GOVERNMENT OF CROSS RIVER STATE, NIGERIA

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT

Of the proposed

CALABAR – IKOM – KATSINA ALA SUPERHIGHWAY PROJECT

Submitted to

FEDERAL MINISTRY OF ENVIRONMENT, ABUJA

MARCH, 2016

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Date of Report: **MARCH 2016**

Project EIA Consultant: **PGM NIGERIA LIMITED**

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LIST OF ABBREVIATION AND ACRONYMS

A.C.I	American Concrete Institute
AISC	American Institute of Steel Construction
ALARP	As low As Reasonably Possible
A.S.T.M	American society for testing and material
APHA	American Public Health Association
ARV	Anti-retroviral drugs
BAT	Best Available Technology
BOD	Biochemical Oxygen Demand
cfu/g	Colony forming unit per gram
cfu/ml	Colony forming unit per millitre
cm	Centimeter
C	Carbon
Ca	Calcium
CDC	Community Development Committee
CEC	Cation Exchange Capacity
Cl^-	Chloride
Cu	Copper
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CRMoW	Cross River Ministry of Works
Db	Decibel
E	East
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Agency in USA
FEPA	Federal Environmental Protection Agency
FRSC	Federal Road Safety Corps
FMEnv	Federal Ministry of Environment
GC	Gas Chromatograph
GPS	Global Positioning System

Ha	Hectare
HAZOP	Hazard and Operability
HEMP	Hazards and effects Management Process
HNO_3	Trioxonitrate (V) acid
HP	High Pressure
HSE	Health, Safety and Environment
HUB	Hydrocarbon Utilizing Bacteria
HUF	Hydrocarbon Utilizing Fungi
H_2SO_4	Tetraoxosulpate (VI) acid
Km	Kilometers
Max	Maximum
Min.	Minimum
m	Metres
mg/kg	milligram per kilogram
mg/l	milligram per litre
ml	millilitre
mm	millimeter
ms^{-1}	metres per second
N	North
NE	North East
NGOs	Non-Governmental Organizations
NMT	Non-Motorise Transport
NOx	Nitrogen Oxides North West
^{O}C	Degree Celsius
PAH	Poly Aromatic Hydrocarbon
PC	Personal Computer
PU	Per Unit
pH	Hydrogen ion Concentration
PGM	PGM Nigeria Limited
ppm	Parts Per Million
ppt	Parts Per Thousand

QC/QA	Quality Control /Quality Assurance
RE	Resident Engineer
ROW	Right of Way
S	South
SE	South East
Spp.	Species
SPM	Suspended Particulate Matter
SSW	South South West
STDs	Sexually Transmitted Diseases
STIs	Sexually Transmitted Infections
SW	South West
TFC	Total Fungal Count
TDS	Total Dissolved Solid
THB	Total Heterotrophic Bacterial Count
THC	Total Hydrocarbon Content
TPH	Total Petroleum Hydrocarbon
TSS	Total Suspended Solids
VOC	Volatile Organic Carbon
W	West
WHO	World Health Organization
%	Percentage
<	Less than

Acknowledgment

The Government of Cross River State wish to thank God the Almighty Father for His mercies, grace and protection, the regulators at the Federal Ministry of Environment (FMEnv), all the affected persons and communities and the Local Government Councils and other stakeholders, for their various contributions and support in the EIA process of this project.

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EXECUTIVE SUMMARY

Introduction

The Government of Cross River State of Nigeria through the State Ministry of Works (CrMoW) proposes to undertake the construction of Calabar-Ikom-Katsina Ala superhighway measuring 260km. The road shall meet all standards of a superhighway including; security lighting, interchange and clover tongues at intersections with other roads, and wi-fi internet access. It is proposed to simply be a digital road for the 21st century and an evacuation corridor from the Calabar Deep Seaport. It will be the link road to Katsina-Ala in Benue State, northcentral Nigeria and Wukari in Taraba State, Numan, Yola and other towns in Adamawa, northeast Nigeria to Maiduguri and other cities in the far northeast. The proposed project is expected to have both negative and positive impacts on the environment and people of the area.

With the proposed building of the new Calabar Seaport, this highway project will be significant in the interfacing of land and water transportation. The project aims at repositioning Cross River State as the number one tourism destination in Nigeria as well as improvement in agriculture and economic activities within the state and bilateral trades between Nigeria with the neighbouring republic of Cameroun.

Environmental Impact Assessment (EIA) Process

The EIA for superhighway project was undertaken in accordance with the *Environmental Impact Assessment Act (Act No. 86 of 1992 now EIA CAP E12, LFN 2004)* and has been guided by international standards. Accordingly, the EIA process comprised of a number of key steps, as listed below:

i. EIA Registration
ii. Site Verification Visit
iii. Screening and Scoping
iv. Baseline data acquisition
v. Stakeholder consultation and disclosure
vi. Impact assessment
vii. Management plans
viii. Reporting and Review
ix. Impact Mitigation Monitoring
x. Audit

LEGAL, POLICY AND ADMINISTRATIVE FRAMEWORK

National Administrative Framework

The Project is subject to regulations implemented and enforced by the following government organisations: The Federal Ministry Environment (FMEnv) is the primary authority for regulation and enforcement of environmental laws. FMEnv enforces a number of policies, acts and guidelines including the *National Policy on the Environment (1989, revised 1999), the Environmental Impact Assessment Act No. 86 (1992) and National Guidelines and Standards for Environmental Pollution Control in Nigeria (1991)*.

Summary of Some Nigerian Environmental Legislation

Nigerian environmental legislation relevant to this project includes the following:

- National Policy on the Environment (1989)
- NESREA Act (2007)
- Environmental Impact Assessment Act No 86 (1992)
- Environmental Impact Assessment LFN Act (2004)
- Water Resources Act (1993)
- National Inland Waterways Authority (LFN 2004)
- National Environmental Protection (Management of Solid and Hazardous Wastes Regulations) (1991)
- National Environmental Protection (Effluent Limitation) Regulations (1991)
- Harmful Wastes (Special Criminal Provisions etc.) Act No 42 (1988)
- Federal Environmental Protection Agency Act (1998)
- National Guidelines and Standards for Environmental Pollution Control in Nigeria (1991)
- Pollution Abatement in Industries Generating Wastes Regulations (1991)

Nigerian Social Legislation

- Nigerian social legislation relevant to this project includes the following.
- Labour Act (1990)
- Land Use Act (Act No. 6 of 1978) and

Federal Road Safety Commission (establishment) Act 2007

Cross River State Ministry of Environment

The Ministry of the Environment is charged with the responsibility of providing decent, orderly and reasonable conducive environment for habitable society, as contained in the assignments of Ministerial responsibilities. In line with the State Government's 10-point development Agenda, the need to restructure the Ministry for efficiency and effectiveness became apparent.

The departments of the Ministry were established to achieve the following responsibilities:

- Conservation of soil and natural resources;
- Environmental sanitation and protection services;
- Control of Environment Pollution, e.g., noise, water, land and illegal trading;
- Supervision of Cross River State Waste Management Authority;
- Supervision of ESEU (Environmental Sanitation and Enforcement Unit);
- Evaluation of Environmental Impact Assessment (EIA) and Environment Audit Report (EAR);
- Ecological matters; and
- Monitoring, co-ordination and evaluation of all World Bank Assisted Projects.

Cross River State Ministry of Lands and Housing

The Responsibilities of the Ministry are as follows:

- Land Use and Allocation Matter;
- Land Policy and Land Matters;
- Acquisition of Land for State Purposes;
- Issuance and Revocation of Certificate of Occupancy;
- Survey Services;
- Lands Registry (Administration and Control);
- Subsequent Transactions including Assignment Mortgages, Leases and Power of Attorney;
- Mapping Matters;
- Resolving land disputes between individuals;
- Neighbourhood Improvement Charge;
- Servicing and Monitoring of Land Use and Allocation Committee; and
- Land Reclamation and dredging.
- Construction of Economic housing units;

- Supervision of Cross River State Development Property Corporation;
- Matters relating to forfeiture of properties;
- Resettlement of displaced people;
- Compensation for acquired properties;
- Valuation of all types of interest in properties; and
- Identification of abandoned properties

Reporting and disclosure

The EIA process and outcomes were drawn together into a draft EIA report which will be submitted to the FMEnv for stakeholders review process. FMEnv will disclose the EIA report to the public for review and comments and will also be the subject of a panel review by FMEnv and appointed experts. FMEnv will base the decision to grant or deny the certification for the EIA, which provides environmental authorisation for the project, on the outcome of the review process.

Project Justification

The justification for the proposed superhighway project has been based on its needs, benefits; economic, technical and environmental sustainability.

Need for the Project

Cross River state produces plenty of cocoa, cassava, rubber and other economic crops, as well as other abundant industrial raw materials such as limestone, uranium, basalt, granite etc. but with underdeveloped transportation infrastructures. There are high costs of transportation, overheads and logistics, restriction in agricultural products or sales and industrial raw material development. These have led to an underdevelopment of the regional economy. After the completion of the proposed road project, there will be a reduction in logistic cost, speed up in the flow of goods and services, acceleration in the state's import and export trade and it will also attract industrial and agricultural investments. This new road project will also reduce travelling time from Calabar to the northern parts of the country.

At present, Cross River State has no railway line, only one civil airport is located in Calabar. As a result, bulk material transportation is done solely on a low-grade Federal highway which has worn out due to stress and lack of maintenance. The existing two lanes roads cannot meet the growing economic needs of the state. This new highway project will become an economic corridor linking the south and north of Cross River State as well as make the state a part of modern transportation system.

Benefits of the Project

The proposed road construction will result in the improvement of infrastructure as well as uplift the social structure in the surrounding communities. The major benefit due to the proposed project will be in the sphere of making Cross River State more safely accessible and generating temporary employment for substantial number of personnel. The construction phase of the road is expected to span over 72 months.

Value of the Proposed Project

The total project estimated cost is NGN800 billion. It also adds to the infrastructural development, economic, social and health advancement of the host communities, State, Federal Governments and Africa at large. Also, it will add value in terms of improved and or additional infrastructural and social amenities, influx of businesses and people, etc. at all levels.

Project Development Options

Four options were considered namely, Do Nothing Option, *Delayed Project Option,* Upgrade existing Federal Calabar-Ikom-Ogoja Highway and the option to *construct the proposed superhighway. The option to construct the proposed superhighway* was chosen considering its economic advantages and also having in mind that all its negative environmental impacts can be mitigated.

Alternative Alignments

Due to the high occurrences of forest reserves, parks and river systems in the Cross River State, the concept of "route selection based on environmental preservation" was adhered to in order to make the route more adaptable and friendly to the environment. Careful route selection was carried out to, ab initio, eliminate or minimize certain potential and associated project negative impacts. One was selected, out of 4 alignment alternatives considered, using such empirical factors as environmental sensitivity, resettlement requirements for affected persons, compensations, length of route and engineering feasibility and costs of construction and of maintenance of the proposed highway project.

The route starts from Bakassi LGA and stretches to Obudu in the north after passing Ikom on the west. The branch line stretches from Okwortung which is a small town situated at the south western end of Obudu and connects Yala which is the major salt mine of Nigeria. Its total length is approximately 260km.

The proposed route going forward along the edge of the Oban forest reserve, is chosen as the recommended route plan in consideration of environmental protection, construction difficulties, engineering works and total cost.

Sustainability

The sustainability of the project can be described in terms of the longer term economic, environmental and social benefits as a result of the project and by ensuring that negative impacts of the proposed road are reduced to as low as reasonably possible (ALARP). The project would create a means for lowering the cost of transporting farm produce and products, minerals and other natural resources from the northern and central Cross River, and of course from the immediate northern States of Benue, Taraba and Adamawa, to Calabar and other southern parts of Cross River State, and to the proposed Calabar seaport (when it becomes operational) for export; and the delivery of imported goods along the same route in reverse order.

This will improve haulage economics by providing a new road infrastructure able to receive more and larger vehicles, and reducing traveling time for all kinds of vehicles. The contributions to environmental sustainability include a decrease in road accidents, loss of lives and spillage of hazardous substances and materials on the road when accidents occur.

PROJECT DESCRIPTION

Project Location

The proposed Calabar-Ikom-Katsina-Ala highway, is located in Cross River state South –South geographical zone of Nigeria. The project commences from Esighi in Bakassi LGA, on latitude 532541.0408N and longitude 435543.0752E and traverses through several communities in a total of twelve LGAs, and ends in Gakem in Bekwarra LGA, on latitude 750435.3509N and longitude 501538.8401E in the north eastern part of the state. The total length of the project is 260km. This project will be implemented in the strategic South- North corridor, connecting the major cities of Obudu and Ikom with Calabar.

Project Components

Construction Works

Clearing of vegetation along the horizontal alignment;

- Cut and fill to change vertical road alignment, remove top layer and to facilitate the construction of road related infrastructure including drainage facilities such as bridges and culverts at specific sections of the alignment;
- Excavation of gravel sub layers and other fill materials;
- Construction of campsites involving the construction of temporary shelters, installation of water and electricity, paving or levelling to accommodate equipment and stores, etc.;
- Construction /setting up of water abstraction points along some of the rivers;
- Transportation of soil and construction materials from their sources
- Construction of road related infrastructure including bridges, culverts, parking spaces/bus bays, road furniture/signs;
- Application and compaction of base layer and sub base natural laterite gravel and sub grade layer of classified material to facilitate road paving and sealing processing;
- Road paving and sealing;
- Road signage;
- Construction of road shoulders and road drainage systems, e.g. drainage off-shoots, stone pitching of side channels;
- Landscaping and rehabilitation of degraded sites including borrow pits and detours;
- Revegetation; and
- Construction demobilization.

Project Schedule

Site preparation and construction is expected to begin by third quarter 2016 and be completed by fourth quarter 2022. Testing and commissioning are expected to take place fourth quarter 2022 following completion of construction. The lifetime of the project is projected at 20 years and the road shall thereafter be subjected to integrity testing prior to extending its usage or any maintenance/upgrades that may be required.

DESCRIPTION OF EXISTING ENVIRONMENT

Baseline Data Collection

Available data was gathered as a basis against which the impacts of the project can be assessed. In addition to a desktop review of existing data and other EIAs for nearby projects, primary data was collected by field studies carried out by biophysical and socio-economic specialists as indicated in *Table 01.*

Table 0.1 Fieldwork for Baseline Data Collection

Data Collection	Date
Socio-Economic Baseline Survey	1st June 2015 -Feb 2016
Wet Season Biophysical Data Collection	Sept, 2015
Dry Season Biophysical Data Collection	21st-29th January, 2016

Stakeholder Consultation

The public participation process involved the following activities:

i. Identification of a preliminary list of stakeholders;
ii. Creation of background information document (bid) for use in communicating with stakeholders;
iii. Meetings with a number of government departments and stakeholder groups; and
iv. Various focus group meetings with local community members.

Hydrobiology

The phytoplankton flora comprised mainly green algae (*Chlorophycaea*) and Diatoms (*Baccillariphycea*). Generally, the gross volume-based productivity was 10.56kcal/m3/day (comprising 62% respiration and 38% net productivity). The zooplankton fauna at the study area comprised predominantly rotifers *Rotatoria*) and *Copepoda while Cladoceria and Anthomedusae* were represented to a lesser extent. The most widely occurring species were the Crustacean *Cyclops stremuus* and *Pseudocalanus elongates.*

The benthic invertebrate macrofauna of the Cross River estuary comprised 13 species belonging to families of Mollusca. The most widely distributed and abundant species include ;*Pachymelania spp, Diplodonta semiaspera, Nuculana Verrilliana* and *Tympannostonus* spp. A total of thirty-five (15) finfish and shellfish species were recorded during the fisheries survey period. The highest number of individuals of species was recorded for the shrimp, *Macrobrachium vollenhoveni*. Phyto- and zoo-planktons, fish, crustaceans (mainly shrimps and crabs) and molluscs dominated the food items of fish species recorded.

Vegetation and wildlife

The types and distribution of [terrestrial habitat types] in the study area include mangrove / brackish swamp forest, freshwater swamp forest, and grassland vegetation. Some of the economic plant species encountered *Alstoniaboonei* in the various vegetation communities within the study area include – *Hevea brasilensis Magnifera indica* ,G*melina aborea*, *Elaeis guineeensis*, *Chromolaena odorata* and *Calotropis procera*. The endangered species in the study area according to IUCN are the mangrove plants. Mammals known to be present in the area (from interview with local communities) included Antelopes , Snakes, Grass cutters, Gorillas , Mona Monkey, African Owl.

Eleven animal species were mentioned in the study area as forbidden; either for reasons of culture, taboo, religion, personal dislike or to encourage conservation. These animals would include; Python, Leopard, Duiker, Civet Cat, Bush Baby, Elephant and Owl. Studies indicated that there has been depletion in the abundance of wildlife in the area which may have resulted from over-cultivation/ hunting and other anthropogenic activities already present in the area.

Socio-economic

The socio-economic survey collated baseline socio-cultural, economic and infrastructure indices of the study areas, while the consultation process elicited responses on stakeholders concern and expectations from the proposed project.

Purposive sampling procedure was utilized to select individuals/groups that were sampled for the survey. In-depth interview session, Focus Group Discussion (FGD) sessions and participatory random walk activities were the primary data collection sources. The study was conducted in communities along the proposed super high way in twelve LGAs of Cross River State. The study covered the socio-cultural resources of these communities, demographic issues including population size and growth, age and sex distribution, and adult literacy.

Stakeholder Participation

Consultations is a major feature of the socio-economic component of the EIA process for any intended project, which in this case incorporates all individuals in the communities that may be directly or indirectly affected by the proposed project. Consultations were aimed at informing relevant stakeholders about the intentions / plans of project proponent. It also attempted to record the major concerns and views of all stakeholders and helps to minimise potential conflicts that could arise during project implementation.

Target Population and Demography

The study area is twenty (20) communities in twelve LGAs of Cross River State. Cross River state with a population of 2,892, 988 (NPC, 2006) is basically an agrarian economy. A total of four hundred (400) questionnaires were administered in the communities and three hundred and eighty two (382) of the questionnaires given were collated for interpretation. Cross River State covers a total of 20,156sqkm land area and shares boundaries with Benue State to the north, Enugu and Abia States to the west, to the east by Cameroon Republic and to the south by Akwa Ibom and the Atlantic Ocean. The household structure of the community parallels the patriarchal leadership structure of most Nigerian ethnic groups.

Gender statistics of the project-affected communities indicates a preponderance of males over females although the margin seems to be dropping off.

During FGDs in the affected communities, groups interviewed indicated that factors which enhance fertility among them include general acceptance of the marriage institution, relatively early sexual activity and marriage, and polygamy.

These values of TFR show that the rate of fertility in the South South states is lower than the national average. Another measure of fertility is the Crude Birth Rate (CBR) which the NBS estimates at about 7 per 1000 in Cross

River State (The Nigerian Statistical Fact Sheets on Economic and Social Development, 2006). These rates indicate that, relatively, the region does not have high fertility.

The people of the study area give the region different traditions and customs that are unique to the area. Traditional dress for men consists of loincloths and a white long-sleeved shirt with a broad hat. Some men also carry a walking stick. Women usually wear wrappers or a blouse, and head scarf.

The Efik, Ekoi, Ibibio, Okele, Igede, Eche, Yala, Yakurr, Ejagham, and Bette are the indigenous and dominant groups in the study area. There is also the Yakurr/Agoi ethnic group in Yakurr LGA. Further up the core northern part of the state are several sub-dialectical groups, among which are Etung, Olulumo, Ofutop, Nkim/Nkum, Abanajum, Nseke and Boki in Ikom, Etung and Boki LGAs. Also, the Yache, Ukelle, Ekajuk, Mbube, Bette, Bekwarra and Utugwang people are found in Ogoja, Yala, Obudu and Obanliku LGA's. There are, however, several other residents in the area who are strangers. Local sources indicated during FGDs that these residents include mostly Hausas, Yorubas, Ibos, Ogonis and Urhobos, among others.

The marriage institution is accepted and revered in all the communities. Marriages are contracted between adult males and adult females; there are no accounts of either same sex or juvenile marriages. Monogamy and polygamy are practiced but local sources say that polygamy is on the decline.

Social Organisations

Community social organizations exist in all communities of the study area, with the ultimate aim of community development. Prominent are the Women groups and the Youth Associations which organize routine sanitation exercises and negotiate members' enrolment in employment slots. Apart from the ubiquitous credit and thrift societies which exist to ensure availability of revolving funds for members' economic advancement, these communities also boast of cooperative groupings. Also important are the age-grades and church based societies. Not much community development activities have been achieved by these social groupings because of the depressed economic situation in the area. However, there is a high level of cooperative tendency which cause the people to speak with one voice and bear allegiance to their groupings of affiliation.

The socio-cultural groups play very significant roles in the maintenance of law and order in all communities, and they also provide a sense of belonging for the average indigenous resident.

Tourism

The study area offers both its visitors and interested indigenes many centres of attraction. The outstanding ones are Obudu Cattle Ranch in Obudu, Old Residency Museum in Calabar, Agbokin Waterfalls in Ikom, Etanpim Cave in

Odukpani LocalGovernment Area and Mary Slessor's Tomb, Calabar, Cross River National Park and Kwa Falls in Akamkpa local government area, Obubra Lake in Obubra and the Calabar Cenotaph in Calabar.

Religion

Residents of area are mostly Christians. There are various Christian denominations with worship places spread across the community. Christian denominations in the community include Cherubim and Saraphim, Church of God Mission, Jehovah Witness, Living Faith Church and Christ Assembly. The main Christian festivals of Christmas and Easter are celebrated across the communities.

Traditional worship practices are carried out by few adherents mostly the elderly and major communal deities and shrines are located in the study area. 84% of the residents are Christian adherents, while 13% and 3% are Moslems and traditional worshippers respectively.

The main traditional festivals celebrated in the area are „Ekpe", „Akata" and „Obon". Ekpe is celebrated any time in the year as decided by the priest. It is marked with masquerade dances.

Livelihood Activities

The economy of the area is highly private sector driven. There is a high level of dependence on natural resources for livelihood sustenance. The land and natural water bodies inhabited by fishes, shrimps crabs, oysters and periwinkles provide major source of livelihood to the people of the area. In essence farming and capture fisheries remain the most important economic activities in the surveyed communities.

Health Conditions

Health Facilities and Services

The study area has both orthodox and non-orthodox health care providers and facilities. The orthodox facilities comprise health centres and health posts while the none-orthodox comprise mainly traditional birth attendants (TBAs). The functional orthodox facilities provide first aid and treatment for minor ailments, as well as immunization services for children and women of child bearing age.

