 65 respectively in surface and subsurface soils depth sequence in the severe gully erosion site and its environs (Table 3.3).

The results show that the texture of soils sampled from the gully erosion site varied from sand, loamy sand to sandy loam fractions depending on *edaphic* conditions and *pedogenic* stage of development. The soils are moderately coarse – textured on the surface while the subsurface show evidence of clay accumulation in most of the locations. With high sand fractions (exceeding 70%), mean silt contents below 15% (in all the locations), the soils have weak surface aggregation (FMANR, 1990). Such soils

lack adsorptive capacity for basic plant nutrients and water (FPDD, 1990). Again, with high sand contents in soils, it may aid available water capacity in direct proportion to their volume owing to its porous nature (Anikwe, 2006). Thus, the soils are susceptible to erosion hazards.

The mean surface value of bulk density of 1.04 mg m^{-1} and the corresponding pore space of 61% reflects the textural classes of soils in the erosion area (Miller and Donahue, 1995; Arshad *et al.,* 1996). With the prescribed textural classes, percent pore space and the bulk densities, nature of terrain, the project area is liable to erosive action, especially during torrential rainfall as generally observed. Generally, aggregate stability in the project area is low owing to the high sand contents, especially with macro-pores, low clay contents and low effective surface area on which cementing materials may set to form adhesive bonds necessary to ensure stability of the aggregates (e.g. Edem and Opara – Nadi, 1997; Obi, 2000). Such soil aggregates are susceptible to deformation under wet conditions which can cause erosion occasioned by poor drainage condition, anthropogenic activities, fragile soils, nature of geology and heavy rainfall.

Soil pH is fundamental to the understanding of soil systems, because it is an indicator of many reactions occurring in the soils (Moore and Loeppert, 1987; SSSA, 2001). It shows whether the soil is acidic, neutral or basic and provides useful information on the availability of the exchangeable cations. Soil pH controls plant nutrient availability and microbial reactions in soils. The soils in the gully erosion area are moderately acid (pH range, 5.0 – 6.6). Such soil pH could be attributed to the high rainfall, up to 3500mm per annum, and associated leaching of basic cations from the soil *solum* in the area (Bulktrade, 1989; Schoeneberge *et al*., 2002). Thus, this range of pH could influence the solubility of nutrients and biochemical transformations with availability of calcium, magnesium and phosphorus (Anikwe, 2006; Schoeneberge *et al*., 2002).

Table 3.3: Summary Results Showing Physico-chemical Characteristics of Soils within Ikot Anwatim Gully Erosion complex, Calabar.

Parameter	Surface Soils Range	Mean	Subsurface Soils Range	Mean	Maximum Permissible Limit
A) Physical Characteristics:					
Sand (%)	80.46 – 96.46	87.73	72.46 – 92.46	81.10	NL
Silt (%)	0.04 – 7.94	3.99	0.06 – 10.94	6.20	NL
Clay (%)	0.06 – 12.60	7.60	5.94 – 18.60	12.01	NL
Texture	s, ls, sl	-	s;ls;sl	-	NL
Bulk density (MgM^{-3})	0.90 – 1.20	1.04	-	-	< 1.40 – 1.60^{++++}
Pore space (%)	55 – 66	61	-	-	NL
Aggregate stability(mm)	6.96 – 8.16	8.22	-	-	NL
B) Chemical Characteristics:					
pH	5.0 – 6.2	5.6	5.1 – 6.6	5.8	5.1 – 6.5
EC (dSm^{-1})	0.089 – 0.293	0.210	0.074 – 0.430	0.200	2 – 4 dSm^{-1+}
Org. C (%)	0.96 – 1.97	1.33	0.75 – 1.14	0.99	2.0%$^{++}$
Total N. (%)	0.05 – 0.07	0.06	0.04 – 0.06	0.05	0.20%$^{++}$
Available P ($Mgkg^{-1}$)	5 – 9	7	4 – 9	7	20$Mgkg^{-1+++}$
Exch. Ca ($cmolkg^{-1}$)	4.18 – 6.26	5.28	3.10 – 6.20	5.08	10 - 20 $cmolkg^{-1}$
Exch. Mg ($cmolkg^{-1}$)	1.01 – 2.70	2.05	1.02 – 2.63	1.90	3 - 8 $cmolkg^{-1+++}$
Exch. K ($cmolkg^{-1}$)	0.04 – 0.18	0.08	0.06 – 0.17	0.09	0.6 – 1.2 $cmolkg^{-1+++}$
Exch. Na ($cmolkg^{-1}$)	0.06 – 0.08	0.07	0.04 – 0.07	0.06	0.7 – 1.2 $cmolkg^{-1+++}$
Exch. Acidity ($cmolkg^{-1}$)	2.16 – 4.90	3.70	3.09 – 5.36	3.78	4.1 $cmolkg^{-1+++}$
ECEC ($cmolkg^{-1}$)	10.02 – 12.90	11.18	8.76 – 13.36	10.90	10 $cmolkg^{-1+++}$
Base saturation (%)	54 – 80	67	56 - 74	65	80%

Legends: + = Miller and Donahue, 1995; S = sand, sl = sandy loam; ls = loamy sand ; scl = sandy clay loam;

++ = FPDD, 1990; ++++ = Arshad *et al*., 1996

Electrical conductivity (EC) values are low (range, 0.074 – 0.293cmolkg^{-1}) as all the values are below 4dSm^{-1}. This range of values indicates that the soils are non-saline as all EC values were less than 4dSm^{-1}. This range of values indicate that the soils are non-saline as all the values are less than 4dSm^{-1}(Miller and Donahue, 1995) and do not exceed the critical values of 2dSm^{-1} for sensitive crop species (FAO,1974). These results clearly indicate that the soils do not have salinity problem.

The element carbon is the foundation of all life (Magddoff, 1992). Carbon compounds are enzymatically oxidized to produce carbon dioxide, water, energy, and decomposed biomass. Soil organic matter contributes to soil aggregation and reduces susceptibility to erosion (Brady and Weil, 1996). In the gully erosion area and its environs, the soils are rated medium (moderate) in organic carbon contents as most values are below 2.0% (FPDD, 1990). Total nitrogen content of soils serve as indices of nitrogen supplying power of the soils. Nitrogen in the form of protein is present in the protoplasm of every cell. The available form of nitrogen in the soil is ammonium or nitrate ion. In the erosion area, total nitrogen values were low when compared with the medium range of 0.10 to 0.45% (Holland *et al*., 1989) in all the soils collected from the erosion environment.

Phosphorus is an essential part of *nucleoprotein* in the cells nuclei, which control cell division and growth, and of *deoxyribonucleic* acid (DNA) molecules. In the gully erosion area, available phosphorus values were generally low (range, 4 – 9 mgkg^{-1}). The low level of available P reflects the textural classes of the soils in the erosion area and its environs. A high content of available P is usually associated with clayey surface soils (Anikwe, 2006). This is different in the case of the present study area. Basic cations were generally low in the soils as the effective cations exchange capacity (ECEC) hardly exceeded 10cmolkg^{-1} for productive soils (Enwezor *et al*., 1990). With mean percent base saturation of 67 and 65 in the surface and subsurface soils respectively, basic nutrients may have occurred in available form in soil solution, regardless of the low cation reserves in the soils of the area.

3.3.3 Heavy Metal Contents

The heavy metal status of the soils are presented in Appendix IV (Annexure 5B) and summarized in Table 3.4. In the project area, mean iron contents ranged from 417.20 to 937.75 mg kg^{-1} with a mean value of 740.91mg kg^{-1} (surface soils) and between 455.24 to 862.00 mg kg^{-1} with a mean of 697.76 mg kg^{-1} for the subsurface soils (Table 3.4). The results show that iron contents were high in surface soils in contrast to subsurface soils. This range of values is within the threshold limit for mineral soil environment (Brady and Weil, 1996).

The mean concentration of zinc in soils of the area varied from 11.12 to 18.51mg kg^{-1} with a mean of 14.65 mg kg^{-1} for the surface soils and 8.00 to 14.80 mg kg^{-1} with a mean value of 11.09 mg kg^{-1} for the subsurface soil samples (Table 3.4). This dose of concentration is within the tolerable limits of 10 – 300 mg kg^{-1} for soil the environment (Bohn *et al.,* 1995).

Copper can be retained in soils by adsorption via non-specific and specific interactions, cum precipitation reaction with hydroxides, carbonates, phosphates and silicates (McBride, 1989; McLaren, 2003). In the gully erosion area, Copper contents ranged from 10.13 to 15.31mgkg^{-1} with a mean of 13.29 mg kg^{-1} (surface soils) while a range of 7.20 to 12.60 mg kg^{-1} with a mean of 9.58 mg kg^{-1} were recorded for the subsurface soils (Table 3.4).

Manganese contents varied from 120.56 to 306.50 mg kg^{-1} with a mean of 257.05 mg kg^{-1} (surface soils) and from 70.11 to 262.10 mg kg^{-1} with a mean value of 202.31mgkg^{-1} in the subsurface soils (Table 3.4). There were mild slight variations in the mean contents of this parameter. In spite of these, manganese contents are within the threshold limits established for mineral soil environment (Brady and Weil, 1996).

The content of Nickel (Ni) was within FMEnv limit (range, 0.40-2.40 mg kg^{-1}) and suggests that the area is completely free from Ni contamination.

However, there were slight numerical variations in all the stations within the gully erosion site and its environs (Table 3.4).

Vanadium contents varied from 0.41 to 0.88 mg kg^{-1} and 0.09 to 0.47 mg kg^{-1} with means of 0.73 mg kg^{-1} and 0.29 mg kg^{-1} for surface and subsurface soils respectively (Table 3.4). This range is within the threshold limits of 20 - 500 mg kg^{-1} established for mineral soil environment (Bohn *et al.,* 1985).

Based on the results, the values of the heavy metals are within tolerable limits established in typical mineral soil environments (Bohn *et al.,* 1985; Brady and Weil, 1996). The low values of the heavy metals may be attributed to the nature of the parent materials. On the basis of these results, the soils of the area are considered free of heavy metal contamination.

3.4 SURFACE WATER QUALITY

3.4.1 Physico-Chemical Characteristics

The distribution of surface water sampling points is shown in Fig. 3.7. The physico-chemical and heavy metals characteristics of surface water samples collected from the Calabar River estuary/streams of the Ikot Anwatim gully complex are summarized in Table 3.5 in relation to drinking water quality standards of WHO (1984, 2006), EEC (1975) and Federal Environmental Protection Agency (1988)[FEPA, now known as the Federal Ministry of Environment (FMEnv)].

The physico-chemical parameters considered in this study include pH, dissolved oxygen, temperature, electrical conductivity, total suspended solids, total dissolved solids and Biological Oxygen Demand (BOD) (Table 3.5).

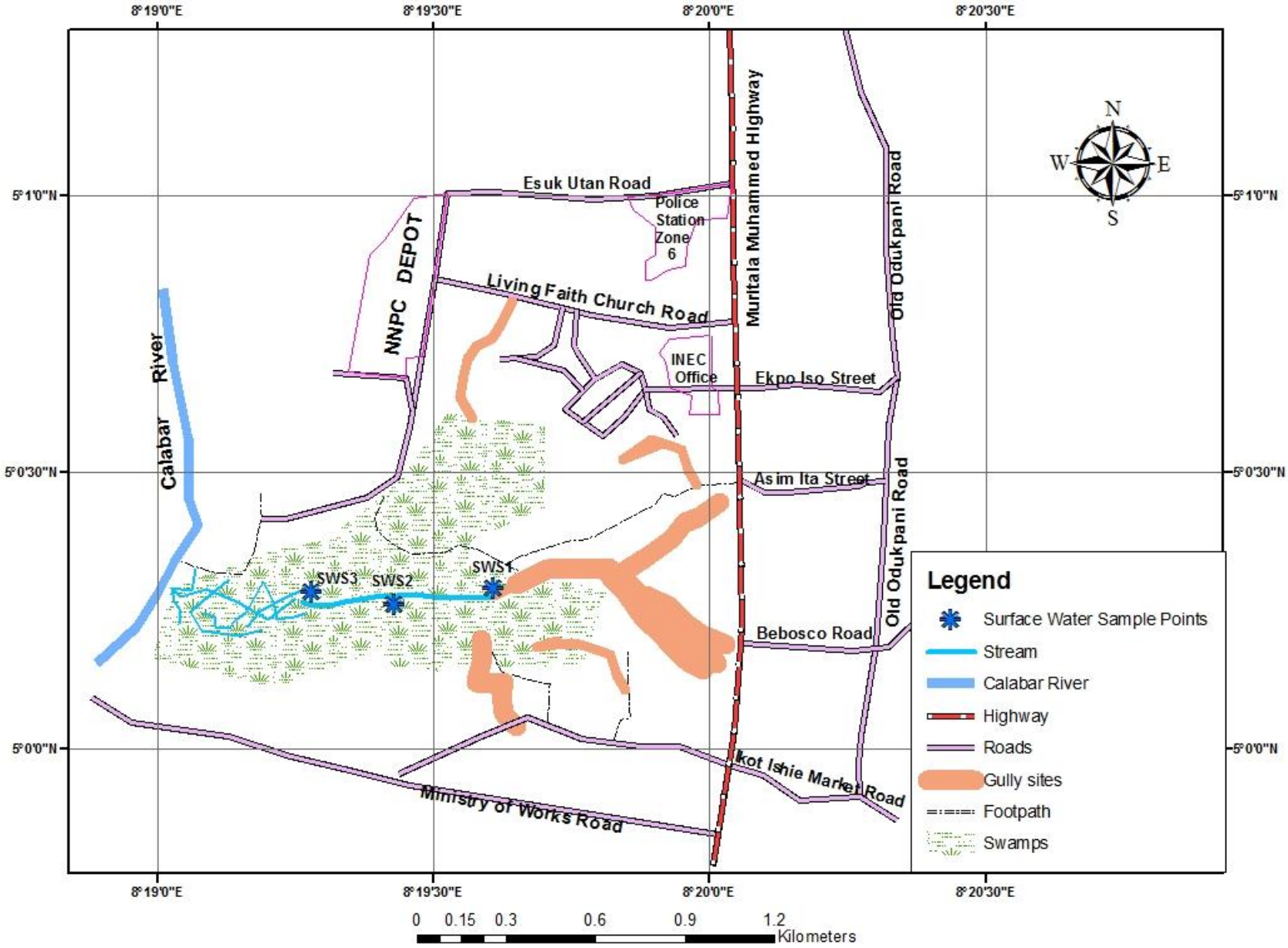


Fig. 3.7: Map Showing Distribution of Surface Water Sampling Points In The Ikot Anwatim Newmap Project Area

Table 3.4**:** Summary Results Showing Heavy Metals Status of Soils sampled within Ikot Anwatim Gully Erosion complex, Calabar.

Heavy Metal (mg/kg)	Surface soils Range	Mean	Subsurface soils Range	Mean	Maximum permissible Limit
Iron (Fe)	417.20 – 937.75	740.91	455.24 – 862.00	697.76	10,000 – 100,000 mg/kg*
Zinc (Zn)	11.12 – 18.51	14.65	8.00 – 14.80	11.09	10 – 300 mg/kg-1**
Copper (Cu)	10.13 – 15.31	13.29	7.20 – 12.60	9.58	2 - 100 mg/kg-1**
Manganese (Mn)	120.56 – 306.50	257.05	70.11 – 262.10	202.31	200 - 2000 mg/kg-1**
Nickel (Ni)	0.55 – 1.84	1.22	0.10 – 1.63	0.73	10 – 1000 mg/kg-1**
Vanadium (V)	0.41 – 0.88	0.73	0.09 – 0.47	0.29	20 - 500 mg/kg-1**

- ***= Brady and Weil, 1996; **** = Bohn et al., 1985;

Table 3.5: Summary results for surface water Chemistry (Ikot Anwatim Gully complex)

Parameters	Range	Mean ± SD	$FEPA_a$	WHO/EEC_b
pH	6.1- 7.84	6.4 ± 0.9	6.5- 8.5	
Temperature (^oC)	28.0 -34.7	28.0 ± 0.6	30.0 – 35.0	25
Turbidity (NTU)	2.0 -382	96.3 ± 61.6	1.0	5.0
Salinity (cl^-) (mg/l)	3.90- 5.12	4.4 ± 0.6	-	-
Total dissolved solids (mg/l)	1-605	401 ± 1.30	500	NL
Total suspended solids (mg/l)	1-606	512 ± 126	30	NL
SO_4 (mg/l)	2.0- 1393	403 ± 1.20	500	400
PO_4 (mg/l)	0.02- 0.384	0.2 ± 0.01	>5	5.0
NH_4^+ (mg/l)	1.1-5.9	4.6 ± 0.01	1.0	0.5
NO_3 (mg/l)	0.4-18.8	9.5 ± 0.12	10.0	50.0
NO_2 (mg/l)	0 – 0.1	0.05 ± 0.01	1.0	0.1
Dissolved oxygen (mg/l)	1.4-5.3±1.2	3.3 ± 1.2	7.5	5.0
BOD_5 (mg/l)	2.0-17.0	1.1± 1.20	0	NL
Conductivity (mS/cm)	6310-45384	28111± 881	4000	4000
Chloride (Cl-)	6.31		250	250
Total Hardness	20.08		200	200
Major Ions/Nutrients/ Heavy Metals (mg/l)				
Calcium (mg/l)	26.00		NL	75
Magnesium (mg/l)	0.58		NL	30 – 150
Potassium (mg/l)	3.31		NL	12
Sodium (mg/l)	0.60		200	200
Lead (mg/l)	0.06 - 0.22		0.05	15 (µg/l)
Zinc (mg/l)	0.3 - 0.44		5.0	
Iron (mg/l)	0.3 - 1.2		1.0	
Nickel (mg/l)	0.2 - 2.0		0.05	20 (µg/l)
Cadmium (mg/l)	0.01 - 0.06		0.01	5 (µg/l)

a = Federal Environmental Protection Agency Guidelines (1988);
b = World Health Organization (WHO) (1984, 2006); European Economic Community (EEC) Guidelines (1975); NL = No Limit

pH Unit

The pH of the water ranged from 5.1 to 9.84 with a mean of 6.4 ± 0.9, indicating slight acidity (Table 3.5). Turbidity ranged from 2.0 to 382 NTU with a mean of 96.3 NTU. The total dissolved solids ranged between 1.0 and 605mg/l, with a mean of 401 ± 1.30mg/l. The mean concentration of suspended solids was 512 ± 126mg/l. The high turbidity and TSS values may be associated with presence of high levels of eroded materials.

Dissolved Oxygen (DO) and Biological Oxygen Demand (BOD) (mg/l)

The dissolved oxygen (DO) values ranged from 1.4 to 5.3mg/l, with mean of 3.3mg/l. This range was within the allowable limits of the FMEnv (1988) and WHO/EEC (Table 3.5). The BOD values ranged from 2.0 to 17.0 mg/L (Table 3.5). This range of concentration values

exceed zero levels established for drinking water quality standards (FMEnv., 1988). This level of BOD could be beneficial for the aquatic organisms in the water bodies in the area. These values suggest that the water is not fit for human consumption except it is subjected to different levels of treatment. The water was highly oxygenated with a mean DO concentration of 3.3 ± 1.2mm/l.

Temperature (°C)

Temperature is one of the physical (in-situ) parameters that determine the tendency of changes in water quality standards. The temperature oscillated between 28.0 to 34.7 °C (Table 3.5). This level of temperature is within the permissible limits for potable water and the normal range for irrigation water quality standards established by Landon (1991).

Total Hardness (mg/L)

Total hardness indicates that magnesium and calcium salts are present in the water sources. Sometimes low values in the wet season are probably due to dilution from rain water. Total hardness had a mean value of 20.33 mg/L. This value is within permissible limit of 200 mg/L outlined by FEPA (1988), WHO (1984) and EEC (1975) water quality standards (Table 3.5).

Electrical Conductivity (EC) (µS/cm)

Cations and anions dissociated in water determine electrical conductivity values. The electrical conductivity values ranged between 6310 and 45384 mS/cm with a mean of 28111 ± 811 mS/cm. Other chemical properties, e.g., SO_4^{-2}, PO_4^{-3} and NH_4^{+} are also shown in Table 3.5.

Mean levels of heavy metals in water samples of study area

The range of the concentrations of heavy metals in the water samples is shown in Table 3.5. These levels are within limits of the Federal Ministry of Environment, except for Pb and Ni (permissible 0.05 and 0.05 mg/l respectively, FEPA guidelines). For many years lead and nickel have been used in products (e.g., as an additive in paint, gasoline, leaded pipes, batteries and ceramics). Natural levels of lead in soil range between 50 parts per million (ppm) and 400 ppm. Lead particles in the environment can attach to dust and be carried long distances in the air. Such lead-containing dust can be removed from the air by rain

and deposited on surface soil, where it may remain for many years. In addition, heavy rains may cause leaching of lead/nickel from wastes deposited in gullies and from surface soils to migrate into water systems.

3.5 HYDROBIOLOGY AND MICROBIOLOGY

3.5.1 Soil Microbiology

Soils are typically richer in nutrient than in the adjoining water bodies, the numbers of microorganisms in the soil are therefore usually high. In the soil heterotrophs are also normally higher in the surface than the subsurface. This is attributable to higher amount of nutrient, especially organic carbon on the soil surface which is available for uptake and incorporation into microbial biomass. Bacteria generally breakdown dead organic material in the soil and this caused the release of otherwise trapped nutrient. These nutrients are readily available for plant uptake thereby enriching the soil.

Within the project area the numbers of heterotrophic bacteria during the sampling period ranged from 2.7 to 5.2 x 10^7 CFU g^{-1} and 2.2 to 4.7 x 10^7 CFU g^{-1} for surface and subsurface samples, respectively. The number of heterotrophic fungi in the samples showed the typical higher surface and lower subsurface pattern of distribution. Heterotrophic fungal count also showed the same pattern of distribution varying from 3.5 to 6.3 x 10^5 CFU g^{-1} and 3.3 to 5.9 x 10^5 CFU g^{-1} respectively within the surface and soil sub surface (Table 3.6). The low microbial counts noticed during this sampling period (wet season) may be attributable to the dilution effect of storm water on the soils sampled. The proportions of hydrocarbon utilizers to heterotrophs during the sampling period were less than 2.5% and suggest that the soils within the project area have not been contaminated recently with hydrocarbon. In the presence of hydrocarbon contamination, a proportion of hydrocarbon utilizers to heterotrophs of up to 10% are expected.

Microbes play very important role in the decomposition of organic material (plant and animal remains) thereby recycling nutrients that were hitherto unavailable in the soil. Decomposing organic materials are always higher at the surface where they are littered and this also explains why bacteria numbers were higher in the soil surface than the subsurface. This process may stimulate plant growth because of improved nutrient uptake in addition to enhancing the stability of soils within the study area.

Table 3.6: Total Number of Heterotrophic and Hydrocarbon Utilizing Bacteria and Fungi in Soil Samples during Wet Season.

Sample Code	Depth (cm)	THB (X 10^7 CFU g^-)	HUB (X 10^6 CFU g^-)	THF (X 10^5 CFU g^{-1})	HUF (X 10^4 CFU g^-)	% HUB/ THB	% HUF/ THF
SS-1	0 -15	3.5	0.6	4.8	1.1	1.7	2.1
	15-30	3.0	0.5	4.3	0.8	1.7	1.9
SS-2	0 -15	3.1	0.5	4.6	0.9	1.6	2.0
	15-30	2.6	0.5	3.8	0.7	1.9	1.8
SS-3	0 -15	2.7	0.6	3.5	0.7	2.2	2.0
	15-30	2.2	0.4	3.3	0.6	1.8	1.8
SS-4	0 -15	2.9	0.6	3.8	0.8	2.1	2.1
	15-30	2.4	0.4	3.5	0.6	1.7	1.7
SS-5	0 -15	4.3	0.8	5.5	1.0	1.9	1.8
	15-30	4.0	0.6	4.9	0.8	1.5	1.6
SS-6	0 -15	3.6	0.7	4.7	0.7	1.9	1.5
	15-30	3.2	0.6	4.1	0.6	1.9	1.5
SS-7	0 -15	4.1	0.7	4.8	0.9	1.7	1.9
	15-30	3.7	0.5	4.5	0.7	1.4	1.6
SS-8	0 -15	4.7	0.7	5.3	1.1	1.5	2.1
	15-30	4.2	0.6	4.7	0.8	1.4	1.7
SS-9	0 -15	4.5	0.8	5.1	0.9	1.8	1.8
	15-30	3.8	0.5	4.6	0.7	1.3	1.5
SS-10	0 -15	5.2	1.1	6.3	1.2	2.1	1.9
	15-30	4.7	0.8	5.9	1.0	1.7	1.7
SS-11	0 -15	3.4	0.6	4.4	0.8	1.8	1.8
	15-30	2.9	0.6	4.1	0.7	2.1	1.7
Range	0 -15cm 15-30cm	2.7 – 5.2 2.2 – 4.7	0.5 – 1.1 0.4 – 0.6	3.5 – 6.3 3.3 – 5.9	0.7 – 1.2 0.6 – 1.0	1.5 – 2.2 1.3 – 2.1	1.5 – 2.1 1.5 – 1.9

3.5.2 Surface Water Microbiology

The presence of micro-organisms in the water is crucial to the sustenance of the aquatic environment. These organisms are responsible for the decomposition and conversion of organic materials into body biomass, for uptake by bacteriovores. Organisms within the microbial food chain transfer same to organisms in the higher trophic levels thereby increasing the availability of food within the food web. They also regenerate nutrients which are available for uptake by phytoplankton for growth. These microorganisms are very sensitive to pollution within the environment and can therefore be used as indicators of changes within the water bodies. The microbial population present in any water body can be dynamic depending on the availability and types of organic carbon present.

The number of heterotrophic bacteria and fungi in water samples collected from the project area during the sampling period (wet season) are presented in Table 3.7. The heterotrophic bacteria and fungi counts in the samples during this season varied ranged from 6.1 to 6.8 x 10^6 CFU ml^{-1} and 8.0 to 8.3 x 10^4 CFU ml^{-1} respectively (Table 3.7). The proportion of hydrocarbon utilizers to heterotrophic bacteria and fungi were less than 3.0%.

In the sediments, the numbers of heterotrophs were generally higher than the overlaying water bodies (Table 3.8). This trend is expected because the sediment receives all the particulate and dead organic materials from the water column. The sediments are therefore very rich environment for heterotrophic activities and production. The sediment is a rich source for dissolved organic material and nutrient for bacteria and phytoplankton utilization within the water bodies. The number of heterotrophic bacteria and fungi varied from 8.6 to 9.7 x 10^7 CFU g^{-1} and 9.3 to 10.5 x 10^5 CFU g^{-1}, respectively, during the sampling period. In the water and sediment samples there were no clear patterns of microbial distribution. This is typical of flowing water bodies with no particular anthropogenic discharge point(s). The proportion of hydrocarbon utilizers to heterotrophs indicates that the area is still in fairly pristine condition with no recent contamination with hydrocarbons.

Table 3.7: Total Number of Heterotrophic and Hydrocarbon Utilizing Bacteria and Fungi in Water Samples during Wet Season.

Sample Code	THB (X 10^6 CFU ml^{-1})	HUB (X 10^5 CFU ml^{-1})	THF (X 10^4 CFU ml^{-1})	HUF (X 10^3 CFU ml^{-1})	% HUB/ THB	% HUF/ THF
WS-1	6.1	0.9	8.0	1.4	1.48	1.75
WS-2	6.8	1.1	8.3	1.7	1.62	2.05
WS-3	6.7	1.3	8.2	1.3	1.94	1.59
Mean	6.5	1.1	8.2	1.5	1.68	1.80

Table 3.8: Total Number of Heterotrophic and Hydrocarbon Utilizing Bacteria and Fungi in Sediment Samples during Wet Season.

Sample Code	THB (X 10^7 CFU g^{-1})	HUB (X 10^6 CFU g^{-1})	THF (X 10^5 CFU g^{-1})	HUF (X 10^4 CFU g^{-1})	% HUB/ THB	% HUF/ THF
SED-1	9.7	2.1	10.5	2.0	2.16	1.91
SED-2	8.5	2.3	9.6	2.1	2.71	2.19
SED-3	8.6	2.0	9.3	1.8	2.33	1.94
Mean	8.9	2.1	9.8	2.0	2.40	2.01

Hydrobiology

Phytoplankton

A total of 9 phytoplankton species representing 4 taxonomic groups were obtained in the Ikot Anwatim study area during the sampling period. In terms of species constitution the taxa Bacillariophyceae constituted 50.0% (4 species) followed by Chlorophyceae 38% (3 species), and Euglenophyceae 12% (1 species) (Table 3.9). Bacillariophyceae was the most abundant and constituted 62.0%, Chlorophyceae 31% and Euglenophyceae 7.0%. The distribution of phytoplankton at the various sampling stations is presented in Fig. 3.8**.** These phytoplankton species are the main source of food for marine organism and therefore play the most important role in the provision of energy in the marine food web. Their abundance is a good indicator of the eutrophic status of the environment. During the wet season the water is more turbid though diluted. This may in part explain the low phytoplankton counts and representative groups during the study period.

Zooplankton

The zooplanktonic fauna of project area are represented by Copepoda, Rotifers and Gastropoda (Table 3.10). The distribution of these taxonomic groups at the sampling locations during the wet season is presented in Fig. 3.9. The order Copepoda dominated in terms of abundance and constituted 59% in all the stations followed by Rotifera with 29% and Gastropoda 12%.

Table 3.9: Composition and abundance of Phytoplankton species (per litre) collected within the study area during Wet season

TAXA	HWS-1	HWS-2	HWS-3
BACILLARIOPHYCEAE			
Amphora ovalis	4	-	2
Navicula mutica	-	6	2
Skeletonema costatum	-	2	-
Synedra ulna	6		4
TOTAL	10	8	8
CHLOROPHYCEAE			
Clostridium gracile	-	3	-
Scenedesmus abundans	-	-	4
Spirogyra sp.	4	2	-
TOTAL	4	5	4
EUGLENOPHYCEAE			
Euglena acus	-	3	-
TOTAL	0	3	0
Total number of individuals	14	16	12
Total number of species	3	5	4

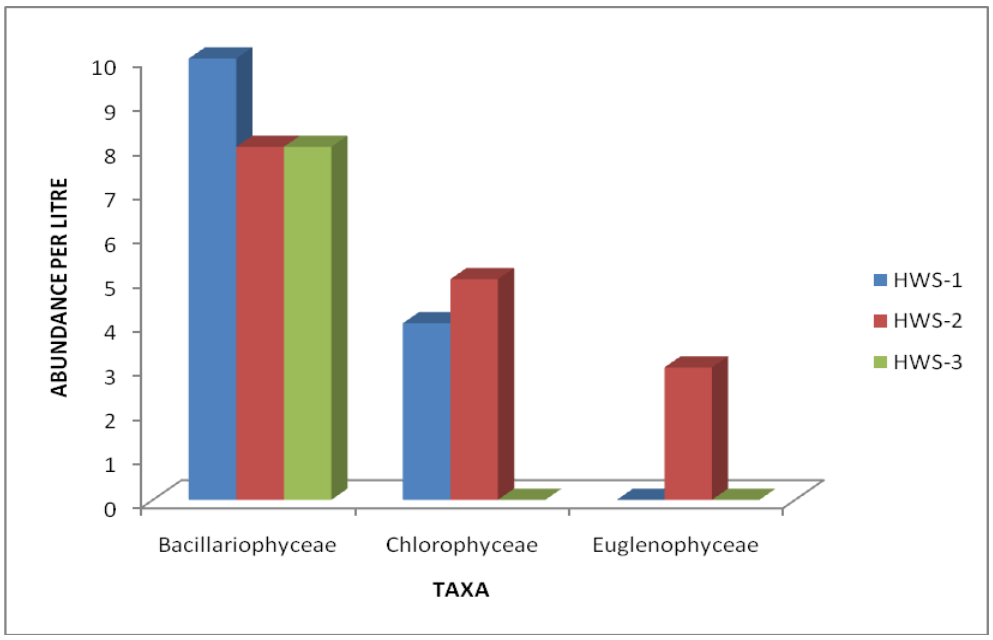


Fig. 3.8 : Relative abundance of phytoplankton Taxa in water samples within the project area during Wet season

Table 3.10: Composition and abundance of Zooplankton species (per litre) collected within the study area during Wet season

TAXA	HWS-1	HWS-2	HWS-3
COPEPODA			
Copepod nauplius	1	2	-
Daphnia pulex	-	1	2
Oncaea venusta	4	-	-
TOTAL	**5**	**3**	**2**
ROTIFERA			
Brachinonus sp	2	-	1
Karatella sp	-	2	-
TOTAL	**2**	**2**	**1**
GASTROPODA			
Carinaria lamarchi	1	1	-
TOTAL	**1**	**1**	**0**
Total number of individuals	**8**	**6**	**3**
Total number of species	**4**	**4**	**2**

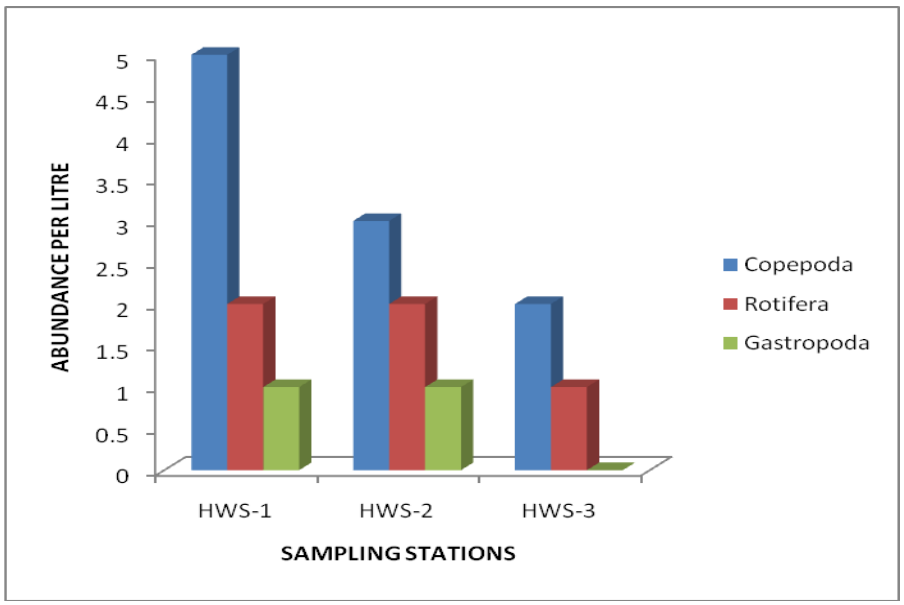


Fig. 3.9: Relative abundance of Zooplankton Taxa in water samples within the project area during Wet season

The zooplankton groups in the study area were mainly monogeneric and the low number of zooplankters could be ascribed to (a) the patchy nature of distribution, (b) vertical migration phenomenon which most species exhibit so that during the day time; they descend to the bottom of the sea. The zooplankters were less abundant and less frequent and showed a paucity of species compared with the phytoplankton as would be expected. This co-variation is expected because they depend largely on phytoplankton for food.