In all the study communities in the tweleve LGAs, there are TBAs and those who provide herbal remedies. About 40% of the TBAs across the study area had attended a training programme organized by the Cross River State and Federal Government, aimed at improving their practice by teaching basic procedures intended to make their operation more hygienic and safer. In most cases, these groups do not offer their services on a full time basis. Those who practice treatment with herbs in particular, offer advice on herbs and roots within the environment which they believe bring relief to certain ailments. The number and distribution of these was also not determined during the study.

Utilization of Health Services

In these communities many of the women prefer to give birth under the care of TBAs. Staff of the Health Centres noted that even when some of the women attend ante natal clinic in the orthodox facilities, they prefer to give birth with TBAs, and they attribute this to preference for the traditional body massage given by TBAs after child delivery. Utilization rate of the Health Centres is quite low at 52%, 42%, 38.%, 38%, 22% 30.0%, 44.5% and 19.8% by the communities in Cababar Municipal, Akampka, Yakurr, Boki,Obudu, Yala, Akpabuyo and Bakassi LGAs, respectively. The major problem with these facilities is that they are mostly not functional; equipment and drugs are not available, and staff are inadequate. Additionally, access to health centres located outside most of the settlements is hampered by the cost and time spent in getting to their locations. Given these conditions and the level of patronage of drug stores, it is possible to deduce that many residents indulge in self-medication.

Water and Sanitation

The sources of water used in households in the study area include water from the surrounding streams and creek, rain water and water from public and private bore holes. Residents of the communities had traditionally used water from the streams and creeks and rain water for domestic purposes. In the past few years, however, some public and private water bore holes have been built in most of the communities for the purposes of providing households with water. Apart from Calabar that have public pipe borne water, the other surveyed communities mostly source their drinking water from boreholes with no official water potability test.

Waste Management Practices

Waste disposal practices in the twelve LGAs are quite similar. Refuse are mostly disposed in the surrounding land and disposal bins provided by the state government (especially in Calabar Municipality). Generally, two methods of sewage disposal practiced are use of pier system toilets and water closet toilets.

It is notable that the common refuse and sewage disposal practices in communities across the study area are not modern, hygienic or safe. Most of these wastes eventually end up in the water bodies around the area or are carried downstream and deposited in other communities.

Infrastructural Base

Available Infrastructure and Their Functional Status

Available infrastructural framework of the study area is dominated by social amenities. The social amenities consist mainly of education, water supply and electrification facilities while the physical amenities comprise mainly of jetties and telecommunications facilities.

Public access to the project affected communities in the twelve LGAs is by road, additionally, telecommunication services from GSM service providers are received in many of the communities, although these services fluctuate in some of the area. These physical infrastructural amenities have been provided mostly by the state government.

Education facilities in the LGAs consist mainly of public primary, junior and senior secondary schools. The infrastructures in many of the schools are inadequate. The students' desks and chairs are broken and insufficient, class rooms are also insufficient, and some of their ceilings, windows, doors and floors are broken.

There is generally a dearth of functional orthodox health facilities in the entire study area. Perhaps the only one that can be considered functional and patronized by a significant number of residents is the General Hospital in Calabar and the University of Calabar teaching Hospital in Calabar. The basic problem with most health facilities in the area are inadequate staffing, broken down and unmaintained equipment and lack of drugs.

The main means of transportation among communities in the study area is by road with the use of cars, motorcycle and bicycles. The people in Ikom also travel to neighbouring Cameroun by water using boats. Most households have access to motorcycles and bicycles which they used to go about their daily business, especially farming.

The people's relaxation and recreational activities involve visits to acquaintances, drinking in groups (men/youth) and various group discussions. There are also a few eateries which also serve as alcoholic drinking parlours and viewing centres. A few hotels exist in the area. There is a Government/public football field by the Local Government Council secretariat and in some public schools for football enthusiasts who visit either to play or watch others play.

Vulnerable Groups

Some groups in the communities have been identified as potentially vulnerable to the likely impacts of the proposed project. Their vulnerability derives from a number of different factors, including inability to cope with certain envisaged changes in the society and economy. A key vulnerable group is the adolescent youths. Within this group it is also possible to differentiate between the adolescent male and the adolescent female. For the male adolescent there is the tendency to abscond or drop out of school to seek casual employment at the project site. This temptation to drop out of school is re-enforced by the state of educational institutions, particularly the poor staffing which makes schooling uninteresting. The adolescent male will be faced with a situation of giving in to peer-pressure and groups that encourage truancy and school dropout, if these groups come into the communities with as itinerant workers or camp followers.

The adolescent female on the other hand is faced with managing her sexuality in an environment where there will be considerable exposure to sexual excesses, activities and the continuous advances by older and more experienced working class males whose income would be an effective instrument to lure the girls. Again with this group there will be the likelihood of school dropout and teenage pregnancy. Teenage pregnancy had in some societies led to stigmatization of the girls.

STAKEHOLDERS ENGAGEMENT

Stakeholder engagement is a two-way process of communication between the project proponent (Cross River State Government) and its stakeholders. It is a key aspect of the EIA process, allowing stakeholders to express their views about the project. It involves sharing information and knowledge, seeking to understand the concerns of others and building relationships based on collaboration, thereby allowing stakeholders to understand the risks, impacts and opportunities of a project in order to achieve positive outcomes.

The overarching purpose of the stakeholder identification process is to establish which organisations and individuals may be directly or indirectly affected, positively or negatively, by the project. Stakeholder identification is an on-going process requiring regular review and updates.

Outcomes

Many stakeholders consulted had heard of the Project via the state owned radio station and other media outlets. Groups and traditional authorities were accepting of the project and willing to work with the State Government. This was due to the hope of economic prosperity, employment for the communities, improved road networks, development and so on.

Impact Assessment

The impact assessment process has the following four main components:

1. Prediction of the consequences of project activities on the environmental and social receptors;
2. Evaluation of the importance and significance of the impact;
3. Development of mitigation measures to manage significant impacts where practicable;
4. Evaluation of the significance of the residual impact.

Where significant residual impacts remain, further options for mitigation may be considered and impacts re-assessed until they are reduced to as low as reasonably practicable (ALARP) levels. This approach takes into account the technical and financial feasibility of mitigation measures. In addition to predicted impacts from planned activities, those impacts that could result from an accident or unplanned event within the Project (e.g. a pollution event) are taken into account.

SUMMARY OF IMPACTS AND MITIGATION

The Project activities will give rise to a range of impacts of varying magnitude and significance. The impacts for the construction phase and the initial operational phase were considered separately, where appropriate. The assessment methodology used to assess the significance of impacts took into account impact magnitude and sensitivity of receptors and resources affected. Impacts were assessed pre-mitigation (but in consideration of existing and in place controls) and a significance rating determined. Mitigation measures to avoid, reduce, remediate or compensate for potential negative impacts and actions to be taken to enhance benefits were identified. Residual impacts were then assessed taking into account proposed mitigation and enhancement measures. A summary of impacts is provided in the *Table 05* below:

Table 05: Summary Implementing Environmental and Social Mitigation Measures

SN	Project Component	Activities	Impacts	Mitigation Measures	Results Indicators / Reference Situation /baseline	Period	Surveillance		Cost Estimate (USD
							Responsible Entity	**Frequency**	
1.	Route Surveying and mapping	Clearing of roadside vegetation and marking of km chainages	Visual intrusion from paint markings and anxiety on the part of the communities.	Sensitization of the communities; Restricting surveying and markings to the road reserve; and Compensation for properties affected during the surveying process	Entire length of the road surveyed and marked.	During RAP and Feasibility studies	**CRMoW**	Every two months	Embedded in the works Contract.
2.	Clearing and construction of the road pavement will lead to flooding of low lying areas.	Construction works	Siltation and flooding of low lying areas	Designs to provide for adequate and appropriate culverts to facilitate discharge of flood waters in this lower section.	Road designs providing for appropriate culverts at this section of the road.	Construction	**CRMoW**	Construction	To be embedded in the works contract
3.	Earth works and clearings	Clearing of vegetation and cutting of areas to attain the required alignments	Soil erosion implications are likely to be generated	Disposal of excess to spoil in approved sites by the RE; Restricting works to designated areas; Bench terracing of hill tops to check soil erosion; Planting of vegetation on open/cleared surfaces	Approved dump sites for cut to spoil identified; Designs for the bench terrace areas in place; Areas with dump sites in place; and Soil erosion control measures instituted (areas planted with grass in place).	During construction	Contractor	Continuous	Embedded in the works contract
4.	Creation of coffer dams for construction of a Bridge across the rivers	Creation of coffer dams for bridges reconstruction will involve filling of	Siltation, impact on water quality and impacting on water	Siltation, impact on water quality and impacting on shall be filled in polythene bags to reduce loose soil materials getting into the rivers; and Costs for water	Coffer dams in place and water quality clear or silt in sections of the dams; Culverts installed as per	Construction	Supervising Engineer	Monthly	Costs in the works contract

Table 05: Summary Implementing Environmental and Social Mitigation Measures

SN	Project Component	Activities	Impacts	Mitigation Measures	Results Indicators / Reference Situation /baseline	Period	Surveillance		Cost Estimate (USD
							Responsible Entity	**Frequency**	
		sections of the rivers at the crossing point.		works mitigation will be taken up by the CRMoW under payments for relocation of utilities.	Engineers designs.				
5.	Clearing, earthworks and construction		Loss of tree crops, biodiversity and lost carbon sequestration potential.	Compensations for Economic plants and structures lost	Schedule of compensation for the forest area in place	Construction	**CRMoW**	Continuous	70,000
6.	Clearing, grabbing and earth works	Earth works will likely take up parts of the farms and rubber and palm plantations along the route	Lost revenue to the farms and plantations owners	Compensation for lost crops Notification of the farmers to harvest the crops in that part of the farms and plantations affected; Cleared crops can be used as mulch on the remaining parts of farms and Plantations	RAP report in place and covering crop costs; and Schedule of compensation for the crops in place.	Construction	Construction Supervising Consultant CRMoW	Continuous	Embedded in RAP Report
7.	Earthworks will generally generate dust that affects visibility and general air quality levels	Air quality concerns	Respiratory effects on the health of the workers, reduced visibility in work sites	Regular sprinkling of water to suppress dust; and Provision of PPEs to the road workers etc	Contractors dust suppression schedules in place; PPEs for the workers procured and worn by the workers	Construction	Supervising Consultant/ CRMoW	Continuous	Embedded in works contract
8.	Land and Property Expropriation Impacts	Surveying and evaluation of properties and lands	Loss of agricultural lands, impacts on crops and grazing areas	Adequate, fair and prompt compensation of affected PAPs; Providing information early enough to the PAPs; and The RAP shall be	The PAPs fully compensated and /or resettled by the project.	Three years	CRMoW	Monthly	Costs in RAP document

Table 05: Summary Implementing Environmental and Social Mitigation Measures

SN	Project Component	Activities	Impacts	Mitigation Measures	Results Indicators / Reference Situation /baseline	Period	Surveillance		Cost Estimate (USD
							Responsible Entity	**Frequency**	
				made responsive to the needs of the PAPs.					
9.	Extraction of construction materials (sand, etc)	Clearing of over-burden and vegetation materials	Creation of borrow pits	Leasing of borrow areas; Systematic opening of borrow pits while stockpiling overburden; Landscaping of borrow areas after works; Retention of 10% of the Contract sum till end of Defects Liability Period; Sequential restoration i.e. starting with unusable boulders and ending up with the over-burden; and Clearance by FMEnv / MMSD on satisfactory completion of restoration of borrow areas	Agreements with landlords over borrow areas in place; Stockpiles of overburden materials from borrow areas in place; Number of fully restored and landscaped borrow areas in place; Certificate of satisfactory restoration of borrow areas issued by FMEnv / MMSD	During construction and Defects Liability Period of the project.	**CRMoW**	Quarterly	Costs in Works contracts
10.	Construction works across built up sections of the highway	Construction works across these sections will affect traffic flow and even diversion to allow for machine works	Creation of deviation routes that will likely take up land; Construction works will likely cause traffic holdings to allow smooth flow across such sections.	Compensate for the deviation routes; Restoration of the deviations after works on the highway; Involvement of the traffic police in regulating traffic flow across construction sections; and Employing flag persons to control traffic flow across sections where works are being undertaken.	with landowners on the creation of deviations; Record of deviations created; Number of route deviations restored at the end of the project; and Number of flag persons employed to regulate traffic on the road	Construction phase	CRMoW/ Supervising Consultant	Continuous	Embedded in works contract
11.	Operation of	General	Noise pollution	Provide PPEs to the	Record and number	Constructio	**CRMoW**	Monthly	Works

Table 05: Summary Implementing Environmental and Social Mitigation Measures

SN	Project Component	Activities	Impacts	Mitigation Measures	Results Indicators / Reference Situation /baseline	Period	Surveillance		Cost Estimate (USD
							Responsible Entity	**Frequency**	
	plant and equipment as well as activities of the project work force.	operations of the equipment and workers	from equipment and the workers which will be a nuisance	workers; Restricting workings to daytime; Contractor(s) to have in place Health and Safety plan for the project.	of PPEs purchased in place; Lists of workers using PPEs; and Contractor's Health and Safety plan in place.	n			contract
12.	Earth works and clearings	Clearing of vegetation and cutting of areas to attain the required alignments	Generation of cut to spoil materials	Disposal of excess to spoil in approved sites by the RE; Restricting works to designated areas; Bench terracing of hill tops to check soil erosion; Planting of vegetation on open/cleared surfaces	Approved dump sites for cut to spoil identified; Designs for the bench terrace areas in place; Areas with dump sites in place; and Soil erosion control measures instituted (areas planted with grass in place)	During construction	Contractor	Continuous	Embedded in the works contract
13.	Construction of roadside drains and discharge channel	Creation of roadside drainage channels along the road sections	Hindered access to homesteads due to the depth of the ditches created along the road.	Temporary access routes be provided to the homesteads; At the end of works, provide culvert access to homesteads after completion of works	Inventory/list of homesteads whose access will be affected in place; Temporary access to homesteads in place; and Number of access culverts in place	Construction Period	**CRMoW**	Quarterly	Embedded in the works contract
14.	Mobilization of workers	People searching for job opportunities likely to flock	Influx of people in search of jobs	Employing local labour Force likely to cause social conflicts and crime increase. Working with the	Number of local people employed in the project Meetings held with local authorities esp.	Continuous	**CRMoW**	**Continuous**	Embedded in the works contract

Table 05: Summary Implementing Environmental and Social Mitigation Measures

SN	Project Component	Activities	Impacts	Mitigation Measures	Results Indicators / Reference Situation /baseline	Period	Surveillance		Cost Estimate (USD
							Responsible Entity	**Frequency**	
		to the area		Local Councilors (LCs) in the recruitment of workers; and Project to work closely with local enforcement agencies to curb crime	LCs; Meetings held with the area law enforcement agencies				
15.	Public health and human safety in the project	Some materials for use in the project may likely be hazardous as well some bye-products are likely to be a potential risk to the health and safety of the workers; and Numbers of people working on project likely to grow to about 600 workers.	Concerns on health and safety of the workforce are likely to arise.	Putting in place, a plan for handling and management of any hazardous materials; Designate specific areas for smoking; OSH plan for the Contractor be in place; Adequate facilities in place for the workers; Adequate and appropriate Accommodation facilities be put in place; and Routine cleanliness of Contractor (s)facilities e.g. toilets etc.	Measures on how to handle waste instituted; Areas for smoking designated; An OSH plan prepared by the Contractor; and Accommodation for workers certified by the health inspectors	Construction	Health Inspectors, FMEnv and CRMoW		
16.	Storage and dispensing of fuel	Operations of the fuel/diesel pump facility	Concerns over oil/ fuel spillages from fuel pump areas and workshop areas of the project.	Areas where fuels and lubricants are stored be paved and of standard types; Standby fire fighting equipment in place	Paved storage areas around the fuel pump; Firefighting equipment in place; Oil interceptor in place around such areas; Put in place standard oil interceptors in place; The facilities	Continuous	FMEnv/ Supervising consultant	FMEnv/Supervising consultant	Integrated in the works contract

Table 05: Summary Implementing Environmental and Social Mitigation Measures

SN	Project Component	Activities	Impacts	Mitigation Measures	Results Indicators / Reference Situation /baseline	Period	Surveillance		Cost Estimate (USD
							Responsible Entity	**Frequency**	
					shall be for filling not servicing plant and equipment				
17.	Generation of waste from the camp site and sites where works are undertaken	Operations of the camp site are like to generate office and domestic waste of varying degrees. Waste in terms of solid waste such as polythene bags, effluent waste etc.	Pollutions and disease concerns. Putting in place waste collection bins in strategic positions in the compounds	Exercise good hygiene in the camp site through routine cleaning of toilets, compound and areas of project activities. Hazardous wastes such used oils, lubricants, old batteries and tyres be recollected by their suppliers	Number of employees dedicated to maintenance of camp site cleanliness and hygiene; Presence of waste collection facilities e.g. bins located in strategic places in the campsite. Copies of evidence of agreements with suppliers of tyres, batteries showing their commitment to pick the used items.	Continuous	Health Inspectors from the areas/ Supervising Consultant/FMEnv	Continuous	Integrated into the works contracts
18.	Influx of people in search of jobs can generate a number of social concerns on the project.	The youth unemployment is estimated at 60% and information About job prospects on the project will likely draw a number of people from near and far	HIV/AIDS and STI/STD incidences Will likely rise from the estimated 1.3% for the two districts	The project will procure the services of an HI/AIDS Service Provider to conduct awareness sensitization, and administration of ARVs.	An HIV/AIDS Service Provider in place; HIV/AIDS and STI/STD sensitization programme in place; Number of HIV/AIDS and STI/STD seminars held	Continuous	CRMoW/Supervising Consultant	Continuous	35,000
19.	The project will employ an estimated	Workers will be needed in most of the	Potential marginalization of a	It is suggested that, about 30% of the workforce will be	Records showing that, 30% of the workers being;	Continuous	Supervising Consultant/ CRMoW	Continuous	30,000

Table 05: Summary Implementing Environmental and Social Mitigation Measures

SN	Project Component	Activities	Impacts	Mitigation Measures	Results Indicators / Reference Situation /baseline	Period	Surveillance		Cost Estimate (USD
							Responsible Entity	**Frequency**	
	400-600 workers and a majority being men	manual and machine based project activities and most of these will be done largely by women	few women who may gain employment in the project (Gender Mainstreaming	allocated to women; There shall be gender sensitivity in allocation of tasks to encourage women involvement in the project; Conduct gender sensitization in the project; And Employment of a Gender/Social Specialist on the project to oversee gender issues in the project	Gender sensitization programmes in place; and A gender Specialist to conduct gender sensitization recruited by the Project.				
20.	Road Safety	Construction based activities will likely involve a number of equipment and construction fleet on the road.	Incidence of accidents will likely rise	The project procures services of Road Safety campaigner to conduct sensitization campaigns of safety aspects of the road be put in place	Road Safety sensitization/ campaigner in place	Quarterly	CRMoW/ Supervising Consultant	Continuous	30,000
21.	Asphalt plant Operations	Processing of asphalt through heating.	Generation of bad odours and cause atmospheric pollution	Asphalt plant to have in-built heating processes that emit minimal odours; Provide workers on the asphalt plant with PPEs; and Regular cleaning of the area around the Asphalt plant	Regularly cleaned areas around the Asphalt plant; and PPEs for the workers on the asphalt plant	Continuous	Supervising Consultant/ FMEnv	Continuous	Built in the contract sum
22.	Safety of workers	Exposure to different project work environment	Accidents and related work risks	Provide workers with appropriate PPEs	PPEs in place	Constructio n	Supervising consultant	Continuous	Embedded in the works contract
23.	Generation of waste from	Operations of the camp site	Pollutions and disease	Exercise good hygiene in the camp site through	Number of employees dedicated		Health Inspectors	Continuous	Integrated into the

Table 05: Summary Implementing Environmental and Social Mitigation Measures

SN	Project Component	Activities	Impacts	Mitigation Measures	Results Indicators / Reference Situation /baseline	Period	Surveillance		Cost Estimate (USD
							Responsible Entity	**Frequency**	
	the camp site and sites where works are undertaken	are like to generate office and domestic waste of varying degrees. Waste in terms of solid waste such as polythene bags, effluent waste etc	concerns. Putting in place waste collection bins in strategic positions in the compounds	routine cleaning of toilets, compound and areas of project activities. Hazardous wastes such used oils, lubricants, old batteries and tyres be recollected by their suppliers.	to maintenance of camp site cleanliness and hygiene; Presence of waste collection facilities e.g. bins located in strategic places in the campsite. Copies of evidence of agreements with suppliers of tyres, batteries showing their commitment to pick the used items.		from the areas/ Supervising Consultant		works contracts.
24.	Storage and dispensing of fuel	Operations of the fuel/diesel pump facility	Concerns over oil/fuel spillages from fuel pump areas and workshop areas of the project.	Areas where fuels and lubricants are stored be paved and of standard types; Standby firefighting equipment in place around such areas; Put in place standard oil interceptors in place; The facilities shall be for filling not servicing plant and equipment	Paved storage areas around the fuel pump; Firefighting equipment in place; Oil interceptor in place	Continuous	FMEnv/Supervising consultant	Continuous	Integrated in the works contract
25.	Earthworks	Disruption of public utilities (water, electricity and water lines)	Interruption in delivery of public services such water and electricity supply	CRMoW to liaise with utility providers	Modalities of payments for utility relocation in place.	Construction	**s**upervising Engineer	Continuous	Embedded in the costs for works contract
26.	Clearing, grabbing and earth works	Earth works will likely impact on the	Potential loss of useful trees such	Compensation for lost trees; Compensatory tree planting;	Budget for roadside trees in place; and Number of trees	Continuous	Supervising Consultant/CRMoW	Continuous	10,000

Table 05: Summary Implementing Environmental and Social Mitigation Measures

SN	Project Component	Activities	Impacts	Mitigation Measures	Results Indicators / Reference Situation /baseline	Period	Surveillance		Cost Estimate (USD
							Responsible Entity	**Frequency**	
		roadside vegetation	as oil palm, mangoes and bananas	Restrict works to only desired sections to minimize loss of vegetation.	planted				
27.	**TOTAL COST FOR EMP IMPLEMENTATION**								**175,000**

MITIGATION, MONITORING AND ENVIRONMENTAL MANAGEMENT

Implementation of the findings and outcomes of the EIA process are described in the ESMP for the proposed Project, as well as the proposed mitigation and monitoring. Elements of this provisional plan will be taken forward and incorporated into a comprehensive project ESMP that will be used to deliver the project's health, safety and environmental (HSE) regulatory compliance objectives and other related commitments. The ESMP provides an outline of the procedures and processes that will be incorporated into project activities to check and monitor compliance and effectiveness of the mitigation measures to which CRMoW has committed. In addition, the EMP shall be used to ensure compliance with statutory requirements and corporate safety and environmental policies.

Environmental and Social Management Planning

In order to implement the EMP responsibilities have been assigned to various parties within the project framework. The recommended mitigation measures will be outlined in the detailed design drawings, and detailed in the Technical Specifications. These mitigation measures will form part of the contract documentation for the road upgrading works. For example, there is to be a component for tree planting of appropriate species as catchment protection above the road and this activity will be undertaken with substantial women's participation. The ESIA and ESMP are to be availed to prospective bidders in order to ensure that normal environmental mitigation costs are factored into construction costs.

The Contractor shall prepare work plans for environmental management in line with the EMP presented in this EIA as well as taking into account some conditions relating to the approval of the project by FMEnv. The costs of incorporating the recommended mitigation measures, including compensation for property and crops and relocation activities, as well as costs for unforeseen/additional mitigation and environmental and social monitoring are to be integrated into the Bill of Engineering Measurement and Evaluation for the project.

Monitoring Programme

The overall objective of environmental and social monitoring is to ensure that mitigation measures are implemented and that they are effective. Environmental and social monitoring will also enable response to new and developing issues of concern. The activities and indicators that have been recommended for monitoring are presented in the ESMP. Environmental and social monitoring will be carried out to ensure that all construction activities comply and adhere to environmental provisions and standard specifications, so that all mitigation measures are implemented. The contractor shall employ an officer responsible for implementation of social/environmental requirements on a full time basis. This person will maintain regular contact with the Supervisor's own Environmental/Social Specialist and the local Environmental Officer. The contractor and CRMoW have responsibility to ensure that the proposed mitigation measures are properly implemented during the construction and operation phases.

In addition, there shall be a Safety Officer in the Team whose role will be ensuring all safety matters on the project are managed in a professional manner. The environmental and social monitoring program will operate through the preconstruction, construction, and operation phases. It will consist of a number of activities, each with a specific purpose with key indicators and criteria for significance assessment. The following aspects will be subject to monitoring:

• Encroachments into ecosystem areas such as wetlands
• Vegetation maintenance around project work sites, workshops and camps
• Works and road safety elements, including a log of accidents
• HIV/AIDS programme implementation and levels at local health centres.

The monitoring of mitigation measures during design and construction will be carried out by the Supervisor's Environmental/Social Specialist. He/she will conduct mitigation monitoring as part of the regular works inspections. The responsibility for mitigation monitoring during the operation phase will lie with the Environmental Unit in CRMoW.

CRMoW will provide FMEnv with reports on environmental compliance during implementation as part of their annual progress reports and annual environmental monitoring reports. Depending on the implementation status of environmental activities, FMEnv will perform periodic environmental reviews in which environmental concerns raised by the project will be reviewed alongside project implementation.

CONCLUSIONS

The findings of the EIA indicate that there are no issues of *Major* or *Moderate* significance that could not be mitigated such that the proposed project was not acceptable from an environmental or socio-economic perspective. Social issues, particularly compensation/resettlement, potential for large-scale hydrocarbon spills, fires and explosions, and impacts to local fishermen were the only issues of *Major* significance identified in the EIA. The significance of all impacts could be reduced to *Moderate* or *Minor* significance provided that the mitigation measures and monitoring requirements outlined in *Chapter 6* are implemented.

The EIA also identified some positive impacts associated with the proposed development including boosts to the local economy and potential employment opportunities for locals. These could be enhanced through giving preferential status to persons from the local community in relation to employment. The project will also work with local development NGOs to seek opportunities for community development projects. Based on these considerations, the results of the impact assessment found no issues that would prevent authorization of the Project, contingent that the safeguard measures described in the EIA and monitoring for potential environmental and social effects are implemented.

Further Commitments by CRSG

• The Contractor shall comply with legal obligations related to this project and shall use the National Environmental Standards as a guide for emission limits. In absence of any emission limits in the national standards, the contractor shall use other internationally acceptable standards for the limits;

• There has been public concern over the possible encroachment into the Oban Forest Reserve in view of the fact that, the Forest lies along the planned route of the superhighway. This has been largely avoided at the planning and design stages, diverting the road from Forest;

All displaced parties and other groups who will lose property shall be fairly and promptly compensated;

• The Contractor shall closely work with FMEnv, State Ministry of Environment and affected Local Government Councils and communities during the entire project implementation period in the implementation of the EMP;

• The contractor shall follow all the formalities related to development control and approval systems for this nature of projects;

• The Contractor shall fully rehabilitate campsites, borrow pits and road sides after project completion;

• A comprehensive programme shall be developed to facilitate sensitizations and training of workers and the general public on HIV/AIDS and STDs; and

• Leased lands that will be used for temporary works of the project shall be returned to the rightful owners after completion of the works.

Chapter 1

INTRODUCTION

1.1 Introduction

The Government of Cross River State of Nigeria through the State Ministry of Works (CrMoW) proposes to undertake the construction of Calabar-Ikom-Katsina Ala superhighway measuring 260km. The road shall meet all standards of a superhighway including; security lighting, interchange and clover tongues at intersections with other roads, and wi-fi internet access. It is proposed to simply be a digital road for the 21st century and an evacuation corridor from the Calabar Deep Seaport. It will be the link road to Katsina-Ala in Benue State, northcentral Nigeria and Wukari in Taraba State, Numan, Yola and other towns in Adamawa, northeast Nigeria to Maiduguri and other cities in the far northeast. The proposed project is expected to have both negative and positive impacts on the environment and people of the area.

With the proposed building of the new Calabar Seaport, this highway project will be significant in the interfacing of land and water transportation. The project aims at repositioning Cross River State as the number one tourism destination in Nigeria as well as improvement in agriculture and economic activities within the state and bilateral trades between Nigeria with the neighboring republic of Cameroun.

1.1.1 Agriculture

Agriculture in Nigeria is a key player in the Nigerian economy. Although not properly harnessed it provides employment as well as income for at least 55% of the national economy but mainly at a subsistent level. Major crops include: maize, beans, sesame, cashew nuts, cassava, yams, cocoa, groundnuts, kolanut, and palm kernels, palm oil, plantains, rice, rubber, and sorghum.

The country's agricultural output is categorized as cash crops and subsistent crops. By 1970, Nigeria had attained a high level of food sufficiency which peaked in 1973 until the influx of American imported food and agricultural products flooded the markets. Cocoa is the leading non –oil foreign exchange earner but dominance of small holders and inadequate modernized agricultural incentives creates a drawback in its outputs. In 1999, Nigeria produced 145,000 tons of cocoa beans, but has the potential for over 300,000 per year. Rubber, is the second –largest non –oil foreign exchange earner.

The economy of Cross river state is agriculture based. The main crops are cassava, yams, rice, plantain, banana, cocoyam, maize, cocoa, rubber, groundnut, and palm produce. Major livestock products in the State are; cattle, goats and sheep. Animal husbandry is undertaken by the local farmers and the Fulani herdsmen, except in the Obudu Cattle Ranch in Obanliku Local government area where modern ranching system is practiced. The raising of poultry birds, pigs and rabbits is carried out on a commercial scale in some parts of the State especially in the State Capital.

1.1.2 Industry and Manufacturing

Nigeria is Africa's largest crude oil producer with an output of 2.5million barrels per day. She is a member of the Organization of Petroleum Exporting countries (OPEC). The national economy is heavily dependent on the oil sector, which accounts for 95% 0f export earnings and over 40% of total government revenues, according to the International Monetary Fund. Nigeria used to be the major supplier of oil to the United States but lately it has been overtaken by china and India. According to the International Energy Agency, in 2011, approximately 33% of Nigeria's crude exports were sent to the United States making Nigeria its fourth largest foreign oil supplier.

Cross River State is located in the crude oil rich Niger Delta region in South-South Nigeria. Drilling operations is carried out in the southern part of the State and within the Nigerian territorial waters bounding the Cameroons.

1.1.3 Mineral resources

Cross River State has a rich deposit of mineral resources which include limestone, clay, salt, tin, granite, basalt, quartzite, kaolin, sand and feldspar. There are so many other mineral substances of high value undergoing research in the State. These are lead, zinc ore, manganese, gold, uranium, titanium, mica and gypsum. Extensive work is being carried out by the State's trade and Investments ministry to find out potentials and viability of these mineral deposits. Recently, a uranium deposit was discovered in Cross River State by the British Geological Survey. In spite of the rich mineral endowments, mining activities have been reduced to limestone only.

1.1.4 Tourism

More recently, the WTTC in a report titled : Travel and tourism economic impact in 2012, put the total contribution of tourism to Nigeria's GDP at n598.6 billion which represents 1.6% of the total GDP, and estimates the growth rate of 6.3% per annum from 2012-2022. Furthermore Travel and Tourism directly supports 838,500 jobs an equivalent of 1.4% total employment in 2011. This also will be expected to rise by 3.7% annually creating 1,289,000 jobs or 1.6% employments in 2022. However, the tourism sector has some factors militating against it. These include; bad road networks, inadequate power supply, insecurity in some parts of the country etc. moreover, the lack of adequate empirical data has hindered policy makers and other stakeholders on the potentials and viability of the already existing tourism destinations in Nigeria.

Cross River State is one of the most prominent tourism destinations in Nigeria; it is noted for its yearly Christmas Carnival which is Africa's biggest street party. Other spectacular and breath taking sites include; a for 4km cable car at the Obudu Cattle Ranch in Obanliku LGA, an area with temperate weather conditions, Agbokim Waterfalls in Ikom, Stone Monoliths also in Ikom, the Old Residency Museum in Calabar, the Afi mountains in Boki which is the holds the biggest Swallow birds roost in the world, the canopy Walkway, the Cross River National Parks in Oban and Okwango which are forests reserves as well as home to endangered species of gorillas and chimpanzees. A number of these tourists' sites have been developed but efforts complimenting tourism-related infrastructure and activities to attract more international recognition are still in infantile stage. The hospitality sector accounts for 5.9% of the states GDP and this is expected to grow rapidly as improved income status will prompt more Nigerians to go on holiday and visit these tourism sites.

1.2 Proponent and Intent

The proponent, the Cross River State Ministry of Works (CrMoW), recognizes the importance of comprehensive Environmental Planning and Management to the success of any project and is committed to the necessary studies to understand the environmental system of the proposed project area in order to address areas where significant negative environmental impacts (natural, physical and social) may occur, with a view to addressing them, adequately.

In pursuance of this, CrMoW is conducting an Environmental Impact Assessment (EIA) of the project prior to the commencement of the project. This EIA is in line with the Federal Ministry of Environment's (FMEnv's) Environmental Impact Assessment Procedural/Sectoral Guidelines for infrastructural projects as well as other international environmental standards.

The contact information for the proponent:

The Honourable Commissioner,
Cross River State Ministry of Works
Calabar

P. M. B. 1056, Calabar,
Tel: (087) 232786, 235050
Fax: (087) 232786, 239191

1.3 Proposed Project Location

The proposed Calabar-Ikom-Katsina-Ala highway, is located in Cross River state South –South geographical zone of Nigeria. The project commences from Esighi in Bakassi, on latitude 532541.0408N and longitude 435543.0752E and traverses through several communities in a total of eleven LGAs, and ends in Gakem on latitude 750435.3509N and longitude 501538.8401E in the north eastern part of the state. Figure 1.1 shows the Administrative map of Cross River State and the route of the proposed road. The total length of the project is 260km. This project will be implemented in the strategic South- North corridor, connecting the major cities of Obudu and Ikom with Calabar.

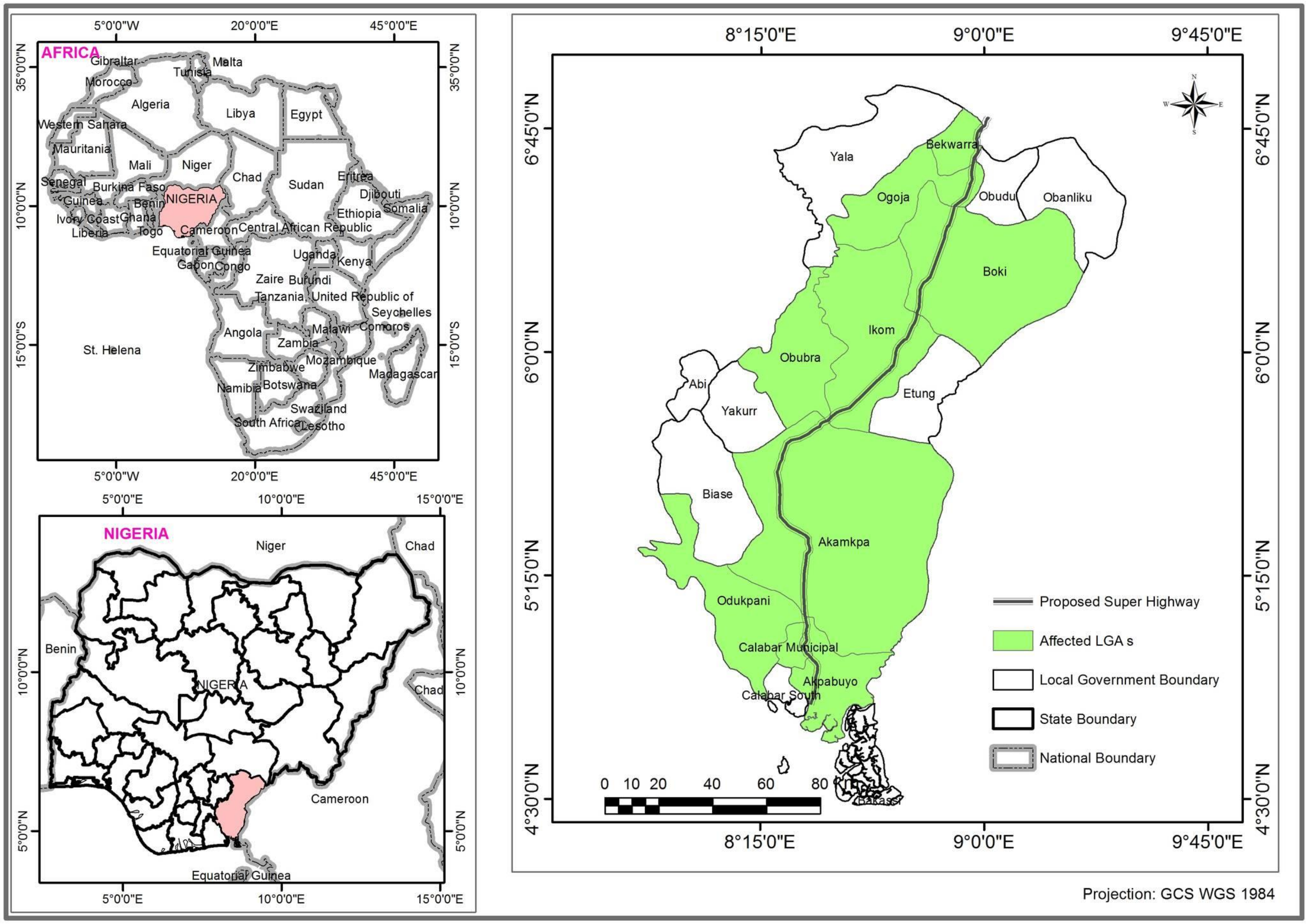

Figure 1.1: Map of Cross River State Showing affected LGAs (in green) and showing the proposed route

1.4 Legal and Administrative Framework

This section summarises the institutional framework applied to the Project, as well as the most relevant legislation and applicable standards that have been taken into consideration in the preparation of the EIA report. In particular, this section provides a description of the following:

- Nigerian administrative and legislative organization;
- the Nigerian environmental and social laws and regulations applicable to the Project;
- status of protected areas and species that may be affected by the proposed development;
- international conventions and standards to which Nigeria is a signatory and which the Project must therefore take into account;
- consideration where relevant, of other international conventions and standards with which the Project will also be consistent;
- International treaties, conventions and protocols relevant to the Project relate to such issues as biodiversity, climate change, marine pollution and employment conditions; and

National Administrative Requirements

This sub-section summaries relevant Nigerian environmental and social laws and regulations deemed applicable to the project and international conventions and standards to which Nigeria is a signatory country and with which the project will be consistent.

Background

Within Africa, environmental protection has largely been synonymous with conservation of natural resources. In Nigeria's case, a need for environmental enforcement was recognized in 1988, when illegal dumping of toxic wastes became an issue of concern, especially due to the fact that the toxic wastes were of international origin. This incident resulted in the launch of the Federal Environmental Protection Agency (FEPA), as the overall (unitary) body charged with the responsibility of protecting the environment in Nigeria. The FEPA executed its functions in accordance with the goals of the National Policy of the Environment, which was launched on 27th November 1989.

In 1999, the Federal Ministry of Environment (FMEnv) took over FEPAs function. Today, the FMEnv is the primary authority for regulation and enforcement of environmental laws, specifically the National Environmental Policy, as revised in 1999, which remains the overarching legislative framework for environmental management in Nigeria.

Federal Ministry of Environment

Primary authority for regulation and enforcement of environmental laws rests with the FMEnv. The specific policies, acts and guidelines enforced by FMEnv that are relevant to the Project include:

- National Policy on the Environment (1989, revised 1999);
- Environmental Impact Assessment Act No 86 (1992);
- Environmental Impact Assessment LFN of 2004
- Water Resources Act of 1993;
- Land Use Act, 1978
- National Environmental Protection Regulations, 1991;
- Federal Environmental Protection Agency Act (1988);
- National Inland Waterways Act, 1997;
- Management of Solid and Hazardous Waste Regulations, 1991; and
- Harmful Wastes (Special Criminal Provisions etc) Act No 42, 1988.

The FMEnv EIA process is shown in Figure 1.2.

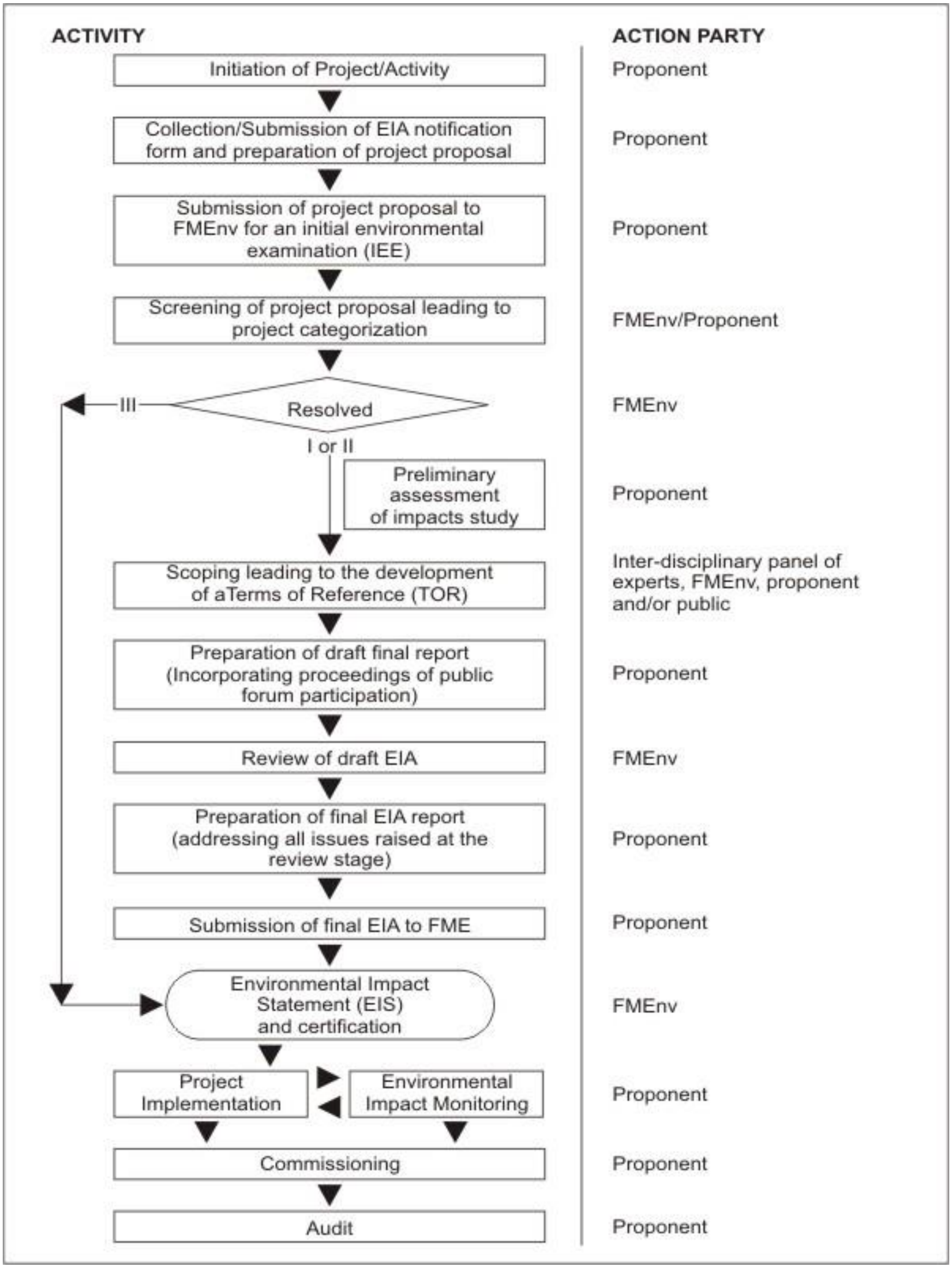

Figure 1.2: The Federal Ministry of Environment Environmental Impact Assessment Process

The Federal Ministry of Environment (FMEnv) administers and enforces environmental laws in Nigeria. Prior to the implementation of the FEPA Act (1999), each State and local government in the country could set up its own environmental protection body and State Ministry of Environment for the protection and improvement of the environment within the State.

National Environmental Policy and Legislation

National Policy on the Environment (1989)

Environmental management in Nigeria is based on the National Policy on the Environment (1989), as revised in 1999. The goal of this policy is to achieve sustainable development, in particular to:

- secure for all Nigerians a quality of environment which is adequate for their health and well-being; conserve and use the environment and natural resources for the benefit of present and future generations;
- restore, maintain and enhance the ecosystems and ecological processes essential for the functioning of the biosphere, to preserve biological diversity and the principle of optimum sustainable yield in the use of these natural resources and ecosystems; and
- raise public awareness and promote understanding of essential linkages between the environment and development and to encourage individual and community participation in environmental improvement efforts.

All environmental regulation in Nigeria is intended to align with the National Policy on the Environment.