The results of abundance, distribution and occurrence of organisms surveyed in this investigation would be critical future benchmarkers for monitoring the ecosystem for compliance and for assessment of her integrity and health status.

Benthos

A compilation of the benthic fauna of the sediments sampled within the project area during the sampling period is presented in Table 3.11**.** The benthic samples were very poor in terms of abundance. A total of 6 species were encountered at the 3 sampling stations and these belong to 3 major taxonomic groupings. The contributions of different groupings to the total macrobenthos are Annelida (50%), Arthropoda (37.5%) and Mollucsa (12.5%). The prevalence of the various benthic groups at every sampling station is presented in Fig. 3.10**.** In this survey, Annelids were present in every station sampled and this may explain their abundance in the sediments obtained within the study area. All the benthic organisms identified in the study area during the survey are also monogeneric and therefore stand the risk of extinction if changes in environment especially pollution affects any species or group of organisms adversely. The benthic fauna live mainly on remains of plant and animal in the sediment. They are most affected during pollution because of their inability to move away from pollutant and the benthic fauna largely bio-accumulate pollutants within their body biomass. Their abundance, distributions and tissue bioassay may also give an indication of the environmental pollution status. Samples for analysis of phytoplankton, zooplankton and benthos were obtained from the same locations as for surface water analysis (Fig. 3.7).

Table 3.11: Composition And Abundance Of Benthic Organisms (Per 0.1m^2) Sampled Within The Study Area During Wet Season

TAXA	HSS-1	HSS-2	HSS-3
ANNELIDA			
Capitella capitata	1	0	1
Glycera convolute	-	1	0
Nereis sp	1	0	0
TOTAL	**2**	**1**	**1**
ARTHROPODA			
Clibinarus africanus	0	1	1
Gammarus sp	0	0	1
TOTAL	**0**	**1**	**2**
MOLLUSCA			
Donax pulchellus	0	1	0
TOTAL	**0**	**1**	**1**
Total number of individual	**2**	**3**	**4**
Total number of species	**4**	**3**	**3**

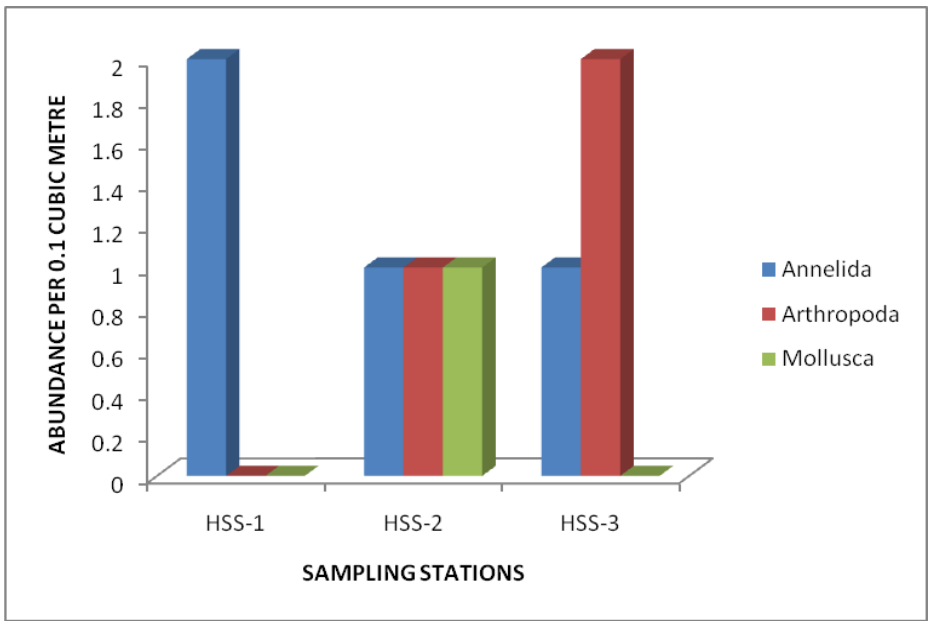


Fig. 3.10: Relative abundance of Benthic organism in sediment samples within the project area during Wet season

3.6 ECOLOGY

The Ikot Anwatim gully complex area falls within the tropical rain forest/fresh water swamp biome. However, the complex structure (physiognomy) and species richness of lowland rainforests have been eliminated as the area has urban-semi-urban setting, with high human population density and hilly to relatively flat topography. Most disturbances are through human influence for which there is ample evidence in the form of asphalted roads, human settlements, business establishments and industrial concerns. Land use patterns, as elsewhere in Nigeria, promoted the exploitation of both timber and secondary non-timber produce to an extent that endangered the existence of forests. A checklist of plant species and their relative abundance is shown in Annexure 5B, and the forest data summary (mean dendrometric parameters) are shown in Table 3.12.

The sites exhibited very low species composition, with a maximum of 10 tree species and 8 families recorded (Table 3.12, Annexure 5B). The species diversity indices were low (0.7-1.91) and the average heights of the five tallest trees were below 14 m (with the exclusion of palms) (Table 3.12, Annexure 5B). Structurally, there was one discernible stratum, dominated by 'protected' species (mostly *Gmelina arborea* and *Bambusa vulgaris*.). Oil palm, with a frequency of up to 28 %, constituted the dominant emergent canopy species in these areas. These indices suggested that trees of timber size/value were lacking and that these communities are of recent origin or affected by recent changes (i.e. past 30-40 years). Such communities are unstable and likely to change rapidly. Consequently, the gully sites are typically low in biodiversity value (poor species composition and an absence or rarity of trees of timber value). In ecological context these areas now fall under the "partially modified lowland rainforest" ecozone.

The ground vegetation was dominated by herbaceous genera and weeds. The dominant grass species included members of the Poaceae family (*Eleusine indica, Acroceras zizanoides, Panicum maximum*), Malvaceae (*Sida acuta*), Asteraceae (*Chromolaena odorata, Ageratum conyzoides*) and Fabaceae (*Centrosema pubescens*). Generally vegetation was luxuriant with no obvious signs of stress (e.g. chlorosis) arising from deficiency of nutrients or from pollutants in the environment.

Fig. 3.11: Profile of typical vegetation in NEWMAP Ikot Anwatin Gully Project Area. The dominants are represented diagrammatically

The command areas of the main gully and the fingers are a mix of residential housing, homestead farms and small forest groves. The gully complex includes small-medium sized active gullies in sub-watershed, with sizable secondary and tertiary forests, mixed vegetation, and the traditional multi-story cropping dominant throughout the Niger Delta. Vegetation removal has contributed to gully expansion and carbon emissions. The gullies have removed significant areas of land from high value cultivation/production. Severe erosion and developing/mature gullies ultimately deliver sediment to the river systems. Sediment run-off from eroded gullies and associated deposition of sand has significantly contributed to water quality decline in the Calabar River. The loss of the natural riparian vegetation has also affected water quality in the area. The riparian zone has the capacity to filter, metabolize and bioaccumulate nutrients and pollutants.

Table 3.12: Forest data summary in the Ikot Anwatim gully erosion complex area

Veg. Transect	No. species	No. families	Palm freq. (%)	Av. Height*	Diversity Index**
Main gully	10	8	25	11.0	1.91
Finger 1	5	5	20	9.0	1.54
Finger 2	4	4	18	13.0	0.70
Finger 3	8	7	14	13.8	1.86
Finger 4	6	6	15	8.4	1.53
Finger 5	7	7	28	5.6	1.67

**** Average height, 5 tallest trees (exclusive of palms) ** Trees species diversity Index (Shannon-Wiener).***

Wildlife studies

The vegetation in the gully site provides cover and forage for a variety of insect, small mammal, reptile, and bird species. The identified wildlife resources have been grouped under the following major headings: mammals, avifauna, reptiles and amphibians (Table 3.13). The mammalian species were predominantly rodents (small mammals) like *Cricertomys gambianus* (giant rat), *Rattus rattus* (common rat) and *Xerus sp* (squirrel). The conservation status of small mammals is satisfactory (survival not threatened) as they have naturally high fecundity as well as adaptability to changing habitat conditions. The avifauna were the most conspicuous form of vertebrate wildlife and included weaver birds (*Plesiositagra cucullatus*.), kites (*Milvus migrans*) and cattle egrets (*Ardea ibis*).

Herpetofaunal species (amphibians) included toads, lizards and snakes. In general, very low densities and patchy distribution of wildlife were observed.

Conservation Status of project area

The proposed project area has undergone tremendous conversion in recent times (the past 30-40 years). Trees of timber value were lacking. None of the plant or wildlife species identified is on the IUCN endangered list. No known areas of natural or critical habitat (endemic species, wildlife breeding sites) or archaeological significance were found within proposed project boundaries. The area might therefore be considered as having a low conservation priority index.

Table 3.13 Wildlife species found in the proposed Ikot Anwatim gully erosion intervention project Area

Class	Species	English Name	Detection Method	Conservation status (NARESCON)	Relative Abundance
Amphibia	*Bufo regularis*	Toad	DS	Satisfactory	Common
	Ptychodena sp.	Long-Legged frog	DS	Satisfactory	Common
	Osteolaemus tetrapis	Crocodile			
Reptilia	*Agama agama*	Redhead Lizard	DS	Satisfactory	Common
	Hemidactylis gasciatus	Wall gecko	DS	Satisfactory	Common
	Dendroaspis viridis	Green mamba	DS	Satisfactory	Common
	Veranus niloticus	Monitor lizard	SL	Satisfactory	Rare
Aves	*BIRDS*				
	Neophron percnopterus	Hooded vulture	DS	Satisfactory	Common
	Accipiter erythropus	Chicken Hawk	DS	Endangered	Rare
	Milvus nigrans	Black kite	DS	Satisfactory	Common
	Hirundo sp.	Swallow	DS	Satisfactory	Common
	Ploceus cucullatus	Village weaver	DS	Satisfactory	Common
		Pigeon	DS	Satisfactory	Common
	Ceryle rudis	Pied kingfisher	SL		Rare
	Ceyx picta				
	Ardea ibis	Cattle egret	DS		Common
	Ardea cinerae	Grey heron	SL		Rare
Mammalia	*Phinolophus sp.*	House bat	DS	Satisfactory	Common
	Rattus rattus	Black house rat	DS	Satisfactory	Common
	Cricertomys gambianus	Giant rat	SL	Satisfactory	Common
	Heliosciurus Rufobranchium	Squirrel	DS	Satisfactory	Common
	Cercocebus spp.	Monkeys			

DS, Direct sighting; SL, Information provided by locals

CHAPTER FOUR

SOCIO-ECONOMIC CHARACTERISTICS AND CONSULTATION WITH STAKEHOLDERS

The socio-economic aspect of this study gives base line information on the social and economic aspects of the host and catchment communities of the Ikot Anwatim gully erosion complex area. This study analyzes various socio-economic variables that may be affected by gully erosion intervention project. Primary data used for this socioeconomic report was generated during field studies in the communities which took place during March-April 2014. Secondary data for the study were drawn from Government Gazettes and Census Publications. The socio-economic survey adopted a combination of several data collection techniques to achieve the objectives of the study. Details of the survey methods used are provided in Appendix 5A of this ESMP report.

4.1 People, History, Governance and Hierarchical structure

Calabar, the Cross River State capital city, has two local government areas (Calabar Municipality and Calabar South). It has an area of 406Km^2 and a population of 373,028 (National Population Commission, 2006). Calabar has three indigenous ethnic groups, namely Efik, Qua and Efut. Calabar is a coastal city, about 55 kilometres from the Atlantic Ocean and encompassed by numerous creeks and rivers. The city is characterized by lowland terrain with the highest point being about 200 metres above sea level, while the lowest point is as low as zero metre above sea level.

The Ikot Anwatim gully complex area falls under Calabar Municipality. The people in the study area belong to two main ethnic groups, the Quas and the Efiks. The Quas are known to have migrated from Cameroon, from a village known as Mamfe. They migrated from there and settled in their present locations covering the areas from Calabar to Ogoja. They are generally called the Ekoi people and speak Ejagham language. The Quas are governed by an organized chieftaincy hierarchy headed by clan heads called Ntoe. The Ntoe is supported by family heads called Esi Njo, and women and youth leaders who all together form the Council that govern the communities. The Efiks trace their origin to Creek Town from where they migrated to their various present locations in Akpabuyo, Calabar and Odukpani. They speak the Efik language and the culture of the people has unique features.

While the Quas were originally hunters and warriors, the Efiks were fishermen and traders. These have affected their culture, norms and traditions.

In traditional society, the communities had women groups that were known to play very important roles when the communities had any function. They were always involved in the planning for celebrations. The women were always organized and had well constituted and respected executives that propelled the women activities. The youths were also well organized with their leaders who gave the youths direction at all times. The youths were the main force behind the village heads and formed his executing instrument. Presently, the traditional hierarchy of authority shows the Paramount chief referred to as the *Obong* for the Efiks and *Ntoe* for the Qua's as the Head of any community. The Paramount Chief is the chairman of all council meetings and superintends over such meetings. Under this council are the *Etuboms* and *Ntufams* for the Efiks and Quas respectively. Membership of this council includes the village Heads and traditional title holders. The traditional governance hierarchy is presented in Fig. 4.1.

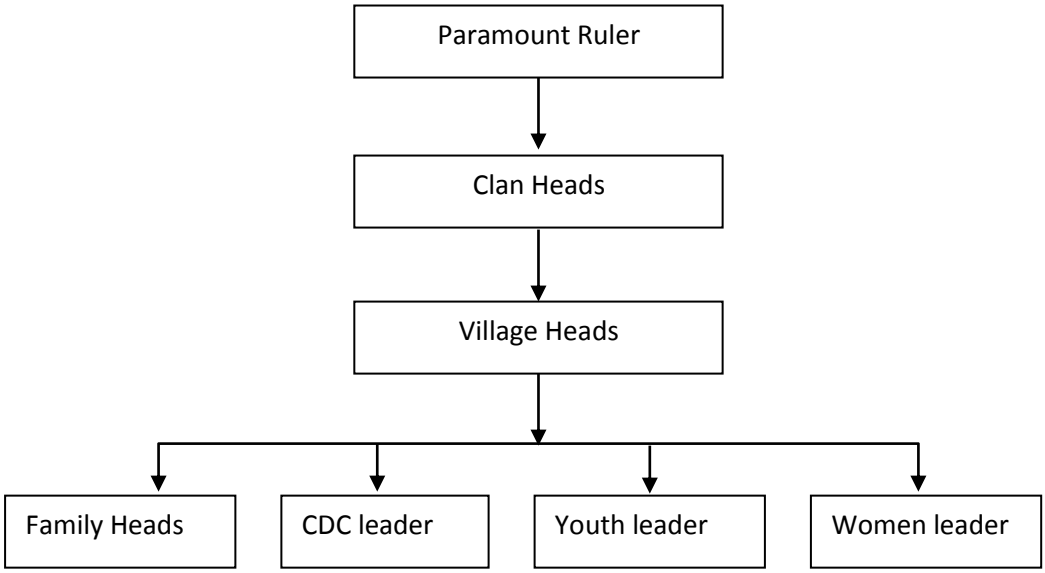


Figure 4.1: Hierarchical Structure of the Traditional Institution in the Sampled Communities

4.2 Land ownership/acquisition

Land in the study communities belongs either to the communities, family or individuals. In the sampled communities, the ownership structure was different in terms of hierarchy. The land ownership pattern gives an indication of the level of communities' participation and

ownership rights as a group. There is usually more communities' coherence when land is communally owned. This also gives more powers to the Chief and his council members since they decide for the communities most of the time. However because of development and expansion, most communal and family land in the sampled area now belong to individuals as they have been allocated by the family or community. The summary of land ownership structure in the sampled communities is presented in Table 4.1.

Table 4.1: Land Ownership structure in communities of the Ikot Anwatim gully complex area

S/N	Communities	Land Ownership	Settlement
1	Ikot Ansa	Communal, Family, Individual	Urban
2	Ikot Anwatim	Individual, Family, Communal	Semi urban
3	Ikot Akpanam	Communal, Family, Individual	Semi urban
4	Ikot Ishie	Individual, Family, Communal	Urban
5	Ikot Abasi Obori	Communal, Family, Individual	Semi urban
6	Kasuk	Individual, Family, Communal	Semi urban

4.3 Settlement pattern

The settlement pattern is a measure of the level of land availability and urbanization as most communities had very compact nucleated linear settlements due to pressure on people to build houses on the available land. The community belongs administratively to Calabar Municipality. Therefore, settlements are mostly nucleated and linear with houses lined along major roads or streets. The settlement pattern in a community gives an indication of land availability and population density. Nucleated linear settlements along the main roads were predominant within the sampled communities (Table 4.2). This pattern usually indicates cohesion and brotherliness within the communities. Nucleated settlements may also be associated with areas where land is scarce.

Table 4.2: Settlement Pattern in in communities of the Ikot Anwatim gully complex area

S/N	Communities	Settlement Pattern
1	Ikot Ansa	Nucleated linear
2	Ikot Anwatim	Nucleated linear
3	Ikot Akpanam	Nucleated
4	Ikot Ishie	Nucleated linear
5	Ikot Abasi Obori	Nucleated linear
6	Kasuk	Nucleated

4.3.1 Housing

The structure and types of houses in the communities was a function of and a good indicator of the income level of the household. The least house quality were houses with mud walls and thatch roof, followed by mud walls and corrugated iron roofing sheets, followed by mud walls plastered with cement and corrugated iron roofing sheets, and lastly cement block walls with corrugated iron roofing sheets (Fig. 4.2). The proportions of the housing types in the communities are presented in Table 4.3 and Fig. 4.2 and shows that majority of the houses were made with cement blocks and a small proportion were made with mud walls. Majority of the houses had corrugated iron roofing sheets.

Table 4.3: Proportions of different housing types in sampled communities

S/N	Communities	Mud or wooden walls & Thatch	Mud walls & roofing sheet	Cement Plastered mud walls & roofing sheet	Cement block walls & roofing sheet
1	Ikot Ansa	2	4	15	78
2	Ikot Anwatim	3	5	15	77
3	Ikot Akpanam	4	5	20	71
4	Ikot Ishie	5	5	25	65
5	Ikot Abasi Obori	5	6	26	63
6	Kasuk	5	6	27	62
Total		24	31	128	416
Mean		4	5.2	21.3	69.3

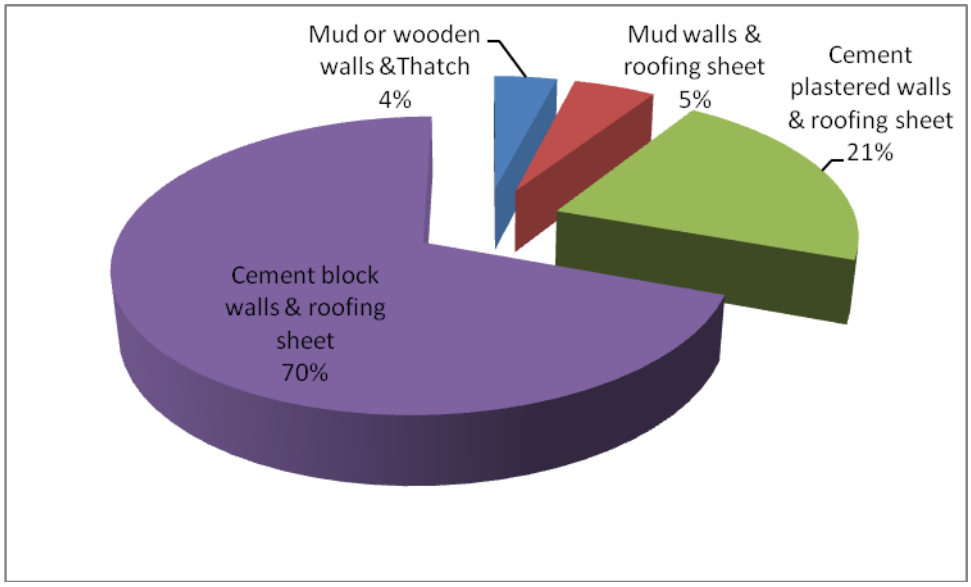


Fig. 4.2: Mean Proportions of different housing types in all sampled communities.

4.4 Educational attainment

The educational levels attained by the individuals were collected during the questionnaire survey. There were more people that had secondary education as the maximum level of education than any other group. However, this was closely followed by those with primary education. The picture was found to be the same in all the sampled communities (Table 4.4). The means also showed a similar picture (Fig. 4.3). Education generally influences occupation and income. The implication is that the proposed project will have people in the various cadres to engage as workers.

Table 4.4: Distribution of Communities by Educational level attained by respondents

S/N	Communities	No formal education	Primary education	Secondary education	Tertiary education
	Ikot Ansa	14	38	38	10
	Ikot Anwatim	10	30	51	9
	Ikot Akpanam	11	37	44	8
	Ikot Ishie	20	32	38	10
	Ikot Abasi Obori	16	37	39	8
	Kasuk	11	45	34	10
Total		82	219	244	55
Mean		13.7	36.5	40.7	9.2

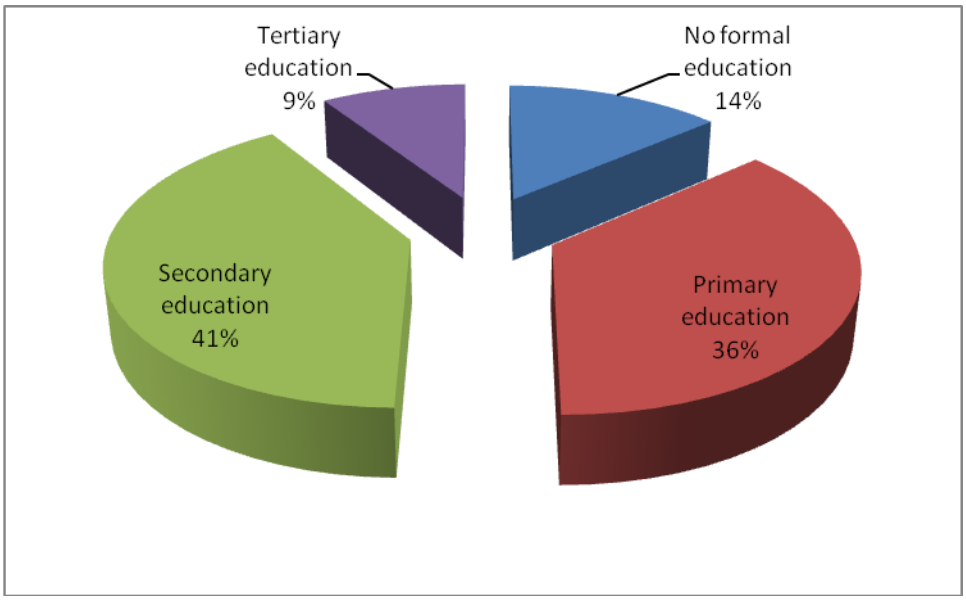


Fig 4.3: Mean Distribution of Communities by Educational level attained by respondents

4.5 Occupational distribution

The distribution of occupation of members of the communities is presented in Table 4.5 and Figure 4.4 and this shows that trading, civil service employment, and artisans were the predominant occupation in the sampled communities. The occupational trend was similar in the sampled communities. The youths were mostly not satisfactorily engaged and wanted better employment especially civil service employment.

Table 4.5: Distribution of Occupational groups in Sampled Communities.

S/N	Communities	Farming	Trading	Civil service	Artisan	Others
1	Ikot Ansa	2	55	31	25	13
	Ikot Anwatim	12	24	23	21	11
	Ikot Akpanam	11	33	22	21	9
	Ikot Ishie	10	35	15	28	12
	Ikot Abasi Obori	30	20	20	17	13
	Kasuk	15	29	17	16	10
	Total	80	196	128	128	68
Mean		13.3	32.7	21.3	21.3	11.3

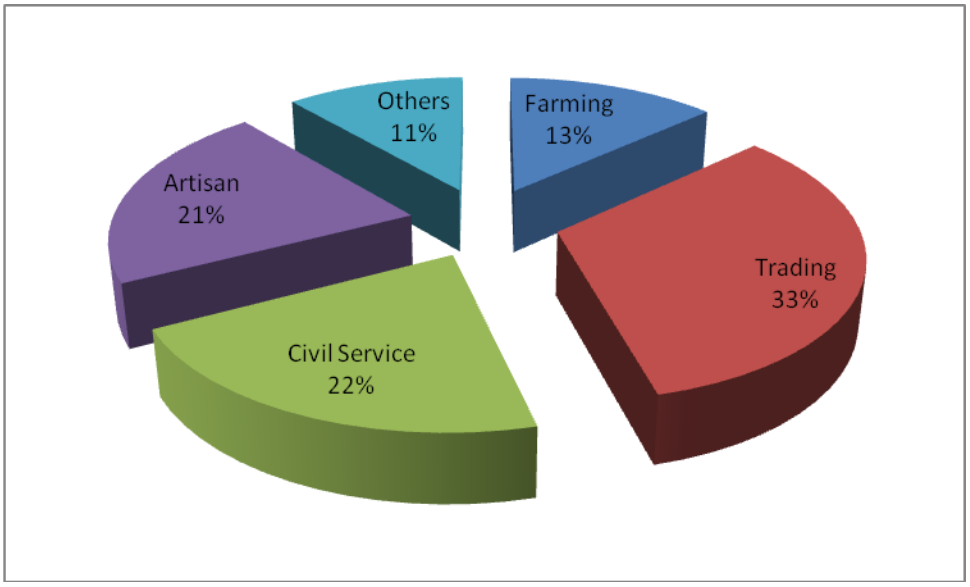


Fig 4.4: Mean Distribution of Occupational groups in sampled Communities

4.6 Income distribution

The distribution of respondents among the various income classes shows that there was a higher concentration in the income range of 20001-30000 than in the other income classes. This income distribution gives an indication of the standard of living of the people. The income class distribution of sampled communities is presented in Table 4.6 and the mean values for all sampled communities are presented in Fig. 4.5.

Table 4.6: Percentage Distribution of Respondents by income classes per month in Naira

S/N	Communities	1,000 – 10,000	10,001 – 20,000	20,001 – 30,000	30,001 - 40,000	40,001 – 50,000	50,001 – 60,000	60,001 – 70,000	Above 70,000
	Ikot Ansa	24	16	25	15	10	6	2	2
	Ikot Anwatim	17	19	18	15	13	11	4	3
	Ikot Akpanam	18	19	20	17	10	8	5	3
	Ikot Ishie	19	15	22	15	10	8	6	5
	Ikot Abasi Obori	20	16	22	16	11	7	5	3
	Kasuk	8	15	16	16	13	10	10	12
Total		106	100	123	94	67	50	32	28
Mean		17.7	16.7	20.5	15.7	11.2	8.3	5.3	4.7

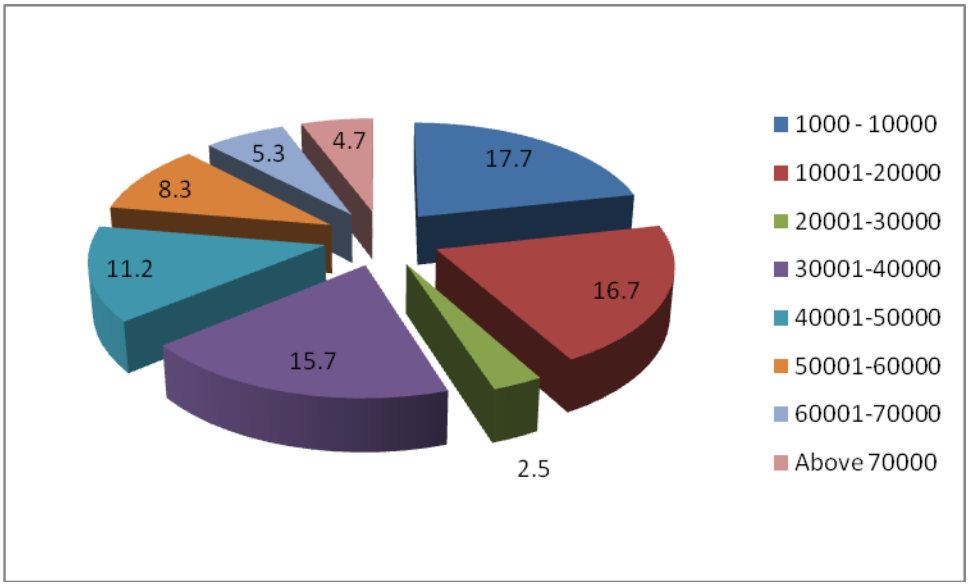


Fig. 4.5: Mean Percentage Distribution of Respondents by income classes per month in Naira for sampled communities

4.7 Population Structure and Distribution

The population of Calabar Municipality, based on the 2006 census figures, were obtained from the National Population Commission. Population figures for individual communities are not available in the report. The male and female populations for Calabar municipality are presented in Table 4.7. The population of 2006 was projected to 2021 using the exponential population growth method using 3.18% growth rate per annum. The total expected population in the local government to be affected by the project was 269,024 people. This population values are significant in that they give an indication of the number of people likely to be impacted by the proposed project in terms of negative and positive side effects. The population also gives us an indication of available work force in case there is need to employ local manpower for the proposed project.

Table 4.7: Population of Males and Females in Calabar Municipality

Calabar Municipality	Both Sexes	Male (2006)	Female (2006)	Exponential (2021)
	183,681	93,092	90,589	295,953

However, to capture the specific impact of the project on the communities, an analysis of the exponential population growth rate in the communities was carried out using the 1991

census figures (National Population Commission (NPC) 1996). This was limited to the communities where population data were available. The projected population for the communities at the Ikot Anwatim gully erosion site is presented in Table 4.8 below. The project is expected to positively impact about 11,842 persons by 2016, either directly or indirectly at the site.

Table 4.8: Exponential population projection for some sampled Communities at 3.18 percent growth rate.

Years	1996	2001	2006	2011	2016	2021
Ikot Anwatim	6,724	7,746	8,924	10,280	11,842	13,642
Ikot Ansa	15,012	17,293	19,923	22,951	26,439	30,458
Ikot Ishie	5,825	6,724	8,005	9,385	11,003	12,899

Source: Computed from National Population Commission census data (1991)

4.7.1 Population Structure

Figure 4.6 illustrates the mean age-sex distribution of two of these communities. It is immediately apparent that the population is made up mostly of young people. Those aged less than 20 years account for about 54 % of the total population. This value compares favourably with the national profile as a whole, where those below the age of 20 accounted for 55 percent of the 1991 population census figures (NPC, 1996). These are school age, dependent group that usually makes the greatest demands on social infrastructures/facilities such as schools, hospitals etc. The population was less loaded in the older age bracket as those aged 65 years and above accounted for about 1 percent of the total population.

The study also revealed that on average, the female population slightly exceeded that of the male with a sex ratio of 110.08 and a dependency ratio of 121.23.

The Sex Ratio is expressed as:

$$\frac{No.of\ males}{No.of\ females} \text{ X } 100$$

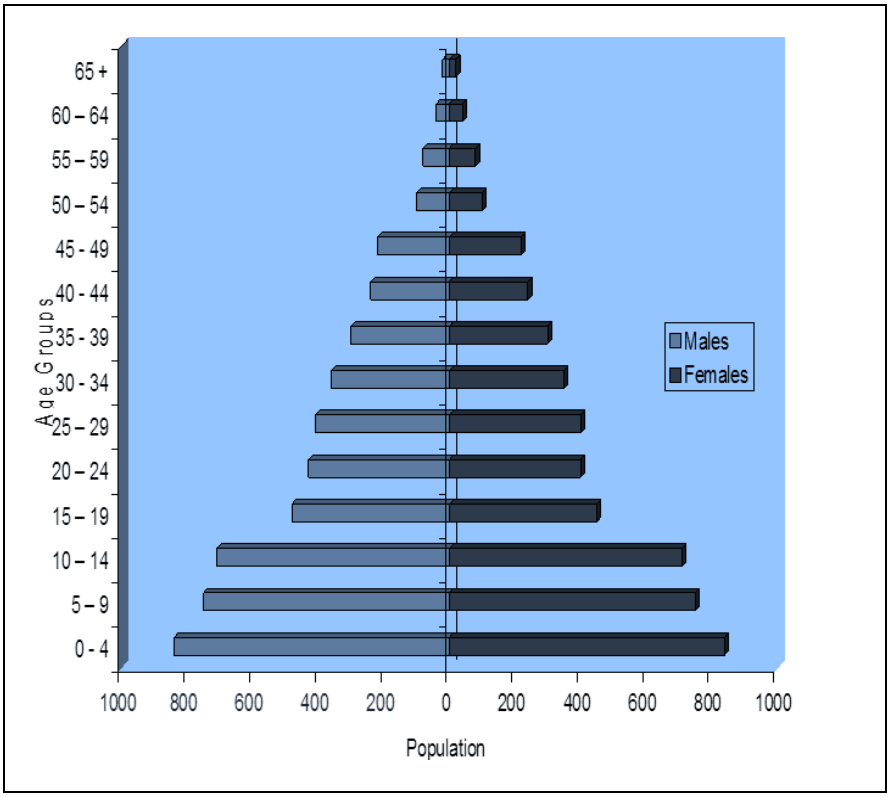


Figure 4.6: Mean Age groups and Gender distribution in Ikot Ansa and Ikot Ishie communities

4.8 Infrastructure

The level of infrastructure in communities gives an indication of the level of development and urbanization of the place. The sampled communities varied in the level infrastructural amenities available to the people. The availability of infrastructure in the sampled communities is summarized in Table 4.9. Government provision of infrastructure for use by people is oftentimes inadequate. Some communities on their own are able to fund and provide some of the amenities they need.

Schools

The distribution of schools available in the communities is presented in Table 4.9 and shows that all the sampled communities have at least one government primary school (Plate 4.1). Nursery schools are also present in the area. The people have access to all available higher institutions within the Municipality.

Plate 4.1: A primary school in Ikot Anwatim gully complex area

Health facilities

The sampling showed that there are primary health care centres in Ikot Ansa and Ikot Ishie and health posts in the other communities. These facilities refer their difficult cases to the General Hospital in Calabar or the University of Calabar Teaching Hospital (UCTH).

Water sources

The primary sources of drinking water in the sampled communities are bore holes and water from the State Water Board. A few wells and streams were found in Ikot Ansa. The people also use a lot of rain water during the rainy season.

Market and periodicity

The communities sampled have daily markets where goods are bought and sold. They also have access to the lager markets in Calabar (– Watt and Ika Ika Oqua markets).

Roads, Transportation and telecommunication

Some of the roads traversing the sampled communities are tarred. Some other roads are not tarred and in bad state (Plate 4.2). All types of vehicles ranging from bicycles, motorbikes, cars, buses and trucks are used to convey goods and people. Cars are however the most common means of transportation in all the sampled communities. The telecommunication services available in the communities are provided by MTN, Glo, Airtel and Etisalat.

Electricity

Electricity is generally present in the sampled communities as they are all connected to the national grid. Power supply from the national grid is generally irregular. The people have to depend on lanterns and standby generators for power. The generators are a major source of noise and pollution.

Table 4.9: Distribution of available infrastructure in the communities sampled

Community	INFRASTRUCTURE									
	Electricity	Sources of water.	Nature of roads within	Nursery School	Primary School	Secondary	Tertiary	Health Facilities	GSM	Market & Periodicity
Ikot Ansa	PHCN	Water board, boreholes, wells, Streams	Earth, tarred	Several	2	3	None	Health Centre	Airtel, MTN Glo & Etisalat	Daily
Ikot Anwatim	PHCN	Water board, boreholes, wells, River	Earth, tarred	Several	1	None	None	Health post	Airtel, MTN Glo & Etisalat	Daily
Ikot Akpanam	PHCN	Water board, boreholes, wells.	Earth, tarred	Several	1	None	None	Health post	Airtel, MTN Glo & Etisalat	Daily
Ikot Ishie	PHCN	Water board, boreholes, wells.	Earth, tarred	Several	2	2	None	Health post	Airtel, MTN Glo & Etisalat	Daily
Ikot Abasi Obori	PHCN	Water board, boreholes, wells.	Earth, tarred	Several	1	None	None	Health post	Airtel, MTN Glo & Etisalat	Daily
Nkasuk	PHCN	Water board, boreholes, wells.	Earth, tarred	Several	1	None	None	Health post	Airtel, MTN Glo & Etisalat	Daily

4.9 Shrines/ Sacred places and Taboos

Christianity and urbanization have greatly reduced worship in shrines and sacred places in the community. The people still treasure and respect their inheritance from the ancestors. Some deities and sacred sites are still recognized in the area. For example, *anansa* and *asibong ekondo* in Ikot Ansa and the *Mgbe* shrine in some of the communities. These deities still have worshippers who offer sacrifices as the need arises. The locations of

shrines are sacred and people are not allowed freely into such locations. These shrines are not located within project boundaries.

Plate 4.2: An eroded access road in Ikot Anwatim.

Religion

There are three main religions in the sampled communities namely Christianity, Islam and African Traditional Religion. Most community members are Christians. Several churches of different denominations are located in the area. Muslims are few and mostly of Hausa or Yoruba extraction. The people practicing African Traditional Religion mostly combined it with Christianity.

Celebrations

The annual celebration of Christmas and New Year celebrations on the 25th December and 1st January are popular in the community. There is also the Christian celebration of Easter. Celebration generally involves cooking, eating, drinking, dancing, and merry making. The observance of national public holidays is significant to the people and most civil servants look forward to these holidays which include; workers day on 1st May, Independence day

on 1st October, Democracy day on 29th May, and Muslim celebrations of Eidel Fitri and Eidel Malud whose dates are fixed based on the appearance of the moon in some months of the Islamic calendar.

4.10 The Local Economy

The economies of the communities are highly private sector driven, with multiple sources of income and depicting the urban/semi-urban nature of the communities. Retail trading in markets/home is the common primary occupation of the people (33% of respondents). Most residents are engaged in a wide array of other activities including farming (13%), public service (21%), and artisans (21%) of a wide range of services. The crops grown and their frequencies were similar for all communities and are listed in Table 4.10. Many tree crops are also planted within the communities especially around family compounds. A list of commonly found trees and their frequencies is presented in Table 4.11. Other economic activities that contribute to the local economy include transportation and ownership/casual labour in small scale enterprises. Additional resources also come from the Calabar River in the form of fishing, sand mining, recreation and transportation activities.

Table 4.10: Food Crops grown in the Study area and frequencies mentioned by respondents.

S/N	Food Crops	Frequency
1	Cassava	140
2	Coco yam	110
3	Plantain	105
4	Banana	103
5	Yam	93
6	Water yam	78
7	Maize	90
8	Melon	66
9	Bitter leaf	56
10	Pumpkin	87
11	Water leaf	130
12	Okro	57
13	Pepper	75
14	Garden egg	45

Table 4.11: Tree Crops grown in the Study area and frequencies mentioned by respondents.

S/N	Tree Crops	Frequency
1	Mango	110
2	Orange	90
3	Pawpaw	79
4	Guava	45
5	Avocado pear	55

4.11 COMMUNITY HEALTH STATUS AND QUALITY OF LIFE

Communities in the Ikot Anwatim gully complex area have the indices of typical semi-urban to urban Nigeria. These communities are located within Calabar Municipality. Most of the respondents are involved in petty trading, civil service, artisanship, farming and a few are involved in fishing. Like many semi-urban to urban settings in Nigeria, there are no reliable data on life expectancy but the national average is 50 years for females and 45 years for males, while the aged are above 70 years. The common causes of morbidity include Malaria, Febrile convulsion, Diarrheal disease, and Measles amongst the under-fives, with Hypertension, Typhoid fever, Diabetes mellitus and Stroke being common amongst the adults. The health status and quality of life were assessed through relevant indices namely, housing, water supply, sanitation, nutrition, education level, disease trend, health risks, life style habits and existing health infrastructure. A summary of the health indicators shown in Table 4.12 indicates that the health status of the community is relatively poor.

Table 4.12. Indicators of Community Health Status

S/N	Parameter	Community			
		Ikot Ansa	Ikot Anwatim	Kasuk	Ikot Ishie
1	Hospital	-	-	-	-
2	Maternity/ Health Centre	1	1	-	1
3	Private Clinic	1	-	-	3
4	Patent Medicine Store	1	3	1	4
5	Potable Water (Spring/Borehole)	2	1	-	5
6	Home toilet facility (pit latrine)	> 80%	50%	30%	70%
8	Environmental hygiene /sanitation/ Waste Management practice	good	Poor	poor	good
9	Housing	Poor	Fair	fair	good
10	Health-seeking behavior	Fair	Fair	fair	Fair
11	KAP on health issues	Fair	Fair	fair	good
12	Community needs	Pressing	Very pressing	Pressing	pressing

Housing

Housing is one of the basic necessities of life, the state of which has a direct bearing on health and quality of life of a people. The Housing facilities in the communities show a mixture of typical rural/ semi urban Nigerian setting, overcrowded, unplanned and without adequate consideration for proper drainage and availability of basic and essential social amenities to support good quality of life.

Poor housing has grave health implications. About 70% of the houses have block walls, with corrugated roofing sheets. About 21% have plastered mud wells with roofing sheets while the remaining 9% have mud walls with thatched roofs or roofing sheets. Overcrowding is a prominent feature, with most households having up to 4 persons/room, which is more than the World Health Organization's (WHO) recommended standard of 1-2 persons/room. Inadequate room spacing and poor sanitary surroundings is partly attributable to the erosion menace. Some of the residents have taken extraordinary measures to stem the encroaching erosion by building embankments and concrete supports around vulnerable houses. The prevailing situation has the potential to escalate major health risks to the people. Overcrowding and poor ventilation are considered major risk factors in the spread of Pulmonary Tuberculosis, and exacerbation of Asthma/Chronic Obstructive Pulmonary Disease (COPD).

Air Pollution and Environmental Health

Fire wood is a major source of fuel for cooking, with the kitchen often located very close to the main living quarters. This constitutes a threat to indoor health as smoke from the fire place pollutes the living rooms and degrades air quality, with potential adverse health consequences. Respiratory problems such as Asthma, Upper Respiratory tract infection, and chronic obstructive pulmonary diseases (COPD) could result. Most of the disease burden due to indoor air pollution reportedly falls on children under 5 years of age (WHO 2008).

Outdoor Hygiene

The sanitary state of the immediate surroundings is also a measure of the housing condition. Houses in the community are generally in close proximity to each other and with no proper drainage systems. There are collapsed culverts, with clogged gutters laden with all sorts of waste products. Some of the wastes are deliberately thrown into drains/gullies to slow down runoff and check erosion, especially at the gully head (Plate 4.3).

Consequently, immediate surroundings in these communities are generally untidy, with litters of various sorts, like dry and decaying leaves, kitchen /human wastes and empty cans. Generally, outdoor hygiene is poor.

Water Supply

The source of water is a major index of health in a community. The lack of access to clean water is one of the major issues tackled by the Millennium Development Goals, MDG. The communities in the Ikot Anwatim gully complex area are bereft of good sources of clean drinking water. The people draw water for drinking and domestic purposes from private boreholes, public water source and rain water during the rainy season. Water is untreated and thus exposing the people to health/environmental hazards and risk of contracting water-borne and skin diseases. The present situation requires Government intervention to improve on the people's quality of life.

Sanitation

The access to basic sanitation is measured by the proportion of the population that has access to good sanitary facility and waste disposal system. By the World Health Organization (WHO) standard, at least 50% of the rural population or urban communities should have access to sanitary waste disposal.

Human Waste Management

The use of pit toilet is popular among community members. However, most homes have water cistern toilet facilities installed but poor water supply limits its use. Despite these, some community members still urinate /defecate in surrounding bushes, open drains and into the gully erosion sites, with attendant consequences on community health (increased air borne/ water borne diseases).

Waste Management and Environmental Hygiene

Proper sanitation and hygiene in the project area were fairly maintained. The waste stream in the area comprises bio-degradable and non– biodegradable wastes. As a general practice in these communities, refuse is collected, taken and dumped in the bush where the refuse is occasionally burnt or buried. Refuse is also dumped into the ravine (Plate 4.3) and some are stored in bins provided by the municipal authority. Uncleared refuse constitutes breeding sites for disease vectors and agents such as flies, mosquitoes and other insects,

and also provides food and shelter for rodents and snakes. Human excreta and refuse constitute an important source of pathogenic organisms. These practices pose a serious health hazard to the community inhabitants.

Plate 4.3: Use of gully as a refuse dump in Ikot Anwatim

Nutrition

The host communities are made up mostly of civil servants, few petty traders and some self employed persons. These communities share the same social-demographics and as such their staple food types are similar, including cassava based-foods like foo-foo and garri, pounded yam, rice, plantain, a variety of vegetables, and fruits like mango, pear and orange. Their major sources of animal protein are fish, goat, chicken and bush meat . There are no food taboos in any of these communities so nutritional deficiencies were not seen. The nutritional status of the people can be said to be fairly good.

Disease Trend

i. Common Illnesses

As seen in similar studies in South South Nigeria, the most recorded health conditions according to the respondents during the Focus Group discussion in order of prevalence are:

a. Malaria (febrile illness)
b. Diarrheal disease
c. Respiratory Tract Infection
d. Measles
e. Cough (TB)
f. Typhoid fever

g. stroke
h. Arthritis
i. Hypertension and Stroke

However, the most common illnesses/health conditions amongst children under 5 years are:

a. Malaria
b. Diarrheal disease
c. Measles
d. Febrile convulsion
e. Asthma

While among the Middle age /elderly the common illnesses are:

a. Hypertension
b. Osteoarthritis
c. Stroke
d diabetes mellitus

Skin diseases are not common.

ii. Disease Vectors

Some of the common disease vectors and transmitters of disease agents found in the community are insects like mosquitoes, housefly, sand flies, cockroach and rodents. The practice of open dumping of refuse and disposal of human waste indiscriminately as well as the vivid closeness of houses to bush patches, are factors contributing to the proliferation and menace of disease vectors and agents in the community.

iii. Occupational Health Risks

The occupational health risks prevalent in the community are summarized in Table 4.13

Table 4.13: Occupational Health Risk prevalent in the Community

S/N	Health Risk	Ranking (1-10)	Predisposing Factor
1	Drowning in run-off water/mud	10	Severe rainfall/flooding, landslides
2	Burns	8	Use of fire wood, bush fires etc.
3	Matchet cut	9	Farming
4	Insect /snake bite	10	Farming, proximity of bush/farmland to human habitation
5	Hoe injury	5	Farming
6	Respiratory infections	7	Pollution from use of fire wood, charcoal etc.
7	Opportunistic infections	5	Farm injury, lack of medical care, poor waste management

Ranking 1(very low) -10 (very high) based on degree of risk.

Knowledge, Attitude and Practice on Health Issues

All the respondents claim to have attained primary school education, more than 50% secondary and 10% tertiary education. Thus, there is evidence of a fair knowledge of key public health issues, e.g. HIV/AIDS, STI, Hypertension, Malaria, and Climate Change from Global warming. The current media enlightenment on these issues in the country has helped in promoting such knowledge amongst the people. Surprisingly the health-seeking attitude and practice of the respondents is good as over 50% of the population under study do seek medical attention to illness. Consequently, self medication and use of traditional medication are not very prominent practice.

i. Life Style and habits

Some of the life styles and habit of the people that are indicators to healthy living are alcohol consumption, substance abuse, bodily exercises, health-seeking behavior, sexual behavior and personal hygiene. Tobacco and alcohol are prominent issues on the WHO's list of health indicators. Most of the respondents indulge in alcohol consumption, some use Tobacco and a few indulge in use of hard drugs especially among the youths. A few people engage in light exercises.

Health Facilities

There is gross inadequacy of standard health facilities in all of the communities. There are Primary Health Centers in Ikot Ansa and Ikot Ishie, with a few private clinics. There are health posts in Ikot Anwatim and Kasuk communities, established by the communities to cater for Antenatal Care of pregnant women/Immunization of infants and under 5s. The health posts are manned by Community Health Assistants. Some residents patronize patent medicine stores and indulge in self medication but most claim to travel to the General/Teaching Hospital if they require comprehensive treatment. There is dearth of health records in the health centers, making it rather difficult to authenticate the prevalent illnesses and total numbers of those who were sick/died over the past one year.

Community Health/General Needs

The priority health-related and general needs of the community based on focus group discussions, interviews and questionnaire survey, compared with direct observation by the

HIA team suggest that the people are well aware of their problems. All the communities were unanimous in demanding an end to the flood menace and checking further encroachment of the ravine. Their Health Needs are summarized in table 4.14 below.

Table 4.14: General/Community Health Needs

S/N	Priority needs	Rank
1	Erosion Control	10
2	Hospital/Medical Doctor / Nurse	10
3	Good Drinking Water	10
4	Schools	8
5	Good road	5
6	Employment	8
7	Electricity	4

Ranking: 1 – 5: pressing need; 6 – 10: Very pressing need

4.12 Public Consultations and Disclosure Requirements

To capture and address issues and concerns of every stakeholder to this project, wide reaching consultation was conducted. The principal objective is to acquire and disseminate information, identify and address legislative, community, and environmental concerns associated with the NEWMAP intervention project at the Ikot Anwatim gully erosion complex area. Initial consultation started with community leaders and stakeholders being informed of the proposed gully erosion intervention project by NEWMAP Project Management Unit (PMU). Subsequently, Stakeholder consultations were carried out (in March-April 2014) with the community, government agencies, parastatals and the CRS NEWMAP PMU. Consultations included interactions with the following:

- State Ministry of Environment
- The Host Communities (Ikot Ansa, Ikot Akpanam, Ikot Ishie, Ikot Abasi Obori and Kasuk)
- CRS NEWMAP Team Members
- Other key stakeholders

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 CRS NEWMAP.

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
- Creating awareness in the communities of the proposed project to avoid conflicts in course of project execution through misunderstanding of the project,
- Identifying issues relevant to the proposed project that might affect existing social, economic and environmental equilibrium,
- Mobilizing host communities to express their collective concerns regarding the perceived negative and positive impact of the proposed project and,
- Obtaining relevant information on the social, political and economic conditions of the community,
- Sensitize the people on possible resettlement as a result of the project.

Some of the photos taken at consultation sessions, with a list of participants are presented as Plate 4.4, Plate 4.5, Annexures 1 and 7.

Identification and involvement of key stakeholders

CRS 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:

o World Bank

o Cross River State Ministry of Environment

o Representatives of Community leaders and youths in proposed project area

o 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 municipality 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.

Plate 4.4: Cross section of stakeholders (project communities' leaders, some CRS NEWMAP staff/consultants etc) during consultation held at Nkonib (Ikot Ansa Town Hall) in March 2014. Standing 6th from right (front row) is Clan Head of Ikot Ansa, HRH Ntoe (Dr.) Patrick Inok Oquagbor V.

Plate 4.5: Stakeholder consultation with Ishie Clan community leaders at palace of the Clan Head, HRH Etubom Effiom Okon Effiom (Seated 4th from left) in March 2014.

Stakeholders Issues:

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.

4.13 Fears and Expectations

Fears

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

- The main fear expressed by the people is whether the gully intervention/road rehabilitation project will be abandoned or completed as scheduled.
- Fears have also been expressed on ensuring timely payment of compensation for project affected houses and economic trees.
- Some community members have expressed concern over the environmental and social hazards (e.g. road obstruction, dust etc) that might be associated with project works.

Expectations

The people have certain expectations from the State and Federal Government of Nigeria and the World Bank. The underlisted were generally considered the priority needs in the community as determined by the needs assessment.

- Internal roads within the community
- Provision of potable water for the people
- Upgrading of schools in the communities
- Provision of standard clinic in the communities

- Compensation for land taken up by project
- Youths employment during intervention works amongst other opportunities
- 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 waiting for and they are very expectant of the benefits this will bring to the people. The project is expected to save lots of houses, land and lives that are currently threatened by erosion. This project therefore is expected to have both short and long term benefits to the host community, Cross River State and the Nigerian nation.

4.14 Grievance Mechanism

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 robberies, prostitution, HIV etc. In general, there are potentially several areas of social impact some of which are mitigated through Corporate Social Responsibility efforts. CRS NEWMAP will 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. A grievance can be submitted in the following ways:

- Using existing grievance mechanism channels. The grievance/complaint is made directly or through Chiefs to the Clan Head/Ward Chairman or Councillor (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 CRS NEWMAP PMU;
- By submitting the grievance directly to CRS NEWMAP PMU (either verbally or via letter/note); and
- By submitting the grievance to the principal contractor who will then be responsible for informing CRS NEWMAP PMU.

All grievances forwarded to the CRS NEWMAP PMU will be recorded in a Grievance/Complaints Register. CRS NEWMAP PMU will be responsible for implementing the grievance response mechanism.

Grievance Response Mechanism

When a grievance is received, the mechanism for dealing with it will be as follows:

- Grievance received;
- Grievance recorded in the Grievance/ complaints Register;
- For an immediate action to satisfy the complaint, the complainant will be informed of corrective action;
- Implement corrective action, record the date and close case;
- For a long corrective action, the complainant will be informed of proposed action; and implement corrective action, record the date and close case.

CHAPTER FIVE

DESCRIPTION OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Various components of the biophysical, health and social environments would be impacted by the NEWMAP Ikot Anwatim gully complex intervention project. The potential impacts are expressed as threats or opportunities to human and environmental wellbeing. Project activities/environmental interfaces generally encompass a broad range of issues: air pollution, water pollution, effects on employment and community structure. These issues have been considered in arriving at the potential impacts of the proposed NEWMAP Ikot Anwatim gully complex intervention project.

5.1 Methodology of the Impact Assessment

Establishing the basis

- ***Baseline development***

- Collection of environmental (biophysical, social and health) baseline data in the project area.

- Integration of environmental (biophysical, social and health) baseline data to develop an integrated understanding of the existing natural and social environment. Baseline data have been described in Chapters 3 (Biophysical characteristics) and 4 (Socio-economic characteristics).

The identified potential project impacts were evaluated qualitatively and categorized as adverse (-would produce negative effects on the biophysical or socio-economic environment) or beneficial (-would produce positive effects on the biophysical or socio-economic environment). Impact significance was evaluated on the basis of risk and frequency of impact and rating of importance of affected environmental component through consensus of opinions among the project stakeholders.

- ***Identification of primary impacts andIdentification***

The identification of the impacts was phase-sensitive. The relevant project phases include mobilization, construction, operation and decommissioning. This approach helped in identifying impacts that cut across most of the project phases. The rationale for screening the likely significant potential impacts of the proposed drainage on the environmental components and characteristics and indicators are derived from the following:

(a) the project activities, equipment types and project facilities layout;

(b) findings of other EIA studies on similar projects;

(c) series of expert group discussions and meetings; and

(d) experience of consultants on similar projects.

The potential severity of impacts and the likelihood of an impact resulting was determined using a Severity and Likelihood Ranking Table and the level of risk determined using a Risk Matrix (Table 5.1)

Table 5.1: Severity, Likelihood Ranking of the identified impacts and risk matrix table.

Severity		
Level of significance		Consequence
1	Minor/Low	Short term localized impact; No detectable impact to the existing environment; Minor illness or injury
2	Moderate	Prolonged but reversible impact on the environment and socio-economic activities
3	Major/Significant	Prolonged impact to the environment which may not be reversible and threatens sensitive ecosystems; Long-term losses of significant resources; Ill health.
4	Catastrophic/High	Irreversible changes to the existing environment leading to loss of biodiversity/sensitive ecosystems and closure of businesses; Fatal injuries/Ill health.
Likelihood Ranking		
Level		Likelihood
A	Almost certain	Typically experienced frequently (i.e. every time)
B	Likely	Will probably occur in most circumstances (i.e. several times, monthly)
C	Moderate	Will occur sometimes (i.e. quarterly)
D	Unlikely	Could occur sometime during project life
E	Rare	Unlikely to occur but can happen in exceptional circumstances

Risk Matrix

		1	2	3	4	5
Likelihood		Insignificant	Minor	Moderate	Major	Catastrophic
A	Almost certain	S	S	H	H	H
B	Likely	M	S	S	H	H
C	Moderate	L	M	S	H	H
D	Unlikely	L	L	M	S	H
E	Rare	L	L	M	M	S

Who is Responsible

H (High impact): Senior Management involvement and planning is needed

S (Significant impact): Senior Management attention needed and careful planning and implementation

M (Moderate impact): impact Management responsibility must be specified

L (Low impact): Managed by routine procedures

5.1 Impact Indicators

The environmental impact indicators are easily observable parameters that will indicate change/deviation, which can be used to monitor the various environmental components. Those considered in this study are summarized in Table 5.2 below.

Table 5.2: Environmental components and potential Impact Indicators

Environmental component	Potential Impact Indicator
Climate	Temperature, Rainfall, Relative humidity, Wind direction/speed.
Air quality	Suspended Particulate Matter(SPM), Nitrogen Oxides (NO_X), Sulphur dioxide (SO_X), Carbon Monoxide (CO), Volatile Organic Compounds (VOCs), Hydrocarbons etc.
Noise and Vibration	Disturbance, Hearing Loss, Speech Interference.
Surface and Ground Water quality	Physico-chemistry (Dissolved and suspended solids, pH, Biochemical Oxygen Demand, Chemical Oxygen Demand, turbidity etc), Microbiology (Total Heterotrophic bacteria and fungi), Toxicology and elemental content.
Pelagic and Benthic fauna	Diversity, Abundance, Productivity, Catch/yield
Shoreline	Vegetation, dynamics, soil, etc.
Biodiversity (Vegetation/wildlife)	Diversity and Abundance
Soil/Agriculture	Soil type, Soil pH, Total Organic Carbon (TOC), Soil nutrients, Total Heterotrophic bacteria and fungi, Hydrocarbon Utilizing bacteria and fungi and Coliform, Hydrocarbon Utilizer; topography.
Socio-economic/Health	Needs and concerns of host community, perceived employment, income level, health risks, waste stream Handling, Treatment and disposal, health, safety and security and infrastructure change etc.

5.2 Potential Impacts

The NEWMAP gully erosion intervention project will be an effective way of controlling flood and erosion, and the consequent environmental damage and loss of property ravaging the Ikot Anwatim gully erosion complex area. The screening of activities of the gully project on the environment indicates that site clearance and excavations and civil works (construction of permanent project facilities, including stone revetment to reclaim and protect exposed soil surface to stop scouring action of flow velocity) pose threats to the biotic and abiotic components. The likely impacts of the Project (positive and negative) on the biophysical and cultural components of the study area are described below. Most negative adverse

potential impacts, especially during the construction phase will be on air quality, relief, water quality and fisheries. Other potential impacts will be on relief/hydrology and wildlife. Anticipated potential beneficial impacts would emanate from increased economic activities in the host community as a result of construction activities, re-vegetation activities, influx of workers, transportation activity, betterment of infrastructure and improvement of education (through skills development). These potential impacts are summarized in Table 5.3 below.

5.2.1 Description of Potential Impacts

Significant Negative Impacts

Road Traffic Accidents

Road traffic Accidents involving motorists, cyclists and pedestrians especially pupils are likely to increase if the volume of vehicular traffic on routes to schools increases. During the construction stage, dismantling of structures, cutting of trees, clearing of bush and foliage, haulage of laterite and other construction materials can form dust bowls obscuring vision. Associated spillage of lubricants on roads can generally cause accidents and increasing speed by truck drivers, not minding road signs, can increase the severity of accidents.

Impacts On Air Quality

Project activities like vegetation clearing, excavation, provision of laterite for filling etc. will impact on the air quality due to generation of dust and gaseous emissions from movement of heavy trucks/machineries. The traffic volume, proximity and vehicle type and pollutant emissions may have negative health impacts. The particulate matter that would be released into the air could reduce visibility and settle on photosynthetic surfaces (leaves). Exhaust fumes from heavy machinery may contain gaseous hydrocarbons and noxious oxides like CO_x, NO_x and SO_x. Gaseous discharges and dust particles from vegetation clearing, excavation and heavy machinery/vehicles during construction could impair lung functions and lead to or aggravate respiratory disorders such as bronchitis and asthma. However, impacts shall be localized to the immediate vicinity of the emission source, and short-term in nature. Due to the localized and short-term nature of the gaseous emissions, coupled with the diluting effect of the local winds, the execution of the gully intervention project shall not significantly affect the air quality of the project area. The potential effects of

prolonged emissions as pollutants of the environment on health are shown in Table 5.4. High risk groups affected by particulate matter include the elderly, infants and those with existing acute respiratory infection or cardiovascular problems (Pope 2000). Evidence base shows that increase in particulate matter can exacerbate asthma (Gavett 2001).

Noise

Prolonged exposure to noise of frequencies greater than regulatory limit can result in temporary or permanent hearing loss. Noise and vibration from heavy construction equipments such as heavy duty trucks, pay loaders, excavators and caterpillars can adversely affect houses close to the construction site with resultant cracks and falling plaster. If the foundation is defective with poor quality blocks used in construction, this could result in collapsed buildings and death. The loud noise and vibration can also cause hearing impairment and communication interference. If no compensation is paid for these damages, this could result in anxiety disorder with its associated consequence of hypertension and stroke.

Table 5.3: Potential Impacts during Different Project Phases

Description of impact	Project Phases		
	Mobilization	Construction	Operation/ Maintenance
Job creation	●	●	●
Improved Business Opportunities/ Economic Enhancement		●	●
Improvement of existing Infrastructure		●	●
Skills acquisition		●	●
Increase in potential for road traffic Volume and risk of accidents/injury	●	●	
Movement of heavy equipment to work sites which may pose danger to public	●	●	
Influx of people, *leading to*			
Alteration in age-sex distribution	●	●	
Increase in local population	●	●	
Pressure on existing infrastructure	●	●	
Increase in communicable diseases (including STIs)	●	●	
Increase in cost of living/Inflation	●	●	
Increase in social vices/awareness	●	●	
Stress on existing security Structures	●	●	
Injury/fatalities in workforce/Communities	●	●	
Increase in respiratory diseases	●	●	
Alteration/destruction of ecosystem	●	●	
Reduction in air quality	●	●	
Increase in noise nuisance	●	●	
Emotional disturbances	●	●	
Potential for increased community Unrest	●	●	
Migration of birds and animals		●	
Loss of medicinal plants and economic trees		●	
Reduction in biodiversity/ Loss of Flora Fauna		●	
Increased water run-off		●	
Potential for erosion and flooding		●	
Decreased quality of run-off water		●	
Increase in breeding grounds For disease vectors		●	●
Alteration of soil fauna community		●	
Soil degradation and soil/groundwater contamination		●	
Loss of employment (after commissioning)			●
Impacts to endangered species			

Table 5.4: Selected pollutants and their health effects

Pollutant	Health effect	Comment
Carbon monoxide	Cardiovascular disease	Clear side effect
Nitrogen dioxide	Lung function response to allergens and cardiovascular disease (CVD)	Definite association
Ozone	Respiratory symptoms, lung function impairment	Depletion of Ozone layer causes adverse health effect.
Fine particles	Respiratory, Asthma CVD, myocardial infarction, carcinogen	Definite effect of fine particles from motor fuel especially diesel
Sulphur dioxide	Respiratory, CVD	

Source: HIA on St Mellon Link Road Development 2002

Impacts On Surface Waters

Domestic water quality is fair to good and is sourced mostly from boreholes and to a limited extent from local streams. During the execution of the NEWMAP intervention project in the Ikot Anwatim gully erosion complex area, several wastes shall be generated. Some of these wastes could end up in the adjoining Ikot Anwatim stream and Calabar River. These activities/sources of wastes shall include:

- Site clearing
- Deep excavation and embankment
- Provision of laterite for filling
- Construction of concrete culverts and drainage facilities.
- Use of organic/inorganic fertilizers for re-vegetation purposes.

The impacts on water quality shall include the following:

- Suspended inorganic solids (storm water contaminants) can induce blanketing morphological changes (light reduction), resulting in reduced productivity and physical damage to organisms.
- Suspended organic solids induce enrichment blanketing and reduce dissolved oxygen (DO) levels, resulting in altered carbon fluxes and alteration of successional processes. At sub-lethal levels toxic organics can be bioaccumulated, leading to selection of tolerant species and alteration of natural successional processes.

Impacts on Fisheries and Fishing Activity

Storm waters from the project will ultimately terminate in the Calabar River, the main fishing ground for shoreline communities. However, no fishing activity was observed within proposed project boundaries. Moreover, the project does not envisage movement of heavy equipment and supply boats along the Calabar River, which could also cause temporary disturbance to fishing activities along midstream and the bankside. The project will not have significant impact on fishing activity. Ordinarily, one would expect that spawning sites at the discharge point could be destroyed. The project is expected to significantly reduce the volume of sand/debris getting into the Calabar River. Consequently any negative impacts on fisheries are expected to be minimal. Any disturbance to spawning sites will be compensated for by several other spawning sites that are available along the estuarine coast.

Impacts On Soils

Soil will be exposed to direct rays of sunlight as vegetation is removed. This may elicit erosion, increase in soil temperature and changes in soil moisture regimes. These will in turn lead to changes in soil physical characteristics and subsequent mortality of edaphic organisms. The impact of machines that will be used will lead to soil compaction, loss of organic matter, deterioration of soil structure and reduction in infiltration rate and water holding capacity. These impacts will be direct and long term. Other impacts include:

- Loss of residence and farmlands (including homestead farms)
- Loss of soil structure and increased soil erosion tendencies
- Reduction of soil productivity via soil pollution and pedoturbation (fauna, flora etc);
- Decreased fungal and microbial load of soil environment could deprive the inhabitants of major microbial benefits of the ecosystem. Nutrient cycling of organic matter will be obstructed. This can affect primary producers and affect crop production and yield.
- Increased use of land for recreational and non-residential purposes.