The NESREA Act (2007)

The National Environmental Standards and Regulations Enforcement Agency (NESREA) Act repealed the Federal Environmental Protection Agency Act (FEPA Act) and establishes the NESREA. The Agency has the responsibility to enforce compliance with environmental standards, regulations, rules, laws, policies and guidelines. NESREA is also responsible for the protection and development of the environment, biodiversity conservation, sustainable development and the development of environmental technology. The NESREA Act is an over-arching piece of legislation providing a framework for other detailed legislation.

EIA Act No 86 (1992)

The Act sets out the procedure to be followed and methods to be used in undertaking an EIA. Section 2 (2) of the Act requires that where the extent, nature or location of the proposed project or activity is such that it is likely to significantly affect the environment, an EIA must be undertaken in accordance with the provisions of the Act. The Act requires that project proponents apply in writing to FMEnv prior to embarking on the proposed project, in order that an EIA can be undertaken while the project is still in the planning stages.

Section 4 (a) – (g) sets out the following minimum requirements for an EIA:

- description of the proposed activities;
- description of the potentially affected environment of the proposed project including specific information necessary to identify and assess the environmental effects of the proposed activities;
- description of practical activities, as appropriate; assessment of the likely potential environmental impacts of the proposed activities and the alternatives, including direct or indirect, cumulative, short and long term effects;
- identification and description of measures available to mitigate adverse environmental impacts of the proposed activities and an assessment of these measures;
- indication of gaps in knowledge and uncertainty;
- indication of whether the environment of any other state or Local Government Area(s) or areas outside Nigeria are likely to be affected by the proposed activity or its alternatives; and
- brief and non-technical summary of the information provided under the above provisions.

Section 7 of the Act requires that FMEnv must give opportunity to government agencies, members of the public, and experts in any relevant discipline and interested groups to comment on the EIA prior to making a decision. Section 9 (1) requires that FMEnv provides its decision in writing, and includes reasons for the decision and required provisions, if any, to prevent, reduce or mitigate any negative impacts on the environment.

The proposed project requires an EIA under the terms of the Nigerian EIA Act (1992). An EIA is required for projects listed in the Schedule to the Act. The Act allows a list to be drawn up of projects that are likely to have minimal environmental effects and which do not need EIA. Where a project is not listed in the Schedule to the Act and is not listed as being excluded, a screening report must be produced.

The Nigerian Urban and Regional Planning Act 1992

Act 88 of 1992 established a Development Control Department (DCD) charged with the responsibility for matters relating to development control and implementation of physical development plans at Federal, State and Local Government levels within their respective jurisdiction.

- Approval of the relevant DCD shall be required for any land development
- A developer shall submit a development plan for the approval of the DCD of local Government, State or Federal Government.
- A developer (whether private or government) shall apply for a development permit in such manner using such forms and providing such information including plans, designs, drawings and any other information, as may be prescribed,
- A developer shall at the time of submitting his application for development submit to an appropriate Development Control Department a detailed Environmental Impact Statement (EIS) for an application for,
    - A residential land in excess of 2 hectares or
    - Permission to build or expand a factory or for the construction of an office building in excess of four floors of 5000 square meters of a settable space or
    - Permission for a major recreational development

National Inland Waterways Authority (NIWA)

The National Inland Waterways Authority, as part of the Ministry for Transport, enforces environmental legislation pertaining to Nigeria's rivers, creeks, lagoons, lakes, and intra-coastal waters. As a body they; issue licences for inland jetties etc, undertake hydrological and hydrographical surveys, clear invasive species e.g. the Water hyacinth, and undertake EIA's for their dredging operations.

Harmful Wastes (Special Criminal Provisions etc) Act No 42

Activities relating to the purchase, sale, importation, transit, transportation, deposit and storage of harmful wastes are prohibited and declared unlawful under the Act. From the commencement of this Act, any person who, without lawful authority: (a) carries, deposits, dumps or causes to be carried, deposited or dumped, or is in possession for the purpose of carrying, depositing or dumping, any harmful waste on any land or in any territorial waters or contiguous zone or Exclusive Economic Zone of Nigeria or its inland waterways; or (b) transports or causes to be transported or is in possession for purpose of transporting any harmful waste; or (c) imports or causes to be imported or negotiates for the purpose of importing any harmful waste; or (d) sells, offers for sale, buys or otherwise deals in any harmful waste, shall be guilty of a crime under this Act. Remaining provisions deal with prosecution, crimes by body corporate and penalties.

Nigerian Guidelines and Standards

The National Guidelines and Standards for Environmental Pollution Control in Nigeria were defined in March 1991 to serve as a basic instrument for monitoring and controlling industrial and urban pollution. Some of these guidelines and standards later evolved into national regulations in August 1991. The main considerations of the guidelines and standards include:

- effluent limitations;
- pollution abatement in industries and facilities generating wastes;
- management of solid and hazardous wastes; and

A summary of the key applicable guidelines and standards are presented below.

National Effluent Limitation Regulation:

The National Effluent Limitation Regulation, S.1.8 of 1991 (No. 42, Vol. 78, August, 1991) makes it mandatory for industries such as waste generating facilities to install anti-pollution and pollution abatement equipment on site. The Regulation is specific for each category of waste generating facility with respect to limitations of solid and liquid discharges or gaseous emissions into the environment. Appropriate penalties for contravention are also prescribed.

Pollution Abatement in Industries Generating Wastes Regulations:

The Pollution Abatement Regulation, S.1.9 of 1991 (No. 42, Vol. 78, August, 1991) imposes restrictions on the release of toxic substances and stipulates requirements for pollution monitoring units, machinery for combating pollution and contingency plan by industries; submission of lists and details of chemicals used by industries to FMEnv; requirement of permit by industries for the storage and transportation of harmful or toxic waste; the generator's liability; strategies for waste reduction; permissible limits of discharge into public drains; protection of workers and safety requirements; environmental audit (or EIA for new industries) and penalty for contravention.

Management of Hazardous and Solid Wastes Regulations:

The Management of Hazardous and Solid Waste Regulation, S.1.15 of 1991 (No. 102, Vol. 78, August, 1991) defines the requirements for groundwater protection, surface impoundment, land treatment, waste piles, landfills, and incinerators. It describes the hazardous substances tracking programme with a comprehensive list of acutely hazardous chemical products and dangerous waste constituent. It also states the requirements and procedure for inspection, enforcement and penalty.

Nigerian Standard for Drinking Water Quality (Industrial Standard NIS 554:2007):

This standard is intended to ensure the safety of drinking water supplies and protection of public health, and to encourage the improvement of management of all drinking water systems in the country. The standard sets parameters and maximum allowable limits in drinking water in Nigeria. It also includes normative references/laws guiding drinking water quality, definition of terminologies, institutional roles and responsibilities, monitoring, data management and compliance criteria.

Nigeria's Cultural Policy (1996):

The national cultural policy is generally regarded as an instrument of promotion of national identity and Nigerian unity, as well as of communication and cooperation among different Nigerian and/or African cultures.

Cross River State Requirements

Cross River State Ministry of Environment

The Ministry of the Environment is charged with the responsibility of providing decent, orderly and reasonable conducive environment for habitable society, as contained in the assignments of Ministerial responsibilities. In line with the State Government's 10-point development Agenda, the need to restructure the Ministry for efficiency and effectiveness became apparent. Hence the existing six departments were increased to include three additional departments. Similarly, the former World Bank Assisted Projects Department was renamed Multi-Lateral Projects department for wider coverage.

The three new departments were established to achieve the following responsibilities:

- Conservation of soil and natural resources;

- Environmental sanitation and protection services;
- Control of Environment Pollution, eg, noise, water, land and illegal trading;
- Supervision of Cross River State Waste Management Authority;
- Supervision of ESEU (Environmental Sanitation and Enforcement Unit);
- Supervision of Cross River State Environmental Protection Agency;
- Evaluation of Environmental Impact Assessment (EIA) and Environment Audit Report (EAR);
- Ecological matters; and
- Monitoring, co-ordination and evaluation of all World Bank Assisted Projects.

Cross River State Ministry of Lands and Housing

The Responsibilities of the Ministry are as follows:

- Land Use and Allocation Matter;
- Land Policy and Land Matters;
- Acquisition of Land for State Purposes;
- Issuance and Revocation of Certificate of Occupancy;
- Survey Services;
- Lands Registry (Administration and Control);
- Subsequent Transactions including Assignment Mortgages, Leases and Power of Attorney;
- Mapping Matters;
- Resolving land disputes between individuals;
- Servicing and Monitoring of Land Use and Allocation Committee; and
- Construction of Economic housing units;
- Supervision of Cross River State Development Property Corporation; Matters relating to forfeiture of properties;
- Resettlement of displaced people;
- Compensation for acquired properties;
- Valuation of all types of interest in properties; and
- Identification of abandoned properties

With respect to transport, the Local Governments are responsible for local Traffic Management Units and have responsibility for all aspects of parking. They are also responsible for leasing out permits for roadside trading. The LGAs are responsible for the regulation of many of the community based organizations who are key stakeholders in the proposed project.

FRSC Act cap 141 (LFN).

In February 1988, the Federal Government created the Federal Road Safety Commission through Decree No. 45 of the 1988 as amended by Decree 35 of 1992 referred to in the statute books as the FRSC Act cap 141 Laws of the Federation of Nigeria (LFN). Passed by the National Assembly as Federal Road Safety Commission (establishment) Act 2007. The functions of the Commission generally relates to:

- Making the highway safe for motorists and other road users.
- Recommending works and devices designed to eliminate or minimize accidents on the highways and advising the Federal and State Governments including the Federal Capital Territory Administration and relevant governmental agencies on the localities where such works and devices are required, and
- Educating motorists and members of the public on the importance of discipline on the highway.

In particular the Commission is charged with the responsibilities for:

- Preventing or minimizing accidents on the highway;
- Clearing obstructions on any part of the highways;
- Educating drivers, motorists and other members of the public generally on the proper use of the highways;
- Designing and producing the driver's license to be used by various categories of vehicle operators;
- Determining, from time to time, the requirements to be satisfied by an applicant for a driver's licence;
- Designing and producing vehicle number plates
- The standardization of highway traffic codes;
- Giving prompt attention and care to victims of accidents
- Conducting researches into causes of motor accidents and methods of preventing them and putting into use the result of such researches;
- Determining and enforcing speed limits for all categories of roads and vehicles and controlling the use of speed limiting devices;

National Social Legislation

In the consideration of Nigerian social legislation, the following issues may be some of the important social aspects of the Project:

- resettlement and displacement;
- community health and safety;
- labour, working conditions and employment;
- cultural properties;
- economic activities; and
- access to fishing.

The Labour Act, (1990)

The Labour Act (1990) is the primary law protecting the employment rights of individual workers. The act covers protection of: wages; contracts; employment terms and conditions; and recruitment. It also classifies workers and special worker types. Union membership is governed by the Trade Union Amendment Act (1995). 1999 constitution includes stipulation of "equal pay for equal work without discrimination on account of sex, or any other ground whatsoever".

While Nigeria has ratified all eight core International Labour Organisation Conventions and enacted laws to enforce the provisions, there are indications of restrictions on the trade union rights of workers in Nigeria, discrimination, child labour and forced labour.

The National Inland Waterways Authority (ACT CAP N47 LFN 2004)

The National Inland Waterways Authority (NIWA), hitherto Inland Waterways Department (IWD) of the Federal Ministry of Transport, metamorphosed into an Authority vide an act of the National Assembly, CAP 47, Laws of the Federation of Nigeria (LFN), 2004 (Decree No. 13 of 1997), established with the primary responsibility to improve and develop Nigeria's inland waterways for navigation.

The law establishing NIWA gave it the following statutory roles

- Provide regulation for inland water navigation;
- Ensure development of infrastructural facilities for a national inland waterways connectivity with economic centers using the River Ports and nodal points for inter-nodal exchanges;

- Ensure the development of indigenous technical and managerial skills to meet the challenges of modern inland waterways transportation; There are several other functions and powers of the authority properly enunciated and documented in laws establishing NIWA (NIWA ACT CAP N47 LFN 2004).

Land Use Act No 6 (1978)

The Land Use Act of 1978, the Constitution of 1999 and the Public Lands Acquisition Laws of the relevant states constitute the governing policy for land acquisition in Nigeria. As is the case with most national and state laws on compulsory acquisition of land in the public interest or for a public purpose, the legislation enables the State to acquire land (more precisely, to abrogate leases and other authorizations to occupy land). The Act also specifies the procedures the State must follow to clear the land, and defines the compensatory measures the State must implement in order to compensate the people affected.

Under the Land Use Act, there are two types of land rights:

- **Statutory occupancy rights**: Individuals and entities can obtain a statutory right of occupancy for urban and non-urban land. Recipients of certificates of occupancy are obligated to pay the state for any unexhausted improvements (ie improvements with continuing value such as a building or irrigation system) on the land at the time the recipient takes possession and must pay rent fixed by the state. Rights are transferrable with the authorisation of the state governor.
- **Customary right of occupancy**: Local governments may grant customary rights of occupancy to land in any non-urban area to any person or organisation for agricultural, residential, and other purposes, including grazing and other customary purposes ancillary to agricultural use. The term for customary rights (which is contained in the application form and not the legislation) is 50 years, and may be renewed for a second 50-year term. Recipients of customary rights of occupancy must pay annual tax on the land and cannot transfer any portion of the rights without approval of the governor (for sales of rights) or the local government (other transfers).

The Act vests all land in the urban areas of each state under the control and management of the governor of the state. The governor of the state holds the land in trust for the people of the state and is solely responsible for the allocation of land in all urban areas to individuals who reside in the state and to organizations for residential, agricultural and commercial purposes. All other land in the state subject to conditions under the Land Use Act is under the control and management of the local government. The act divests traditional owners of land and vests such land in the state governor for the benefit and use of all Nigerians. It provides the processes through which land may be acquired by the federal government.

On rural land where there are no formal title deeds and any land rights are customarily held, compensation for land acquisition is only provided for buildings, crops and other 'improvements' to the land as well as rent for the year the land was occupied. Payment is not paid for land itself since customary ownership is not recognised by government.

For community-owned land where ownership is not claimed by any one individual or family, the governor will determine who receives the compensation. This might be the community or the chief or a community leader who can make use of the money according to customary law.

Alternatively, money can be paid into a community fund. The governor has the power to cancel the right that any person has to live on or make use of any piece of land, if the land is required for use in the interest of the public. This includes road construction, sea port, and mining and oil pipelines. Rights to land cease with immediate effect upon receipt of notice from the governor.

There are some differences between the Nigerian laws for resettlement and the IFC requirements. These differences are related to: the requirements for seeking alternative sites; preparation of a Resettlement Plan and Restoration Plan; timing, formal consultation requirements (with resettled and host communities); emphasis on vulnerable groups and indigenous people; definitions of a cut-off date; the requirements to provide assistance; grievance mechanisms and monitoring; and evaluation requirements. CRMoW will be undertaking the project in alignment with both the National Nigerian law and the international best practice of the IFC Standards.

Nigerian Minerals and Mining Regulations 2011

The Federal Ministry of Mines and Steel Development (the 'Ministry') recently issued new mining regulations titled the Nigerian Minerals and Mining Regulations 2011 (the 'Regulations') which is intended to establish a more coordinated and accountable solid minerals sector in the country and to stamp out the discretionary grant of mineral titles. The Regulations were issued for the purpose of setting out the rules, procedures and processes for the acquisition of mineral titles, and to give effect to the Minerals and Mining Act No. 20 of 2007 (the 'Act').

International Agreements and Conventions

Nigeria is a signatory to a number of international conventions and agreements relating to industry, development and environmental management. In certain cases conventions and agreements have influenced policy, guidelines and regulations and must be complied with during the planning, construction and operation of the proposed road project.

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal:

Nigeria is signatory to this convention. The convention is designed to provide a global framework for regulating the movement of hazardous waste across international borders. The Convention is also intended to minimize the amount and toxicity of wastes generated, to ensure their environmentally sound management as closely as possible to the source of generation, and to assist less developed countries in environmentally sound management of the hazardous and other wastes they generate.

United Nations Convention on Biological Diversity (1992)

The objectives of the Convention include the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising out of the utilisation of genetic resources.

United Nations Framework Convention on Climate Change (1992)

To achieve stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.

Convention Concerning the Protection of the World Cultural and Natural Heritage Sites (1972)

The convention sets aside areas of cultural and natural heritage for protection. The latter is defined as areas with outstanding universal value from the aesthetic, scientific and conservation points of view.

Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) (1979)

The Bonn Convention concerns the promotion of measures for the conservation (including habitat conservation especially for endangered species listed in Bonn) and management of migratory species.

Montreal Protocol on Substances that Deplete the Ozone Layer (1987)

The purpose of this protocol is to protect the ozone layer through enhanced international cooperation by taking precautionary measures to control equitably total global emissions of substances that deplete it. Signatories undertake to communicate statistics on annual production, imports and exports of the substances as indicated in the protocol and to promote research and development activities and information exchange.

African Convention on Conservation of Nature and Natural Resources (1968)

The contracting countries undertook to adopt the measures necessary to ensure conservation, utilization and development of soil, water, flora and faunal resources in accordance with scientific principles and with due regard to the best interests of the people

International Best Practice Standards and Guidelines

There is the possibility that CRSG may seek financing from financial institutions that have specific requirements for environmental and social performance. As such, the Project design and recommended mitigation will endeavour to uphold international best practices and maintain or reduce impacts to ALARP (as low as reasonably practical) levels. This EIA report may be updated at a later date should specific standards or requirements, such as those of the IFC be determined necessary.

It is the policy of the CRSG to consider international standards and industry best practice in all projects including joint ventures and supply chains.

Responsible Business Practices

CRSG shares the goal of promoting responsible governance and focuses on two main areas: anticorruption and responsible procurement. In promoting fair, clean business dealings, CRSG does not accept bribery, and opposes and aims to eliminate facilitation payments, which are widespread in many parts of the world.

As a responsible government, CRSG also attempts to positively influence supplier's sustainability performance by adopting internationally agreed standards for responsible business conduct and embedding these into the supply chain.

Endangered Species Act 11, 1985

In pursuance of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, CITES, the Federal Government of Nigeria enacted the Endangered Species (Control of International Trade and Traffic) Act 11,1985 which makes among others, provisions for the conservation, management and protection of some of the country's endangered species.

Section 1 absolutely prohibits the hunting or capturing or trading in the threatened animal species. The list of endangered species include reptiles, birds (Aves) and mammals (insectivores, primates, rodents, carnivores)

1.5 Impact Assessment Objectives

The objectives of this EIA Report are to:

- Facilitate an understanding of the elements of the existing baseline conditions that are relevant to resources/receptors that could be significantly impacted by the project;
- Inform and obtain input from stakeholders, (e.g., governmental authorities, the public, and indigenous communities) and capture their relevant issues and concerns;
- Consider project-induced environmental and social impacts, whether they be adverse of positive impacts, and identify means to either eliminate or minimise the adverse impacts whilst at the same time seeking to enhance the positives.
- Identify which of these project aspects may result in significant impacts to resources/receptors;
- Predict and evaluate the significance of the impacts of the Project;
- Identify the aspects of the Project that need to be managed, and recommend appropriate and justified mitigation and enhancement measures;
- Determine the significance of impacts, considering implementation of mitigation measures;
- Identify plans for the management and monitoring of impacts including the development of an Environmental and Social Management Plan; and
- Document how stakeholders have been involved in the EIA Process, and make recommendations on how they should continue to be involved as the Project progresses.

It is the aim of this EIA Report to meet the requirements or recommendations of the applicable national and international regulations and standards. The report will also be guided by the policies, guidelines, and procedures of the relevant international treaties and agreements.

1.6 Study Limitations

This EIA is based on data and information obtained from project impacted communities and CRSG at the time of the study. Any future changes to the Project Description, as presented in Chapter 3, upon which this report is based or additional relevant information revealed as Project design, equipment and service procurement proceed may affect the analysis, assessment and conclusions contained in this report. Should such changes occur, they shall be the subject of further study to verify that the conclusions of this EIA do not change and to determine whether any additional mitigation, management or monitoring measures are warranted.

1 .7 **Structure of the EIA Report**

The EIA Report would be presented in eight chapters.

i. Chapter one is an introduction, containing relevant background information and the legal and administrative framework for EIA in Nigeria among other information.

ii. The second chapter presents the project justification, the need/value and its envisaged sustainability as well as the project development and site/route options considered.

iii. Chapter three contains detailed description of the proposed project including its location, overall layout, basis for design, type and specifications of equipment/facilities to be installed and operation/maintenance of the proposed project.

iv. The fourth chapter describes the baseline ecological and socio-economic status of the study area respectively. Information on consultation with stakeholders is presented in this chapter.

v. Chapter five discusses the identified impact assessment methodology of the proposed project.

vi. Chapter six presents the various mitigation measures proffered against the identified significant impacts.

vii. Chapter seven provides a cost-effective environmental management plan that would be adopted throughout the project's lifecycle. It also enumerates the environmental monitoring programme, the waste management programme and the project's decommissioning/abandonment plan.

viii. Chapter eight concludes the report and requests approval for project implementation.

Other sections of the report include (not in any chronological order) the table of content, the list of references, list of EIA preparers, list of abbreviations and acronyms, acknowledgement page, the executive summary and various appendices.

Chapter 2

2.0 PROJECT JUSTIFICATION

2.1 Introduction

Roads play a key role in the socio-economic development of any nation. Developments in the industry, agriculture, service, trade and other major sectors of a country's economy depend to a large extent on the efficiency of the existing road networks.

This chapter presents the needs, benefits; economic, technical and environmental sustainability of the proposed project. Also presented are project options and alternatives that were considered during the project design.

2.2 Project Objectives

The objective of the proposed project is derived from the following:

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- To connect the important economic towns within the state with the proposed Calabar sea Port in Cross River state thereby accelerating cash crops and mineral materials trade
- Improvement of accessibility (road networks) in the State and Nigeria at large
- Improvement of infrastructure.
- Ensure sustainable economic development in Cross River State and Nigeria.
- Improvement of the socio-economic status of the nation.

2.3 Need for the Project

The Cross River state produces plenty of cocoa, cassava, rubber and other economic crops, as well as other abundant industrial raw materials such as limestone, uranium, basalt, granite etc. but with the underdeveloped transportation infrastructures. There are high costs of transportation, overheads and logistics, restriction in agricultural products or sales and industrial raw material development. These have led to an underdevelopment of the regional economy. After the completion of the proposed road project, there will be a reduction in logistic cost, speed up in the flow of goods and services, acceleration in the state's import and export trade and it will also attract industrial and agricultural investments. This new road project will also reduce travelling time from Calabar to the northern parts of the country.

At present, Cross River State has no railway line, only one civil airport is located in Calabar. As a result, bulk material transportation is done solely on a low-grade Federal highway which has worn out due to stress and lack of maintenance. The existing two lanes roads cannot meet the growing economic needs of the state. This new highway project will become an economic corridor linking the south and north of Cross river state as well as make the state a part of modern transportation system.