Hydrogeology Impacts

- Compaction and settlement of the subsurface due to imposed load.
- Interruption of subsoil and overland drainage patterns.

- Increase in volume and velocity of runoff. Improper canalization (especially at the project end point), broken down/blocked canals could increase the frequency and severity of flooding in some areas.
- Increased risk of land slippage/slumping and accelerated soil erosion.
- Decreased base flow (ground water contribution to stream flow). This decrease in water can cause streams in the study area to become intermittent or dry.
- Seepages of effluents: Construction equipment generates large volumes of waste oil. Improper discharge and/or storage, and leakage (including effluents from sewage tanks) can result in the contamination of soils, surface water and underground water.

Impacts On Ecology (Ecosystem Response)

Migration of Wildlife/Loss of Biodiversity

Clearing of remnant forests along the project intervention route will result in habitat destruction. Habitat destruction will result in loss of biodiversity, destruction of potential nesting/breeding sites and emigration of wildlife from the project area. Where there is no adjoining vegetation for refuge, these animals may gradually be exterminated or turn to be pests or disease vectors in human homes. Other impacts include loss of natural runoff/storage capacity in vegetation, wasteland and soil. The design of the proposed intervention project envisages the channeling of storm waters from some of the gully fingers, following dissipation of detrimental hydraulic energy of flow through the stilling basins/check dams, into the swamp forests at the project endpoint. This could cause changes in hydrological regime in the area, with new tolerant communities emerging in balance to the new hydrological regime. Though these impacts may be local in extent but may be serious, direct and irreversible.

Impacts on Health of workers and project community

The health impacts of the project on the host community will be associated with construction activities, traffic, air quality, noise level, waste management, soil erosion, occupation, safety, relocation and resettlement. The impacts include:

- Increase in communicable diseases (including STIs): The influx of a largely youthful, sexually active people, many of whom are likely to be single is anticipated to

increase the potential for casual sex and the transmission of STIs. Experience from past projects indicates that commercial sex workers often constitute a significant proportion of camp followers and if the same occurs for this project, it is likely to increase the risk of contracting STIs. Also, the presence of youthful people could lead to various social pathological conditions such as increase in crime rate, fraud, prostitution, drug and alcohol abuse, etc.

- Vibrations may also create ground water (aquifer) pollution. Consequently water borne diseases such as typhoid, paratyphoid, fever shigellosis, amoebic dysentery etc could increase.
- Increase in breeding ground for disease vectors. Standing bodies of water (if storm waters are not properly channeled) could enhance the breeding of *Anopheles gambiense* and *Aedes aegypti,* the main species of mosquitoes that serve as vectors in the transmission of malaria.
- Personnel injury/death resulting from welding burns and malfunction/ mal-operation of excavator/cranes etc.
- During excavation, workers and members of the project community are likely to be exposed to a lot of dust and consequent respiratory problems. Besides, bacterial and parasitic infections are likely to occur since casual workers often pass excreta on bare ground at the roadside. This could pollute local water bodies and expose community members to health problems. Pollution of water bodies could also result from continued dumping of refuse in project re-vegetated areas.
- Non-payment of compensation commensurate with demolished buildings, workshops/sheds, destroyed farmlands/economic trees within project boundaries can result in ill health.

Socio-economic Impacts

The influx of workers and service providers will result in more social diversity with the potential social problems of conflict and deviant behaviour. This will put pressure on existing security facilities/personnel in the locality. CRS NEWMAP and her contractors shall work with traditional leaders and existing social groups in the area to ensure good relations, with youths and women being included as important stakeholders.

The NEWMAP Ikot Anwatim gully complex intervention project will provide some employment opportunities to the unemployed youths particularly during site construction. However, most of the youths may not possess skills that are related to project activities. The number of people employed shall depend on the total work force and the proportion of the work activities that can be handled by unskilled personnel. Provision of employment during the construction activities shall have the additional benefit of augmenting household incomes and improving their wage earning ability. Although the length of employment and number of employees may decrease progressively, income earned from such employment could be used as capital for small businesses etc., and this could further boost their economic position and overall welfare.

During mobilization of personnel and equipment to site, there might be increased traffic along some sections of the Murtala Mohamed Highway, particularly from Ikot Ansa bus stop (gully finger 1), through Beebobsco road intersection and the Calabar- Calabar round about. This could result in occasional, though localized, disturbance to local commuters, residents and people getting into Calabar.

Some of the socio-economic impacts are summarized as follows:

- During mobilization**,** movement of goods, personnel and equipment will create unskilled jobs (offloading, storing, security-related, etc.) that should go mostly to locals.
- During the site preparation (demolition/excavation etc) and construction, community members and a few nationals will benefit from land clearance and ground preparation jobs. During actual construction, locals and nationals will be engaged in most of the skilled and some of the non-skilled job positions.
- Movement of the workforce during the mobilization phase will trigger an increase in local economic activity especially for food vendors, retailers, landlords, transporters, etc. This will promote economic empowerment of the local populace.
- During the construction phase, in particular, it is estimated that slight increases in the population of the area could occur due to incoming workers and camp followers. The local economy will enjoy a "boom" that is expected to last throughout this phase and even slightly beyond. However, during the operations phase, when most of the

workers might have been demobilized, the local economy might suffer a "bust", as demand levels will drastically drop.

- Skills Acquisition: The construction, operation and management of the project have the potential to offer to qualified community members (who may be employed in the project), new skills in construction, watershed management, landscaping/forestry practice and overall project development and management.
- Increased potential for road traffic volume and risk of accidents/injuries: It is anticipated that road traffic might be disrupted during mobilization of personnel and equipment to site. Throughout the construction phase traffic is also expected to be disrupted because people and vehicles may be diverted away from the project area or confined to use only a section (lane) of the road. Given the present narrow condition of most existing roads, these disruptions and increases in volume of traffic have the potential to cause traffic jams and increase the risk of accidents.
- Pressure on existing infrastructure: Influx of people mostly during the mobilization and construction phases will put more pressure on the already deficient physical, social and economic institutional infrastructure. Increased pressure on existing infrastructure may also result from the disruption/destruction of power and telecommunications cables crossing roads in and to the project area.
- Increase in Community Unrest: During all project phases, there would be an influx of people (job seekers, business persons, CSWs, etc). If the locals perceive that the immigrants would deprive them of job/business opportunities, it could lead to community unrest. Intra-communal conflicts with respect to job opportunity allocation might also occur.
- Non-payment of compensation commensurate with demolished buildings, workshops/shades destroyed farmlands/economic trees along the project site can result in apathy towards Government or World Bank funded projects. The sense of personal loss associated with loss of ancestral lands (for those who might be relocated or resettled) may result in resistance to relocation.

5.3 ENHANCEMENT & MITIGATION MEASURES

Recommendations have been made to mitigate or control the negative impacts identified in this study. The control/mitigation measures are based on the baseline conditions with

regards to the biophysical environment, socio-economic and health status of the host community. The baseline information referred to in this study has been incorporated into this ESMP document (See Chapters 3, 4). Also considered were the project activities and their envisaged impacts and concerns of stakeholders during consultation meetings and socio-economic/health status of the host community. The mitigation measures proposed are in keeping with World Bank's performance standards, Nigerian environmental laws at National and State levels (FMEnv; Cross River State Ministry of Environment policies), Social wellbeing and Concerns of stakeholders. To successfully mitigate all the social impacts that may be associated with this project, it is recommended that CRS NEWMAP PMU establishes a Stakeholder Forum to include directly affected parties, representatives from the local municipality and other identified persons. The forum will serve to communicate project progress, material changes to the project, grievances received and corrective action taken. Further details on stakeholder participation are provided under public consultations and disclosure requirements (please see Chapter 4 of this ESMP report).

The mitigation measures proposed for the predicted impacts of the proposed gully erosion intervention project recognized the following:

- Feasibility of application of the measures in Nigeria
- Concerns of stakeholders.

Impact mitigation may involve all or some of the following:

- Avoiding the impacts altogether by not taking a certain action or parts of an action.
- Minimizing the impacts by limiting the degree or magnitude of its action.
- Rectifying the impact by repairing, rehabilitating/restoring the affected environment.
- Compensating for the impact by replacing or providing substitute resources.
- Assessment of residual impact after implementation of mitigation measures and a demonstration that any residual impact is as low as reasonably practicable (ALARP).

5.3.1 Description of Mitigation Measures

Increase in Road Traffic Volume and Risk of Accidents/Injury

In order to mitigate the anticipated increase in road traffic during all phases of the project, CRS NEWMAP shall request the contractor(s) to ensure that roads in the project site are

pedestrian friendly. Furthermore, in order to reduce traffic congestion and discomfort to road users, especially during the mobilization and construction phases, movement of large and slow-moving vehicles will be scheduled during off-peak traffic periods. Arrangements should be concluded to map out alternative routes that will be traversed by vehicular traffic in the case of temporary denial of access ways.

Personnel Injury (Prevention of risks from confined spaces and excavations)

Confined spaces that may be present in construction or demolition sites include silos, vats, hoppers, utility vaults, tanks, sewers, pipes and access shafts. Ditches and trenches may also be considered confined spaces when access or egress is limited. The appropriate measures are addressed in the WB/IFC General EHS Guidelines. In addition to this guidance, the occupational hazards associated with confined spaces and excavations in construction and decommissioning sites should be prevented according to the following recommendations:

- Controlling site-specific factors which may contribute in excavation slope instability including, for example, the use of excavation dewatering, side-walls support and slope gradient adjustments that eliminate or minimize the risk of collapse, entrapment or drowning.
- Providing safe means of access and egress from excavation, such as graded slopes, graded access route, or stairs and ladders.
- Avoiding the operation of combustion equipment for prolonged periods inside excavation areas where other workers are required to enter unless the area is actively ventilated.

Loss of biodiversity

Light in construction areas should be directed so as to reduce illumination of surrounding areas and minimize disturbance to nocturnal fauna, where security and health and safety factors allow. Vegetation from cleared areas should be left to rot and burning should be prohibited if a fire hazard exists (as in the dry season). All construction personnel should be provided with appropriate training in ecological awareness, as appropriate to their work activities. Effective short term measures for slope stabilisation, sediment control and subsidence control should be provided.

Loss of livelihoods

Providing alternative activities, capacity building training or employment opportunities can lessen the effects of this impact. The influx of more money into the local economy will likely have a positive impact upon the traders by having a higher demand for their products and more customers with the attendant higher prices for their goods. However, it may negatively impact upon the standard of living for other inhabitants in the area, particularly among socially marginalized groups.

Movement of the workforce during the mobilization and construction phases will also trigger an increase in activity for food vendors, landlords, transporters, etc. This will promote economic empowerment of the local populace. The local economy will enjoy a "boom" that is expected to last throughout this phase and even slightly beyond.

The gully erosion intervention project is expected to create jobs during different phases. During mobilization, and construction, a number of jobs will be created that locals and nationals will be expected to take advantage of. Also, in order to sustain enhanced job creation opportunities throughout the life of the project, CRS NEWMAP shall encourage qualified contractors from the project area to bid for subcontracts they are capable of executing.

Increase in community unrest

The presence of a large number of vehicles and unusual movements is likely to create agitation within the communities given the present state of the roads. As a mitigation measure, the contractor and CRS NEWMAP shall maintain established channels of communication and inform communities in advance of all the phases of the project.

Community unrest could stem, amongst others, from perceptions of failure by CRS NEWMAP to deal even-handedly with all strata of community stakeholders. This situation may continue during the project. In order to deal with this, CRS NEWMAP shall establish channels of communication with the communities during all phases of the project.

During construction, there could be agitation for employment. CRS NEWMAP shall require contractors to hire local labour where feasible. Unskilled labour shall be drawn from the community; preference shall be given to qualified skilled labour from the project area. It is important that CRS NEWMAP ensures that the contractors adopt transparent approaches in matters of employment even for the unskilled labour. CRS NEWMAP shall honour all MOU items with the local communities.

Reduction in quality of health

Site clearing is expected to cause the proliferation of environmental disease vectors, e.g. mosquitoes, rodents, snakes etc. and also injuries from construction activities. The community has no standard health facility. CRS NEWMAP should ensure contractor maintains a well equipped Accident/emergency unit or maintains a medical retainers hip with a nearby clinic during the construction phase of the project. Also, there is need for periodic health education/enlightenment programmes to raise people's awareness and change their attitude and practice of sanitation and waste management. Contractor should arrange for provision of clean, hygienic and potable water in the event of disruption of water supplies from boreholes within the project boundary.

Soil degradation and Soil/Groundwater Contamination

The major refuse disposal methods seen within the community are open dumping, burning and dumping into the gully or shallow pits beside the house. Pit toilet is commonly used for human waste disposal. There is no deliberate waste management practice in place. Construction equipment generates some volumes of waste oil. Its proper handling is critical because improper discharge and/or storage, and leakage can result in the contamination of soils, surface and underground water if there is a lack of a controlled fuelling, maintenance and servicing protocol for construction machinery at the project site. Storage areas should, therefore, be made of impermeable materials and fuel handling and storage should take place on impermeable surfaces.

The following matrices (Table 5.5) provide a summary of the mitigation and enhancement measures identified and recommended to ameliorate all the significant associated and potential impacts identified for the NEWMAP Ikot Anwatim gully complex intervention project.

Table 5.5: Mitigation measures for identified associated and potential impacts of the NEWMAP Ikot Anwatim gully complex intervention project.

Associated and Potential Impacts	Mitigation Measures
Land-take for project works/demolition of existing (19?) buildings, sheds, septic tanks and other structures within the limits of construction; Legal issues.	Required resettlement of residents and businesses; Providing alternative activities, capacity building, Equity, conflict prevention and resolution mechanisms; Promotion of vegetative, and adaptive natural resource based livelihood measures/ Community based forest management planning of restored sites. Ensure that measures outlined in the Resettlement Action Plan for the project are implemented.
Increase in potential for road traffic volume, traffic jams and risk of accidents/injuries	• CRS NEWMAP PMU shall ensure pre-mobilization inspection of all vehicles. • Vehicles shall be maintained at optimal operating condition to avoid breakdown and obstruction of roads. • NEWMAP PMU shall ensure that contractor provides a mobile workshop in case of unforeseen breakdown. • Visible warning signs shall be placed on roads and large construction vehicles. • If vehicles are parked on an incline set parking brakes and chock wheels. • Effective journey management (Large and slow moving vehicles shall be scheduled during off-peak periods). • Contractor shall ensure that only certified and medically fit drivers are used for all vehicles. • Arrangements should be concluded to map out alternative routes that will be traversed by vehicular traffic in the case of temporary denial of access ways. • Contractor shall organize Defensive Driving Course for all vehicle drivers. • Contractor shall maintain adequate first aid in all project vehicles; • Awareness creation amongst communities on potential of increase traffic. • Daily pep talk are conducted with job hazard analysis carried out
Waste generation from construction activities	Waste minimization, Recycle, Reuse, Give away or sell.
Site Hazards – Community interaction with site works; Accidents resulting in injury or death.	Where there is a potential for the community (including workers) to be exposed to hazards. The Contractor shall: • Identify the hazard; • Inform all individuals/communities as to the presence and nature of the hazard/increased traffic. • Restrict public access to work areas including construction areas, staging and storage sites via appropriate security. This will include: • Security fencing and appropriate signage;

	• The presence of security personnel; • Permitting of site access with a requirement for site induction and the use of appropriate personal protective equipment (PPE). • Identification and enforcement of haul routes (including avoiding dangerous routes during specific times); • Establishment and enforcement of speed limits for all construction related vehicles;
Personnel Injury (fatalities in workforce resulting from ergonomic Risks and malfunction/wrong operation of equipment).	• Provision of training to all drivers on the requirements for safe driving measures, e.g., speed limits; • Consult with local emergency services to agree on procedures for accidents/ emergencies relating to construction activities; • Compensation for proven project-induced injuries, accidents and fatalities • Equipment used shall be properly maintained. • Equipment operation shall be by competent personnel with years of experience in excavation. • Use PPE as appropriate for the task (e.g. hard hats, gloves, work vests). • Provide conveniently located equipment for lifting heavy objects; • Train workers on ergonomic risks and prevention. • Prevention of risks from confined spaces using appropriate EHS measures (discussed in Section 5.3.1 below)
Disruption of power cables crossing road underground power and communications cables, water pipes etc.	• Conduct pre-construction survey to identify any existing underground Cables and pipelines. These should be properly relocated before trenching/ Excavation. • Drivers and vehicles shall avoid physical contact with power cables at road crossings during movement of equipment/bulky materials.
Loss of top soil; soil degradation, potential for erosion and flooding on the project site	• Soil shall be stabilized especially in hilly areas using Compactors/stone pitching/grassing to reduce erosion potential. • Use of Gabions and Reno Mattress to stabilize side slopes in areas affected or not affected by filling/cut. • Storm waters shall be properly channeled, with provision for stilling basins and check dams and rip rap at the outfall. This will dissipate detrimental hydraulic energy of flow before final discharge to the swamp (project end point). • Preserve forested areas. Any non-paved area to be re-vegetated immediately. • Provision of interlocking blocks for slope protection around the gully head • NEWMAP PMU shall encourage community members to minimize impervious area (minimize paved yards) by grassing/tree planting.

Pollution of stream/river from storm water Contaminants (especially at project end point); change in hydrological pattern.	• Preserve forested areas. Vegetated areas are essential to filter the water before discharge into stream/river. • Sediment traps/Trash rack shall be provided at the entrance point of drainage channels upstream to prevent debris from entering into the channel.
Contamination of soils, surface water and underground Water from spilled oil/fuel from storage facilities and sedimentation.	• Operators shall be trained on safe fuel handling practice. • Storage containers shall be periodically checked for leaks. Containers shall be provided with secondary containment capable of holding 110% of its contents. • Monitor waste water and sewage discharges in line with FMEnv. requirements. • All effluents shall be treated to regulatory limits before discharging into the environment. • Contractor shall ensure that untreated effluents are not released into the public drain or bush. • Storage areas should also be made of impermeable materials. • Fuel handling and storage should take place on impermeable surfaces.
Increase in breeding ground for disease Vectors	• Burrow areas should be well selected in order to cause minimum negative impact. • CRS NEWMAP to ensure maintenance of chute channels and stilling basins during operation
Reduction in biodiversity/Loss of Flora and Fauna; Alteration/destruction of ecosystem.	• Preserve forested areas. Site for base camp shall be at a location with the most minimal impact on the vegetation and forestry resources. • Site clearing shall be limited to the area needed. • Use of bulldozers for site clearing shall be minimized. • Re-vegetation of trucking space shall be carried out as far as practicably possible.
Reduction in air quality/ Increase in respiratory diseases/ Increase in noise nuisance	• Contractor shall ensure that only pre-mobbed equipment/vehicles are used • Water shall be sprayed on construction site to reduce fugitive dust levels especially during dry season. • Inspections and regular maintenance of equipment shall be conducted. • Construction workers shall be compelled to use PPEs (including nose masks) as appropriate. • Engines shall be switched off or reduced to idle when not in use. • Contractors should enforce no night driving policy. • Communities shall be consulted by the Contractor prior to periods of expected peak noise levels. • Contractors shall ensure that combustion engines are fitted with effective silencers;
Pollution from solid wastes	• Woody plant debris, Cement slurries and mix, Scrap metal, metal clippings, nails etc. resulting from the project shall be periodically moved to designated scrap yard for further management. The scrap yard shall

	be located around the project/camp site.
Change in public health due to workers influx (Increase in communicable diseases including STIs)	• CRS NEWMAP shall undertake community based training on the prevention of common communicable diseases, water protection/purification techniques and basic sanitation. • CRS NEWMAP shall support activities of National Action Committee on Aids (Cross River State) in the area. • CRS NEWMAP shall encourage workers to as much as possible avoid sexual interaction with the locals. • Contractor shall include requirements for entrance and exit medical exams for recruitment of workers.
Pressure on existing infrastructures	• Workforce shall as far as practicable, be isolated from host communities. • Base camp should be self sufficient with medical facilities. • Prior to commencement of the construction phase, CRS NEWMAP/contractor shall advertise construction Jobs that will be available. This will, hopefully, discourage unqualified personnel from moving into the project area.
Blockage of drainage canals. Potential for increased injuries /fatalities (if poorly maintained)	• CRS NEWMAP shall ensure regular de-silting and repairs to concrete canals, chute channels and stilling basins
Increase in social vices	• Intensive enlightenment campaign and health education for the abatement of abuse of drugs and alcohol shall be carried out in the communities and among workers throughout the life of the project. • CRS NEWMAP shall ensure that Contractor enforces the no alcohol & drug policy for staff. • CRS NEWMAP shall support public health lectures with emphasis on common communicable diseases such as malaria, TB, STIs including HIV/AIDS. • CRS NEWMAP shall ensure that Contractor Implement social and health awareness programs for all workers at Induction and on a continuous basis throughout the life of the project.
Armed robbery attacks	• Engagement of private security agents • Contractor should perform appropriate due diligence on any security personnel with regard to past performance (e.g. violence, etc.). • Engagement of Police whenever money/materials are to be moved to site; • Materials shall not be handled in a way to attract third party • Cash shall not be paid on site or transported to site without security arrangement.
Damage to designated sacred sites and shrines	Not applicable as no sacred sites and shrines were found in and around the vicinity of project boundaries.

Agitations by stakeholder communities	• CRS NEWMAP shall brief all employees and contractors to ensure awareness of and sensitivity to local cultures/traditions of the host community. CRS NEWMAP shall advise all employees and contractors against entering sacred forests or tampering with totems where applicable. • CRS NEWMAP shall maintain established channels of communication with host community throughout the duration of the project. • CRS NEWMAP shall require contractors to hire local labour for unskilled job positions and possibly skilled jobs. • Utilisation of imported labour should be reduced to the very barest minimum and should be concentrated on skilled activities for which local personnel may not be readily available. • No night-driving policy shall be enforced by all the contractors; Construction activities shall be limited to daytime hours; Contractor shall utilize low noise generating equipment as much as practicable.

[1]The RAP report identifies a total of about 322 PAPs (for all sites) using an offset (from the gully edge) of 5-15 m, respectively.
Land-take for project works includes displacement of people, change of livelihood and encroachment on private property. Comments refer to land that has been purchased/transferred and affects people who are living and/or squatters and/or operate a business on land that is being acquired. A displaced person refers to any person or persons who would be identified, during the project/ subproject to be affected by any of the following circumstances: Whose business/livelihood is in part or as a whole affected by the project.

5.3.1

5.4 Stakeholder Perceptions/Participation

Public interest in this project is high because of the elimination of the threat to lives and property caused by gully activities and the anticipated reconstruction of the laterite road washed away by gully activities. Also, the project is likely to engender socioeconomic transformation coupled with its impacts on the surrounding communities during the construction and operation phases (e.g. noise, traffic, dust, emissions etc) and through the influx of workforce.

A number of impacts were judged to be perceptions of stakeholders rather than impacts arising from (scientific) assessment of a cause and effect relationship of the project activities. Such perceived impacts include:

Availability of potable water

- The community members perceive that potable water will be extended to them in the course of the project execution.

In spite of the measures recommended to mitigate adverse impacts, stakeholder perceptions are likely to persist. The following reasons have been given as responsible for unsuccessful and non-sustainable programmes and projects in developing economies:

- Lack of effective participation and involvement by stakeholders in decision-making processes and planning, because a top-down planning approach is usually adopted.
- Lack of education and training at community level
- Lack of recognition of indigenous practices by professionals and other key players.

Consequently, the project proponents should utilize participatory mechanisms to carry the host community along during all the phases of the proposed project. Stakeholder participation and consideration of stakeholder perceptions have been utilized in this ESMP preparation. This will ensure that the proposed project is successful and sustainable.

CHAPTER SIX

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

General

CRS NEWMAP has developed this Environmental and Social Management Plan (ESMP) to identify the environmental and social management and mitigation actions required to implement the NEWMAP Ikot Anwatim gully complex intervention project in accordance with the World Bank's Performance Standards and the requirements of applicable Nigerian legislation and environmental policies. It provides an overview of the environmental and social baseline conditions of the project area, summarizes the potential impacts associated with the proposed gully intervention project and sets out the management measures required at all phases of project development in an Environmental and Social Management Plan (ESMP). The ESMP is to be utilized by the contractors commissioned by CRS NEWMAP for the project and will form the basis of the site-specific management plan that will be prepared by the contractors as part of their construction methodology. The potential impacts and associated mitigation measures and management procedures presented in this ESMP are based on the baseline information and assessments made during a single-season field data gathering exercise in March-April 2014.

The objectives of this ESMP include but not limited to the following:

- Achieve, enhance and demonstrate sound environmental performance built around the principle of continuous improvement;
- Avoid, where practicable, and reduce impacts on terrestrial and aquatic habitats and specific habitat features of ecological importance.
- Minimize potential air emission impacts on receptors.
- Minimize potential effects on water resources and associated receptors (i.e. rivers, streams, drainage channels, ponds, groundwater resources and associated users and specific flora and fauna).
- Minimize, contain, transport, handle and dispose of solid and liquid wastes arising from project construction activities in such a manner as to minimize impacts to human health and the environment;

- Prevent risk and resulting adverse impacts of the contractors activities on the health, safety and wellbeing of individuals and the community.
- In the event that damage or harm is caused, take action to repair and return to condition comparable to pre-impact condition;
- Implement a system to maintain communication with the community and raise awareness of proposed construction activities and the potential impacts that they may represent.
- Identify the roles and responsibilities of the environmental and social management organization of the project; and
- Ensure compliance with existing legislation.

6.1 Environmental Management System

Organization and Responsibility

For clarity in the management structure, the Project Management Unit (PMU) of CRS NEWMAP will be the focal point for environmental management issues related to the operation and construction phases of the project implementation programme. That is, CRS NEWMAP PMU will be responsible for the management of all phases of the project and also have overall responsibility for planning, implementation, monitoring and enforcement of activities associated with this ESMP and environmental and health and safety performance. CRS NEWMAP PMU shall assign an environmental officer with the responsibility to liaise with the contractors/sub-contractors towards review and implementation of the mitigation measures necessary. Environmental protection should be seen as a line responsibility for which everyone has accountability. Individual responsibility, from senior administrators who allocate resources and monitor environmental performance to individual staff and contractors who have responsibility for environmentally sound practices in their workplace, will be defined in job descriptions and company contracts. These guidelines shall ensure that the detailed design complies with the conceptual design. The project implementation team (i.e. PMU) shall include:

- The environmental officer, who shall be an environmental specialist, preferably of the status of a Director.
- The project quality assurance engineer/scientist of CRS NEWMAP.
- The community liaison officer (CLO) of CRS NEWMAP.

- Representatives from the immediate host community.
- Relevant government departments (CRS Min. of Env., Forestry Dept. etc.).

It shall be the responsibility of the environmental officer to ensure that the design provided for implementation conforms to those in the concept plan. The design presented for implementation may be reviewed using relevant checklists and approved, referred or rejected if considered environmentally unjustifiable.

Consequently, the EMP shall be updated and revised periodically, throughout the project's life span to incorporate improved technologies, better environmental management systems and in the event of new policies or guidelines from governmental agencies.

This ESMP shall remain a dynamic working tool and will be owned by CRS NEWMAP or at project expiration such other establishment that will take over her responsibilities. Constructive suggestions by users (contractors, management, line and operating personnel) shall be assessed by the PMU and integrated into the ESMP. It shall be reviewed with changes in regulatory regime and in the event of new policies or guidelines from regulatory/governmental agencies. All contractors and subcontractors shall comply with the ESMP requirements as applicable to the tasks they are employed to undertake. The measures and procedures outlined in this ESMP are commitments made by CRS NEWMAP PMU and therefore remain responsible for their implementation. It is recognized that practical implementation of many of the measures may rest with contractors and subcontractors and consequently, CRS NEWMAP PMU will require the implementation of a robust review/audit programme, as described in this ESMP, to measure and ensure that it is executed on her behalf.

The contractor shall ensure that all personnel responsible for the execution of the tasks and requirements contained in this ESMP are competent on the basis of education, training and experience. The Contractor's training activity associated with this ESMP shall be appropriately documented by means of a training needs assessment, training matrix/plan and records of training undertaken.

Legislative Background and Standards

Legislation concerning development, planning and environmental protection for the NEWMAP Ikot Anwatim gully complex intervention project has been reviewed and incorporated into this ESMP document (please see Chapter Two). The environmental management activities for the different phases have been guided by environmental standards including World Bank policies, national legislation, international conventions and agreements and policies of the Cross River State Ministry of Environment.

6.2 Training and Awareness (Capacity Building)

CRS NEWMAP and the principal contractor shall ensure that all persons responsible for undertaking work during the life of the project must be trained on the contents of this ESMP. All staff of CRS NEWMAP and all members of the workforce for the gully intervention project will be made aware of their environmental responsibilities through induction and training courses. All site personnel must have a basic level of environmental awareness training. Topics covered should include:

What is meant by "Environment"?
Why should the environment be protected and conserved?
How do construction activities impact on the environment?
What can be done to mitigate against such impacts.
The training shall also include the following:

- Safety induction course,
- Emergency and spill response drill,
- Social responsibility during construction (Community interaction and relations)
- Basic First aid for first aiders and more in depth training for selected personnel,
- Defensive driving,
- Permit to Work System

The awareness programme will help develop environmental awareness and sensitivity amongst the personnel and shall be reviewed periodically. Safety awareness campaigns shall also be conducted for the host community and general public with the aim of sensitizing them to the potential impacts and hazards associated with the CRS NEWMAP gully intervention project and the appropriate response to accidents/incidents. The

public awareness campaigns shall be conducted periodically and the proceedings documented for subsequent audit.

6.3 Construction Guidelines

The principal contractor will be required to allocate the responsibility of overseeing day to day compliance with the ESMP to a senior member of his/her staff. The principal contractor will be responsible for the implementation of all measures included in the ESMP for all activities undertaken in terms of the construction contract (including work undertaken by sub-contractors). Compliance reviews will be submitted by the principal contractor to CRS NEWMAP PMU on a weekly basis. Non-conformances, incidents and deviations from the action plan will be communicated to CRS NEWMAP PMU as soon as possible within 24hours from the time of occurrence. All tendering contractors will be required to provide a formal commitment to comply with the requirements of this ESMP. The contractor will undertake to provide formal written reports to CRS NEWMAP PMU. General environmental management conditions for construction contracts and civil works are summarized in Annexure 3 of this ESMP document.

6.3.1 Human Resource Policies and Procedures

All workers for the appointed contractor must have a contract which describes the employment relationship. The contract shall describe all policies and procedures related to working conditions and terms of employment. There shall be no discrimination against vulnerable groups, including women workers, young workers (but not child labour), migrant workers and workers with disabilities (i.e. Non-Discrimination & Equal Opportunity). Policies and procedures must cover all workers, including direct, contracted and supply chain workers.

6.3.2 Occupational Health and Safety

The appointed contractor will identify potential hazards and develop responses (including organization, use and maintenance of workplaces, working environment and work processes) to eliminate sources of risk or minimize workers' exposure to hazards. Where hazards are inherent to the project activity, or it is otherwise not feasible to completely eliminate the hazard, residual risks shall be managed through appropriate protective measures, such as controlling the hazard at source through protective solutions and by

providing adequate personal protective equipment at no cost to the worker. Training must be provided to all workers on all relevant aspects of occupational health and safety associated with their daily work, including emergency arrangements. Third parties (visitors and external service providers) must be briefed on the relevant aspects of health and safety and emergency response when accessing the premises. The appointed contractor must document and report occupational injuries, illnesses and fatalities. Adequate access to first aid and medical assistance in cases of work related accidents or injuries must be provided.

Community Disease

The Contractor will be responsible for putting in place adequate surveillance programs to screen the health of workers, which may include documenting and reporting on existing diseases to avoid the introduction of new or highly resistant diseases and communicable diseases into the host community. Any health information obtained as part of these efforts may not be used for exclusion from employment or any other form of discrimination. Steps to mitigate potential project related health risks to the community (such as air and water quality impacts) have been discussed in Chapter Five of this ESMP document.

Safety and Security

Measures to reduce safety and security risk must include (but not limited to) the following:

- Access to construction sites must be restricted
- Trespassing on neighbouring properties (by workers) must be prohibited and the appropriate disciplinary action must be taken in the event of transgression;
- The appropriate signage must be placed on the boundary or at the entrance to all construction sites, warning against entering the site and highlighting the health and safety risks; and
- Public awareness programmes must be developed to identify areas of particular risk and approaches to reduce risk. This should be expanded to include programmes in any school in the project area in order to advise children on the dangers of traffic and construction activities.

Prevention of Accidents/Incidents/Emergency Response

Compliance to regulatory standards, operations/maintenance codes as well as safety guidelines shall form the basis for the execution of the ESMP, in order to avert or minimize workplace accidents and incidents. However, emergency situations could still occur as a result of equipment failure, weather, negligence and/or sabotage. Consequently, a contingency plan shall be developed as back up to other containment systems put in place to handle such occurrences. As a minimum, the contingency plans shall address the following emergency situations:

- Fires and Explosions;
- Serious injury or illness affecting many students and staff;
- Weather related disasters; and
- Land vehicle mishaps.

Project contractors shall be required to submit project security plans to CRS NEWMAP PMU for review and approval. Where required, the PMU shall organize security workshops to identify, evaluate and recommend contingency plans for all security risks associated with the gully erosion intervention project. The PMU shall ensure that they are in touch with the State Security agencies and call them at times of distress.

6.3.3 Transport Operations

The project shall manage all transportation operations in line with the following guidelines in order to forestall accidents/incidents.