2.4 Benefits of the Project

The proposed road construction will result in the improvement of infrastructure as well as uplift the social structure in the surrounding communities. The major benefit due to the proposed project will be in the sphere of making Cross River State more safely accessible and generating temporary employment for substantial number of personnel. The construction phase of the road is expected to span over 72 months.

The proposed road project will have the following benefits:

i. Temporary employment for indigenes of affected and the neighboring communities during construction phase.

ii. Providing Cross River State and surrounding adjoining states with easy access to the existing Calabar Free Trade Zone, and of course the Calabar seaport.

iii. Shorten the road travel distance by over 100km, the difference between the existing and the proposed roads.

2.5 Value of the Proposed Project

The total project estimated cost is NGN 800 billion. It also adds to the infrastructural development, economic, social and health advancement of the host communities, State, Federal Governments and Africa at large. Also, it will add value in terms of improved and or additional infrastructural and social amenities, influx of businesses and people, etc. at all levels.

2.6 Analysis of Project Alternatives

The following project options were considered based on

- The Health, Safety and Environmental Impacts.
- Best Available technology
- Economic/Social considerations

2.6.1 Project Development Options

i. Option 1: Do Nothing Option

This options means that the project of constructing the proposed Bakassi –Ikom – Katsina Ala Superhighway is abandoned and the road users to continue using the existing, entirely failed Calabar – Ogoja federal highway. Under this Option, the Government of Cross River State will have saved on the funds for the road construction but the issues of traffic congestion, noise, accidents and lost time by trucks and passenger vehicles would remain unattended. This is not a suitable option and was therefore rejected because of the need to improve infrastructure base of the State, especially through effective and sustainable road network.

2.6.2 Option 2: Delayed Option

This means the manifest and associated benefits of the projects will also be delayed, so this option was also rejected.

2.6.3 Option 3: Upgrade existing Federal Calabar-Ikom-Obudu Highway

This option was also rejected because it is longer compared to the proposed Calabar-Ikom-Katsina Ala superhighway. In addition, there are bureaucratic bottlenecks in the State Government taking over the responsibility of this road upgrade, or rehabilitation, which is the Federal Government's.

Option 4: Construct Proposed Calabar-Ikom-Katsina Ala Superhighway Project

This Option was chosen considering its economic advantages and also having in mind that all its negative environmental impacts can be mitigated.

2.7 Alternative Alignments

Due to the high occurrences of forest reserves, parks and river systems in the project area, the concept of "route selection based on environment" was adhered to in order to make the route line more adaptable and friendly to the environment. Careful route selection was carried out to, ab initio, eliminate or minimize certain potential and associated project negative impacts. One was selected, out of four alignment alternatives considered, using such empirical factors like environmental sensitivity, resettlement requirements for affected persons, compensations, length of route and engineering feasibility and costs of construction and of maintenance of the proposed highway project.

The 3- dimensional digital route selection method has been applied based on google earth platform for this project. The proposed route starts from Bakassi LGA and stretches to Bekwarra after passing Ikom on the west. The branch line stretches from Okwortung which is a small town situated at the south western end of Obudu and connects Yala which is the major salt mine of Nigeria. Its total length is approximately 260km.

Figure 2.1 shows the alignment various alternatives considered while Table 2.1 and Table 2.2 show the linear and relief characteristics of the different routes and routes interceptions with land-use respectively.

2.7.1 Alternative A (western alignment)

This measured 257km with 10 interceptions with rivers and aligned to the west of the existing Calabar-Ikom-Ogoja federal highway. It has the advantage of avoiding the forest but posed engineering and social impediments, having lots of rock outcrops and large settlements in its wake. This was considered unsuitable and therefore rejected.

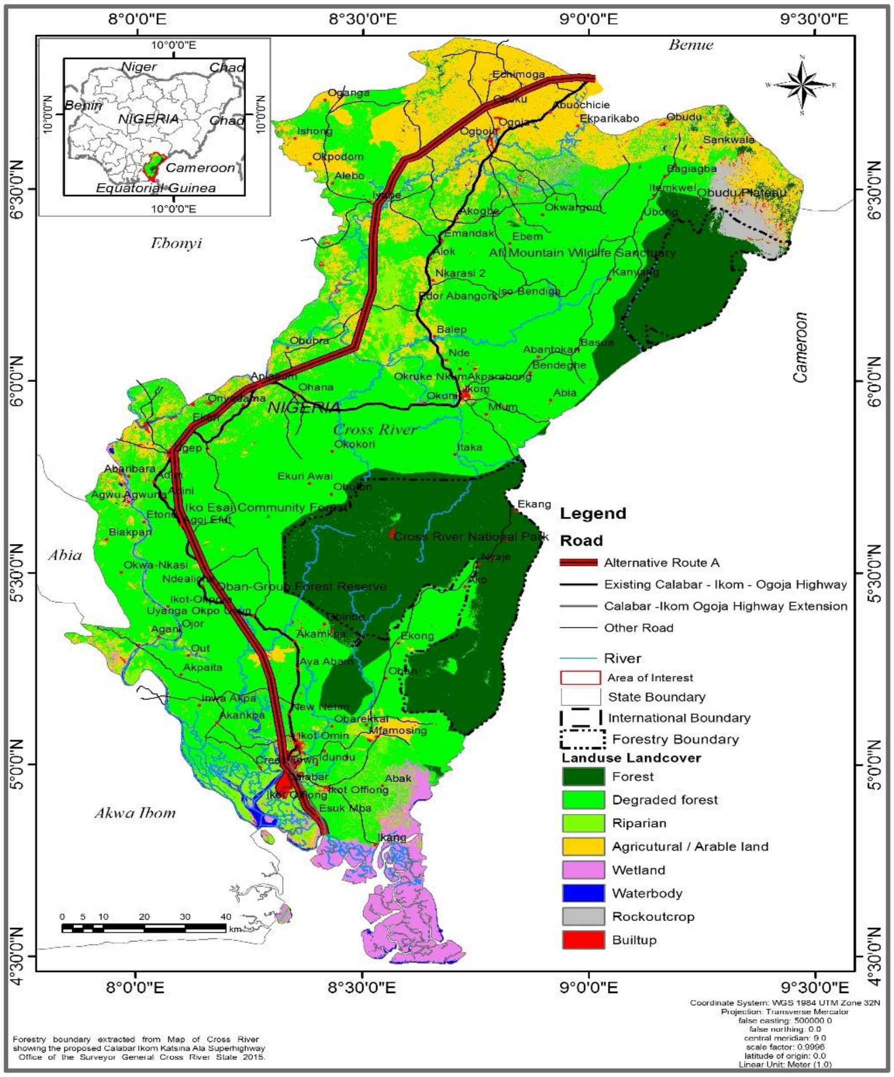

Figure 2.1: Map of Cross River State showing Alternative Route A

2.7.2 Alternative B (middle alignment 1)

This measured 258km with 11 interceptions with rivers and aligned slightly to the east of the existing Calabar-Ikom-Ogoja federal highway. It has the disadvantage of traversing a section of the Oban Forest Reserve and also posed social challenges, having lots of settlements in its wake. This was considered unsuitable and also therefore rejected.

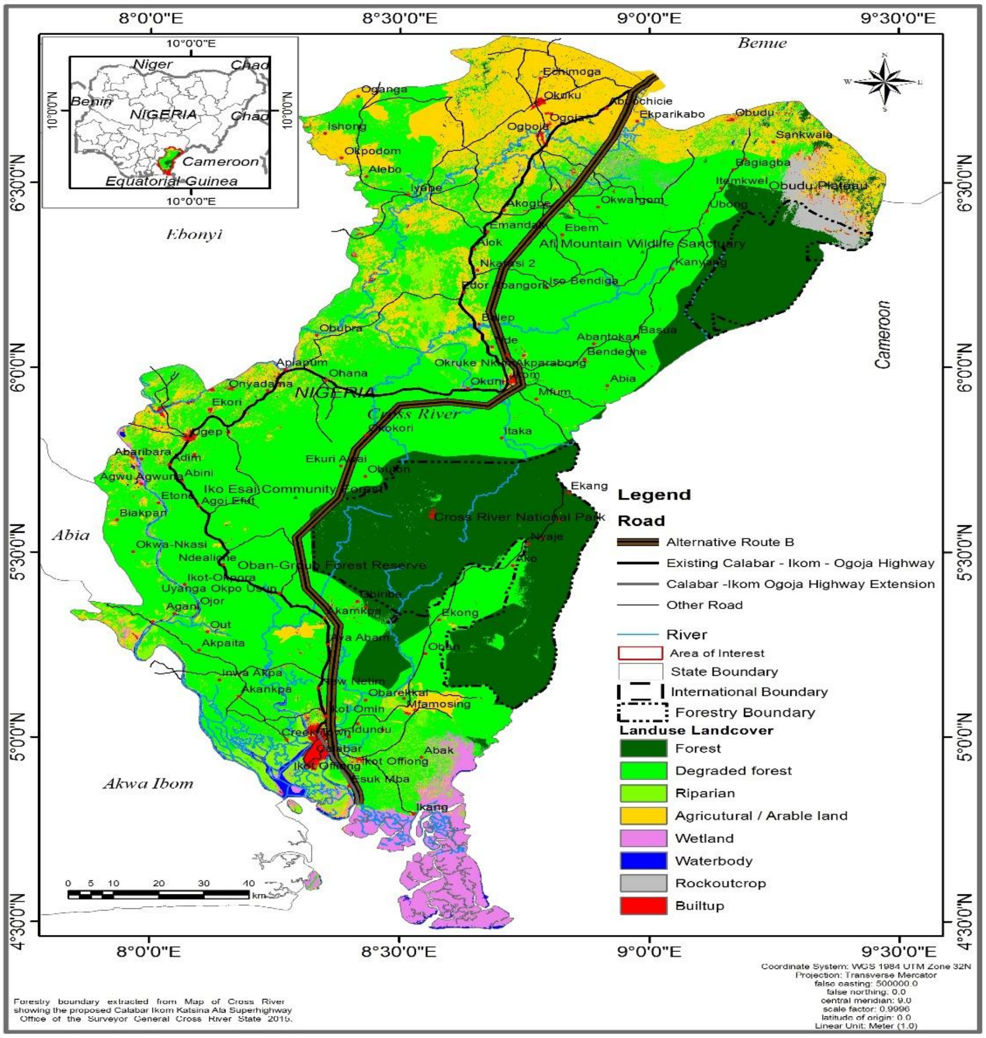

Figure 2.2: Map of Cross River State showing Alternative Route B

2.7.3 Alternative C (eastern alignment)

This measured 256km with only 4 interceptions with rivers and aligned slightly to the east of the existing Calabar-Ikom-Ogoja federal highway. It has the disadvantage of traversing a section of the Oban Forest Reserve and also posed social challenges, having lots of settlements along the line. This was considered unsuitable and also therefore rejected.

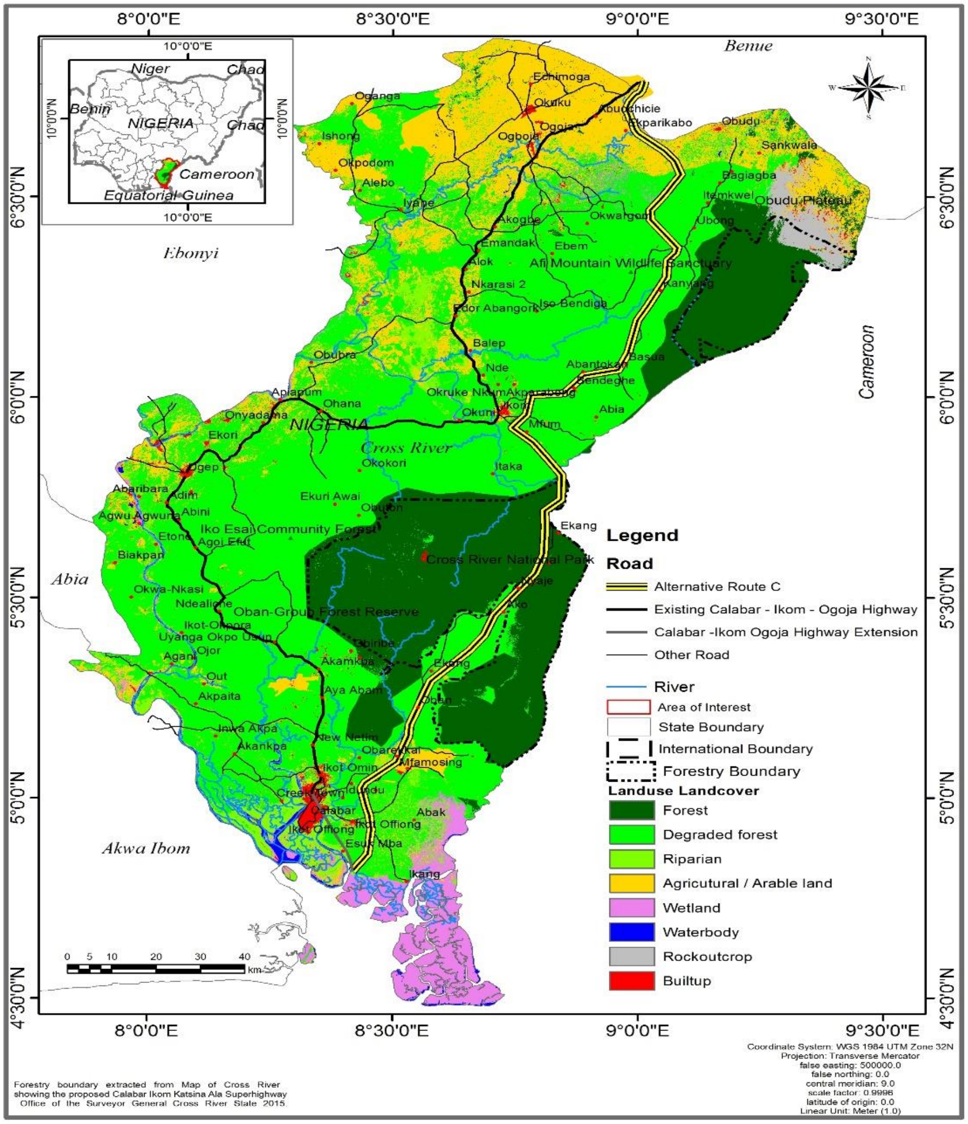

Figure 2.3: Map of Cross River State showing Alternative Route C

2.7.4 Alternative D (middle alignment 2)

This measured 256km with only 4 interceptions with rivers and aligned slightly to the east of the existing Calabar-Ikom-Ogoja federal highway. It also enjoys the advantage reasonably avoiding but going forward along the edge of the Oban Forest Reserve.

Conclusion and Recommendation on the Best Alternative Alignment

The Alternative D was therefore recommended as the final alignment for the detailed design, offering the most favourable option as it compared with the other alternatives and has the following advantages:

The recommended option has the following advantages compared to the other three options:

• The construction cost is the least of the four options;

• It is the among the shortest routes by comparison;

• It is the route which requires the least land take;

- It avoids the Oban Forest Reserve and the Afi Mountain Wildlife Sanctuary
- It is the route where the least number of buildings will have to be demolished; and
- It is the route where the gentlest vertical alignment can be designed.

Table 2.1: Linear and relief characteristics of the different routes

Road	Length (km)	Road Interception with River	Min – Max Elevation (m)	Mean Elevation
Existing Calabar-Ikom-Ogoja Highway	317	8	16.6 - 167.9	86.5
Route A	257	10	14.4 - 132.8	70.0
Route B	258	11	15.1 - 231.4	113.7
Route C	256	4	11.4 - 431.74	129.0
Route D (Proposed Super Highway)	260	19	11.7 - 232.2	110.2

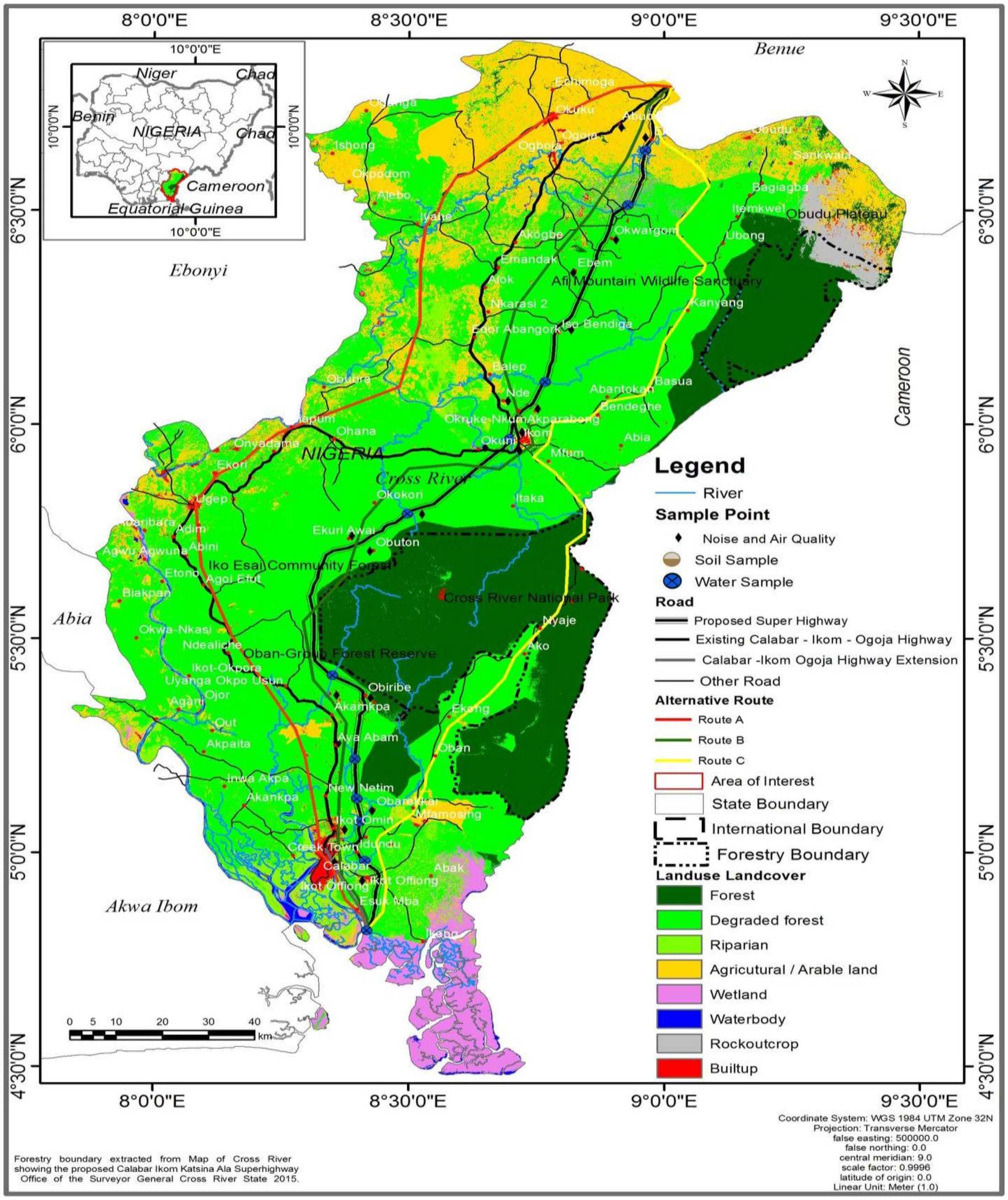

Figure 2.4: Map of Cross River State showing the alignment alternatives considered

Table 2.2: Routes interceptions with land-use

Route	Forest	Degraded forest	Settlement	Rock outcrop	Arable and Agricultural land	Wetl and	Water body	Riparian
Existing Calabar-Ikom-Ogoja Highway	No	Yes	Yes	Yes	Yes	Yes	Yes	No
Route A	No	Yes	Yes	No	Yes	No	Yes	No
Route B	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Route C	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Route D (Proposed Super Highway)	No	Yes	Yes	Yes	Yes	Yes	Yes	No

2.8 Envisaged Project Sustainability

The sustainability of this project stems from the fact that it will satisfy economic contributions, meet the demand for safe transportation and also maintain environmental friendliness. The sustainable development philosophy of minimizing land-take, cost and the impact on the environment shall be adopted for this development project. The set goal is, “meeting the needs of the present without compromising the ability of future generations to meet their own needs”.

The sustainability of the project can be described in terms of the longer term economic, environmental and social benefits as a result of the project and by ensuring that negative impacts of the proposed road are reduced to as low as reasonably possible (ALARP). The project would create a means for lowering the cost of transporting farm produce and products, minerals and other natural resources from the northern and central Cross River, and of course from the immediate northern States of Benue, Taraba and Adamawa, to Calabar and other southern parts of Cross River State, and to the proposed Calabar seaport (when it becomes operational) for export; and the delivery of imported goods along the same route in reverse order. This will improve haulage economics by providing a new road infrastructure able to receive more and larger vehicles, and reducing traveling time for all kinds of vehicles. The contributions to environmental sustainability include a decrease in road accidents, loss of lives and spillage of hazardous substances and materials on the road when accidents occur.

The design for construction and operation of the Project has been developed according to the principles of sustainable development. A fundamental component of the project development is the consideration of environmental and social sensitivities throughout the project and the integrated assessment of the environmental, social and economic aspects. These impacts were identified and assessed through the EIA and preliminary design processes. Potential impacts and associated mitigation measures were identified during conceptual design and for construction and to reduce the negative impacts and enhance benefits that will be incorporated into the technical design of the facility and/ or the EMP to reduce impacts on the biophysical environment.

The project has considered the no-go option as well as a number of alignment, technology, and design alternatives to ensure that all possible scenarios are tested and the most suitable option has been selected. This approach is intended to ensure that the best practicable option is chosen to minimize potential impacts on the receiving environment. With regard to social sustainability, the project will assist in community investment and social development initiatives for the life cycle of the project, through direct and indirect employment opportunities and contribution to the development of the road. The involvement of the relevant officials and organizations within the legislated EIA process has ensured that the planning process obtains valuable input and sometimes local knowledge, helping to ensure that the project is robust and inclusive. Other social benefits will include the induced development along the road corridor.

1.1 Economic and social prospects of the project

Nigeria is classified as a mixed economy emerging markets and has already reached lower middle income status according to the World Bank Report of 2010. It has an abundant supply of natural resources, well developed financial, legal, communications, and transport systems. Nigeria ranks 26th position in the worlds GDP. Nigeria has maintained an impressive growth in last decade with an estimated 7.4% of growth (Gross Domestic Product) GDP in 2013 up from 6.7% in 2012, and it is as well the largest economy in Africa (rebased figures, April 2014). It is also on track to become one of the world’s largest 20 economies in 2020.