Pre-Mobilization of vehicles

All vehicles to be used for the transportation of equipment, personnel and materials shall be pre-mobilized by the responsible HSE officer. The pre-mobilization shall be conducted to ensure that the vehicles are fit for whatever purpose to which they shall be deployed. The pre-mobilization shall also confirm that all the personnel handling the vehicles have the necessary competences needed for the journey. It shall also be confirmed during the pre-mobilization exercise that a job-hazard analysis (JHA) has been conducted for the trip and that all recommended precautions have been adopted.

Journey Management Plan

Each trip to be undertaken in the course of the project shall be managed in such a manner as not to result in injury to life or property. A journey management plan specific to each trip shall be produced and submitted to the environmental focal point for approval. The details of the journey management plan shall include proposed mobilization date, mode of transport, route(s), and nature of cargo as well as the details of the JHA conducted for the trip. The environmental officer for the project shall approve such trips only when all the necessary precautions to forestall accidents/incidents have been demonstrated and confirmed.

Use of Public Rights of Way

All transportation and construction works shall be executed in such a manner that will ensure minimal interference with use of public access roads. However, if operational safety demands that public roads be blocked, then the HSE supervisor may approve such operation only when temporary traffic control and diversion arrangements have been provided. Contractors shall develop road clearing strategies to ensure that public ways are kept clear, safe and passable.

Health and Safety of Workers

Operations at all work sites shall be subject to World Bank, State and federal government regulatory policies and guidelines. All CRS NEWMAP and contractor staff shall be well informed and trained on the CASHES policies and guidelines. All facilities shall also be designed to enhance safety planning and activities shall be executed within the confines of relevant legislation and stakeholders' interests.

Contractors shall provide adequate health services as well as site first aid services for its workforce. The first aid services shall be extended to visiting personnel and casual workers. All construction activities shall be properly managed through careful planning and the application of relevant CASHES policies including the following:

- Use of Permit to Work (PTW);
- Job Hazard Analysis and toolbox meetings;
- Use of PPE in designated hazard areas;

- Prohibition of alcohol during work hours and at work sites and facilities;
- Prohibition of night work;
- Regular emergency drills;
- Prohibition of smoking in fire hazard areas.

6.4 Pre-construction Phase

Site Clearance

All site clearance works shall be carried out within defined perimeters and only when necessary. The permissible time lapse between site clearing and initiation of construction operations shall be reduced to the barest minimum. Clearing of vegetation shall be kept to the barest minimum necessary to permit safe operations. Trees felled from site shall be re-utilized in construction or for the benefit of the host community. Organic waste can also be converted to organic manure through composting for subsequent use in reforestation programmes. Areas cleared in excess of operational requirements shall be re–vegetated with indigenous species.

6.5 Construction Phase

6.5.1 Pollution Control

Surface waters: Pollution of surface waters by project-related waste including wastewater shall be prevented by proper management practices. The contractor(s) shall ensure that regulatory requirements are met before discharge of contaminated or potentially contaminated construction area run-offs. Forested areas should be preserved to ensure reliable quantity and quality of water. The general public shall be educated on the need for prudent watershed management, including forest conservation.

Soil: The Contractor shall ensure that all construction activities are performed by methods that will prevent pollution of the soil media from accidental spills of contaminants, debris, and other objectionable pollutants. In the event of a significant spill, relevant spill control measures shall be applied and contaminated soil shall be cleaned as appropriate. Regular checks shall be conducted on equipment to minimize minor lube oil and combustible leaks from engines. The contractor will undertake regular checks of earth storage mounds and compounds to confirm that there is no

encroachment of soil from storage mounds onto vegetated areas adjacent to work areas.

Control of Erosion and Flooding

During construction, CRS NEWMAP PMU shall ensure that clearing is during dry season so as to put in place appropriate erosion-control facilities before heavy rains begin. Before construction activities begin, the Contractor shall prepare and put in place a storm water pollution prevention plan for erosion during construction. Excessive site clearing shall be avoided and exposed surfaces shall be re-vegetated as soon as practicable to minimize erosion.

All temporary and permanent drains are to be designed and constructed to prevent surface runoff from further eroding natural and built slopes. Catch chambers or settlement ponds should be constructed wherever necessary to prevent eroded materials from reaching water bodies. This will minimize siltation of rivers and streams.

Air Pollution

In operating equipment and machines, the contractor shall utilize all practical methods and devices available to control, prevent and otherwise minimize atmospheric emissions or the discharge of air contaminants. Good engine efficiency of equipment and vehicles shall be maintained. Indiscriminate burning of materials resulting from construction waste, bushes and combustible materials shall not be permitted.

Prevention of Noise Pollution

The CRS NEWMAP Contractor shall comply with all requirements for noise control and with regulatory standards. For example, the contractor shall ensure that all construction equipment is in proper operating condition and fitted with factory-standard silencing features if available. Earmuffs shall be provided for all workers in the vicinity of high noise generating equipment or operations. The Contractor shall use short haulage distances to construction site and as far as possible from sensitive receptors. If noise levels at any time give rise to public complaint, the issue shall be treated as public nuisance and CRS NEWMAP PMU will take appropriate measures to resolve the problem with the appropriate authorities. In any case, the community shall be consulted prior to periods of expected peak noise levels.

6.5.2 Waste Management Guidelines

Waste can be defined as any inefficiency that results in the use of natural resources, labour or capital in larger quantities than those considered necessary for the construction or operation process. Waste includes both the incidence of material losses and the execution of unnecessary work, which generates additional costs without adding value to the project.

There are laws governing the quality of disposable wastes that the environmental components of soil, water and air can readily accept and accommodate without adverse consequences on human welfare and the other life-forms inhabiting them. Some of the more relevant legislations are discussed in Chapter Two and Annexure 2 of this ESMP document. Liquid wastes must meet the recommended BOD and COD values before being discharged into the water environment. The WHO permissible limits to discharge is BOD 10 mg/L and COD 40 mg/L. The Nigerian (FMENv) standard for BOD is 50 mg/L, while maintaining the WHO standard for COD. Solid wastes which are biodegradable can be disposed of in landfills. Non biodegradable forms such as plastics, metal cans and scraps require special treatment.

Contractors shall define and document all wastes generated and transferred in the course of this project. Basic information that must be provided, as a minimum, for adequate definition of wastes include:

- Waste type identification
- Proper waste categorization
- Waste segregation information
- Recommended Management practices.

The contractor shall submit a Waste Management Plan that will outline information on the wastes that will be generated, minimization techniques and transportation methods. Some of the waste management options and waste disposal systems that will be considered for this project are highlighted below:

Solid Waste / Containers (Garbage and Inert Materials)

For effective implementation of appropriate waste disposal methods, it is important that wastes are segregated, preferably at source. The contractor shall provide marked

bins/strategic locations to ensure proper segregation. Components such as wood, plastic and paper should be sent for recycling or reuse. Bulk handling systems should be used to reduce packaging wastes such as paper and plastic. Similarly, bulk transport and storage should be employed for high volume consumption items. Where possible, containers should be refilled and reused. All wastes should be disposed at approved dumps. The waste management guidelines for the gully erosion intervention project are presented in Table 6.1.

The handling, storage and disposal of wastes and the waste management guidelines take into consideration standards of national and international environmental agencies. These standards are binding on all staff and contractors involved in the proposed project with respect to the:

- Emission or release of pollutant, exhaust and/or fugitive gases.
- Discharge of effluent into surface water, swamp or land.
- Discharge of solid wastes (including domestic waste) into surface water, swamp or land
- Generation of noise and vibration.

6.6 Monitoring and Auditing Plans

The CRS NEWMAP PMU and Contractor shall undertake audits to confirm that measures identified in Management Plans are implemented. These include:
Dust and Noise mitigation measures, Erosion and Sediment control measures and waste management plan etc. Also, the contractor will undertake regular audits of storage mounds and compounds to confirm that there is no encroachment of soil from storage mounds onto vegetated areas adjacent to works areas. The potential impact indicators for the various environmental components studied have been listed (Table 5.1) and discussed in Chapter 5 of this ESMP document.

The overall objective of (performance) monitoring shall be to identify any unanticipated changes to the biophysical, health and social environment brought about by the gully erosion intervention project. This ESMP has been formulated with the aim of ensuring that all the identified significant impacts from the project are mitigated to as low as reasonably possible and that key performance indicators are monitored periodically to

track how effectively mitigation measures are implemented. It specifies the mitigation measures, monitoring requirements, duration and frequency of the monitoring, and the action parties to manage the biophysical, social and health environment at the various phases of the project.

ESMP guidelines have been developed to cover all activities of the NEWMAP Ikot Anwatim gully complex intervention project. These include pre-construction activities (mobilizations, establishment of base camp-site, etc), construction activities and operations. These guidelines, with performance indicators for each of the environmental components, are presented in Table 6.2.

Table 6.1: Waste management guidelines for NEWMAP Ikot Anwatim gully complex intervention project.

Source of waste Impact	Composition/ Classification	Potential Impact	Disposal Options
Pre-construction Preparation works. To include waste associated with: Demolition of houses, soakaways, Clearing trees and ground etc.	Concrete, gravel, stone, soil, inert materials, wood, metals, plastics, insulation, packaging (material bags), gypsum, general waste. Some are combustible; recyclable.	Increased generation of Waste; Generation of dust/noise; Pollution of nearby receptors (e.g. streams); flooding, reduced Agricultural productivity and impact on reservoir capacity.	It is envisaged that the majority of the waste generated during demolition is reusable. Incorporate into the design the use of recyclable materials. Disposal of unused materials to landfill. Develop procedures and controls to ensure appropriate storage of waste to minimize risk of pollution. Establish specific erosion and sediment controls, particularly in relation to site preparation earthworks (e.g. soil storage mounds, sediment ponds). The controls should limit the mobilization and dispersion of sediment into freshwater and estuarine environments. Ensure that appropriately licensed transportation contractors and disposal sites are identified and used.
Construction Phase; To include waste associated with: Reconstruction of laterite road washed away at the gully head; sub-grading, excavating and	Concrete, gravel, Soil, stone, inert materials, wood, metals, plastics, insulation, packaging (material bags), gypsum, general waste. Some are combustible;	Generation of stone and waste earth, toxic gas, waste oils, domestic waste. Flooding, reduced agricultural productivity and impact on reservoir capacity.	Develop a waste inventory; this should detail the different waste streams, classification, quantities, storage requirements, potential use, and treatment and disposal arrangements; Provide storage for domestic waste on the construction sites and at the site

embanking the road base; construction of concrete drains with slabs; Construction Equipment, Concrete mixing.	recyclable.		huts. Excavated material shall be used for backfilling, landscaping or other remedial works on site.
Material extraction for road construction.	Waste earth, stone, Gravel.	Physical (i.e. dust, sediments) and chemical (i.e. oil, petrol etc) contaminants resulting in a reduction in water quality. Increased flood risk from surface water run-off; reduced agricultural productivity and impact on reservoir capacity	- If possible, work should be scheduled to avoid heavy rainfall periods (i.e. work during the dry season); - Contouring and minimizing length and steepness of slopes; - Provide temporary surface water drainage system including settlement ponds/ sediment traps prior to discharge points.
Work camp		Domestic waste.	Segregate recyclable materials (glass bottles, paper, plastics, metals etc.) and send to reprocessors; disposal to landfill; Composting of food waste offsite.
Generation of hazardous waste Activities include: Replacing machine oils; Performing Maintenance tasks on equipment etc.	Hazardous / Combustible	Groundwater and surface Water contamination.	Establish and implement operational controls for on-site storage of hazardous waste. Hazardous waste as well as hazardous materials should be stored in a secure area with impermeable surface on concrete hardstanding (or in bunded containers with adequate secondary containment); Ensure containers are labeled so contents can be identified.
Waste water Discharges from Batching plants and dewatering of excavations and washing down of plant and equipment	Waste water, sediments.	Reduced water quality and Associated impacts on fish and benthic fauna	Ensure that waste water from the batching plants is collected and treated recycled for reuse. Ensure that all water used for washing down plant and equipment is collected in a settling pond prior to discharge. This will reduce the load of contaminants prior to discharge, taking into consideration potential impacts of cross media transfer of contaminants during treatment (e.g. from water to air or land).
Empty drums and aerosol Cans (plastic and steel) Miscellaneous scrap metal from construction	Potentially hazardous (non-combustible)	Dependent on original contents of drums (lubricating oil, fuel and corrosion inhibition chemicals); Build up of stagnant water.	Residues from drums shall be purged and cleaned before reuse (subject to quality assurance) otherwise, they shall be returned to the supplier. Recycled/reused, given away or sold. Unusable volumes shall be disposed at an appropriate landfill facility.

Oil, Oily rags and diesel/fuel leaks, used protective clothing (hand gloves, shoes, rainwear, etc)		Maintenance operations, fuel storage, regular work wear	Where possible, oily rags and protective clothing shall be washed and reused at site. Otherwise, these wastes shall be incinerated or disposed at an appropriate landfill facility. Where possible waste oil should be recycled.
Contaminated surface water /stormwater discharge during operation of restored road.		Reduced water quality and Associated impacts on fish and benthic fauna.	Ensure that road drains and silt traps are maintained on a regular basis.
Medical wastes; used dressings, needles and syringes, empty drug containers etc from First aid treatment, clinic	Hazardous (combustible)	Potential to contaminate soil and surface waters	Medical wastes shall be packaged and incinerated or sterilized before disposal.
Woody plant debris	Hazardous (combustible)	Wooden plant debris from site preparation, Trenching, excavation, etc.	Recycled/reused, given away or sold. Unusable materials shall be disposed at an appropriate landfill facility.
Cement slurries and mix	Non-hazardous (non- Combustible)	Concrete works for culverts and drains. Potential health risk	Give out, sell or dispose at appropriate landfill facility.
Compaction of Imported material (filling of site for road reconstruction).		Compaction and settlement of the subsurface due to imposed load; Increased risk of land slippage/slumping and accelerated soil erosion; Interuption of subsoil and overland drainage patterns.	Ensure that all excavated sites are refilled. This will reduce the effect of compaction and settlement; vegetation clearance should be limited to defined project boundaries; Avoid cutting roots of trees where possible, so as to retain land stability; Store excavated soil in a manner to maximise its reuse in restoration, thereby reducing the long term risk of erosion.
Laying of asphaltic bitumen*		Emissions into the atmosphere can affect humans and also lead to wildlife migration; risk of being washed into drains and surface water bodies causing pollution and harming aquatic flora and fauna.	Contractor must have the necessary skills and put systems and precautions in place to prevent wash-off, especially in the rainy season.

*This is optional as project design does not include laying of asphaltic bitumen on laterite road (when restored).
Waste disposal sites have been identified within close proximity of the gully site. The contractor should investigate the materials that each disposal site is authorized to receive and ensure only waste within this scope is dispatched to the site. Where recyclable waste is generated, identify potential buyers or reprocessing facility.

Table 6.2 Environmental and Social Management Plan for NEWMAP Ikot Anwatim gully complex intervention project.

Project Phase And Activity	Potential Impact	Mitigation/Management	Parameter for Monitoring	Frequency of monitoring	Frequency of formal reporting	Responsible Party	**Implementation Costs (₦)****
Pre-construction Land acquisition (if any) Mobilization: Movement of goods, equipment and personnel	Loss of farmland, Loss of income and livelihoods.	Ensure that measures outlined in the Resettlement Action Plan for the project are implemented.				CRS NEWMAP	
	Potential increase in road traffic volume	Large and slow moving vehicles should be scheduled during off peak periods	No driving at night	On going	Monthly	Contractor & CRS NEWMAP	
		Raise community awareness of unusual activity	Record of awareness sessions	Monthly	Six monthly	Contractor/ CRS NEWMAP	
	Potential increase in road traffic incidents	Pre-mob all vehicles---	Pre-mob certificate	Monthly	Monthly	Contractor/ CRS NEWMAP	
		Install visible warning signs on roads and vehicles	Adequate signs/speed breakers	On going	Monthly	Contractor/ CRS NEWMAP	
	Increase in noise level	No night driving	Night driving permit	On going	Monthly	Contractor/ CRS NEWMAP	
		Contractor to ensure that all vehicles conform to limits for noise	Vehicles maintenance records	Monthly	Monthly	Contractor/ CRS NEWMAP	
	Reduction in Air quality (dusts, exhaust fumes)	Contractor to ensure that only pre-mobbed vehicles are used to reduce emissions from exhaust	Pre-mob certificate	On going	Monthly	Contractor/ CRS NEWMAP	
		Defensive driving course for CRS NEWMAP and contractor drivers	Driving permit	Monthly	Monthly	Contractor/ CRS NEWMAP	
		First aid training of workforce and provision of first aid boxes in operational vehicles	Number of first aid certificates; records of vehicles, first aid box audit	Weekly	Monthly	Contractor/ CRS NEWMAP	
Construction Land clearing, Excavation	Community unrest	Contractor to ensure recruitment of locals for clearing and excavation	Employment records for locals;	Weekly	Monthly	CRS NEWMAP	
		CRS NEWMAP to abide by all MOUs signed with host communities.	Record of compliance with MOU items; Use of grievance redress mechanism.	On going	Yearly	CRS NEWMAP	

Project Phase And Activity	Potential Impact	Mitigation/Management	Parameter for Monitoring	Frequency of monitoring	Frequency of formal reporting	Responsible Party	**Implementation Costs (₦)****
	Loss of flora/fauna	Land to be limited to approved drainage route.	Site clearing inspection record; revegetation efforts.	On going	Weekly	CRS NEWMAP	
		CRS NEWMAP to educate workers and community on sensitive nature of biodiversity of area.	Records of HSE meetings	Weekly	Monthly	CRS NEWMAP	
		Re-vegetation of unwanted/un-used area	Implementation records	1 month after clearance		Contractor/ CRS NEWMAP	
	Increase in dust and noise level/ Reduction of air quality	Contractor to ensure that nose masks and earmuffs are worn by workers during excavation	SPM, NOx, CO, SOx, VOC, records of respiratory diseases and noise levels	On going	Monthly	Contractor/ CRS NEWMAP	1,500,000 Air quality and noise in six locations (One per gully site)
		Water to be sprayed at work site especially in dry season	Records of compliance	On going	Monthly	Contractor/ CRS NEWMAP	
	Threat to health of workers/insect/ snake bites, stings, injuries	Contractor to enforce use of PPEs by workers	Compliance records	On going	Monthly	Contractor/ CRS NEWMAP	
		Contractor to provide trained first aiders at work site	First aid records	Monthly	Quarterly	Contractor/ CRS NEWMAP	
		Contractor to ensure availability of anti-venom, anti-histamines at work site	Record of anti-venom/ histamines at work site	Weekly	Monthly	Contractor/ CRS NEWMAP	
		Contractor to ensure that all workers are made aware of dangers from poisonous animals and plants at work site	Awareness records	Monthly	Monthly	Contractor/ CRS NEWMAP	
Influx of migrant labour	Increase in STIs, HIV/AIDS and other illnesses	CRS NEWMAP to encourage sex education and awareness of transmission of HIV.AIDS, other communicable diseases	Record of health awareness lectures	Monthly	Quarterly	CRS NEWMAP	250,000 Community health
		Vector control through regular fumigation of work site	Records of fumigation	Monthly	Quarterly	Contractor/ CRS NEWMAP	
		CRS NEWMAP to support activities of State Action Committee on HIV/AIDS/STIs	Record of support to SACA	Monthly	Quarterly	CRS NEWMAP	
		Contractor to provide clinic at work site for treatment of minor illnesses of workers	Records of attendance at clinics	Weekly	Monthly	Contractor/ CRS NEWMAP	

Project Phase And Activity	Potential Impact	Mitigation/Management	Parameter for Monitoring	Frequency of monitoring	Frequency of formal reporting	Responsible Party	**Implementation Costs (₦)****
	Injury to workers	Contractor to carry out first aid training of workers	Training records	Monthly	Half-yearly	Contractor/ CRS NEWMAP	Component of community health
		Contractor to enforce use of PPE (e.g. boots, hard hats, goggles, etc)	Compliance	On going	Monthly	Contractor/ CRS NEWMAP	
Waste generation	Increase in breeding ground for disease vectors	Contractor to enforce waste management policy	Compliance	On going	Monthly	Contractor/ CRS NEWMAP	
	Contamination of soils, surface and ground water bodies	No discharge of untreated effluents, use of storage containers with secondary containment capacity, Compliance with waste management guidelines.	Compliance; Physico-chemistry, Microbiology.	Monthly	Monthly	Contractor/ CRS NEWMAP	Soil, Ground and surface water six locations. 1,500,000
	Blockage of natural drainages	Contractor to ensure that wastes generated are quickly disposed of at appropriate locations	Compliance	On going	Quarterly	Contractor/ CRS NEWMAP	
Influx of migrant labour	Changes in local population	Contractor to recruit most unskilled labour from host communities	Records of applications at employment office	On going	Monthly	Contractor/ CRS NEWMAP/ Community	
		Contractor to look into development of off-site job recruitment to discourage influx of people	Documentary evidence of implementation	3-months	6 monthly	Contractor/ CRS NEWMAP/ Community	
		Movement of unauthorized persons to worksite to be restricted	Records of access control	Monthly	Quarterly	Contractor/ CRS NEWMAP/ Community	
	Increases in social vices	CRS NEWMAP to intensify enlightenment campaigns and health education against alcoholism, drug abuse in communities and among workers throughout project life	Enlightenment campaign/health education statistics	1- 2 months before start of construction	Annually	CRS NEWMAP	
		CRS NEWMAP to ensure contractors' enforcement of alcohol and drug policy among workers	Records of violation	6-monthly	Annually	CRS NEWMAP	
		CRS NEWMAP to ensure that contractors implement social and health programmes for all their workers at recruitment and on a continuous basis through project life	Records of social/health awareness programmes	At recruitment and quarterly thereafter	Annually	CRS NEWMAP	

Project Phase And Activity	Potential Impact	Mitigation/Management	Parameter for Monitoring	Frequency of monitoring	Frequency of formal reporting	Responsible Party	**Implementation Costs (₦)****
	Pressure on existing infrastructures and utilities	Contractor to develop an accommodation plan for workers prior to mobilization to reduce pressure on local housing	Accommodation plan	3-months prior to mobilization	1 month to mobilization	Contractor/ CRS NEWMAP	
	Potential increase in erosion, Contamination of surface water bodies and loss of agricultural land	Contractor to ensure that trenches are back filled as quickly as possible	Compliance; Physico-chemistry, Microbiology.	On going	Monthly	Contractor/ CRS NEWMAP	350,000 Microbial studies of water and sediments (2 locatiions).
	Potential for falls into trenches by animals/passers-by	Contractor to erect barriers and signs close to trenches	Number and adequate signs/barriers	On going	Monthly	Contractor/ CRS NEWMAP	
Operation and maintenance of Drainage channels, catch pits and impact basins; Forest management		Investment in soil erosion management	Area returned to use, increase in vegetation cover	Annually	Bi-ennially	Community/ CRS NEWMAP	900,000
		Sustaining livelihoods and protecting biodiversity	No. of people employed, No. of people using produce from project area.	Annually	Bi-ennially	Community/ CRS NEWMAP	
		Contractor shall ensure the use by site workers of appropriate personal protective equipment (PPE)	Compliance	Weekly	Monthly	Contractor/ CRS NEWMAP	
		CRS NEWMAP to ensure the training of first aiders	Record of first aid training	Monthly	Quarterly	CRS NEWMAP	
		Contractor to ensure that anti-venom/antihistamine is available in her clinic to mitigate snake bites/insect stings etc.	Records of anti-venom/antihistamine provision	Monthly	Quarterly	Contractor/ CRS NEWMAP	
Grand total Cost							4, 500, 000

** Costs given for implementing monitoring are annual estimates, except for components assessed bi-ennially. No figures are provided for monitoring likely to be done 'in-house'. One sensitive receptor, preferably a primary school compound or a place within the community, will be used for air quality/noise monitoring. Six locations (one per gully site) will be used for surface/ground water and soil monitoring.

The projected costs for implementation of the ESMP are summarized in the table below (Table 6.3).

Table 6.3: Summary table showing projected costs for ESMP implementation

Project phase	Monitoring times	Unit cost (₦)	Total cost (₦)
Pre-Construction			RAP*
Construction			
Air quality/Noise	6	250,000	1, 500, 000
Soil, ground and	6	250,000	1, 500, 000
Surface water			
Water/sediment microbiology	2	175, 000	350, 000
Community health assessment	1	250,000	250, 000
Operation **(2 years)**			
Soil erosion management			
(Maintenance phase)			900, 000
Total			4, 500, 000

***** Resettlement action plan

6.7 Maintenance Procedures

Once operational, CRS NEWMAP PMU shall carry out regular inspection of the project route. The main objective of such inspection shall be to ascertain environmental performance and assess compliance with mitigation measures and recommendations of the ESMP. The inspection team shall, during their visit, examine and inspect all operations along the project route which are likely to cause pollution or environmental degradation. Samples of any effluent discharges and solid waste deposits shall be taken for analyses and interpretation. After each visit the team shall compile a report detailing the specific areas inspected and highlights of any observed non-compliance/persistent negligence. In case of non-compliance the contractor shall be

requested to take appropriate measures. The CRS NEWMAP PMU shall report twice a year to the World Bank on ESMP compliance and to the authorities as per the relevant authorization requirements. Copies of the audit report shall also be forwarded to the CRS Min. of Environment and the operating contractor.

The maintenance system shall include plans and procedures for:

- Normal maintenance {routine maintenance performed by the maintenance technicians (to be trained for the proposed project)};
- Preventive maintenance (activities carried out at pre-determined intervals);
- Predictive maintenance (replacement of section(s) of drain channel that could fail even though it is still working).

Routine maintenance shall include regular de-silting of drains and impact basins to remove accumulated sediments and thrash. Sediment and trash detention can cause blockage of drains.

ESMP and Community Development

The PMU shall ensure that implementation of this ESMP does not conflict with the community development programmes of government authorities, NGOs and aid agencies for the project area. The PMU shall integrate any such Community Development/Assistance project with the NEWMAP gully erosion intervention project.

6.8 Decommissioning and Abandonment

The concept of abandonment of project site fits in with projects which are set up to exploit non-renewable resources like petroleum, gas deposits and other minerals. Since the utilitarian value of the project will not cease, then the project will not be abandoned. Such abandonment will spell doom and a return to the devastating and life threatening effects of 'runaway' gullies. The only circumstance under which this project could be abandoned is if a natural disaster or war destroys the structures or if new knowledge/technology dictates further refinement. Even in such scenarios, the structures can be rebuilt/redesigned to continue to serve an important unique purpose.

CHAPTER SEVEN

SUMMARY, RECOMMENDATIONS AND CONCLUSION

The sites for the NEWMAP Ikot Anwatim gully complex intervention project are typically low in biodiversity value (poor species composition and an absence or rarity of trees of timber value) and with low carbon value, although in ecological context these areas fall under the "partially modified lowland rainforest" ecozone. The sites include sizable secondary and tertiary forests, mixed vegetation, and the traditional multi-storey cropping dominant throughout Nigeria's Niger Delta. Poor ecosystem/resource management has led to uncontrolled land clearing/overexploitation, which in combination with the increasing storm water runoff from properties on the upper watershed has contributed to the acceleration of slope erosion and landslide activity.

The air basin in the project area is generally clear and free of particulate matter and visible pollutants. Oxides of sulphur and carbon from domestic and vehicular sources were below harmful levels. Generally, vegetation, farm crops, ornamental flowers, etc did not show evidence of stress from air pollution. Discussions with community members also suggested the absence of significant incidence of air borne related diseases in proposed project area.

The NEWMAP Ikot Anwatim gully complex intervention project area lies within the eastern margin of the Niger delta sedimentary basin. The rocks are mainly sandstones, shales, sands and gravel which belong to the Benin Formation and range in age from Holocene to Recent. The area is made up of upper and lower aquifers. The local groundwater flow is south wards. The concentrations of ions and heavy metals in groundwater are within the limits of WHO. However, the concentration of Mn is higher than the maximum stipulated value by WHO for drinking and domestic use. The faecal and total coliforms were higher than the WHO standard.

The soil is moderately acidic with sand fractions (-sand, sandy loam and loamy sand texture). Organic carbon contents suggested soils of medium nutrient status. Mean heavy metal contents for both surface and subsurface soils were within tolerable limits in the project site and thus the soils were free of heavy metal toxicity.

The water within the project area is slightly acidic to neutral. Biological Oxygen Demand (BOD) values were above the recommended permissible limits of FEPA/FMEnv, WHO and EEC regulatory standards. These indicated the presence of organic contaminants in the surface waters and thus water that is not fit for human consumption.

In the project design for all the sites, storm waters shall be properly channeled, with provision for stilling basins and check dams and rip rap at the outfall. This will dissipate detrimental hydraulic energy of flow before *intentional routing* to the swamp forests (project end point). The increased amounts of runoff into these swamps could alter hydrological regimes as water level response times (hydroperiod), depths and duration of water detention will change. Water depths in the swamps are likely to increase more rapidly following heavy rainfall. Hydrologic changes could ultimately induce changes in community structure and change the physical condition of the already degraded swamp forests (with extremely low tree density and abundance of herbaceous to shrubby plant species). Although there are no known areas of natural or critical habitat within the project boundaries, most of the lower water shed of the study area is sensitive and fragile, being a freshwater swamp and an estuarine ecosystem. Any stress arising from anthropogenic activities (urbanization, industrialization and agriculturilization from swamp forest conversion) will alter the existing natural balance, disrupt the ecosystem dynamics and cause undesirable changes. Therefore, it is recommended that drainage ditches should be constructed to channel excess runoff from the swamp forests into the nearby Ikot Anwatim stream. This will ultimately discharge into the Calabar River. Moreover, the drainage ditches will continue to drain the lower watershed in the event of further infrastructural development (residential buildings, industrial set-ups etc)

removing more areas of the remnant swamp forests from providing needed ecosystem services. However, since swamp forests are environmentally sensitive and require some protection, the remnant swamp forest block should be preserved (gazetted) by the Cross River State Government as a *reserve* and protected from further development and to serve as *in situ* gene banks.

Public interest in the project is high because of the elimination of the threat to lives and property caused by gully activities. The project is likely to engender socio-economic transformation coupled with its impacts on surrounding communities during the construction phase (e.g. noise, dust, emissions etc) and through the influx of workforce. Environmental management guidelines, with performance indicators for environmental components and responsible parties for auditing/monitoring have been built into this ESMP document. Also built into this report are general environmental management conditions for contracts/civil works.

COMPLEMENTARY INITIATIVES & CAPACITY BUILDING

The project design for intervention works in the gully sites supports actions to stabilize and rehabilitate the gully sites and the underlying causes of gully erosion using both structural and vegetative measures. An estimated 5,279,240 m^3 of soil has been washed away from the main gully and the five gully fingers, with 85% being contributed by the main gully (CRS NEWMAP by Rabiona Engineering Ltd, 2013). The project design envisages restoration of much of the main gully and the five gully fingers. It is expected that during the construction phase, materials haulage and vehicular traffic at the main gully and gully finger 1 shall not be made through the gully head because of the need to avoid further damage to existing facilities and the difficulty of decent through the steep slopes. Haulage routes should such as will minimize the elimination of the remnant secondary and tertiary forests.

The requirement for laterite filling and compaction to make access roads motorable will lead to changes in hydrological patterns and the elimination of unadapted species. Areas cleared in excess of operational requirements shall be re –vegetated with indigenous species. CRS NEWMAP in conjunction with the State Ministry of Transport shall map out alternative routes that will be traversed by vehicular traffic in the case of temporary denial of access ways until the project is completed. In order to reduce traffic congestion and discomfort to road users appropriate mitigation measures (e.g. movement of large and slow-moving vehicles during off-peak traffic periods) have been recommended in this ESMP document.

In line with the recommendations of the project design, the entire area of gully complex area shall be re-vegetated after earthworks using local/domesticated grasses/cover crops (e.g. Vetiver, Elephant grass, Centro, *Calapogonium* etc.) and trees (e.g. Bush Mango, Bamboo, Gmelina, etc.). A minimum vegetation set aside of 5m vegetation is recommended for the drainage route on completion. Top soil shall be used over slopes to support the growth of vegetation. The swamp forest in the gully bed area should be preserved for the development of bio-diversity and left under the supervision of the State Ministry of Environment. NEWMAP incorporates an integrated biodiversity program designed to address threats (habitat conversion), problems (unsustainable use practices) and opportunities (new enterprises). The typology of activities expected as part of investment in soil erosion management should include the following:

- Live perimeter fencing of site with bamboo and vetifer grass etc.
- Promotion of cultivation of cover crops
- Converting waste to organic manure/composting/fertilizer procurement.
- Nursery development (procure seeds, seedlings, vegetative propagation).
- Water retention Wells (rainwater harvesting); Check dams and stilling basins can be designed to serve as water retention wells for use in watering plants in the dry season.

- Afforestation/Reforestation

This ESMP recommends, in line with the recommendations of the project designers that the Cross River State government through its Ministry of Environment cordons off restored areas from the public to allow for full healing and development of bio-diversity before being put to sustainable use. Mining of sand around the gully bed must be prevented to allow the gully stabilize with help of check dams provided. The vegetation corridors (habitat strips) from the gully erosion intervention project and the remnant swamp forests shall serve as indigenous community conserved areas, under the supervision of the State Ministry of Environment. Community based forest management planning is recommended as this will promote vegetative, and adaptive natural resource based livelihood measures. The expected outcomes will include:

- Reforestation of degraded areas.
- Improved watershed protection on escarpment
- Restoration of wildlife migration routes
- Improved supply of forest products for livelihoods
- Reduced degradation of steep slope escarpment forest.
- Improved biodiversity and watershed management

CRS NEWMAP should promote alternative income-generating activities to replace those that will be rendered unproductive and the participation and capacity development of indigenous and local communities in the management of the restored areas. Livelihood options include snail farming, bee keeping, piggery, poultry, fish farming, propagation of waterfeaf, bitterfeaf, pumpkin, Afang (*Gnetum africanum*) and other leafy vegetables (landraces) and in vegetative propagation (grafting and budding) of important economic tree species.

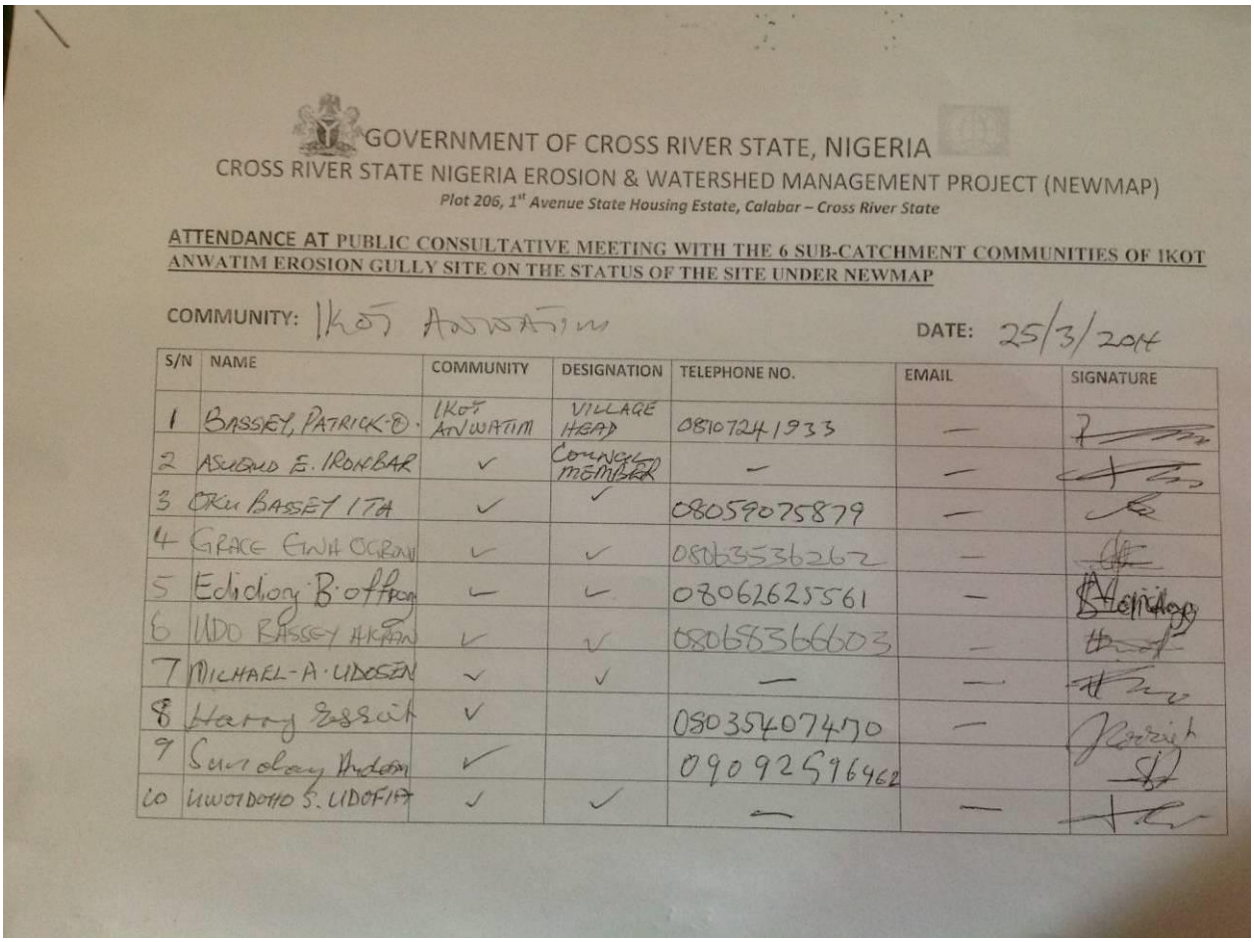
The complementary livelihood initiatives referred to above would require training and provision of financial capital and/or materials for take-off. The Stakeholders Forum could work with relevant technical specialists to develop activities for specified livelihood

options that are technically feasible, financially viable and socially sustainable. CRS NEWMAP PMU will develop specific eligibility criteria consistent with local needs, but targeting especially project affected persons and people needing assistance but having the capacity to acquire new skills and economic activities. Following project completion (operation phase) the community could 'take ownership' of the facilities and the responsibility for maintaining them. CRS NEWMAP and the contractor will provide the technical training required for community members to participate in such activities in the sub watershed (de-silting of drainage channels, forest management etc).

CONCLUSION

CRS NEWMAP has developed this Environmental and Social Management Plan (ESMP) to identify the environmental and social management and mitigation actions required to implement the NEWMAP gully erosion intervention project in the Ikot Anwatim gully erosion complex area in accordance with the World Bank's Performance Standards and the requirements of applicable Nigerian legislation and environmental policies. The proposed project will have significant beneficial impacts on the environment. The economic gains of the project to the communities, the Cross River State cannot be overemphasized. The application of measures embedded in this ESMP and other provisions incorporated herewith will ensure that the gully erosion intervention project is sustainably executed in an environmentally friendly manner.

ANNEXURE 1: LIST OF PERSONS MET DURING STAKEHOLDERS FORUM



GOVERNMENT OF CROSS RIVER STATE, NIGERIA

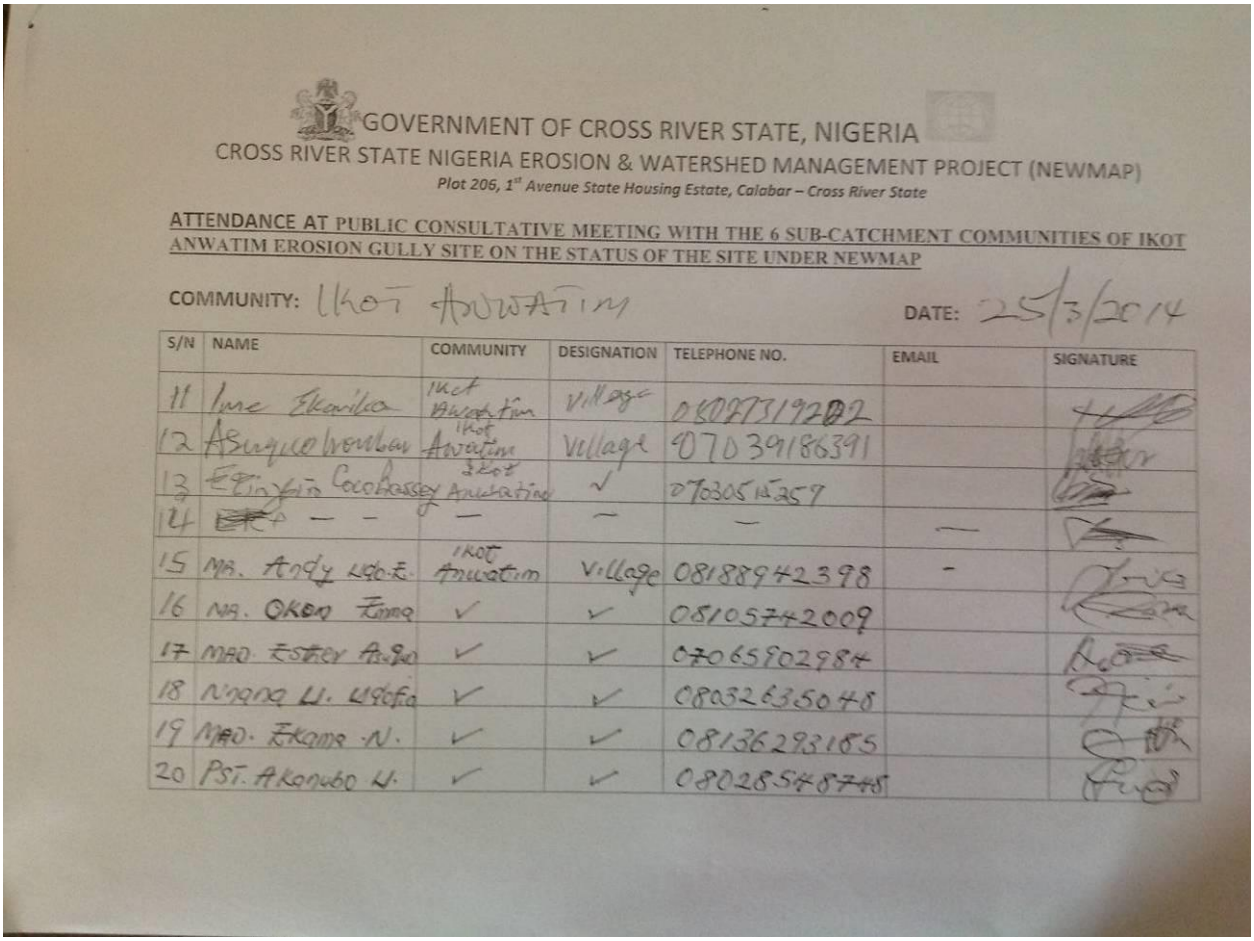
CROSS RIVER STATE NIGERIA EROSION & WATERSHED MANAGEMENT PROJECT (NEWMAP)

Plot 206, 1st Avenue State Housing Estate, Calabar – Cross River State

ATTENDANCE AT PUBLIC CONSULTATIVE MEETING WITH THE 6 SUB-CATCHMENT COMMUNITIES OF IKOT ANWATIM EROSION GULLY SITE ON THE STATUS OF THE SITE UNDER NEWMAP

COMMUNITY: Ikot Anwatim DATE: 25/3/2014

S/N	NAME	COMMUNITY	DESIGNATION	TELEPHONE NO.	EMAIL	SIGNATURE
1	BASSEY, PATRICK O.	IKOT ANWATIM	VILLAGE HEAD	08107241933	—	
2	ASUQUO E. IRONBAR	✓	COUNCIL MEMBER	—	—	
3	OKU BASSEY ITA	✓	✓	08059075879	—	
4	GRACE EWA OGBAN	✓	✓	08063536262	—	
5	Edidiong B. offiong	—	—	08062625561	—	
6	UDO BASSEY AKPAN	✓	✓	08065366603	—	
7	MICHAEL-A-UDOSEN	✓	✓	—	—	
8	Harry Essien	✓		08035407470	—	
9	Sunday Udom	✓		09092596962		
10	UWOIDOHO S. UDOFIA	✓	✓	—	—	



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ATTENDANCE AT PUBLIC CONSULTATIVE MEETING WITH THE 6 SUB-CATCHMENT COMMUNITIES OF IKOT ANWATIM EROSION GULLY SITE ON THE STATUS OF THE SITE UNDER NEWMAP

COMMUNITY: Ikot Anwatim DATE: 25/3/2014

S/N	NAME	COMMUNITY	DESIGNATION	TELEPHONE NO.	EMAIL	SIGNATURE
11	Ime Ekanika	Ikot Anwatim	Village	08077319202		
12	Asuquo Ironbar	Ikot Anwatim	Village	07039186391		
13	Effiong Cocobassey	Ikot Anwatim	✓	07030514259		
14	[illegible]	—	—	—	—	
15	Mr. Andy Ugo-E.	Ikot Anwatim	Village	08188942398	-	
16	Mr. Okon Ema	✓	✓	08105742009		
17	Mrs. Esther Asuo	✓	✓	07065902984		
18	Nsona U. Ubofia	✓	✓	08032635048		
19	Mrs. Ekama N.	✓	✓	08136293185		
20	Pst. Akpabio U.	✓	✓	08028548748		

GOVERNMENT OF CROSS RIVER STATE, NIGERIA

CROSS RIVER STATE NIGERIA EROSION & WATERSHED MANAGEMENT PROJECT (NEWMAP)

Plot 206, 1st Avenue State Housing Estate, Calabar – Cross River State

ATTENDANCE AT PUBLIC CONSULTATIVE MEETING WITH THE 6 SUB-CATCHMENT COMMUNITIES OF IKOT ANWATIM EROSION GULLY SITE ON THE STATUS OF THE SITE UNDER NEWMAP

COMMUNITY: Ikot Anwatim **DATE:**

S/N	NAME	COMMUNITY	DESIGNATION	TELEPHONE NO.	EMAIL	SIGNATURE
21	MR. Francis Jonah	Ikot Anwatim	Village	07033320828		
22	Mr. Egar E.	✓	✓	08035070945		
23	Mr. Peter Eko	✓	✓	07038940740		
24	MR. Afiong T.	✓	✓	08130077308		
25	Mr. Ubong Inwang	✓	✓	08063218095		
26	Alice Sunday E.	✓	✓	08068205979		
27	Mr. Amos Joshua	✓	✓	08162113685		
28	Chief. Mike A.	✓	✓	07030349760		
29	Mr. John Oso	✓	✓	07031974988		
30	Mr. Abubaka G.	✓	✓	08096682234		

GOVERNMENT OF CROSS RIVER STATE, NIGERIA

CROSS RIVER STATE NIGERIA EROSION & WATERSHED MANAGEMENT PROJECT (NEWMAP)

Plot 206, 1st Avenue State Housing Estate, Calabar – Cross River State

ATTENDANCE AT PUBLIC CONSULTATIVE MEETING WITH THE 6 SUB-CATCHMENT COMMUNITIES OF IKOT ANWATIM EROSION GULLY SITE ON THE STATUS OF THE SITE UNDER NEWMAP

COMMUNITY: IKOT ANWATIM **DATE:**

S/N	NAME	COMMUNITY	DESIGNATION	TELEPHONE NO.	EMAIL	SIGNATURE
31	MR Friday Johnson	Ikot Anwatim		08170240136	–	
32	MR A. Michael	–		08060074026		
33	Pst. Ezikiel Tony	–		08010011 4234		
34	THE Apostolic church	–		08037400631		
35	MR oku Bassey	–		0805 9075879		
36	MR Asuquo Ekpo	–		08140201723		
37	MAJ. Comfort	–		08154735783		
38	MR Umoh Igyanema	–		08061561277		
39	ELDER VICTOR J	–		08080507024		
40	MR Friday Aoken			08032507024		

GOVERNMENT OF CROSS RIVER STATE, NIGERIA

CROSS RIVER STATE NIGERIA EROSION & WATERSHED MANAGEMENT PROJECT (NEWMAP)

Plot 206, 1st Avenue State Housing Estate, Calabar – Cross River State

ATTENDANCE AT PUBLIC CONSULTATIVE MEETING WITH THE 6 SUB-CATCHMENT COMMUNITIES OF IKOT ANWATIM EROSION GULLY SITE ON THE STATUS OF THE SITE UNDER NEWMAP

COMMUNITY: NKONG (IKOT ANSA) DATE: 25/26th March, 2014

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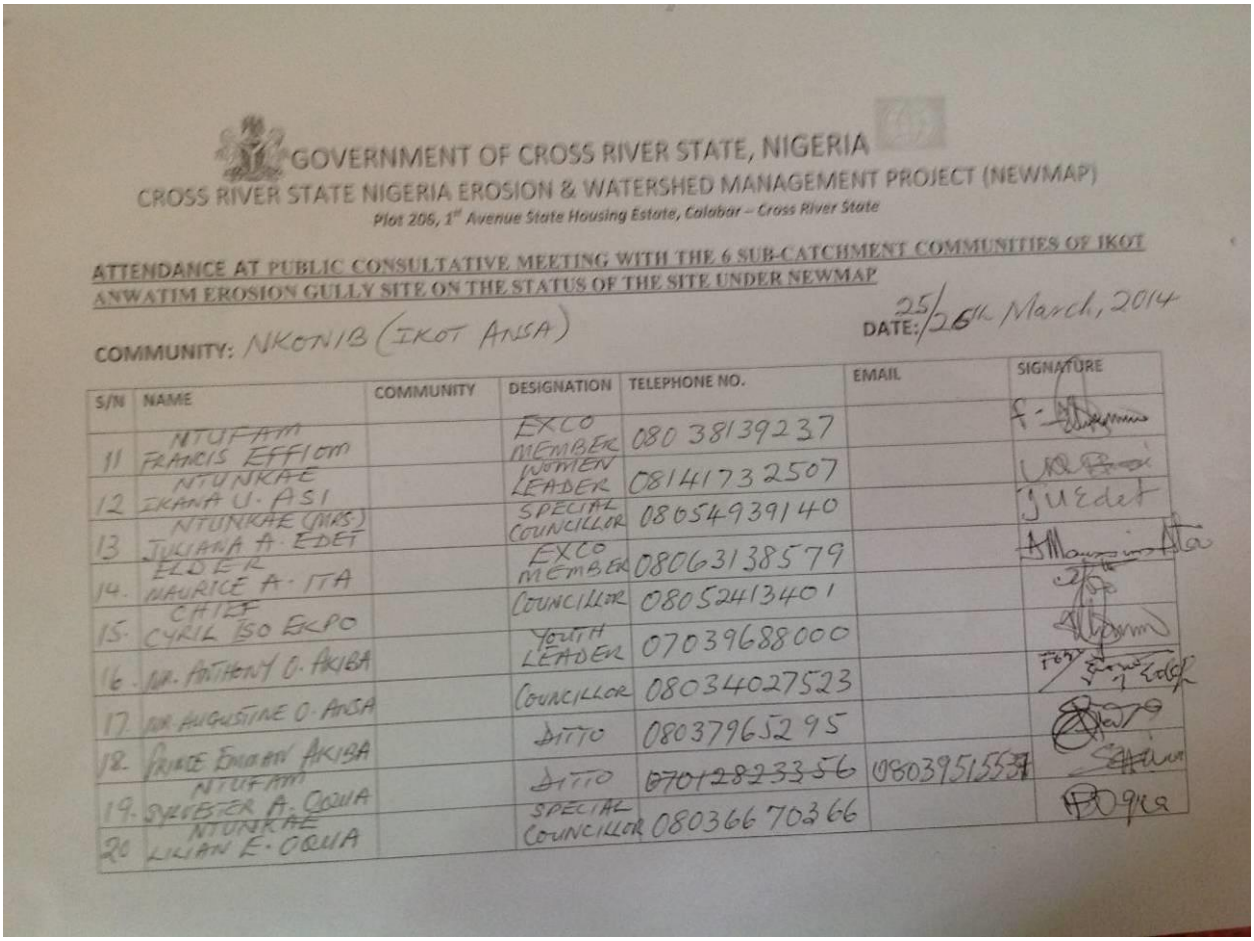
10B Engr. IRONBAR. Comm Engr. 07034457871.



GOVERNMENT OF CROSS RIVER STATE, NIGERIA

CROSS RIVER STATE NIGERIA EROSION & WATERSHED MANAGEMENT PROJECT (NEWMAP)

Plot 206, 1st Avenue State Housing Estate, Calabar – Cross River State

ATTENDANCE AT PUBLIC CONSULTATIVE MEETING WITH THE 6 SUB-CATCHMENT COMMUNITIES OF IKOT ANWATIM EROSION GULLY SITE ON THE STATUS OF THE SITE UNDER NEWMAP

COMMUNITY: NKONIB (IKOT ANSA) **DATE:** 25/26th March, 2014

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GOVERNMENT OF CROSS RIVER STATE, NIGERIA

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COMMUNITY: NKONIB (IKOT ANSA) DATE: 25/26TH MARCH, 2014

S/N	NAME	COMMUNITY	DESIGNATION	TELEPHONE NO.	EMAIL	SIGNATURE
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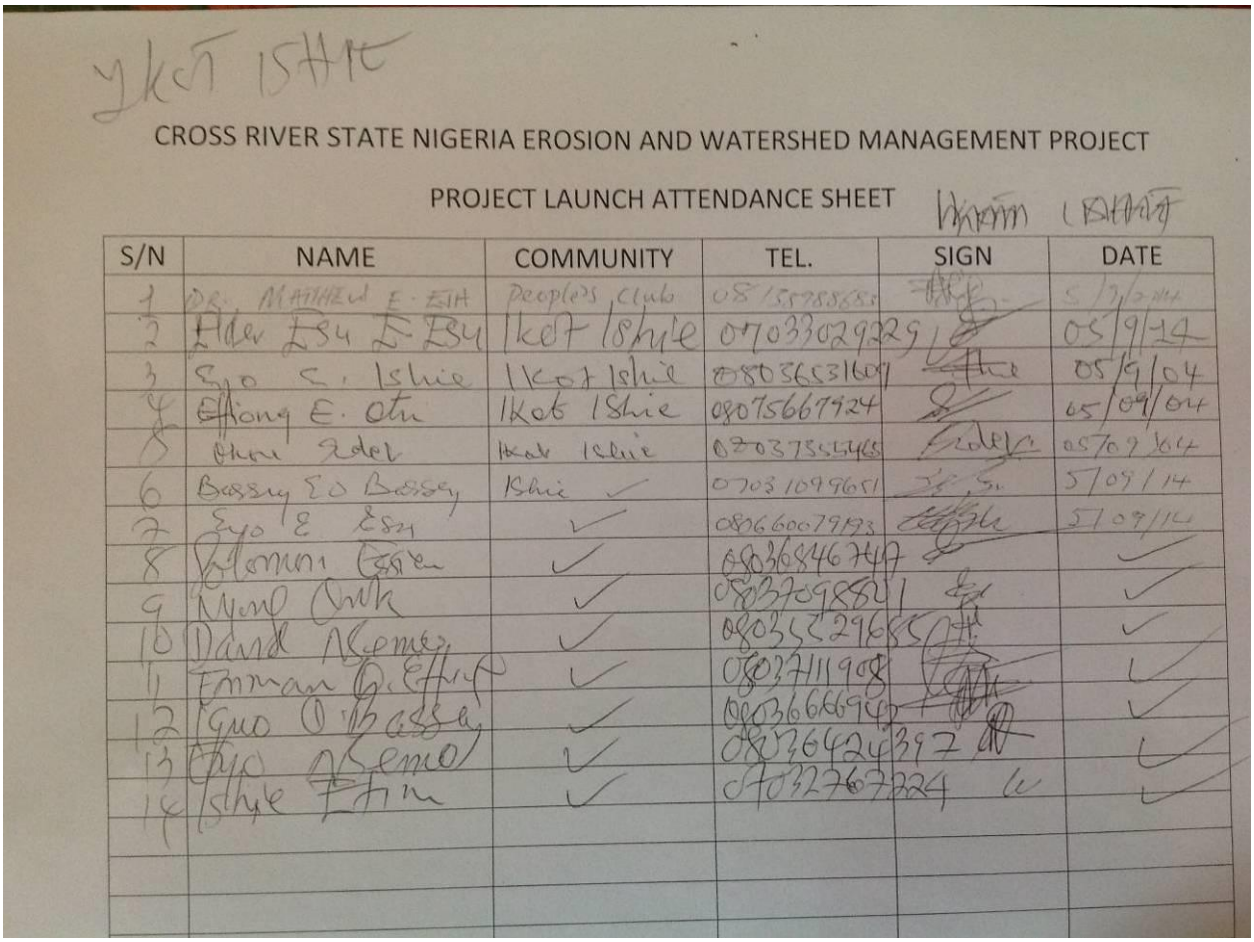
27	MR. CELESTINE E [illegible]		"	08032985425		[illegible]
28	Chief Dominic Ekpenyong		Councillor	08034434850		[illegible]
29	FIDELIS O. I. Atikpo		✓	07037950219		[illegible]
30	Senator Joseph Oqua Ansa (head)			08[illegible]377		[illegible]
31	Hon. [illegible] Augustine B. Edem		Clan Head		—	B.E. EDEM
32	Mr Philomena [illegible]		[illegible]		—	[illegible]
33	Iso, Emil a E.		"	07031813161	—	[illegible]



CROSS RIVER STATE NIGERIA EROSION AND WATERSHED MANAGEMENT PROJECT

PROJECT LAUNCH ATTENDANCE SHEET

S/N	NAME	COMMUNITY	TEL.	SIGN	DATE
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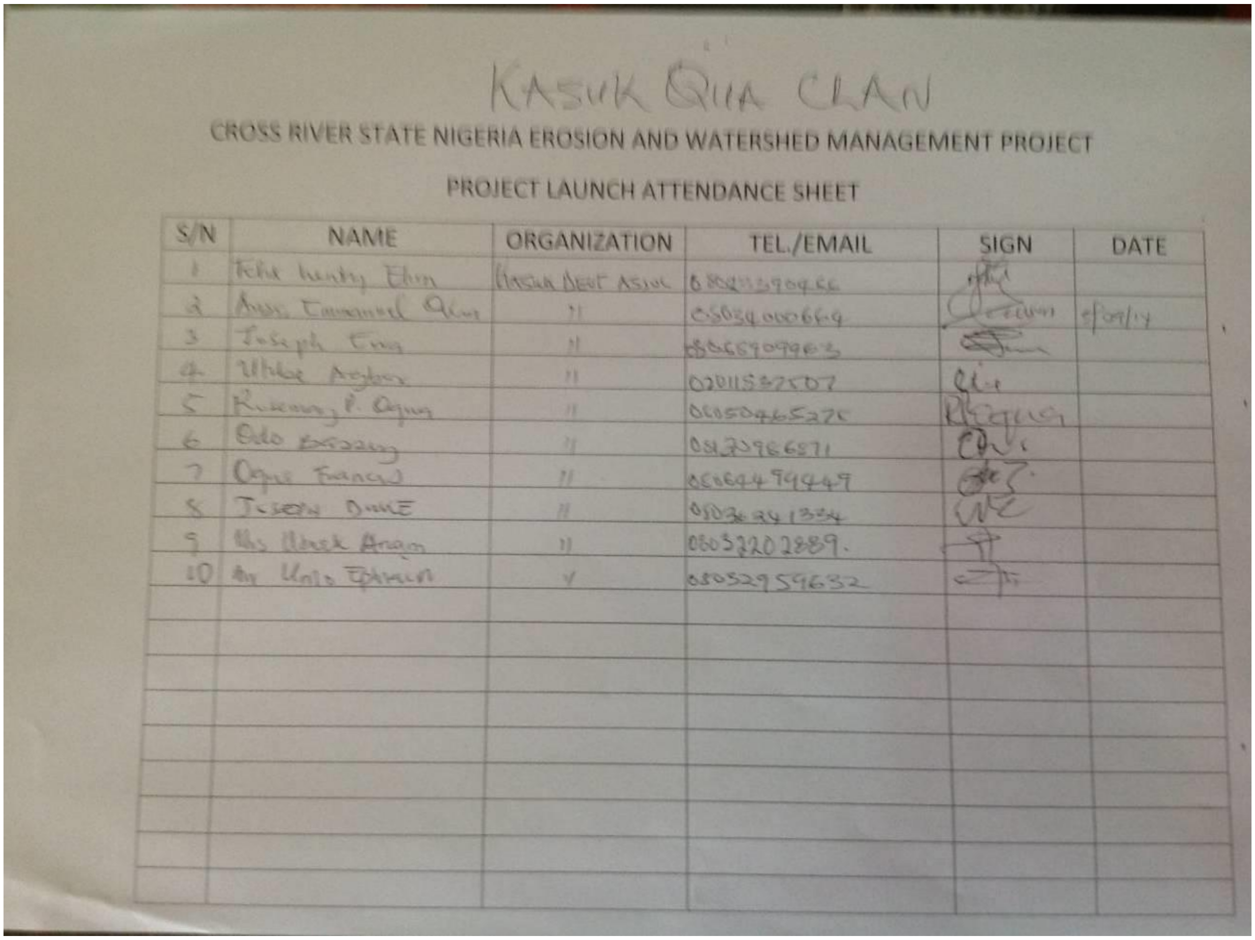
2	Elder Esu E. Esu	Ikot Ishie	07033029229		05/9/14
3	Eyo S. Ishie	Ikot Ishie	08056531607		05/9/04
4	Effiong E. Otu	Ikot Ishie	08075667924		05/09/04
5	Okon Edet	Ikot Ishie	07037555465		05/09/14
6	Bassey Eo Bassey	Ishie ✓	07031099651		5/09/14
7	Eyo E Esu	✓	08660079193		5/09/14
8	Solomon Essien	✓	08036846747		✓
9	Mrs Ubi	✓	08037098821		✓
10	David Ndeme	✓	08035629855		✓
11	Emman O. Effiong	✓	08037111908		✓
12	Iquo O. Bassey	✓	08036669497		✓
13	Eyo Ndeme	✓	08026424392		✓
14	Ishie Etim	✓	07032767224		✓



KASUK QUA CLAN

CROSS RIVER STATE NIGERIA EROSION AND WATERSHED MANAGEMENT PROJECT

PROJECT LAUNCH ATTENDANCE SHEET

S/N	NAME	ORGANIZATION	TEL./EMAIL	SIGN	DATE
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2	Asso. Emmanuel Okon	"	08034000669	[signature]	6/09/14
3	Joseph Eno	"	08056909963	[signature]	
4	Uhbe [illegible]	"	07011532507	[signature]	
5	Rosemary P. Ogung	"	08050465275	[signature]	
6	Edo Bassey	"	08170966871	[signature]	
7	Ogue Francis	"	08064499449	[signature]	
8	Joseph Duke	"	08036341334	[signature]	
9	Mrs Uwek Anam	"	08037202889.	[signature]	
10	Mr Unio Ephraim	"	08052959632	[signature]	

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CROSS RIVER STATE NOTICE No. 2

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EDICT No. 1 of 1996

LS

From His Excellency
The Military Administrator

CALABAR

CROSS RIVER STATE (CLANS CREATION) EDICT 1996

Commencement (1st January 1996)

THE MILITARY ADMINISTRATOR OF CROSS RIVER STATE OF NIGERIA hereby makes the following -

EDICT

Creation of new clans

1. (1) There is hereby created in the general public interest and for the various Local Government Areas of Cross River State of Nigeria new clans named in the second column of the Schedule to this Edict.

(2) The name of each Local Government Area is shown in the first column and the verified villages under which the clans are composed are set out and indicated opposite the respective clans in the third column of the Schedule to this Edict.

Repeal of Section 1 of and Schedule 1 to 1978 No. 14

2. Section 1 of the Traditional Rulers Law 1978 and Schedule 1 thereto are hereby repealed.

Interpretation

3. In this Edict -
"**Clans**" has the meaning ascribed to it in subsection (1) of section 44 of the Traditional Rulers Edict, 1978.

"**Military Administrator**" means the Military Administrator of the State.

"**State**" means Cross River State.

Short title and Commencement

4. This Edict may be cited as the Cross River State (Clans Creation) Edict 1996 and shall be deemed to have come into force on 1st January, 1996.

Repeal of 1991 Edict

5. The Cross River State Clans (Modification) Edict 1991 is hereby repealed.

S/No.	Local Government	Clans	Villages
6.	CALABAR	25. NJAHASANG CLAN	1. Otop Otop II 2. Itankan 3. Omonoko 4. Egbe Mfan Oyen 5. Etimusang 6. Njomidibi 7. Okang Ekpo
		26. NKONIB (IKOT ANSA) CLAN	1. Etab Ekpo 2. Otop Otop 3. Okoroba 4. Nyahasang 5. Etab Agbo Ntoe 6. Etab Oqua Agbo
		27. ENANG AHE CLAN	1. Etab Nneta 2. Etab Ohen 3. Etab Inok Nikae 4. Odoso Otu Ekom 5. Odoso Esebe 6. Etab Iso Odo 7. Etab Omin Iso
		28. IKPAI OHOM CLAN	1. Asari Eso 2. Etab Asi Ekpe 3. Okon Inok 4. Mba Odoso 5. Inyang Effiom
		29. IKPAE OMIN CLAN	1. Asabe 2. Osera Nkoeam (Idak Ukpa) 3. Okon Mban 4. Enima Onun Omin 5. Asabe Village 6. Ebona Nyok-Edim 7. Idoro Ando 8. Adai 9. Eyaha Nse 10. Esikama-Mfuk 11. Akama Nsa
		30. EFIO ATAI CLAN	1. Ikot Ekpo Abasi 2. Ikot Abenyo Ekpo Eyo 3. Akani Mbang Essien Etim Offiong

S/No.	Local Government	Clans	Villages
6.	CALABAR	30. EFIO ATAI CLAN -- continued	4. Ikot Nkebre 5. Ikot Effanga Mkpa 6. Ikot Ekabo Ekpo Eyo 7. Ikot Obot Okoho 8. Ikot Efiom Eyamba 9. Ikot Enebong 10. Ikot Okon Effanga 11. Ikot Edet Antigha
		31. KASUK QUA I CLAN	1. Esam Asi Village 2. Etab Efiom Ngondo 3. Etab Ayi Ito 4. Etab Efa Etim 5. Ikot Efiong Nta 6. Etab Iban Amanso 7. Etab Ntiero Effiom 8. Akai Efa 9. Ndoboti Kasuk 10. Moningon Kasuk 11. Etab Effiong Effiom 12. Etab Okon Effiom 13. Etab Edet Effiom 14. Etab Eyo 15. Etab Nsisuk 16. Etab Uduak 17. Idundu Kasuk 18. Ikot Ika Edem
		32. KASUK QUA II CLAN	1. Etab Agbo Iso 2. Etab Ansa Agbor 3. Etab Mkpanam 4. Ebara Nnika 5. Etab Iso Eta 6. Etab Ayip Kasuk 7. Etab Edem Edet 8. Ibuot Obot 9. Ikot Anwatum Village
		33. BACOCO CLAN	1. Nasarawa 2. Awakada No. 1 3. Awakada No. 2 4. Ibeko Omin Omin 5. Aso Adim

[illegible] INJUNCTION restraining

S/No.	Local Government	Clans	Villages
14.	YALA	32. AYOKO-OROMA CLAN -- continued	9. Okpara 10. Odiubi 11. Ibakpa 12. Ogweleja 13. Ikpakere
		33. ITEGA EKPUDU CLAN	1. Itega Ekpudu 2. Aakwa 3. Oloko 4. Okpudu 5. Ochochi
		34. ITEKPA CLAN	1. Itekpa-Ayekwo 2. Itekpa-Anyeka 3. Itekpa-Iyeche 4. Ireng 5. Akraba 6. Ombodomu-Egrude 7. Adoka 8. Eboda
		35. ALOO CLAN	1. Oba 2. Itari 3. Yakpla 4. Abakpa 5. Okrike 6. Idiku 7. Adeni 8. Ijama 9. Otuche 10. Ahohi 11. Ugwaba

MADE at Calabar this 1st day of January, 1996.