It has an average population density of 93/km^2 and a total GDP of $9,292 Million and per capita income of $3,150 as at 2010. Core industries include; tourism, agriculture, solid mineral and aquaculture.

Investment in the transport sector improves access to economic opportunities by reducing transport costs. These include lower market prices for final products (both rural products and consumer goods), spatial extension of the market (due to the transport-induced changes in production and consumption patterns), higher personal mobility, and stimulation of socio-economic activities. In addition to improving accessibility, transport investment affects employment. The provision of transport services, including the construction and maintenance of transport infrastructure, generates demand for labour (often unskilled) and provides income-earning opportunities for the poor. If a transport project generates jobs for the poor who are otherwise unemployed or under-employed, it contributes to the reduction of poverty.

Chapter 3

3.0 Project Description

Introduction

This Chapter provides a description of the Project in terms of the design, construction and equipment required for the highway and associated project activities during all phases of the Project.

3.1 Technical Standards of the proposed Project

Based on highways service level and constructions conditions in Cross River State, this project adopts the design speed of 80 km/hr and bi- directional four lanes highway. See table 3.1.

Table 3.1: Major Technical Standards of Project

Items	Standards
Section	Calabar- Ikom- Katsina Ala
Design speed	80 km/hr
Road width	2.5m (sidewalk)+ 7.3m (Traffic lanes)+ 1.5m (separate belt)+ 7.3m (Traffic lanes) + 2.5m (side walk)
Lanes	4
Traffic loads	British standards

3.2 Design Principles and Main Works

3.2.1 General Principles

This project is designed based on the main principle of “applicable, safe durable and economizing cost” with the application of advanced highway survey and design of new ideas which will characterize the project. The overall design ideas to be established are stated below.

3.2.2 Focus on Comprehensive Benefits

The general requirements on straightness and shortness of highway corridors are to be met in accordance with the urban layout and plan for the purpose of serving local developments, facilitating transport, attracting passengers and freight flow. The routes are to be selected in reasonable ways to avoid obstacles or difficulties as well as avoid dividing the built-up areas in a city, thereby benefitting the development of local economy and natural resources and maximizing comprehensive benefits.

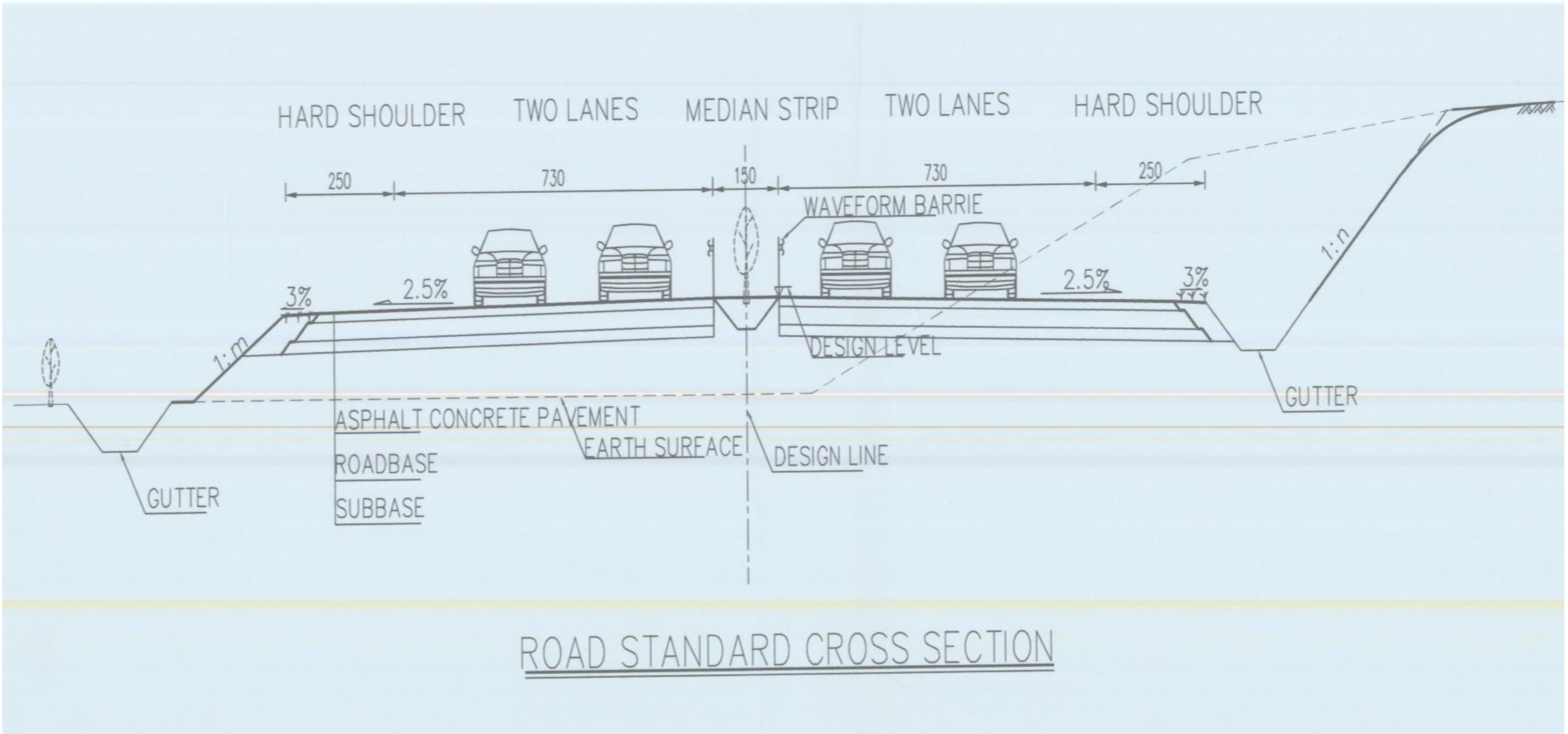

Figure 3.1: Standard Road Cross Section

3.2.3 Co-ordination for Reasonable Use of Existing Facilities

The routes have to be co-ordinated with existing federal highways in Cross River State thus it would make full use of existing sub-grade and other highway facilities to reduce cost.

3.2.4 Increase of Engineering Reliability

The project area features complex terrains, large height difference in rolling areas, and complicated regional geologic structures, as well as greatly-varied geological conditions and many culverts and bridges. For these considerations, the principle of "geologic route selection" were adhered to strictly and the engineering reliability and safety conditions were increased in order to avoid extreme unfavorable geological conditions while ensuring the safety of critical works.

3.2.5 Emphasis on Location Based on Environmental Protection

Due to the high occurrences of forest reserves, parks and river systems in the project area, the concept of "route selection based on environment" was adhered to in order to make the route line more adaptable and friendly to the environment.

3.3 Subgrade and Land Utilizations

Subgrade Design Overview

The length of the subgrade is 260 km in section from Esighi in Bakassi LGA to Gakem in Bekwarra LGA, with 13489505 m^3 filling and 19652473 m^3 cutting earthworks respectively.

Surface Width and Side Slope of Subgrade

The surface width of subgrade is designed in the formation as below and as presented in figure 3.1. "2.5m (sidewalk) +7.3m (Traffic lanes) + 1.5m (separate belts) + 7.3 (traffic lanes) + 2.5m (sidewalk)".

Embankment

Table 3.2: General Slope Grade of Embankment

Type of filling material	Slope height (m)	Slope grade	Remark
General fine grained soil	0-8 8-20	1:1.5 1:1.75	When exceeding 8m set up plain stage of slope at the place 8m under the road shoulder with 2.0 width
Angular (round) gravel, soil, block, stone soil	0-12 12-20	1:1.5 1:1.75	When exceeding 12m set up plain stage of slope at the place 8m under the road shoulder with 3.0 width

Generally, the side slope of embankment is controlled to be 20.0m, when the embankment slope is greater than 20.0m, a bridge shall be arranged to substitute the embankment.

Cutting

The cutting slope grade shall be synthetically determined according to engineering geology, hydro-geological conditions, formation lithology, slope height and other factors, and shall be designed by referring to the Table 3.3.

Table 3.3: General Slope Grade of Cutting

Rock and Soil Type	Maximum Slope Height (m)	General Slope Grade
Granite, gneiss, quartzite	35	1:0.3- 1:0.75
Slate, shale, phyllite	25	1:1 – 1:1.25
Silt clay	15	1:1.25- 1:1.5

Generally, the cutting slope ratio shall be determined through slope stability analysis and calculation according to engineering geology, hydro-geological conditions, formation lithology, slope height and other factors.

3.4 Sub grade drainage design philosophy

i. The sub grade drainage shall be connected to the nearby bridge, culvert and other drainage systems as far as possible to form reasonable dr ainage. Furthermore, comprehensive utilization of agricultural water and consistency shall be considered to avoid loss of irrigation and destruction of farm crops.

ii. At the section with obvious lateral slope of ground, the gutter and drainage ditch shall be made on one side at upper location. Generally the distance from the gutter to the top of cutting shall not be less than 5m at the section with unobvious lateral slope of ground, the gutter and the drainage ditch shall be made on both sides of the sub grades.

iii. Generally, the side ditch shall be C15 concrete ditch.

3.5 Individual Design Philosophy for Sub Grade

Retaining Engineering

In principle, retaining protection will not be made for general sub grade. But when the sub grade has clearance requirement or the slope is high or there is a problem in stability, the slope toe can be set up with a concrete gravity retaining wall. For embankment at the section with steep slope, when the side slope is high or the fill is thin, then C25 rubble concrete retaining wall, pile foundation joist, C35 re- enforced concrete slab-pile wall and cantilever type retaining wall shall be built at proper location by the side slope or road shoulder or embankment.

Sub grade slope protection

i. Embankment: for general areas, the slopes of soil embankment and landscape designed embankment shall be protected by spraying grass seeds;
ii. In principle, slope protection is not considered for road sections filled with hard rocks.
iii. Cutting: for soft rock subgrade, it is recommended to protect the slope by spraying concrete with net during construction.

For hard rock subgrade, it is recommended to adopt smooth blasting during construction, and generally slope protection is not to be considered.

Special Subgrade design

i. Deep cutting: for the complete hard rock deep, smooth blasting, or presplitting, blasting shall be used for slope excavation especially when the joint fracture of a mass develops, combining with the slope ratio, concrete guard wall or spraying concrete with net shall be adopted for reinforcement and protection; if the rock mass is complete, local inserting shall be used for protection; if necessary, retaining structures or pre-stressed anchor cables can be set up for reinforcements.

ii. High Embankment: for high embankments with depth of fill greater than 15.0m, the subgrade surface shall be widened according to requirements for embankments fill, slope height; plane stage of slope with at least 3.0m width shall be made. If necessary, support or retaining structures can be made at the slope formation.

iii. Steep slope subgrade: The subgrade in the line are mainly located in hillside with steep slopes, when the fill is greater than 6m, the slope at one side will be high, and is difficult to ensure the slope stability, therefore retaining structures need to be built at proper locations of the road shoulder or slope formation. In principle, “hillside peeling” should be avoided on the steep soil slope cutting. In the design, the landform, engineering geology and hydrology shall be considered for the construction of cutting retaining wall, slab-pile wall and other retaining structures.

In the design, skid resistance measures shall be taken for steep slope embankment. If necessary, embankment stability shall be checked and calculated; when the lateral slope of ground of the embankment is steep and the fill side has formed into a tiny strip, shoulder retaining wall shall be built for supporting and retaining.

3.5 Principle of Allocation of Subgrade Earth Work

The length of the subgrade is 260 km in section from Esighi in Bakassi LGA to Gakem in Bekwarra LGA, with 13489505 m^3 filling and 19652473 m^3 cutting earthworks respectively.

As for the main line, the excavation is far greater than the filling. The filling and the excavation of the other line are the same. The excavation can be used as main filling material of embankment. Due to the large difference between fill and excavation of main line, spoil ground should be built for central disposal.

For protection of environment, ballast retaining wall should be built at the slope toe of the bank to prevent water and soil erosion. Grass seeds should be sowed in the side of the slope of spoil ground and burrow area for greening and protection. Farm land should not be used as burrow area or spoil ground. It is strictly forbidden to discard the ballast in the upstream of rivers, reservoir, bridges and culverts. The burrow pits should be built intensively in order to ensure the stability of the side slope after burrowing. It is also strictly forbidden to blast rock near the main road. If the burrow pit is subgrade, the horizontal distance between its inner side and top of cutting or slop toe should be more than 0.5m.

3.6 Design Principle of Land using for Subgrade

3.6.1.A Design of Land for Spoil Ground and Burrow Area

The overall stability of burrow area and spoil ground should be maintained and land should be used economically. The burrow area and spoil bank which have nothing to do with the drainage system should be leveled and returned to local authorities as temporary land. The intensive burrow area and spoil ground should which are far from the highway would also be taken as temporary land. Favorable measures should be taken to help environmental protection and prevent water and soil erosion.

3.6.1.B Right of Way of Subgrade

The width of land for cutting, to outside gutter shall be no less than 2.0m. Without gutter; the distance to the outside edge of cutting top shall be no less than 5.0m.

Width of land for embankment: To the outside edge of drain, berm and slope toe shall be no less than 3.0m. If subgrade serves as both, borrow pit and spoil ground / bank for drainage, its outside edge shall be no less than 2.0m. Open space or wasteland should be used as much as possible for the location of borrow pit or spoil bank. When they are far away from highway, a separate land should be used for such purpose.

3.6.2 Pavement

From studies gathered from constructions of high-grade highways, in reference to asphalt concrete pavement structures of advanced technology with new ideas from home and abroad, composite pavement structure is to be so adopted, which consist of the anti-slide surface of 4cm thick modified asphalt concrete (SMA-13C)+

6cm thick below layer of medium-sized aggregate modified asphalt concrete (AC-20)+ 20 cm thick base course of 5% cement stabilized grading crushed stones +30 cm thick sub-based of 5% cement stabilized for fine soil (Table 3.4).

Table 3.4: Pavement structure

Layers	Thickness (cm)	Materials
Top layer	4	Anti-slide surface of 4cm thick modified asphalt concrete(SMA-13C)
Below later	6	Medium –sized aggregate modified asphalt concrete(AC-20C)
Slurry seal	1	Modified emulsified asphalt
Base course	20	5% cement stabilized grading crushed stones
Sub-base	30	5% cement stabilized fine soil
Total thickness	61	

3.6.3 Bridges and Culverts

3.6.3.A Main Design Principles of Bridges and Culverts

i. Designed flood frequency: The designed flood frequency of bridges and culverts is 1/100.
ii. Designed live load: the vertical static load of the traffic adopts HA and HB load according to British standard.
iii. Designed running speed: 80km/hr.
iv. Navigational clearance: Nigerian navigational clearance.
v. Seismic precaution Criterion: There has not been any earthquake incident since independence in Nigeria (1960), thus, the seismic situation is not required.

3.6.4 **Girder**

The bridge structure is determined by various factors such as geography, topography, hydrological characteristics, geological conditions, project cost, construction period etc. usually 20m, 25m, and 30m posttensioned pre-stressed concrete T beams are used for ordinary bridges. As for the bridges whose span is less than 16m, frame structure or reinforced I-beams are suggested to be used according to geography, geology, structure height, construction conditions etc.

As for the high pier bridge with long span or other special bridges, continuous beam or continuous rigid frame should be chosen as main beam. If the bridges are built in the V-shaped ravines or gorges, arch bridge is adopted according to geological conditions.