GREGORY AGBONENI
GROUP CAPTAIN
Military Administrator
Cross River State

The Edict Creates new Clans out of the Traditional Villages and Clans constituting the various Local Government Areas in the State.

- ... restraining

ANNEXURE TWO

SUMMARY OF WORLD BANK SAFEGUARD POLICIES, NATIONAL AND INTERNATIONAL LEGAL POLICIES.

THE WORLD BANK SAFEGUARD POLICIES

Environmental Assessment (OP 4.01)

The OP 4.01 requires among others that screening for potential impacts is carried out early, in order to determine the level of EA to assess and mitigate potential adverse impacts. The Bank's project screening criteria group projects into three categories:

- Category A – Projects whose impacts are sensitive, diverse, unprecedented, felt beyond the immediate project environment and are potentially irreversible over the long term. Such projects require full EA.
- Category B - Projects involve site specific and immediate project environment interactions, do not significantly affect human populations, do not significantly alter natural systems and resources, do not consume much natural resources (e.g., ground water) and have adverse impacts that are not sensitive, diverse, unprecedented and are mostly reversible. Category B projects will require partial EA, and environmental and social action plans.
- Category C - Projects are mostly benign and are likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project, although some may require environmental and social action plans.

The EA ensures that appropriate levels of environmental and social assessment are carried out as part of project design, including public consultation process, especially for Category A and B projects. The OP 4.01 is applicable to all components of Bank financed projects, even for co-financed components.

OP/BP 4.12 Involuntary Resettlement

The Policy on Involuntary Resettlement is intended to assist displaced people arising from development projects, in order not to impoverish any affected people within the area of influence of projects. An action plan that at least restores the standard of living must be instituted, in cases where resettlement is inevitable or loss of assets and impacts on livelihood occurs. Public consultation of "re-settlers" as well as the host communities is significant for the successful resettlement process and implementation of the action plan, in order to incorporate appropriate choices.

OP/BP 4.04
Natural Habitats

This policy recognizes that the conservation of natural habitats is essential to safeguard their unique biodiversity and to maintain environmental services and products for human society and for long-term

sustainable development. The Bank therefore supports the protection, management, and restoration of natural habitats in its project financing, as well as policy dialogue and economic and sector work. The Bank supports, and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. Natural habitats are land and water areas where most of the original native plant and animal species are still present. Natural habitats comprise many types of terrestrial, freshwater, coastal, and marine ecosystems. They include areas lightly modified by human activities, but retaining their ecological functions and most native species.

This policy is triggered by any project (including any sub-project under a sector investment or financial intermediary) with the potential to cause significant conversion, loss or degradation of natural habitats whether directly (through construction) or indirectly (through human activities induced by the project).

OP 4.09 Pest Management

The objective of this policy is to (i) promote the use of biological or environmental control and reduce reliance on synthetic chemical pesticides; and (ii) strengthen the capacity of the country's regulatory framework and institutions to promote and support safe, effective and environmentally sound pest management. More specifically, the policy aims to (a) Ascertain that pest management activity in Bank financed operations are based on integrated approaches and seek to reduce reliance on synthetic chemical pesticides (Integrated Pest Management (IPM) in agricultural projects and Integrated Vector Management (IVM) in public health projects. (b) Ensure that health and environmental hazards associated with pest management, especially the use of pesticides are minimized and can be properly managed by the user. (c) As necessary, support policy reform and institutional capacity development to (i) enhance implementation of IPM-based pest management and (ii) regulate and monitor the distribution and use of pesticides.

The policy is triggered if: (i) procurement of pesticides or pesticide application equipment is envisaged (either directly through the project, or indirectly through on lending, co-financing, or government counterpart funding); (ii) the project may affect pest management in a way that harm could be done, even though the project is not envisaged to procure pesticides. This includes projects that may (i) lead to substantially increased pesticide use and subsequent increase in health and environmental risk; (ii) maintain or expand present pest management practices that are unsustainable, not based on an IPM approach, and/or pose significant health or environmental risks.

OP 4.36 Forests

The objective of this policy is to assist borrower to harness the potential forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development and protect the

vital local and global environmental services and values of forests. Where forest restoration and plantations are necessary to meet these objectives, the Bank assists borrowers with forest restoration activities that maintain or enhance biodiversity and ecosystem functionality. The Bank assists borrowers with the establishment of environmentally appropriate, socially beneficial and economically viable forest plantations to help meet growing demands for forest goods and services.

This policy is triggered whenever any Bank financed investment project (i) has the potential to have an impact on the health and quality of forests or the rights and welfare of people and their level of dependence upon or interaction with their forests; or (ii) aims to bring about changes in the management protection and utilization of natural forests or plantations.

OP/BP 4.37

Safety of Dams

The objectives of this policy are as follows: For new dams, to ensure that experienced and competent professionals design and supervise construction; the borrower adopts and implements dam safety measures for the dam and associated works. For existing dams, to ensure that any dam that can influence the performance of the project is identified, a dam safety assessment is carried out, and necessary additional dam safety measures and remedial work are implemented.

This policy is triggered when the Bank finances:

(i) a project involving construction of a large dam (15 m or higher) or a high hazard dam; and (ii) a project which is dependent on an existing dam. However, for small dams, generic dam safety measures designed by qualified engineers are usually adequate.

OP 7.50 Projects in International Waters

The objective of this policy is to ensure that Bank-financed projects affecting international waterways would not affect: (i) relations between the Bank and its borrowers and between states (whether members of the Bank or not); and (ii) the efficient utilization and protection of international waterways. The policy applies to the following types of projects: (a) Hydroelectric, irrigation, flood control, navigation, drainage, water and sewerage, industrial and similar projects that involve the use or potential pollution of international waterways; and (b) Detailed design and engineering studies of projects under (a) above, include those carried out by the Bank as executing agency or in any other capacity.

This policy is triggered if (a) any river, canal, lake or similar body of water that forms a boundary between, or any river or body of surface water that flows through two or more states, whether Bank members or not; (b) any tributary or other body of surface water that is a component of any waterway

described under (a); and (c) any bay, gulf strait, or channel bounded by two or more states, or if within one state recognized as a necessary channel of communication between the open sea and other states, and any river flowing into such waters.

Physical Cultural Heritage OP 4.11

This policy addresses physical cultural resources, which are defined as movable or
immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. The project in itself will not be implemented in any culturally sensitive site. Sites of cultural significance will be avoided. In the case of a chance find, cultural artifacts will be collected and secured. Physical cultural resources are important as sources of valuable scientific and historical information, as assets for economic and social development, and as integral parts of a people's cultural identity and practices.

International Legal And Administrative Instruments

United Nations Guiding Principles on the Human Environment

The United Nations, concerned about negative environmental trends since its formation, published two major concept documents: Guiding principles on the Human Environment (1972) and the Rio Declaration on Environment and Development (1992). The Guiding Principles are defined as formal declarations that express the basis on which an environmental policy can be built and which provide a foundation for action. The principles relevant to the proposed gully erosion intervention project are summarized below:

Principle Two

The natural resources of the earth, including the air, water, land, flora and fauna and especially representative samples of natural ecosystems, must be safeguarded for the benefit of present and future generations through careful planning or management, as appropriate.

The Rio Declaration on Environment and Development

The 1992 United Nations Conference on Environment and Development (Rio de Janeiro) added more principles to the original 1972 guiding principles, the more relevant being:

Principle Ten

Environmental issues are best handled with the participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities

in their communities and the opportunity to participate in decision-making processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided.

Principle Thirteen

States shall develop national law regarding liability and compensation for victims of pollution and other environmental damage. States shall also cooperate in an expeditious and more determined manner to develop further international law regarding liability and compensation for adverse effects of environmental damage caused by activities within their jurisdiction or control to areas beyond their jurisdiction.

Principle Seventeen

Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.

Biological diversity convention (1992)

The objectives of this Convention, which was opened for signature at the 1992 Rio Earth Summit, are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits arising out of the utilization of genetic resources, including appropriate access to genetic resources and appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.

National Legal And Administrative Instruments

One of the most relevant legislation for NEWMAP is the *Environmental Impact Assessment Act No. 86 of 1992* of the Federal Government of Nigeria. The Act makes EIA mandatory for any development project, and prescribes the procedures for conducting and reporting EIA studies. It requires that development projects be screened for their potential impact. The EIA Act is in agreement with World Bank EA requirements for any development project. The World Bank provides 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 addition to these, there are several national and international environmental and social policies and regulations that are applicable to NEWMAP and its sub-projects. A number of government Ministries, Departments and Agencies (MDAs) have enabling laws, which support the objectives of the ESMP study. Most States in Nigeria also have environmental regulations backed by State laws. Nigeria is signatory to a number of international treaties and conventions, including those on climate change, oil and chemical pollution, labour and others.

Environmental Impact Assessment (EIA) Act

In Nigeria, the Federal Ministry of Environment (FMENV) is the nation's regulatory authority for the environment. Act No. 58 of 1988 established the Federal Environmental Protection Agency (FEPA) (now defunct) as the chief regulatory body for environmental protection in Nigeria. The Federal Ministry of Environment (FMENV), created in June 1999, now oversees the functions of the defunct FEPA. The Act establishing the Ministry places on it the responsibility of ensuring that all development and industry activity, operations and emissions are within the limits prescribed in the National Guidelines and Standards, and comply with relevant regulations for environmental pollution management in Nigeria as may be released by the Ministry. Thus, the Ministry ensures that environmental and social issues are mainstreamed into development projects. As part of the effective utilization of the EIA tool, the Ministry has produced Sectoral guidelines detailing the necessary requirements of the EIA process from each Sector. The Ministry enforces the EIA Decree which sets out to:

(i) Consider the likely impacts and the extent of these impacts on the environment before embarking on any project or activity.

(ii) Promote the implementation of appropriate policy in all federal lands consistent with all laws and decision-making processes through which the goal of this Act may be realized.

(iii) Encourage the development of procedures for information exchange, notification and consultation between organizations and persons when the proposed activities are likely to have significant environmental effects on boundary or trans-state or on the environment of bordering towns and villages.

Furthermore, FEPA regulations S.1.8, S.1.9 and S.1.15 of 1991 provided guidelines and standards for the following:

- Effluent limitations
- Pollution abatement in industries generating wastes
- Solid and hazardous wastes management

National Environmental Protection (Effluent Limitations) Regulation (S.1.8) 1991

This regulation makes it mandatory for industries generating wastes to install anti-pollution and pollution abatement equipment on site. The regulation is specific to each category of waste generating facility with respect to limitations of solid and liquid discharges or gaseous emissions into the ecosystem. Appropriate penalties for contravention are specified in the regulation.

National Environmental Protection Regulation (S.1.9) 1991

The National Environmental Protection (Pollution Abatement in Industries Producing Waste) Regulation of 1991 regulates the release of toxic substances, requirement for pollution monitoring unit, machinery for combating pollution and contingency plan by industries. It also provides that industries producing wastes should submit lists and details of chemicals used by such industries to FMNEV as well as permissible limits of discharge into public drains. It details protection of workers, requirements for environmental audit and penalty for contravention.

National Environmental Protection (Management of Solid Hazardous Wastes) Regulation (S.1.15) 1991

This regulation spells out the requirements for groundwater protection, surface impoundment, land treatment, waste piles, landfills, incinerators, etc. It also describes the hazardous chemical products and dangerous waste constituents.

The Land Use Decree, 1978

The Land Use Act of 1978 states that "… it is also in the public interest that the rights of all Nigerians to use and enjoy land in Nigeria and the natural fruits thereof in sufficient quantity to enable them to provide for the sustenance of themselves and their families should be assured, protected and preserved". The Act vests ownership of land on government. Individuals acquire certificate of occupancy from government.

The Endangered Species (Control of International trade and Traffic) Decree No. 11, 1985; Endangered species Decree CAP 108 LFN 1990

This Decree stipulates that the hunting, capture of, or trade in the animal species listed in its Schedule 1 (endangered species) has been absolutely prohibited. The Decree also stipulates that the hunting, capture, trade in, or unapproved dealing with an animal species listed in its Schedule 2 (threatened species) was permitted only if the individual possessed a license issued under the Decree.

Urban and Regional Planning Decree

Section 33 of the Nigeria Urban and Regional Planning Decree No. 88 of 1992 stipulates that a developer shall submit application for development permit, along with a site-plan and a detailed Environmental Impact Assessment Report, stamped and duly signed by a registered town planner as a necessary approval requirement to beef up land use control and management for communal development. The decree is aimed at ensuring the mainstreaming of all physical development efforts into the environment.

Cross River State Ministry of Environment Edict

Environmental issues are not only regulated by Federal Acts and Decrees but also by State edicts, International Conventions that are ratified by both the Federal and State Governments. The EIA Decree

No.86 of 1992 also recommended the setting up of State Environmental Agencies to participate in regulating the consequences of project development on their environment. The provisions of section 24 of the FEPA Decree 58 of 1988 and chapter 131 of the laws of the Federation of Nigeria ensured the establishment of the Cross River State Environmental Protection Agency (CRSEPA), now the Ministry of Environment. The functions of the Ministry that are related to the proposed project include:

- The Ministry should liaise with project developers and conduct Environmental Impact Assessment of new and existing projects and make recommendations for corrective measures where necessary.
- The Ministry should survey and monitor the water, air, land and soil environment in the State to determine pollution levels (if any) in them, and collect baseline data there from.
- The Ministry shall cooperate with the Federal Ministry of Environment, State Environmental Protection Bodies, Federal and State Ministries, Local Government Council, Statutory bodies and Research agencies on matters and facilities relating to environmental protection.

ANNEXURE THREE

GENERAL ENVIRONMENTAL MANAGEMENT CONDITIONS FOR CONSTRUCTION CONTRACTS/CIVIL WORK

This section deals with the purpose and structure of the Contract. It allocates responsibilities and sets up the procedures for making the Contract work. Underlying it are the basic principles of clear definition of roles, responsibility for outcomes, and promoting best practice. The management conditions for construction contracts detailed here have been extracted and modified, as appropriate for the gully erosion intervention project, from the Environmental and Social Management Framework for State and Local Governance Reform (SLOGOR) Project of the Federal Government of Nigeria (2013) and the New South Wales (Australia) Government General Conditions of Contract (GC21; 2013).

General responsibilities

The Contractor must:

Construct the Works in accordance with the Contract; and

Perform and observe all its other obligations under the Contract.

The Principal (herein also referred to as CRS NEWMAP PMU) must:

Pay the Contractor the Contract Price for its performance, in accordance with and subject to the Contract; and

Perform and observe all its other obligations under the Contract.

The CRS NEWMAP PMU may give instructions to the Contractor concerning the Works and anything connected with the Works, and the Contractor must comply at its own cost unless the Contract expressly provides otherwise.

Contractor's Authorized Person

The Contractor must ensure that, at all times, there is a person appointed to act as the Contractor's Authorized Person. The Contractor's Authorized Person acts with the Contractor's full authority in all matters relating to the Contract. The Contractor must promptly notify the Principal of the name and contact details of the Contractor's Authorized Person and of any change in those details. If the Principal reasonably objects to the Contractor's Authorized Person at any time, the Contractor must replace that person.

Principal's Authorized Person

The Principal must ensure that, at all times, there is a person appointed to act as the Principal's Authorized Person. The Principal must promptly notify the Contractor of the name and contact details of the Principal's Authorized Person and of any change in those details.

The Principal's Authorized Person does not act as an independent certifier, assessor or Valuer. The Principal's Authorized Person acts only as an agent of the Principal.

The Principal's Authorized Person may delegate any of its contractual functions and powers to others by written notice to the Contractor.

Co-operation

The parties must do all they reasonably can to co-operate in all matters relating to the Contract, but their rights and responsibilities under the Contract (or otherwise) remain unchanged unless the parties agree in writing to change them.

Duty not to hinder performance

Each party must do all it reasonably can to avoid hindering the performance of the other under the Contract.

Early warning

Each party must promptly inform the other if it becomes aware of anything that is likely to affect the time for Completion, or the cost or quality of the Works. The parties must then investigate how to avoid or minimise any adverse effect on the Works and Scheduled Progress.

Evaluation and monitoring

As the Contract proceeds, regular meetings (usually monthly) allow the parties and selected stakeholders to evaluate performance and identify priorities for improvement.

The parties must meet regularly to evaluate and monitor performance of the Contract.

The parties must decide jointly who will participate in the meetings. Participants may include Subcontractors, Suppliers, Consultants and, if appropriate, representatives of government authorities, end users and local communities. Participation in meetings does not give the participants any additional rights or responsibilities.

Participants in the evaluation and monitoring meetings must meet their own costs for attendance, and the parties must share equally the other costs.

The Contract

The Contract is formed by the Principal sending a Letter of Award to the Contractor, unless the Principal requires the Contract to be formed by execution of a formal agreement or deed.

The Contract is made up solely of the Contract Documents, which supersede all understandings, representations and communications made between the parties before the Date of Contract in relation to the subject matter of the Contract.

The Contract Documents must be read as a whole, and anything included in, or reasonably to be inferred from, one or more documents must be read as included in all other documents, unless the context requires otherwise.

The terms of the Contract cannot be amended or waived unless both parties agree in writing.

Even where a Letter of Award has been used to form the Contract, the Principal may require the Contractor to execute a formal agreement or deed on terms no different from those contained in the existing Contract Documents. If required, the Contractor must execute and return to the Principal two copies of the agreement or deed within 14 days after the Principal's written request for their execution. The Principal will return an executed copy to the Contractor.

Scope of the Works, Temporary Work and work methods

The Contractor acknowledges that:

- it is both experienced and expert in work of the type, complexity and scale of the Works;
- it has made full allowance in the Contract Price for the matters referred to in the contract document;
- unless the Contract expressly provides an entitlement to payment, everything required to be done by the Contractor under the Contract is to be done at the Contractor's own cost.

The Contractor acknowledges that Variations instructed by the Principal may change the scope of the Works.

Unless the Contract specifies, or the Principal instructs, that the Contractor use a particular work method or perform particular Temporary Work, the Contractor is solely responsible for determining the work methods and the requirements for all Temporary Work.

If requested in writing by the Principal, the Contractor must, within the time specified in the request, advise the Principal of:

its price (excluding all costs of delay or disruption) for any proposal by the Principal to use a particular work method or perform particular Temporary Work proposed by the Principal or to change a work method or Temporary Work specified in the Contract;

the anticipated effect of the Principal's proposal on achieving Completion; and

the effect of the Principal's proposal on any other matter specified by the Principal.

If the parties agree in writing on the effects of the Principal's proposal and the Principal instructs the Contractor to carry out the proposal, any affected Contractual Completion Dates and the Contract Price must be adjusted as agreed.

Assignment

The Contractor must not assign a right or benefit under the Contract without first obtaining the Principal's written consent.

Governing law of the Contract

The Contract is governed by World Bank Operational Directives, the laws of Nigeria and the Cross River State (See Annexure 2 of this document), and the parties submit to the non-exclusive jurisdiction of the courts of Cross River State.

Subcontractor relationships

The Contractor is solely responsible for all Subcontractors and is liable for their acts and omissions as if such acts or omissions were those of the Contractor. Subcontracting of any obligation under the Contract does not affect the Contractor's obligations or liability under the Contract.

The Contractor indemnifies the Principal against all claims (including Claims), actions, loss or damage and all other liability arising out of any acts or omissions of Subcontractors.

The Contractor must include in every Subcontract:

details of the Contractor's obligations in connection with the Contract which are to be carried out by the Subcontractor;

consent for the Subcontract to be novated to the Principal or its nominee, if required by the Principal; and when possible, a right of termination for convenience.

12. Contract Provisions for Civil Works: Environmental and Social Impacts

1. General Provisions and Precautions

The contractor shall take all necessary measure and precautions and otherwise ensures that the execution of the works and all associated operations on the work sites or off site are carried out in accordance with the World Bank's Performance Standards and the requirements of applicable legislation and environmental requirement of Nigeria. The contractor shall take all measures and precautions to avoid any nuisance or disturbance arising from the execution of the work. This shall, wherever possible, be achieved by suppression of the nuisance at source rather than abatement of the nuisance once generated. In the event of any soil or debris or silt from the work sites being deposited on any adjacent land, the

contractor shall immediately remove all such spoil debris or silt and restore the affected area to its original state to the satisfaction of the responsible authorities.

2. Water Quality

The following conditions shall apply to avoid adverse impacts to water quality:

- The contractor shall prevent any interference with supply to, or abstraction from, water resources and the pollution of water resources (including underground percolating water) as a result of the execution of the works.
- The contractor shall not discharge or deposit any matter arising from the execution of the work into any waters except with the permission of the regulatory authorities concerned.
- The contractor shall at all times ensure that all existing stream courses and drains within and adjacent to the site are kept safe and free from any debris and any material arising from the works.
- The contractor shall protect all water courses, waterways, ditches, canals, drains, and the like from pollution, silting, flooding or erosion as a result of the execution of the works.

3. Air Quality

The following conditions shall apply to avoid adverse impacts to air quality:

- Open burning will be prohibited.
- In periods of high wind, dust- generating operations shall not be permitted within 200 meters of residential areas having regard to the prevailing direction of the wind.
- Asphalts and hot- mix plants sites shall be located at least 500 meters away from the nearest sensitive receptor (e.g. schools).
- Water sprays shall be used during the delivery and handling of materials when dust is likely to be created and to dampen stored materials during dry and windy weather.
- Stockpiles of materials shall be sited in sheltered areas or within hoarding, away from sensitive areas. Stockpiles of friable material shall be covered with tarpaulins.
- Vehicle with an open load-carrying area used for transporting potentially dust-producing material shall have proper fitting side and tailboards. Materials having the potential to produce dust shall not be loaded to a level higher than the side and tail boards, and shall be covered with a clean tarpaulin in good condition. The tarpaulin shall be properly secured and extend over the edges of the side and tailboards.
- In periods of adverse weather adverse, impacts to adjacent residents or site employees during construction will be mitigated by either discontinuing until favourable conditions are restored, or, if warranted, sites may be watered to prevent dust generation.
- Machinery and equipment will be fitted with pollution control devices, which will be checked at regular intervals to ensure that they are in working order. Best available pollution control technologies will be used.

4. Protection of soils

Borrow pits. The following conditions shall apply to borrow pits:

- Borrow areas will be located outside the ROWs.
- Pit restoration will follow the completion of works in full compliance of all applicable standards and specification.
- The excavation and restoration of the borrow areas and their surroundings, in an environmentally sound manner to the satisfaction of regulatory authorities is required before final acceptance and payment under the terms of contracts.

- Borrow pit areas will be graded to ensure drainage and visual uniformity, or to create permanent tanks\dams.
- Topsoil from borrow pit areas will be saved and reused in re-vegetating the pits to the satisfaction of regulatory authorities.
- Additional borrow pits will not be opened without the restoration of those areas no longer in use.

To avoid potential adverse impacts due to erosion, the contractor shall:

- Line spillage ways with riprap to prevent undercutting.
- Provide mitigation plantings and fencing where necessary to stabilize the soil and reduce erosion.
- Upgrade and adequately size, line and contour storm drainage to minimize erosion potential.
- To avoid erosion and gullying, the contractor should reduce his earthworks during the peak of rainy seasons, use gabions and miter drains.

5. Avoidance of Social Impacts

To avoid adverse social impacts, the Contractor shall:

- Coordinate all construction activities with neighboring land uses and respect the rights of local landowner. Written agreements with local landowners for temporary use of the property will be required and sites must be restored to a level acceptable to the owner within a predetermined time period.
- Maintain and cleanup campsites.
- Attend to health and safety of their workers by providing basic emergency health facilities for workers and incorporate programs aimed at the prevention of sexually transmitted diseases as a part of all construction employee orientation Programs.
- Obtain approval of all diversions and accommodation of traffic. The Contractor shall provide a written traffic control plan which is to include when and where flagmen shall be employed and when and where traffic cones or other devices such as barricades and \or lights will be used.

6. Noise

To avoid adverse impacts due to noise, the contractor shall:

- Consider noise as an environmental constraint in planning and execution of the works.
- Use equipment conforming to international standards and directives on noise and vibration emissions.
- Take all necessary measures to ensure that the operation of all mechanical equipment and construction processes on and off the site shall not cause any unnecessary or excessive noise, taking into account applicable environmental requirements.
- Maintain exhaust systems in good working order; properly design engine enclosures, use intake silencers where appropriate and regularly maintain noise–generating equipment. Schedule operations to coincide with periods when people would least likely be affected and by the contractor having due regard for possible noise disturbance to the local residents or other activities. The contractor must observe statutory requirements which regulate working hours and working days (-Construction activities will be strictly prohibited at night).
- Incorporate noise considerations in public notification of construction operations and specify methods to handle complaints. Disposal sites and routes will be coordinated with local officials to avoid adverse traffic noise.

7. Protection of Utilities

To avoid potential adverse impacts to utilities, the Contractor shall:

- Ascertain and take into account in his method of working the presence of utility services on and in the vicinity of the site.
- Take into account the periods required to locate, access, protect, support and divert such services, including any periods of notice required to effect such work in consultation with authorities operating such services.
- Assume all responsibility to locate or to confirm the details and location of all utility services on or in the vicinity of the site.
- Exercise the greatest care at all times to avoid damage to or interference with services.
- Assume responsibility for any damage and \or interference caused by him or his agents, directly or indirectly, arising from actions taken or a failure to take action, and for full restoration of the damage.

8. Waste Disposal and Hazardous materials

- Water and waste products shall be collected, removed via suitable and properly designed temporary drainage systems and disposed of at a location and in a manner that will cause neither pollution nor nuisance.
- Insofar as possible, all temporary construction facilities will be located at least 50 metres away from a water course, stream or canal. The contractor shall not dispose of used cement slurry or material in the bush or road side, nor in water courses or wetlands. Such material shall be utilized or disposed of in places approved by the CRS Min. of Environment.

9. Environmental Monitoring

Monitoring or direct impact will be carried out by CRS NEWMAP and Min. of Environment and will include, but not restricted to, the following concerns:

- Erosion along highway segments and borrow sites during and after construction;
- Silting and increased sediment loads to streams.
- Verification that proper waste disposal at construction sites and base camps is done;
- Assurance that construction sites and base camps are cleaned after construction and
- Inspection of vegetation covers (removal and re- growth) on the basis of field examinations.

10. Scheduled Progress

- The Contractor must carry out all work in connection with the Contract so as to achieve Scheduled Progress.
- Whenever requested, the Contractor must demonstrate to the Principal that it is achieving Scheduled Progress.

11. Care of people, property and the environment, indemnities and limitations

Obligations of care

- The Contractor is responsible for all of the following:
    - preventing personal injury or death;
    - preventing loss or damage to the Site and the Works;
    - preventing loss or damage to adjoining and other properties and the environment arising in connection with carrying out the Works;
    - locating and caring for existing services;

- repairing or making good loss or damage to the Works and the Site; and

  bearing the cost of repairing, or making good, loss or damage to adjoining and other properties and the environment arising in connection with carrying out the Works.

- If, in the opinion of the Principal, urgent action is required to avoid death, injury, loss or damage, and the Contractor does not take the necessary action immediately when the Principal requests it, the Principal may take the action (without relieving the Contractor of its obligations), at the Contractor's cost, and the Principal's costs of doing so will be recoverable as a deduction from the Contract Price.

Indemnities for property, personal injury or death

The Contractor indemnifies the Principal against loss or damage to:

- the Works, from the date the Contractor begins carrying out the Works; and the Site and anything brought onto the Site for the purposes of the Contract from the date the Contractor is given access to the Site, or the relevant part of the Site, until and including the Actual Completion Date of the whole of the Works except that, in respect of any part of the Works which is occupied or taken into use by the Principal, this indemnity ceases when that part is occupied or taken into use and the indemnity then applies as if the Actual Completion Date had been achieved with respect to that part.
- After the Actual Completion Date of the whole of the Works, the Contractor indemnifies the Principal against loss or damage to the Works, the Site, and anything brought onto the Site for the purposes of the Contract:

  Arising out of carrying out its obligations under the Contract, including carrying out Variations, making good Defects and removing Materials from the Site.

ANNEXURE 4

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ANNEXURE 5A

TECHNICAL APPROACH AND METHODOLOGY

Conduct of Field Work and Laboratory Analysis

Field work was undertaken in March- April 2014. The following issues relevant to the successful conduct of fieldwork were documented:

- Data requirements
- Sample size, sampling procedure
- Sampling points/locations
- Details of methodology

All laboratory analyses were carried out in the PTDF (Petroleum Trust Development Fund) Laboratory, Faculty of Science, University of Calabar, Calabar. Quality control was assured through sending spiked samples for analysis in the BGI Resources Limited Laboratories, Aba-PH Expressway, Port Harcourt.

Bio- Physical environment

Air Quality/Climate/Meteorology

The strategies adopted for sampling will ensure coverage of entire area likely to be impacted during construction activities at the prioritized erosion intervention sites. Air quality study was carried out to generate data needed as baseline data for the area. All parameters 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 sampling exercise.

(a) Selected gaseous pollutants.

Concentrations of some selected common air pollutants were determined. CROWCON GASMAN portable gas monitors were used to automatically detect the ambient concentrations of these pollutants in the prioritized erosion intervention sites. The selected gaseous pollutants included H_2S, SO_2, NO_2, Cl_2, NH_3, HCN, and CO. Gasman Gas Monitors (manufactured by CROWCON) have electrochemical sensors, which utilize the principle of electrochemistry to determine the ambient concentration of gaseous pollutants in the atmosphere. The monitor operates by gas diffusion in the sensor, which is placed directly under the exposed filter. When the atmospheric air under analysis comes in contact with the sensor, electrochemical reactions take place and the current generated or consumed is amplified and displayed on the output meter or LCD (Liquid Crystal Display) screen. Gasman electrochemical sensors show high specificity and are well established means of monitoring low parts per million (ppm) levels of gases.

(b) Hazardous dust or suspended particulate matter (spm).

Average concentrations of fine suspended particulate matter (spm) were obtained at the sampling stations using the 10µm Particulate Monitor and known as the HAZ-DUST$_{TM}$ (manufactured by Environmental Devices Cooperation). The instrument is a portable direct reading particulate monitor that uses infra-red (IR) electromagnetic radiation to sense airborne particles. The HAZ-DUST$_{TM}$ adopts the principle of near-forward-light scattering which utilizes a light source-emitter and a photo-detector positioned at 90^0 angle. As particles traverse the sensing volume, they scatter IR at a forward angle of 45-90 degrees. The amount of scattered light is directly proportional to the aerosol or fine particles of 10µm (or below) diameter concentration in the air. The mass concentration readout (in the LCD) is expressed in milligrams per cubic meter (mg/m^3). The instrument complies with OSHA Air Contaminant Exposure Standards and can be used for all industrial and environmental particulate air monitoring applications.

(c) ***Noise Level***

The ambient noise levels in the prioritized erosion intervention sites were determined using the Digital Impulse Sound Level Meter (DAWE D-1422C). The meter is suitable for free field and random incidence noise monitoring and provides a clear and unambiguous digital display of the sound level on a Liquid Crystal Display

Soil/Sediment Studies

Field studies and sampling Design

The proposed gully project area was divided into 11 sampling stations sampled at different intervals (distance). Essentially, samples were taken within erosion head, side and finger end depending on the spread and complexity using the soil auger. A total of 22 soil samples were obtained from the 11 sampling stations for surface and subsurface depth sequence (that is, 0-15 and 15-30cm respectively). Samples for bulk density and total porosity determinations were collected along the site. The choice for this design was informed by the topography of the landscape to give equal representation of the land area and in addition to the erosion fingers and spread. Samples were also taken for bulk density. Samples for these were carried out 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 exist *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 certified laboratory.

Laboratory Analysis

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 105^0C 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/cm^3. The weight of the oven-dry samples were later taken and recorded accordingly. The bulk densities of the samples were evaluated using the equation:

$$BD = \frac{\text{Wt. of oven dry sample (gm)}}{\text{Volume of sample } (Cm^3)}$$

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 assayed by Atomic Absorption Spectrophotometry following digestion of soil samples with a mixture of concentrated $HN0_3$ and HCl (Barnhisel and Bertsch, 1982).

Geology/Hydrogeology

The general objective of the study was to carry out an assessment and potential impact on the geology and hydrogeological environment in respect of the proposed works at the Ikot Anwatim gully complex sites. 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

The geographical locations and characteristic features of established sampling stations were recorded. Surface geological mapping was acheived using available maps, reports and data. In addition the bearing and pacing method was used in the field. This was aided through the use of compass – clinometer and existing roads that traverse the project area. 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.

Water Use

Information on water use was gathered through direct interview and observations by consultants.