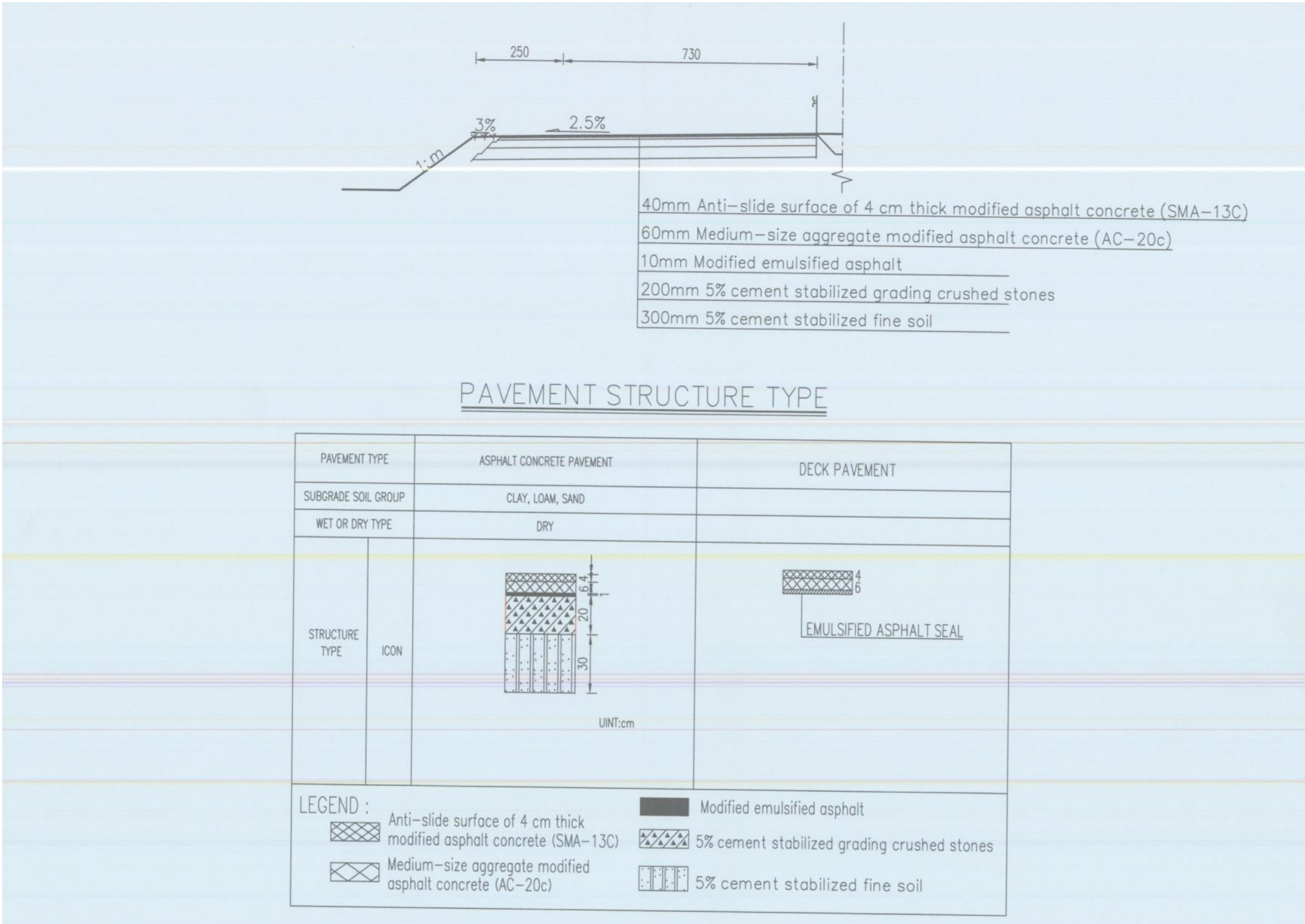

Figure 3.2: Pavement Structure Chart

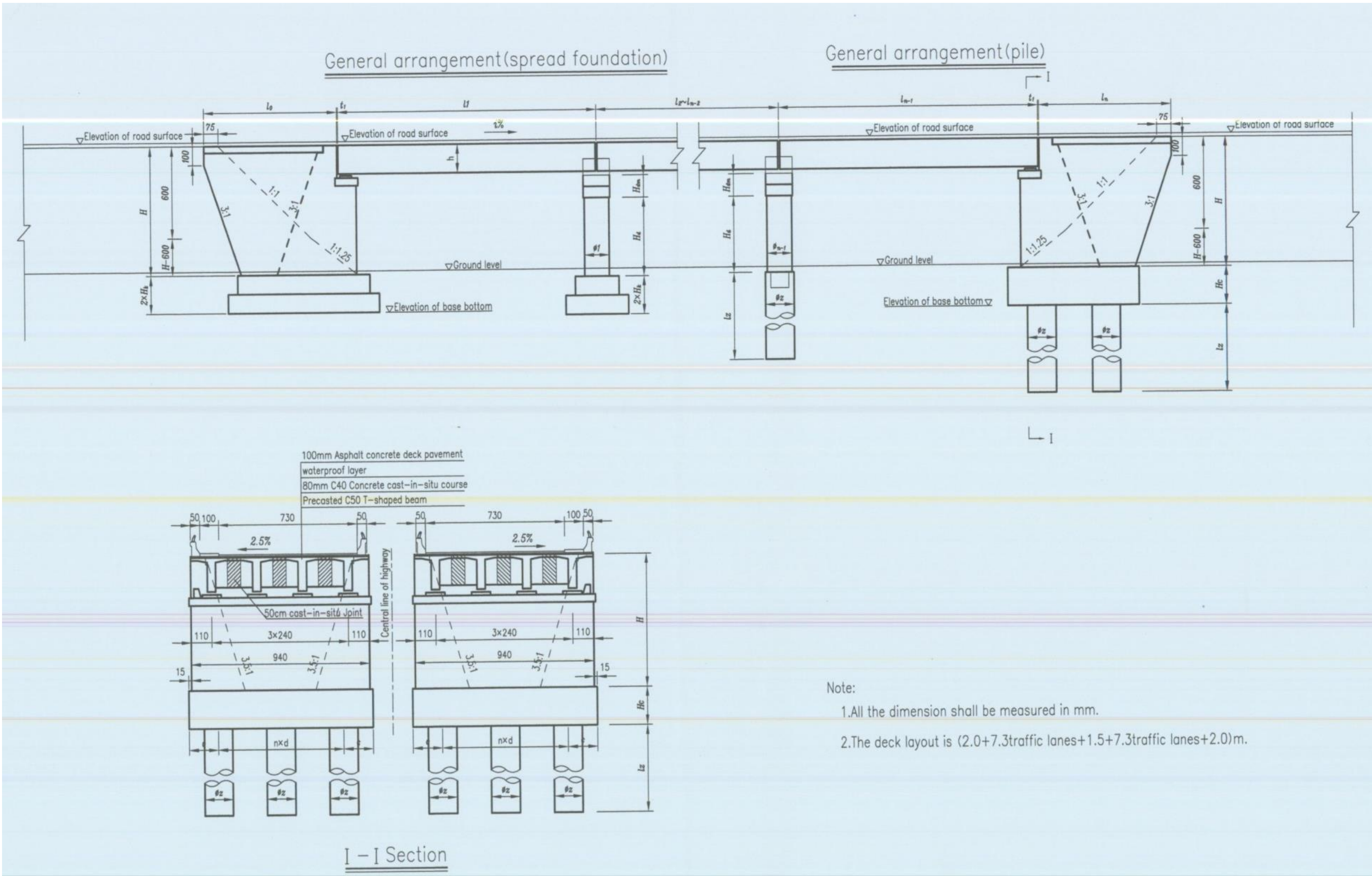

Figure 3.3: General arrangement of T-shaped beam bridge

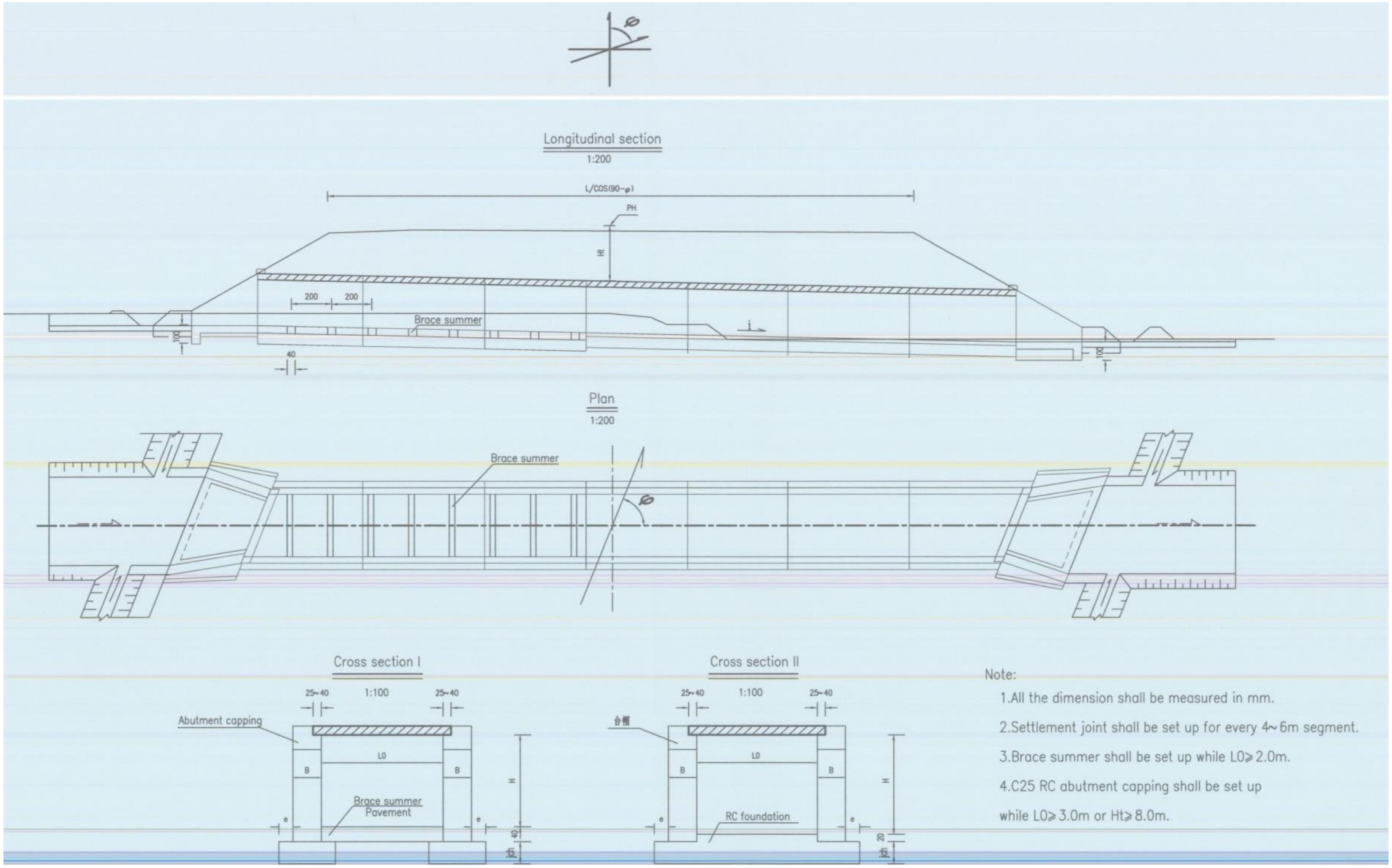

Figure 3.4: General arrangement RC slab culvert

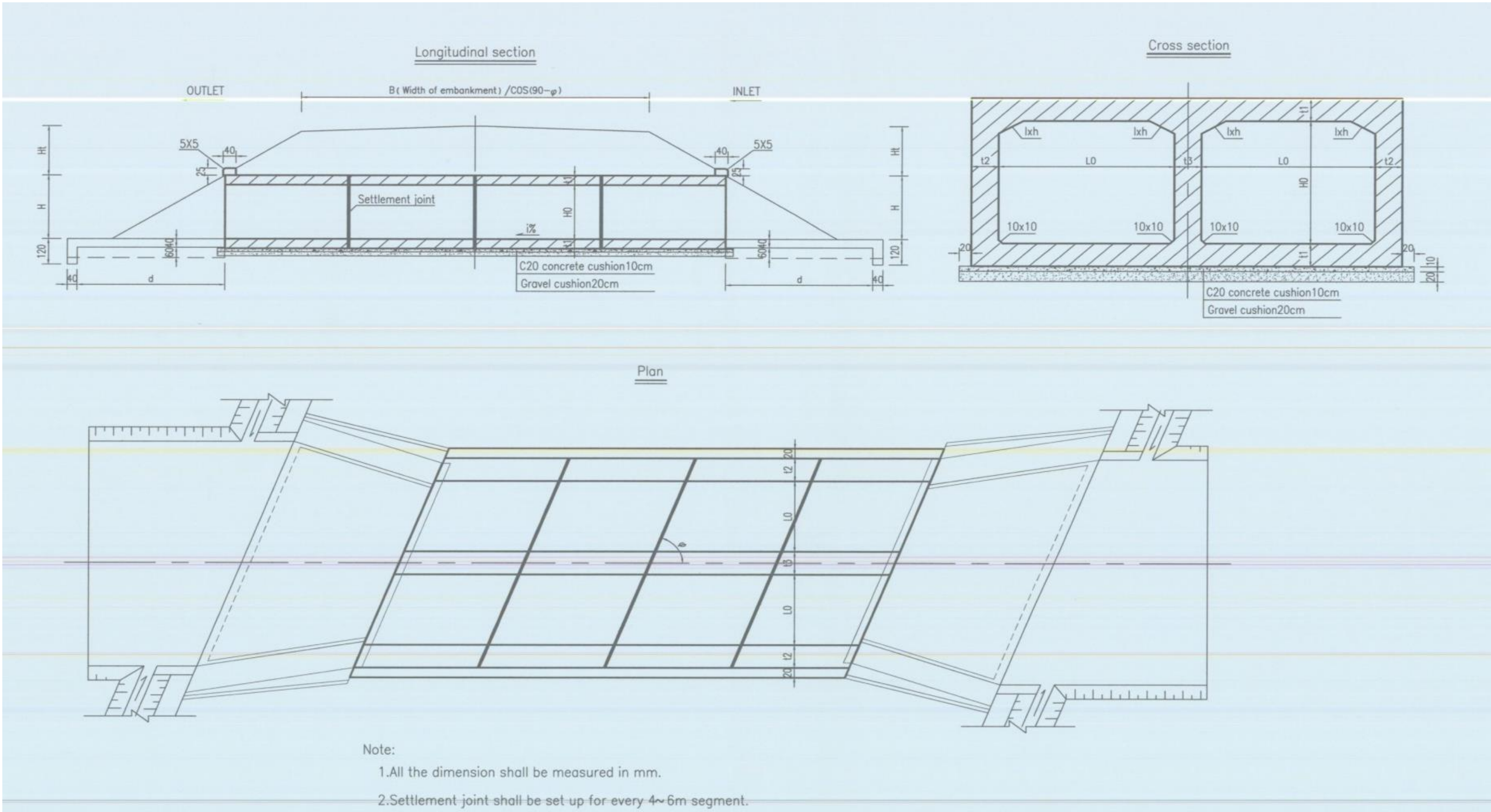

Figure 1.5: General arrangement RC frame culvert

3.6.5 Piers and Abutments

According to the pier height, hydrological conditions, etc. single column pier or multiple column pier is adopted. U-shaped Abutment or Pillar-shaped Abutment serves for this project (Figure 3.6).

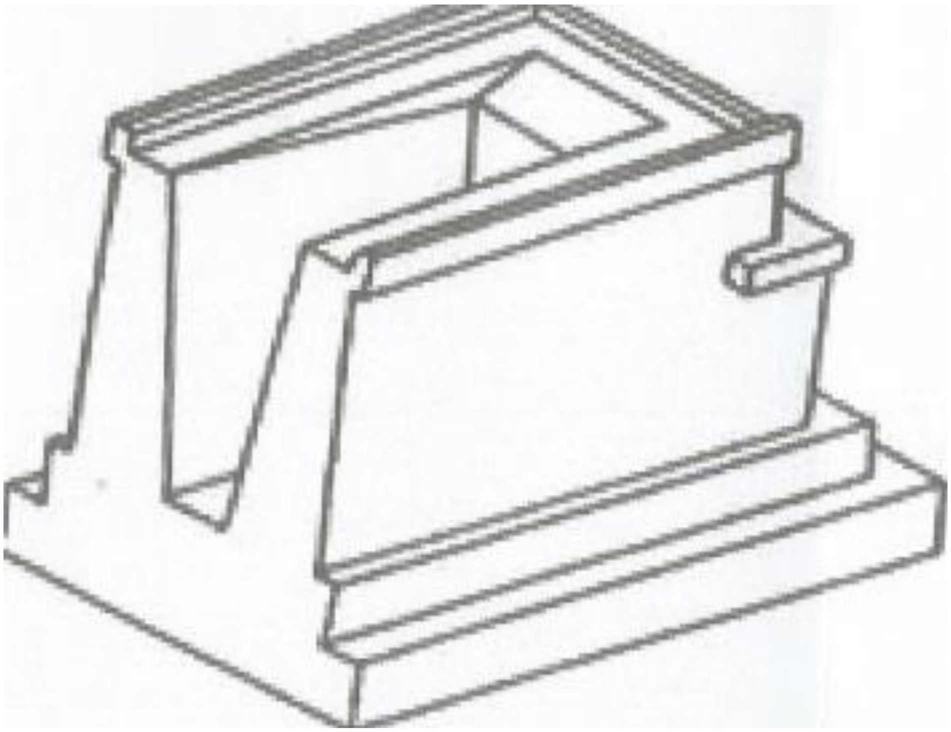

Figure 3.6: U-Shaped Abutment

3.6.6 Other Facilities

9 Rotary islands have been arranged at the junctions with other highways and municipal roads.

3.7 Environmental protection and landscapes

3.7.1 Environmental Protection

To develop environmentally – friendly and sustainable highway, his project shall follow the guidelines stated below:

i. Provide a net increase in environmental functions and values of watershed.

ii. Go beyond minimum standards set by Nigerian environmental laws and regulations.

iii. Identify and protect historical and cultural landmarks.

iv. Avoid, identify, and protect critical resource areas.

v. Maximize use of existing transportation infrastructure.

vi. Use recycled materials to eliminate waste and reduce energy required to build highway.

vii. Link regional transportation plans with local food partnership.

viii. Protect the hydrology of wetlands and streams and channels through restoration of natural drainage patterns.

ix. Result in a suite of targeted environmental outcomes based on local environmental needs.

x. Reduce disruptions to ecological processes by promoting wildlife corridors and passages in areas identified through wildlife conservation plans.

xi. Encourage smart growth by integrating and guiding future growth and capacity building with ecological constrains.

3.7.2 Landscapes

Highway landscape design principle is to make alignment, along bridge, sub-grade, and other facilities in harmony with the natural landscape architecture group. It should be achieved through the following goals;

i. Attempting to match and make compatible landscape response to surrounding landforms.
ii. Working with and balancing existing landforms to minimize extent of earthworks.
iii. Site sensitive road geometry that fits the road into existing topography, frames views, providing an alternating and interesting sequence of experience for motorists.
iv. Avoiding continuous planting along corridors unless it is part of a habitat link and providing regular vegetation breaks, particularly at significant vistas and viewing locations.
v. Reducing obtrusive roadside structures such as barriers and advertising structures, unless required for safety purposes.

vi. Considering local landholders needs; factors such as stock/ herds crossings and machinery access.

vii. Minimizing vegetation clearing through the alignment and road formation.

viii. Ensuring hydrological regimes are not significantly altered through provision of suitable structural infrastructure and drainage devices.

Chapter 4

4.0 Description of existing Environment

4.1 Introduction

This chapter presents the existing environmental conditions of the proposed Calabar – Ikom– Katsina Ala superhighway route. Data and information for the description of the existing environmental condition of the study area were obtained from desktop studies and field investigations carried out by biophysical and social specialists.

Baseline information was collected using the following methods:

- Desktop review of existing reports related to the project site and the surrounding environment;
- Two seasons of the field sampling, measurements and laboratory analysis; and
- Additional information gathered from consultation with surrounding communities.
- For the purposes of defining the study area, environmental components within a 5-km radius of the project center-point have generally been considered as appropriate. Other environmental resources and components located further away from the site have also been described where relevant to this study. Baseline field surveys were conducted in September 2015 (wet season), and in January 2016 (dry season) and were witnessed by FMEnv staff.

4.1.1 Desktop studies

Desktop studies involved the acquisition of relevant background information on the biophysical environment of the study area. Information was sourced from the following public institutions:

- Federal Ministry of Works
- Cross River State Ministry of Works
- Cross River Basin Development Authority
- National Population Commission
- The Nigerian Meteorological Agency
- Federal Office of Statistics
- National Population Commission

Other sources of information include: previous environmental surveys in the study area, publications, journals, textbooks, maps as well as online sources.

4.1.2 Field Sampling

In order to effectively characterize the biophysical environment of the study area and determine variations in the environmental parameters, sampling locations were identified using recent satellite imagery of the study area. The basis of the sampling design was informed by a preliminary classification of habitat types in the study areas through desktop research and previous environmental assessment studies. These were done in terms of air quality, vegetation / wildlife studies, noise, surface water, ground water, hydrobiology and sediment sampling. Each sampling location was geo- referenced on the GPS.

The water, sediments and soil samples were collected, labeled and transported to the Ministry of Science and Technology (Environment) Laboratory in Uyo, Akwa Ibom state and analyzed for required parameters. This laboratory is accredited by the Federal Ministry of Environment. The results of the field sampling and measurements were compared with relevant Nigerian regulatory standards, World Bank Group / IFC EHS Guidelines and World Health Organization (WHO) guidelines and limits. The analysis results and measurements were compared with the most stringent standards.

Table 4.1: Soil Sample Coordinates (Projected Coordinate System: WGS 1984 UTM Zone 32N)

S/No.	Longitude	Latitude
1	437340	540206
2	435418	550217
3	433954	560317
4	433129	570221
5	433076	580397
6	435251	590383
7	426225	600267
8	424107	610258
9	423673	620275
10	427670	630194
11	457680	650232

S/No.	Longitude	Latitude
12	466710	660227
13	472225	670502
14	475773	680254
15	478897	690156
16	483274	700286
17	486637	710210
18	492755	720282
19	495369	730228
20	497495	740216
21	501565	750397

Table 4.2: Water Sample Coordinates (Projected Coordinate System: WGS 1984 UTM Zone 32N)

S/No.	Longitude	Latitude
1	435540	532540
2	435030	550579
3	434047	560617
4	433365	566580
5	432948	576795
6	428088	598488
7	444385	640202
8	466566	659560
9	474225	674230
10	492121	719887
11	495953	734014

Table 4.3: Noise and Air Quality Sample Coordinates (Projected Coordinate System: WGS 1984 UTM Zone 32N)

S/No.	Longitude	Latitude
1	495967	737327
2	489635	710881
3	480317	702347
4	479865	687661
5	472597	667216
6	469225	661172
7	432314	634393
8	436234	630473

S/No.	Longitude	Latitude
9	428997	593220
10	436315	592556
11	429449	580899
12	436678	563346
13	430729	558491
14	434517	545340
15	428515	550168
16	468618	656414

S/No.	Longitude	Latitude
17	461245	657253
18	466196	669239

S/No.	Longitude	Latitude
19	490715	739947
20	447525	640034

4.1.3 Consultation with Local communities

Information was gathered during the stakeholder consultation and socioeconomic baseline study undertaken within the local communities of IKot Omin, Ikot Eneobong and Ikot Effanga (in Calabar), Oban (in Akamkpa), Obubra, Ikom, Yala and host of others. Information relating to the biophysical aspects and socio-cultural aspects of the site was captured through these interactions and details are presented in this chapter. The additional information gathered from the local communities relates to the ecosystem services and livelihood aspects within the study area.

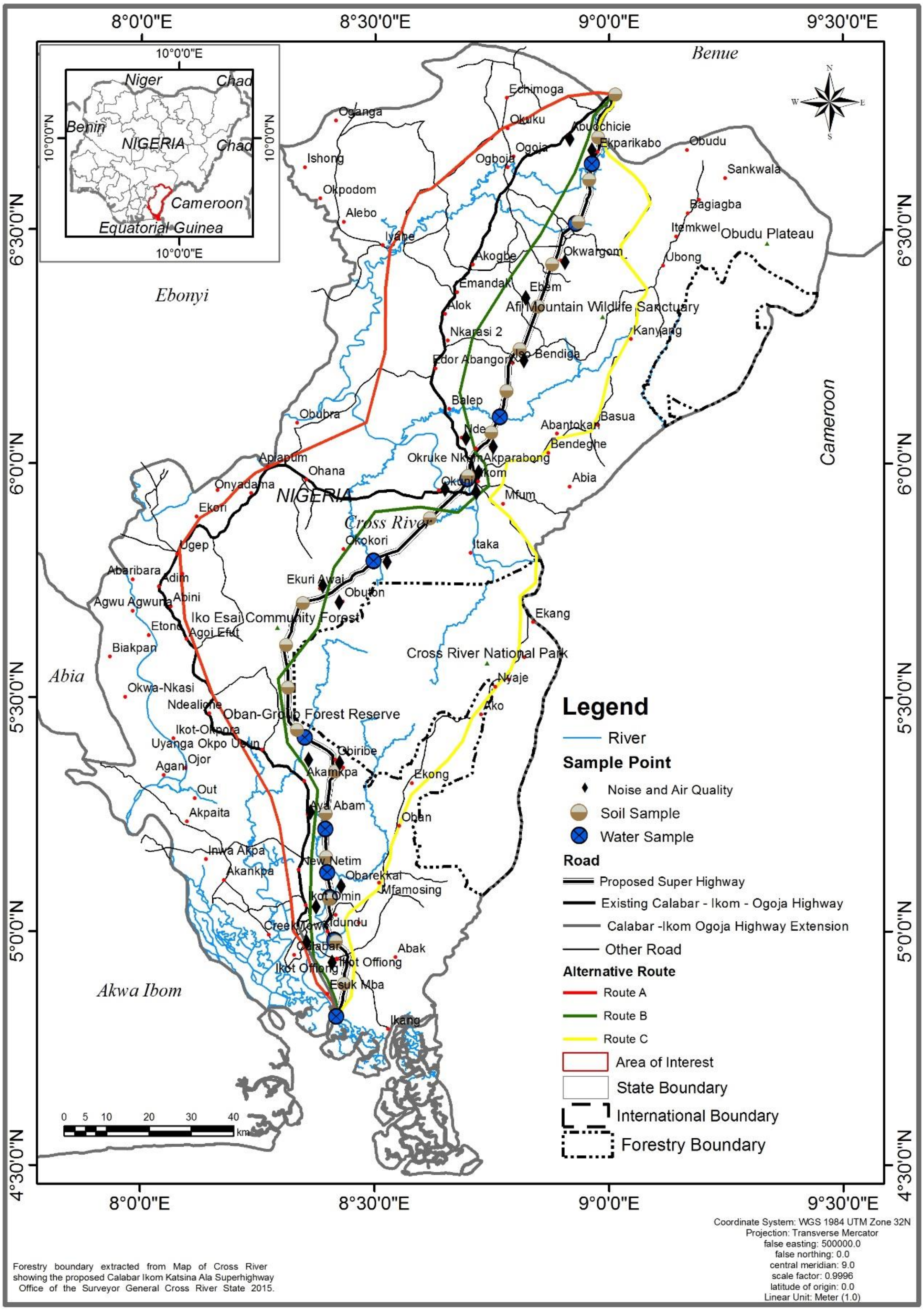

Figure 4.1: Map of Cross River State showing sampling locations

4.2 Geology and Geomorphology

4.2.1 Geological Overview

Cross River State is located between 4 1/2 degrees and 7 degrees north of the equator at the western edge of the Guinean-Congolian basin (2.8 million km^2). Cross River State is very extensive, covering an area of approximately 23, 000 km^2. The main physical features of the area include highlands with elevations in excess of 400 m above sea level. These include the Obudu and the Oban massifs. By contrast, the lowlands have elevations up to 350 m, decreasing southwards to a few meters near the coast: Cross River Plains and the Calabar Coastal Plains.

From geological point of view, the area consists of Precambrian crystalline basement (Obudu plateau and Oban massif) and a sedimentary cover ranging in age from Cretaceous to Tertiary. The basement complexes consist predominantly of gneisses, schist, amphibolite, pegmatite, granites, granodiorites, diorites, tonalities etc. Cross River State is underlain by three sedimentary basins viz: Calabar Flank, Ikom-Mamfe Embayment and southern Benue Trough. The sedimentary Formations consist mostly of conglomerates, sandstones, shale, limestone, marls, clays, sands and silts. The hydrogeology is largely dependent on the lithology of the area. The major hydrogeological units are the crystalline basement; sandstone-siltstone-limestone-intrusive; shale-intrusive; shale; coastal plain sand and alluvium (Edet, 1993; Okereke et al., 1998).

Most of the state is rolling or flat with significant areas of mangrove along the coast and inland freshwater wetlands, particularly along the Cross River. Forested areas generally occur on rolling and mountainous topography rising to 1180m in the Oban Division of the National Park and 1820m in the Okwango Division.

4.2.2 Geomorphology

The land surface of Nigeria is understood to have resulted from alternating erosion and deposition activities resulting in three broad geomorphological units and major relief features, namely; the plains, the highlands and the river valleys (Federal Department of Land Resources (FDALR), 1990. Modern depositional land surfaces extend to the west coast of Nigeria, and are composed of sedimentary rocks, comprising Sandstones, Shale and Clays of Cretaceous and Tertiary ages.