Surface Water Quality

Water sampling and analysis

Water samples for physico-chemical were collected in one litre polyethylene bottles and stored in a cool box at approximately 4^{o}C until refrigerated. Samples were analysed in the laboratory within 5 days of collection. Samples were analysed in the laboratory within 5 days of collection. Samples for heavy metals analysis were collected in 50ml polyethylene bottles and preserved by acidifying to pH 2 with nitric acid (HNO_3) until analysis. Surface water samples were collected from three (3) sampling locations within the designated site with the aid of aseptically certified plastic containers. The samples were transferred into ice chest, amidst other preservative methods in strict accordance to the parameters to be analyzed. Sampling was in line with the American Society for Testing and Material (ASTM) and American Public Health Association (APHA) sampling protocols. 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. The various probes were immersed in water and measurements recorded from the equipment's screen. Values were immediately logged into the field notebook. The methods used for analysis of physico-chemical and chemical parameters are shown in Table 1 below.

Table 1: Methods and equipment for physical and chemical analyses in the study area

Analytical Equipment/Method and Reference	Parameter(s)
Cyberscan pH 20 meter	pH, E_h
Cyberscan low 20 conductivity meter	Temperature, conductivity, TDS
Microprocessor Oximeter 196	Dissolved Oxygen (DO)
Atomic Absorption Spectrophotometer (ASS)	K, Na, Heavy metals
Spectrophotometrically by	
(a) Turbidimetry using barium chloride (APHA, 1989)	Sulphate, SO_4^{2-}
(b) Diazotisation method (Parsons et al, 1984)	Nitrite (NO_2)
(c) As nitrite after reduction in a calcium reduction system (Parsons et al, 1984)	Nitrite (NO_3)
(d) Molybdenum blue method (Parsons et al, 1984).	Phosphate (PO_4^{3-})
(e) Formazine standards according to HACH	
(f) Nesslerization method (APHA, 1975)	Turbidity (NTU)
	Ammoninm (NH_4^+)
Titrimetrically using:	
(a) Silver nitrate and potassium dichromate as indicator (Rodier, 1975)	Chloride (Cl)
(b) Complexometric technique using EDTA as Titrant (APHA, 1989).	Calcium (Ca), Magnesium (mg)
(c) Titration using indicators like muraxide etc.	Total hardness, bizabonate and alkalinity.
Difference between initial oxygen concentration in sample and concentration after 5 days incubation in DO bottles at 20^oC (APHA, 1989)	Biochemical Oxygen demand, BOD_5.

HYDROBIOLOGY AND MICROBIOLOGY

Collection and treatment of Water, Sediment and 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. Three surface water and sediment samples were also collected (from same locations for water quality studies) to assess the distribution and abundance of heterotrophic bacteria and fungi, and hydrocarbon carbon utilizers within the project area.

Water samples were collected with a clean polyethylene sampling bottles. These were kept in a cool-box with an ice pack. Sediment samples were collected with hand trowel and the contents were emptied into a clean cellophane bag, and stored in a cool-box. Twenty two 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.

Total Heterotrophic Bacterial Count (THBC)

Ten-fold serial dilution of each sample ranging from 10^{-1} to 10^{-6} (for sediment soil) and 10^{-1} to 10^{-4} (for water) was undertaken (Atlas and Bartha 1998), 1ml of aliquot from appropriate dilutions was seeded into sterile petri-dishes in triplicates and THBC was determined by pour-plate techniques using nutrient agar. The medium was supplemented with filtered sterilized cycloheximide antibiotics to inhibit fungal growth. The counts were expressed as CFU per ml. or gm after 24 – 48 hrs incubation.

Total Heterotrophic fungal count (THFC)

Using appropriate dilution as described above, this was carried out in triplicate using malt extract agar supplement with $0.5mg1^{-1}$ streptomycin antibiotics to inhibit bacterial growth. The counts were expressed as CFU per ml or gm after 24 – 48 hrs incubation.

Total Hydrocarbon utilizing Bacteria (THUB)

The population of hydrocarbon-utilizing bacteria was determined by using aliquots of appropriate ten-fold dilutions on mineral salt medium (MSM) of Zajic and Supplison (1972) in triplicates. A sterile filter paper (Whatman No 1) saturated with filtered sterilized crude oil was aseptically placed on the cover of the inverted Petri dishes (Atlas and Bartha, 1998). The plates were taped round with masking tape to

increase the vapour pressure within the dishes. After incubation for 14 days at room temperature, the plates were counted as CFU per ml or gm (water or sediment).

Total Hydrocarbon Utilizing Fungi (THUF)

In this case the procedure just above was repeated but the medium was supplemented with 0.5mg per ml streptomycin to inhibit bacterial growth. In all these procedures un-inoculated plates were used as control.

Hydrobiology

Phytoplankton Studies

At each station, 20 litres of water sample was filtered through 55µm mesh size plankton net sieve. All biological samples were preserved in 4% conc. Formaldehyde. Each preserved sample was allowed to settle and subsequently concentrated to 10ml. 1ml of concentrated sample was subsequently examined under the microscope and counting conducted in a Sedgewick-Rafter Counting Chamber and results recorded. Five separate counts were conducted for each sample and the results pooled and expressed as number of organisms/ml.

Zooplankton Studies

The methods and locations adopted for zooplankton studies were similar to those for the phytoplankton above.

Benthic Macrofauna

At the designated sampling locations, 10 hauls of benthic samples were collected with a hand trowel within a 0.25m^2 area. The composite samples were then gently washed through a 500µm mesh size sieve and invertebrates sorted out and preserved in borax buffered 5% formaldehyde in appropriately labeled jars for subsequent analyses in the laboratory. In the laboratory, the preserved samples were washed with water through 500µm sieve to remove the preservatives and fine sediments. Individual animals were sorted, counted using binocular microscope in the laboratory and identified to species level. Benthos counts were expressed as number of organisms/m^2.

Biodiversity Studies

Vegetation

The access route around the command area of mature gully sites constituted the major transect for biodiversity assessment. The location of each sampling transect/sub-transect was determined using GPS. At each sampling location, plants were identified from 40m x 40m quadrats along the transect or sub-transect. 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). For each transect information on habitat, vegetation structure and species were recorded. Habitat data included vegetation description, latitude, longitude and altitude. Vegetation structure has been described in terms of heights of plants, grouped into ground layer (less than 2 m), shrub layer (2-5 m) or tree layer (more than 5m). A pair of binoculars (Model: HELIOS Fieldmaster, 8 x 40) was employed to aid field identification of some trees. Features of ecological interest were documented with a SONY DCR- TRV340 digital video camera recorder. The dendrometric parameters recorded included height (m) and diameter (cm) of trees. Tree species diversity was calculated as the Shannon-Wiener (H^1) index while the abundance of herbaceous genera has been expressed in semi-quantitative terms (dominant, frequent, occasional, rare) (Pryor, 1981). On this basis a species having a wide distribution with many stands would be classified as a common, abundant, widespread species. Alternatively, a species may have a similarly wide distribution but with very few stands and would be classified as an infrequent, restricted or occasional species. Species of limited geographic distribution and with a few stands are classified as rare and are vulnerable to elimination because of their limited extent alone, apart from any other factors. Some species are considered rare where little is known about their distribution.

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

Foliar samples from representative plant species were used for tissue analysis. Samples were dried to constant weight and digested by boiling in 10 ml of a 1:2 mixture of nitric and hydrochloric acids in a fume hood. The chemical composition of the resulting solution was analyzed by atomic absorption spectrophotometry.

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. Hideouts such as crevices, leaf litters, logs etc were probed with props to rout out any hidden animals. Tree canopies were observed with a pair of binoculars (Model: Helios Fieldmaster 8 x 40) for birds and other arboreal animals such as monkeys, squirrels and snakes. The indirect count method was also employed, particularly for animals that do not readily offer themselves for observation. This method utilizes evidence of animal presence or occupation for evaluation of any given species without physically seeing them. Such evidence includes the presence of burrows, droppings, footprints, feathers, carcass, tracks sloughed skin, devoured fruits and calls of different animals. Animals were identified using the field guides and keys of Kingdom (1997) and Happold (1987). The status of identified wildlife was categorized based on IUCN (1994) procedures and the provisions of the Endangered Species Decree No. 11 (1985).

Socio-Economic Studies

The socio-economic survey adopted a combination of several data collection techniques to achieve the objectives of the study. A combination of the following methods was adopted at varying degrees for the different parameters of interest in the communities;

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

The host and catchment communities of the proposed erosion intervention project were used for the study. Other communities were selected based on their proximity to the erosion site.

Table 4.0 : Communities Sampled and number of Questionnaires administered

S/N	Communities	Local Government Area	No of Questionnaires
1	Ikot Ansa	Calabar Municipality	55
2	Ikot Anwatim	Calabar Municipality	70
3	Ikot Akpanam	Calabar Municipality	45
4	Ikot Ishie	Calabar Municipality	47
5	Ikot Abasi Obori	Calabar Municipality	37
6	Kasuk	Calabar Municipality	34
Total			288

Data was collected on various socio-economic parameters such as; Demography, livelihood activities, social infrastructure, and cultural practices etc. These were analyzed using descriptive statistics and

population projection models. Two population projection models (Palmore and Gardner, 1983) were used, linear and exponential;

(a) *Linear Extrapolation Model*

$P_n = P_0 + na$ ..... (1)

Where P_o = the base population,

a = some fixed percentage of the base population (growth rate), and

n = time elapsed in years.

(b) *Exponential Growth Model*

$$P_n = P_o\ (1 + r)^n \text{.....} (2)$$

where P_0 = base population

r = rate of growth (rate of change per unit time) and

n = time period in years.

The *Dependency Ratio* is given by the formula:

$$\frac{\text{No. of Persons under 18 or over 64}}{\text{No. of Persons 18-64 yrs old}} \times 100 \text{ .....} (3)$$

The *Sex Ratio* is expressed as:

$$\frac{\text{No. of Males}}{\text{No. of Females}} \times 100 \text{ .....} (4)$$

The questionnaire survey involved sampling households within the communities using a set of questionnaire. A total of 288 questionnaires were administered. The random sampling technique was employed using selected households. The main objective of the socio-economic study was to provide a baseline data of the social and economic conditions of the community that will form a basis for assessing the effect of the project on the community. The Focused Group Discussion (FGD) involved the traditional rulers and other chiefs and elders of the respective communities. Other members of different groups within the communities such as youths and women were represented. The objective of the FGD/consultation included:

(i) facilitating communication and mutual understanding between project's proponent and host community,

(ii) identifying issues relevant to the proposed project that might affect existing social, economic and environmental equilibrium

(iii) avoiding future conflict between proponents and host community

(iv) sensitizing host community to key into the project,

These discussions provided information on social organization of the communities, ethnic composition, population and demographic characteristics, as well as the extent of commercial activities, employment, and occupational distribution of the respondents. Photographs of focused group discussion sessions and other activities and features of relevance to this study were taken.

Land Use and Agriculture

The study of the land use and agriculture of the communities of the project area project was undertaken. Information on Agricultural land use practices was obtained using the On-site Visual Assessment (OVA), Oral interviews, well-designed Rapid Rural Appraisal Techniques and Single-visit farm –household Resource Monitoring Approach (SRM).

Health Assessment Studies

A community health status survey involving epidemiological and environmental health data collection and analysis was conducted through the use of:

i. Structured Questionnaire survey
ii. Focus Group Discussion
iii. Knowledge, Attitude and Practice studies
iv. Direct Observation
v. Door to door personal Interviews
vi. Stakeholders consultation

Document Review

Relevant literature and available related documents were reviewed at inception to gather useful information for the HIA study. These include:

i. Environmental Impact Assessment (EIA) Process Manual
ii. EIA Act No 86, 1992
iii. Project Objectives and Technical Details
iv. Previous HIA studies
v. Health Aspects of Environmental Assessment, World Bank 1997

vi. World bank EIA source book Vols.1-111,1991

vii. Handbook of Proposed Resettlement Action Plan, IFC 2002

Access to the communities and their involvement in the survey were negotiated through planned community consultations involving all levels of the administrative, social strata and stakeholders in the Hosts Communities. Some indigenous field assistants were recruited to join the survey team…

ANNEXURE 5B RECORDED DATA

Appendix I: Sampling coordinates and site description of soils sampled within Ikot Anwatim Gully Erosion Site and its Environs, Calabar.

Sample Code	Number of Soil samples (top and bottom Inclusive)	GPS Coordinates	Site Location Name
S_1	2	N04^0 59' 22''; E008^o 20'.24''	NPA Quarters, Ekorinim II, Calabar
S_2	2	N05^0 00'.01''; E008^o 19'.40''	Gully head, Ikot Anwatim
S_3	2	N04^0 59'.59''; E008^o 19'.22''	Redeemed Church, Ekorinim II, (Active)
S_4	2	N05^0 0'.29''; E008^o 19'.56''	Ekpenyong Eya, Ikot Anwatim
S_5	2	N05^0 0'.36''; E008^o 19'.34''	Ekpenyong Eya, Ikot Anwatim
S_6	2	N05^0 0'.24''; E008^o 19'.58''	Brotherhood Road, Ikot Anwatim
S_7	2	N05^0 0'.15''; E008^o 19'.53''	Existing main gully Stilling Basin
S_8	2	N05^0 0'.12''; E008^o 19'.57''	Valley Bottom of main gully
S_9	2	N05^0 0'.7''; E008^o 19'.49''	Gully Head, Green Valley Hotel
S_{10}	2	N05^0 0'.7''; E008^o 19'.50''	Gully Belly, Green Valley Hotel
S_{11}	2	N05^0 0'.1''; E008^o 19'.52''	Green Valley Hotel

Appendix II: Physical characteristics of soils sampled within Ikot Anwatim Gully Erosion Site and its Environs, Calabar, Cross River State

Station Code	Depth (cm)	Particle size distribution (%) Sand	Silt	Clay	Textural Class(USDA)	Bulk density (Mgm^{-3})	Pore space (%)	Aggregate Stability (sieve openings) 0.50mm	2.0mm
S_1	0 – 15	83.46	6.94	9.60	Ls	1.50	57	10.32	12.46
	15 – 30	72.46	8.94	18.60	Sl				
S_2	0 – 15	81.46	5.94	12.60	Sl	1.10	59	10.10	14.65
	15 – 30	76.40	7.94	15.66	Sl				
S_3	0 – 15	95.46	1.06	3.48	s	1.90	72	12.43	17.78
	15 – 30	92.46	1.06	6.48	s				
S_4	0 – 15	84.46	7.94	7.60	ls	1.90	72	18.29	19.20
	15 – 30	82.46	9.60	7.94	ls				
S_5	0 – 15	92.46	0.06	0.06	s	1.10	59	14.49	14.00
	15 – 30	80.46	5.94	5.94	sl				
S_6	0 – 15	93.46	0.04	6.50	s	1.90	72	12.11	12.02
	15 – 30	86.46	4.94	8.60	ls				
S_7	0 – 15	96.46	0.06	3.48	s	1.60	60	12.25	14.36
	15 – 30	92.46	0.06	7.48	s				
S_8	0 – 15	84.46	4.94	10.60	ls	1.10	59	12.79	13.49
	15 – 30	72.46	8.94	18.60	sl				
S_9	0 – 15	89.46	2.06	8.48	s	1.20	55	10.10	13.50
	15 – 30	83.46	2.94	13.60	sl				
S_{10}	0 – 15	80.46	7.94	11.60	sl	1.10	59	10.10	12.80
	15 – 30	77.40	6.94	15.66	sl				
S_{11}	0 – 15	83.46	6.94	9.60	sl	1.90	72	10.45	12.55
	15 – 30	75.46	10.94	13.60	sl				

ls = Loamy sand; s = sand; sl = sandy loam; ls = loamy sand; standard particle size = $2.65gm/cm^3$; USDA = United States Dept. for Agriculture

Appendix III: Chemical characteristics of soils sampled within Ikot Anwatim Gully Erosion Site and its Environs, Calabar, Cross River State

Station Code	Depth (cm)	pH (H_2O)	EC dSm^{-1}	Org. C (%)	Total N (%)	Avail. P Mg kg-1	Exchangeable bases ($cmolkg^{-1}$)				EA ($Cmolkg^{-1}$)	ECEC ($Cmolkg^{-1}$)	Base saturation (%)
							Ca	Mg	K	Na			
S_1	0 – 15	5.8	0.156	1.01	0.06	8	6.26	2.14	0.04	0.06	4.40	12.90	66
	15 – 30	5.2	0.140	1.04	0.06	7	5.24	1.02	0.09	0.07	5.10	11.52	56
S_2	0 – 15	6.0	0.270	1.26	0.05	6	5.22	2.67	0.07	0.08	3.15	11.19	72
	15 – 30	6.6	0.199	0.75	0.04	8	5.78	2.01	0.07	0.07	3.87	11.80	67
S_3	0 – 15	5.8	0.186	1.97	0.06	9	4.74	1.01	0.06	0.08	4.88	10.77	55
	15 – 30	5.5	0.277	1.03	0.06	6	4.40	1.52	0.06	0.07	3.52	9.57	63
S_4	0 – 15	5.5	0.214	1.28	0.07	8	5.47	2.38	0.06	0.06	3.24	11.21	71
	15 – 30	6.0	0.430	0.82	0.06	7	3.68	1.88	0.07	0.05	3.49	9.17	62
S_5	0 – 15	5.0	0.218	1.20	0.05	7	4.18	1.26	0.07	0.06	4.67	10.24	54
	15 – 30	5.1	0.412	1.04	0.05	4	3.10	1.98	0.08	0.05	3.55	8.76	60
S_6	0 – 15	5.3	0.293	1.16	0.06	6	5.15	2.05	0.12	0.08	3.82	11.22	66
	15 – 30	5.9	0.074	1.14	0.05	8	5.18	2.33	0.10	0.05	3.09	10.75	71
S_7	0 – 15	6.0	0.270	1.26	0.05	6	6.20	2.10	0.07	0.06	2.16	10.59	80
	15 – 30	6.1	0.178	1.00	0.04	7	5.19	2.01	0.14	0.05	3.17	10.56	70
S_8	0 – 15	5.4	0.106	1.62	0.07	8	6.20	2.14	0.04	0.06	3.20	11.64	73
	15 – 30	5.6	0.149	1.07	0.05	5	5.25	1.08	0.06	0.05	3.18	9.62	67
S_9	0 – 15	5.3	0.216	1.74	0.07	9	5.12	2.09	0.07	0.06	2.68	10.02	73
	15 – 30	5.4	0.211	1.01	0.05	4	6.2	2.63	0.06	0.04	3.19	12.12	74
S_{10}	0 – 15	5.3	0.293	1.16	0.06	6	5.15	2.01	0.18	0.06	3.65	11.05	67
	15 – 30	5.9	0.074	1.14	0.05	9	6.18	2.33	0.10	0.05	4.04	12.70	68
S_{11}	0 – 15	6.2	0.089	0.96	0.06	5	4.43	2.70	0.08	0.08	4.90	12.19	60
	15 – 30	6.0	0.098	0.83	0.05	9	5.68	2.09	0.17	0.06	5.36	13.36	60

Appendices IV: Heavy Metal Status of Soils sampled within Ikot Anwatim Gully Erosion Site and its Environs, Calabar Cross River State

Station Code	Depth (cm)	Fe (Mg/Kg^{-1})	Zn (Mg/Kg^{-1})	Cu (Mg/Kg^{-1})	Mn (Mg/Kg^{-1})	Ni (Mg/Kg^{-1})	V (Mg/Kg^{-1})
S_1	0-15	417.20	12.73	10.13	306.50	1.39	0.78
	15-30	572.00	10.46	7.26	250.19	0.86	0.47
S_2	0-15	477.85	18.51	15.31	220.46	1.82	0.59
	15-30	466.10	14.80	12.60	150.10	0.90	0.20
S_3	0-15	615.12	14.50	14.05	217.55	1.69	0.88
	15-30	551.84	9.60	10.20	169.20	1.63	0.41
S_4	0-15	590.18	11.12	11.31	120.56	1.84	0.88
	15-30	455.24	8.00	7.20	70.11	0.78	0.28
S_5	0-15	937.75	15.40	15.16	306.25	0.55	0.62
	15-30	861.00	11.00	11.11	250.10	0.10	0.10
S_6	0-15	936.40	16.05	14.51	306.06	0.92	0.87
	15-30	862.00	13.00	11.11	262.10	0.62	0.39
S_7	0-15	820.33	15.41	12.96	230.81	0.92	0.41
	15-30	750.15	11.40	7.41	161.00	0.71	0.09
S_8	0-15	567.22	12.73	10.13	306.50	1.39	0.78
	15-30	572.00	10.46	7.26	250.19	0.86	0.47
S_9	0-15	913.85	13.23	12.97	200.55	1.38	0.75
	15-30	862.00	9.26	9.01	150.17	0.80	0.30
S_{10}	0-15	937.75	15.40	15.16	306.25	0.55	0.62
	15-30	861.00	11.00	11.11	250.10	0.10	0.10
S_{11}	0-15	936.40	16.05	14.51	306.10	0.92	0.87
	15-30	862.00	13.00	11.11	262.10	0.62	0.39

Appendix V: Plant species composition and abundance in the Ikot Anwatim gully erosion complex area.

	Common Name	Family	Abundance/ Conservation status*	Number of trees	Height (m)	Diameter (cm)
(Main Gully)						
Trees						
Elaeis guineensis	African oil palm	Arecaceae	LC	6	10	28
Bambusa vulgaris	Bamboo	Bambusae	NE	4	12	8
Harungana madagascariensis	Blood tree	Hypericaceae	NE	2	5	5
Anthocleista vogelii	Cabbage tree	Potaliaceae		2	4	_
Alchornia cordifolia	Christmas bush	Euphorbiaceae	LC	3	4	7
Pterocarpus santiliondes	Water cam wood	Fabaceae	LC	1	6	11
Baphia pubescens	Benin camwood	Fabaceae	NE	3	4	-
Albizia adiantifolia	Albizia	Fabaceae		1	7	13
Draceana arborea	Dragon tree	Agavaceae		2	6	9
Gmelina arborea	Yamene	Verbenaceae	LC	5	6	27
Herbs						
Chromolaena odorata	Siam weed	Asteraceae	Common; NE			
Emilia sonchifolia	False tassle flower	Asteraceae	Common; NE			
Aspilia africana	Haemorrhage plant	Asteraceae	Common; NE			
Panicum maximum	Guinea grass	Poaceae	Common; NE			
Panicum laxum		Poaceae	Common; NE			
Paspalum orbiculare	Ditch millet	Poaceae	Common; NE			
Ipomoea involucrata	Morning glory	Convolvulaceae	Occasional; NE			
Scoparia dulcis	Sweet broom weed	Scrophulariaceae	Occasional; NE			
Calapogonium mucunoides	Calapo	Fabaceae	Abundant; NE			
Heterotis rotundifolia	Chick weed	Melastomataceae	Occasional; NE			
Gully Finger No.1 (Ikot Ansa Bus Stop)						
Trees						
Croton zambescicus	Thunder plant	Euphorbiaceae	LC	3	4	4
Musanga cercropioides	Umbrella tree	Moraceae	NE	2	12	20
Elaeis guineensis	African oil palm	Arecaceae	LC	3	10	29
Bambusa vulgaris	Bamboo	Bambusae	NE	5	7	8
Mangifera indica	Mango	Anacardiaceae	DD	2	5	16
Herbs						
Ipomoea involucrata	Morning glory	Convolvulaceae	Common; NE			
Sporobolus pyramidalis	Cat's tail	Poaceae	Common; NE			
Eleusine indica	Bull grass	Poaceae	Common; LC			

Cynodon dactylon	Bahama grass	Poaceae	Occasional; NE			
Panicum maximum	Guinea grass	Poaceae	Common; NE			
Paspalum orbiculare	Ditch millet	Poaceae	Common; NE			
Dactylocterium aegyptium	Crowfoot	Poaceae	Occasional; NE			
Axonopus compressus	Carpet grass	Poaceae	Common; NE			
Emilia coccinea	False tassle flower	Asteraceae	Common; NE			
Chromolaena odorata	Siam weed	Asteraceae	Common; NE			
Tridax procumbens	Coat's button	Asteraceae	Common; NE			
Aspilia africana	Hemorrhage plant	Asteraceae	Common; NE			
Physalis angulata	Gooseberry	Solanaceae	Occasional; NE			
Amaranthus spinosus	Spiny amaranth	Amaranthaceae	Occasional; NE			
Calapogonium mucunoides	Calapo	Fabaceae	Common; NE			
Solanum torvum	Prickly solanum	Solanaceae	Occasional; NE			
Kyllinga erecta		Cyperaceae	Occasional; NE			
Urena lobata	Cadillo	Malvaceae	Common; NE			
Asystasia gangetica	Hunter's weed	Acanthaceae	Common; NE			
Gully Finger No. 2 (Ikot Anwatim)						
Trees						
Cola rostrata		Sterculiaceae	NE	2	4	12
Bambusa vulgaris	Bamboo	Bambusae	NE	13	6	8
Newbouldia laevis	Tree of life	Bignoniaceae	NE	2	7	13
Elaeis guineensis	African oil palm	Arecaceae	LC	3	4	-
Herbs						
Asystasia gangetica	Hunter's weed	Acanthaceae	Common; NE			
Panicum maximum	Guinea grass	Poaceae	Common; NE			
Mariscus umbellatum		Cyperaceae	Occasional; NE			
Costus afer	Bush cane	Costaceae	Common; NE			
Alternanthera sessilis	Khaki weed	Amaranthaceae	Common; LC			
Pityrogramma calomelanos	Silver fern	Adiantaceae	Common; NE			
Chromolaena odorata	Siam weed	Asteraceae	Common; NE			
Gully Finger No. 3 (Winners Chapel)						
Trees						
Elaeis guineensis	African oil palm	Arecaceae	LC	2	15	28
Pterocarpus santalinoides	Waterside camwood	Fabaceae	LC	2	5	8
Bambusa vulgaris	Bamboo	Bambusae	NE	3	15	8
Musanga cercropioides	Umbrella tree	Cecropiaceae	NE	1	12	22
Harungana madagascariensis	Blood tree	Hypericaceae	NE	2	6	5
Gmelina arborea	Yamane	Verbenaceae	LC	3	12	25

Artocarpus communis	Breadfruit	Moraceae	DD	1	6	17
Icacina tricantha	Earth ball	Icacinaceae	NE	2	2	_
Herbs						
Phyllanthus amarus	Egg woman	Euphorbiaceae	Common; NE			
Costus afer	Bush cane	Costaceae	Common; NE			
Senna alata	Craw craw plant	Fabaceae	Common; NE			
Senna occidentalis	Coffee senna	Fabaceae	Occasional; NE			
Mariscus umbellatum		Cyperaceae	NE			
Lasienthera africana		Icacinaceae	DD			
Gully Finger No. 4 (Green Valley)						
Trees						
Bambusa vulgaris	Bamboo	Bambusae	NE	6	6	
Musanga cercropioides	Umbrella tree	Cecropiaceae	NE	2	7	
Harungana madagascariensis	Blood tree	Hypericaceae	NE	1	6	5
Gmelina arborea	Yamane	Verbenaceae	LC	1	12	25
Persea americana	Avocado pear	Lauraceae	Satisfactory	1	10	22
Elaeis guineensis	African oil palm	Arecaceae	LC	2	5	28
Herbs						
Centrosema pubescens	Centro	Fabaceae	Common			
Calapogonium mucunoides	Calapo	Fabaceae	Abundant			
Emilia coccinea	False tassle flower	Asteraceae	Common			
Aspilia africana	Haemorrhage plant	Asteraceae	Common			
Chromolaena odorata	Siam weed	Asteraceae	Common			
Alternanthera bettzickiana		Amaranthaceae	Occasional			
Asystasia gangetica	Hunter's weed	Acanthaceae	Common			
Panicum maximum	Guinea grass	Poaceae	Common			
Eleusine indica	Bull grass	Poaceae	Common			
Lindernia diffusa		Scrophulariaceae	Common			
Urena lobata	Cadillo	Malvaceae	Common			
Gully Finger No. 5 (Ekorinim II)						
Trees						
Elaeis guineensis	African oil palm	Arecaceae	LC	4	8	28
Cola rostrata		Sterculiaceae	NE	2	5	12
Bambusa vulgaris	Bamboo	Bambusae	NE	3	5	8
Gmelina arborea	Yamane	Verbenaceae	LC	3	6	8
Mangifera indica	Mango	Anacardiaceae	DD	1	6	16
Casuarina equisetifolia		Casuarinaceae		1	5	15

Pterocarpus santalinoides	Waterside camwood	Fabaceae	LC	2	3	_
Herbs						
Asystasia gangetica	Hunter's weed	Acanthaceae	Common; NE			
Eleusine indica	Bull grass	Poaceae	Common; LC			
Sporobolus pyramidalis	Cat's tail	Poaceae	Common; NE			
Panicum maximum	Guinea grass	Poaceae	Common; NE			
Commelina nodiflora	Wandering Jew	Commelinaceae	Common; NE			
Sida acuta	Broom weed	Malvaceae	Common; NE			
Cyperus rotundus	Nut grass	Cyperaceae	Occasional; LC			
Lagenaria breviflorum	Wild colocynth	Cucurbitaceae	NE			
Economic Crops						
Manihot esculenta	Cassava	Euphorbiaceae				
Anacardium occidentale	Cashew	Anacardiaceae				
Mangifera indica	Mango	Anacardiaceae				
Cocos nucifera	Cococnut	Arecaceae				
Psidium guajava	Guava	Myrtaceae				
Persea americana	Avocado	Lauraceae				
Vernonia amygdalina	Bitter leaf	Asteraceae				
Carica papaya	Pawpaw	Caricaceae				
Citrus sinensis	Orange	Rutaceae				
Telfairia occidentalis	Pumpkin	Cucurbitaceae				
Ananas comosus	Pineapple	Bromeliaceae				
Musa paradisiaca	Plantain	Musaceae				
Capsicum frutescens	Chilli pepper	Solanaceae				
Colocasia esculenta	Cocoyam	Araceae				
Dioscorea rotundata	White yam	Dioscoreaceae				
Dioscorea dumetorum	Sweet yam	Dioscoreaceae				
Dioscorea alata	Water yam	Dioscoreaceae				
Abelmoschus esculentus	Okro	Malvaceae				
Talinum triangulare	Waterleaf	Portulacaceae				

* None of the species listed is on the IUCN endangered list. NE, not evaluated; LC, Least concern; DD, data deficient.

ANNEXURE 6

MAPS

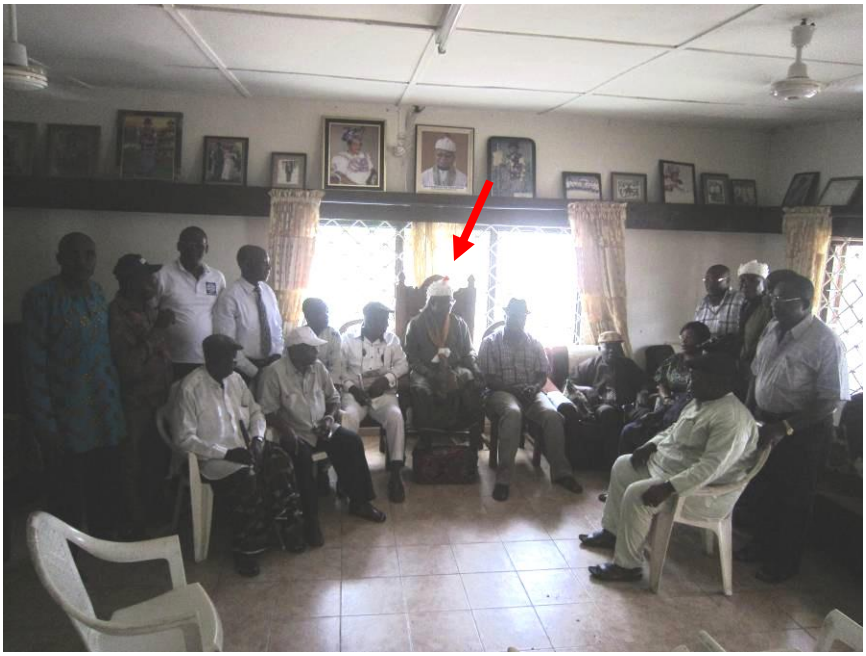
All maps relating to the preparation of this ESMP document have been incorporated into appropriate sections of this document (please see Chapters One and Three).

ANNEXURE 7 PHOTOS
STAKEHOLDER CONSULTATION

HRH Ntoe (Dr.) Patrick Inok Oquagbor V, Clan Head of Ikot Ansa, with some chiefs being escorted by NEWMAP staff to venue of stakeholders' consultation (Ikot Ansa Town Hall), March 2014.

Engr. Osam Okpa of CRS NEWMAP (1st right) and ESMP consultant Prof. Ani Nkang (standing) during stakeholder consultation with project communities at Nkonib (Ikot Ansa Town Hall) in March 2014. The Clan Head of Ikot Ansa, HRH Ntoe (Dr.) Patrick Inok Oquagbor V chaired the meeting.

Section of some participants during stakeholder consultation with project communities at Nkonib (Ikot Ansa Town Hall) in March 2014



Stakeholder consultation with Ishie Clan community leaders at palace of the Clan Head, HRH Etubom Effiom Okon Effiom in March 2014.

CRS NEWMAP staff and ESMP consultant during Stakeholder consultation with Ishie Clan community leaders at palace of the Ikot Ishie Clan Head in March 2014.

BIOPHYSICAL ENVIRONMENT

Remnant freshwater swamp forest at lower watershed of project area.

Ikot Anwatim stream and sand awaiting evacuation. The stream ultimately empties into the Calabar River.

Route for evacuating sand mined at discharge end of Ikot Anwatim main gully.

Remnant freshwater swamp forest at lower watershed of project area. Project design envisages release of water into the swamp following dissipation of hydraulic energy through use of stilling basins and check dams.

Housing development on a street leading to remnant freshwater swamp forest at lower watershed of project area.