The Calabar area was likely a refuge during past arid climate phases and was probably isolated during the Pleistocene. This fact combined with variable rainfall and a pronounced elevation gradient in some areas has resulted in an area of outstanding biological diversity with high endemism. It is estimated that

12% of the ~4000 plant species in the area are endemic and that wildlife species are diverse (e.g. over 1000 species of forest butterfly) with high levels of mammal, snake, and amphibian endemism.

Most of the state is rolling or flat with significant areas of mangrove along the coast and inland freshwater wetlands, particularly along the Cross River. Forested areas generally occur on rolling and mountainous topography rising to 1180m in the Oban Division of the National Park and 1820m in the Okwangwo Division.

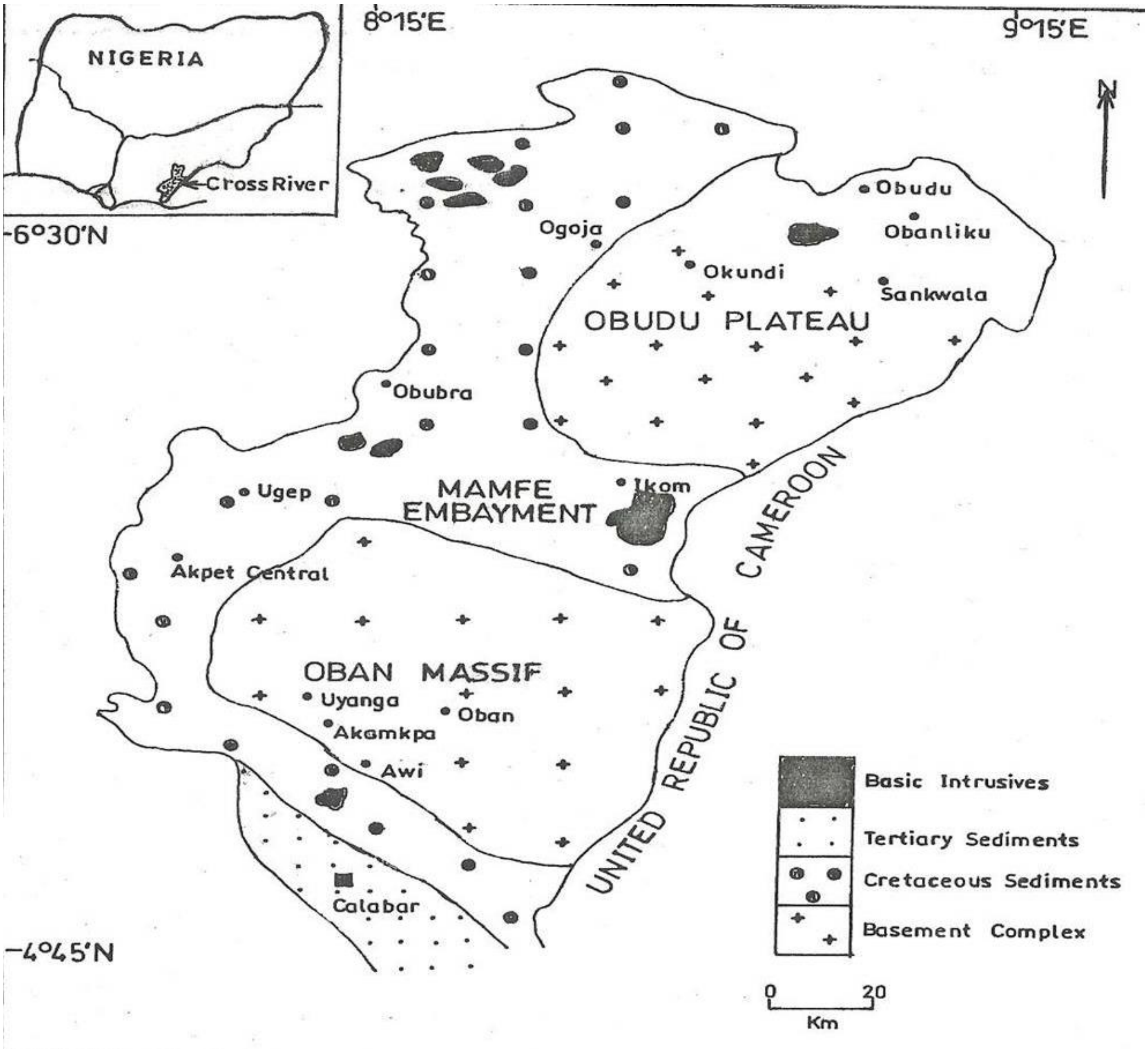

Figure 4.2: Geomorphological Map of Cross River State

Obudu forms a part of the Southeastern basement complex that has not been properly harnessed geologically. The area consists of high grade gneisses of granite facies (Chanoklic gneisses, magmatic gneisses and meta-peridolite). These are intruded by porphyritic granite, bottle – granite, leucogranite, diorite and dolerite dykes as well as quarto-feldspethic –pegmatite veins. Other structural signatures found in the area are quite different from those of south western Nigeria. The rocks are however similar to those of the South western Cameroon basement. The Southwestern Obudu plateau probably is an extension of the Cameroon Bamenda massif into Southern Nigeria. The geomorphological map of Cross River State is illustrated in **Figure 4.2.**

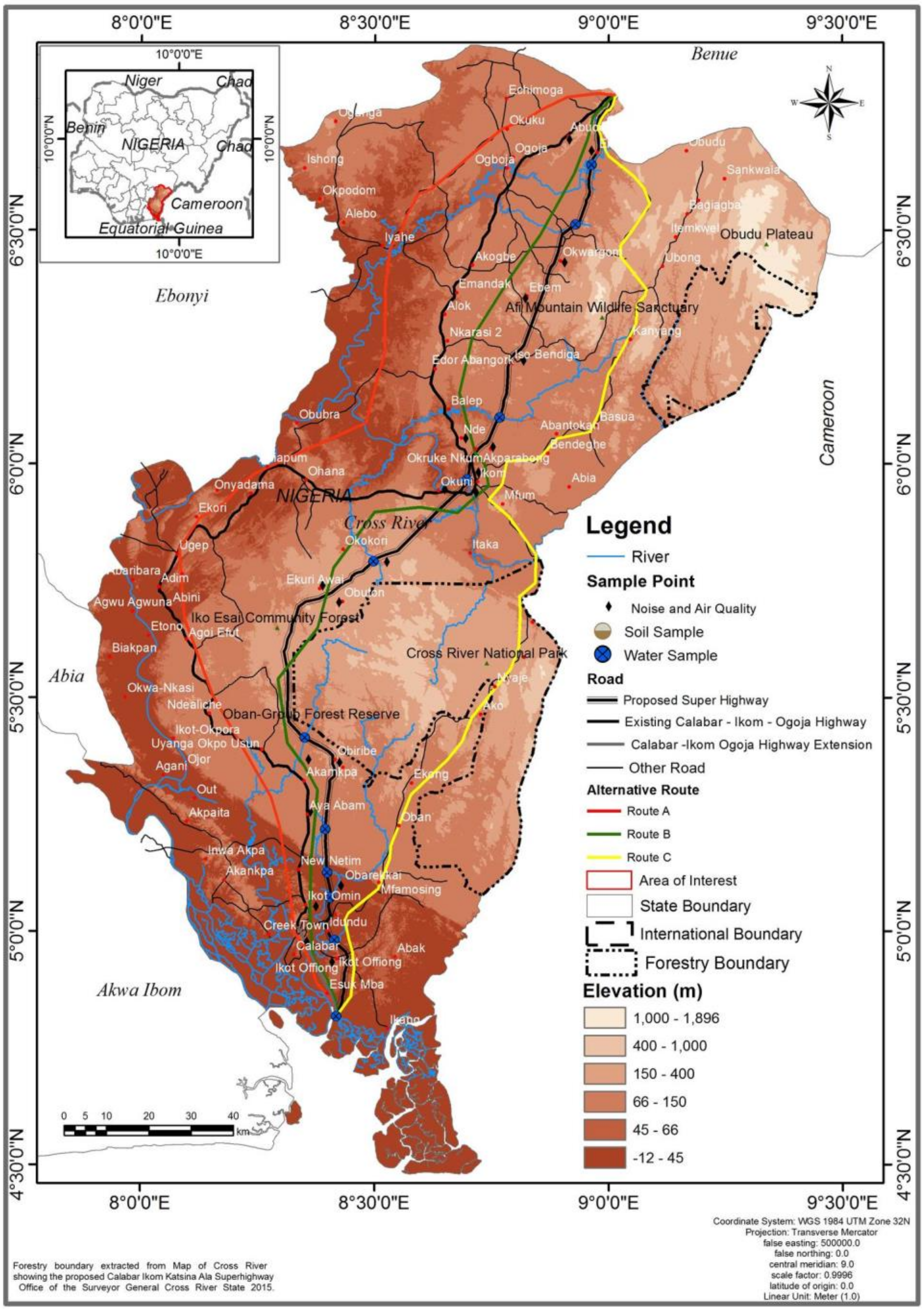

Figure 4.3: Relief Map of Cross River State

4.3 Soils

Cross River soils are predominantly of five types. These are: (i) the steep, shallow, yellowish and red, gravely soils on the Oban and Obudu Hills; (ii) the deep, lateritic, fertile soils on the Cross River Plain; (iii) the dark clayey basaltic soils in Ikom; (iv) the sandy, heavily leached, sandy soils on the older coastal plain; and (v) the swampy hydromorphic soils of the lower deltaic coastal plain that are usually flooded during the rains these are younger quaternary formations and those from recent alluvium formations which are derived from alluvium of fine littoral and tributaries sediments. The proposed super highway will cut across all the aforementioned soil types.

Soils on the coastal plain are predominantly sands and silts with low cohesion values, high internal pore pressure and seepage forces, and low angle of internal friction making them highly susceptible to gully erosion. Because of the intensity of weathering (due to high rainfall levels), soils throughout the state are often deficient in weatherable minerals. Soils in forested areas can be generally characterized as acid, medium to coarse textured, with low cation exchange capacity, and leached of mineral elements. Conservation of organic matter is a vitally important aspect of maintaining soil fertility in these types of soils.

4.3.1 Soil Types

The soils in the elevated terrain on the site are deep, moderately well drained, with grayish brown, loamy sand surface underlain by dark yellowish brown to very pale brown loamy sand sub-soils. The soils are strongly acid (pH 5.0 - 5.8), and the exchangeable cations are moderately high for Ca2+, Mg^{2+} and Na^{+} but low for K^{+}. The soils sandy tropical soils and indicative of young soils with low fertility but which can support arable crops. Differences in the soils' properties (on the elevated areas), between the wet and dry season, were not significant. The soils on the flat areas close to the lagoon are deep and poorly drained. They have dark gray, sandy surfaces over light brownish gray to light gray, sandy sub-soils. In the topsoil, the soils range from extremely acid to very strongly acid (pH 4.1 - 4.5). Exchangeable bases are low for Ca^{2}+, K^{+} and Na^{+} but moderate for $Mg^{2+.}$ The soils are considered to be acidic tropical soils, with low fertility. The ground water table is high and the soils typically experience annual deep flooding during the wet season.

4.3.2 Physico-chemical Characteristics

The results of the physiochemical characteristics of the soil samples in the study area are presented in **Appendix 1** while the summary of the results obtained are shown in **Table 4.4.** The soils from the study area are predominantly sandy in texture and brownish in colour.

- ***pH***

pH is a most commonly measured soil quality parameter. It shows the acidity, neutrality or alkalinity of a particular soil and indicates the availability of exchangeable cations (e.g., Ca2+, Mg2+, K+ etc). The pH of the soil samples collected from the study area was weakly acidic with a pH range of 5.1 - 5.9 during the wet season and 5.3 -5.9 during the dry season. The values were within the FMEnv/WHO stipulated limits and consistent with reported values from previous studies around the project area.

- ***Soil Organic Matter***

Soil organic matter is a complex of diverse components, including plant and animal residues, living and dead soil microorganisms, and substances produced by these organisms and their decomposition. It influences the chemical, biological, and physical properties of the soil in ways that are almost universally beneficial to crop production. The most common sources of organic matter in farming are crop residues, cover crop residues, manures, and composts (Brady and Weil, 1996). Values recorded for organic matter had mean values of 2.08% and 2.02% for wet and dry seasons respectively, slightly going above the FMEnv/ WHO limits of 2% at some sampling stations. According to WHO (1996), soils containing less than 2.0% organic matter are considered low in organic content.

- ***Electrical Conductivity and Cations***

Electrical conductivity which is a measure of appraising soil salinity had values ranging from 0.03-0.25 µS/cm in the wet season and 0.04- 0.3 µS/cm in the dry season. Conductivity is directly related to the presence of Na^+, K^+, Ca^{2+} and Mg^{2+} which are the major ions contributing to soil salinity. None of the three ions exceeded the FMEnv/ WHO limits of 0.11, 0.2. 10-20 and 3.6 cmol/ kg for sodium, potassium, calcium and magnesium respectively, indicating a highly saline soil. Conductivity of soil has been related to plant growth. Critical values greater than 1.00 μScm^{-1} have been indicated to cause severe damage to plants while values ranging from 0 to 0.25 μScm^{-1} are suitable for most plants if recommended amounts of fertilizer are used. It is obvious that the soils in the proposed project area are non-saline.

- ***Phosphorus and Nitrogen***

Phosphorus and nitrogen are essential elements classified as macronutrients because of the relatively large amounts required by plants. They are two out of the three nutrients generally added to soils in fertilizers. One of the main roles of P in living organisms is in the transfer of energy. Organic compounds that contain P are used to transfer energy from one reaction to drive another reaction within cells. Adequate P availability for plants stimulates early plant growth and hastens maturity. Proper management of nitrogen is important because it is often the most limiting nutrient in crop production and easily lost from the soil system. However, these elements are more readily available in the soil as phosphates, nitrates or nitrites. Values for available Phosphorus were found to be in the range of 5.1-31.5% for wet season and 5.11-30.5% for dry season as against the FMEnv/ WHO limits of 20%. Nitrogen had mean values of 0.07% for the two seasons less than the FMEnv/ WHO limits of 0.2%.

- ***Base Saturation and ECEC***

Base saturation is a measurement that indicates the relative amounts of base cations in the soil. By definition, it is the percentage of calcium, magnesium, potassium and sodium cations that make up the total cation exchange capacity. For example, a base saturation of 25 % means that 25 % of the cation exchange capacity is occupied by the base cations. If the soil does not exhibit an anion exchange capacity, the remainder 75 % of the CEC will be occupied by acid cations, such as hydrogen and aluminum. Generally, the base saturation is relatively high in moderately weathered soils that formed from basic igneous rocks. Base saturation had mean values of 68.7% for the two seasons less than the FMEnv/ WHO limits of 80% at some stations.

The effective cation exchange capacity (ECEC) which is closely related to base saturation is defined as the total amount of exchangeable cations, which are mostly sodium, potassium, calcium and magnesium in non-acidic soils and bases plus aluminum in acidic soils. This had values ranging between 3.9 and 15.1cmol/kg during the wet season and 3.7 – 9.74 cmol/kg during the dry season also slightly going beyond the limits of the FMEnv/ WHO of 10 at some sampling stations. These values confirm that the soils are thoroughly leached as the soils contain very high rates of infiltration.

- ***Heavy Metals***

The heavy metals analysed include iron, zinc, manganese, copper and lead. Out of all the heavy metals analysed, only iron exceeded the FMEnv/ WHO limits of 36.13mg/kg having mean values of 210.4 mg/kg and 211.9 mg/kg for wet and dry seasons respectively. Zinc, manganese, copper and lead were all less than the FMEnv/ WHO limits. Zinc had mean values ranging between 6.39- 6.43mg/kg for the two seasons. Manganese had a mean value of 12.3 for the two means that for copper was 6.50 and 6.58mg/kg for wet and dry seasons respectively while that for lead were 4.65mg/kg and 4.66mg/kg for wet and dry seasons respectively.

Table 4.4: Summary of Results of Physico-chemical Analyses of Soils around the Study Area

Parameters	**Wet Season**			**Dry Season**			**FMEnv/ WHO limits**
	Min	**Max**	**Mean**	**Min**	**Max**	**Mean**	
pH	5.1	35.5	7.32	5.3	5.9	5.6	5.1-6.5
EC(μScm^{-1})	0.03	0.25	0.10	0.04	0.3	0.12	
Organic matter (%)	1.4	2.92	2.08	1.4	2.85	2.02	2.0

Parameters	Wet Season			Dry Season			FMEnv/ WHO limits
	Min	Max	Mean	Min	Max	Mean	
Total nitrogen (%)	0.03	0.1	0.07	0.04	0.13	0.07	0.2
Available P %	5.1	31.5	16.9	5.11	30.5	16.7	20
Calcium (cmol/kg)	13.0	23.2	19.2	13.0	22.5	19.0	10-20
Magnesium(cmol/kg)	1.2	4.2	3.12	1.3	4.3	3.0	3.8
Sodium (cmol/kg)	1.0	20.6	9.37	1.2	20.9	9.44	0.7-20
Potassium (cmol/kg)	0.2	1.3	0.65	0.3	1.5	0.8	0.6-1.2
EA (cmol/kg)	1.3	4.95	2.73	1.32	4.55	2.73	4.0
ECEC (cmol/kg)	3.9	15.1	9.63	3.7	15.5	9.74	10.0
Base saturation (%)	50	84.5	68.7	50.5	84.1	68.7	80
Iron (mg/kg)	77.5	350.0	210.4	82.7	355	211.9	36.13
Zinc (mg/kg)	1.65	13.6	6.43	1.66	13.1	6.39	61.10
Manganese (mg/kg)	0.05	25.5	12.3	0.07	25.5	12.3	92.00
Copper (mg/kg)	0.39	25	6.50	0.33	25.5	6.58	36.00
Lead (mg/kg)	0.35	10	4.65	0.33	10.2	4.66	78.20

Source: CRSG EIA (PGM Fieldwork) 2015

4.3.3 Soil Microbiology

The soil represents a very favourable habitat for microorganisms and is inhabited by a wide range of microorganisms, including bacteria, fungi, algae, viruses and protozoa. Microorganisms are found in large numbers in the soil (usually between one and ten million microorganisms are present per gram of soil) with bacteria and fungi being the most prevalent. However the availability of nutrients is often limiting for microbial growth in soil and may increase soil fertility and plant growth. From the microbial counts obtained for the two seasons, it can be observed that the dry season values were basically lower than the wet season values; this can be attributed to the difference in moisture contents during the two seasons, which favours more microbial growth during the wet season. The results obtained are shown in **Tables 4.5.**

Microbial analyses revealed mean heterotrophic bacteria counts of 4.82 x 10^7cfu/g and 4.39 x 10^7cfu/g for the wet and dry seasons respectively. Mean fungal counts of 3.31 x 10^5cfu/g and 2.95 x 10^5cfu/g for wet and dry seasons respectively. Hydrocarbon degrading bacteria were 3.34 x 10^2cfu/g and 2.92 x 10^2cfu/g respectively for wet and dry seasons while hydrocarbon degrading fungi were 4.26 x 10^2cfu/g and 3.52 x 10^2cfu/g for wet and dry seasons respectively.

Comparatively, the hydrocarbon degraders were the least in population. It can therefore be said that there is no significant hydrocarbon pollution around the study area.

Table 4.5: Microbial Population (cfu/g) in Soil Samples Collected from the Road Project Environment for Wet and Dry Seasons

SAMPLE CODE	HETEROTROPHIC BACTERIA (X 10^7 CFU/G)		FUNGAL COUNT (X 10^5 CFU/G)		HYDROCARBON DEGRADING BACTERIA (X 10^2 CFU/G)		HYDROCARBON DEGRADING FUNGI (X 10^2 CFU/G)	
	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
SS1	5.2	3.6	3.7	3.0	5.2	4.3	7.1	4.3
SS2	4.4	4.3	2.5	2.9	2.4	2.1	6.5	4.4
SS3	5.0	3.3	3.4	3.2	5.6	4.4	4.6	3.5
SS4	7.3	3.9	2.2	2.2	1.4	1.8	2.4	3.0
SS5	5.3	4.9	4.7	3.3	6.6	4.0	5.3	4.2
SS6	5.6	4.5	3.1	2.0	2.3	2.6	2.7	2.2
SS7	3.0	3.1	2.7	3.0	2.7	2.0	5.7	4.2
SS8	7.1	3.9	2.4	3.0	3.0	3.4	2.5	2.0
SS9	4.3	6.5	2.7	2.5	4.7	2.9	6.4	3.7
SS10	3.5	6.0	2.5	2.0	2.7	2.5	4.3	4.5
SS11	4.4	4.2	5.0	4.0	3.4	4.0	5.6	5.2
SS12	4.9	7.0	4.3	3.2	2.8	2.6	4.4	4.1
SS13	5.0	4.8	3.8	3.0	2.7	3.0	1.9	1.5
SS14	2.8	2.8	4.0	3.2	3.0	3.0	3.0	2.7
SS15	4.0	3.2	3.5	3.3	3.1	2.9	2.6	3.2
SSC1	5.0	4.5	3.7	4.0	4.2	2.5	3.6	3.7
SSC2	5.1	4.1	2.0	2.3	2.5	1.6	3.9	3.3
MEAN	4.82	4.39	3.31	2.95	3.43	2.92	4.26	3.52

Source: CRSG EIA (PGM Fieldwork) 2015

The microorganisms isolated from the soils include *Escherichia coli, Bacillus subtilis, Bacillus licheniformis, Lactobacillus bulgaricus, Clostridium butyricum, Micrococcus roseus, Staphylococcus aureus, Pseudomonas aeruginosa, Streptococcus feacalis, Aspergillus niger, Aspergillus fumigatus, Rhizopus* sp, *Trichophyton rubrum, Trichophyton megnini, Candida tropicalis, C. albicans, Penicillium sp*. *Saccharomyces sp and Cephalosporium spp.* Among these are some hydrocarbon degraders which may be present in the soils facultatively or as a result of slight pollution of the study area by hydrocarbons, possibly from vehicular emissions and household generating sets from neighbouring communities.

4.4 Hydrogeology and Hydrology

The aquifers in the area, i.e., the underlying sands, are recharged both from the surface (vertical) as percolation from rain and from the sides (horizontal) by the rivers and the tributaries which is in contact with the water bearing sands.

4.4.1The Cross River

The proposed road project traverses the Cross river, which lie to the south and east of the site. The Cross River is one of the major river systems of the Guinea Coast of West Africa (Webb, 1958). The formation of the river is a result of the movement of sand eastwards along the coast which has taken place since the last glacial period. The Cross River is a great expanse of deep water extending southward to the Atlantic, through the Calabar River to Qua Iboe River in Akwa Ibom State. The Cross River is connected to the open Atlantic Ocean through the Calabar Harbor (about 8km long) and there is a semidiurnal movement of water into and out of the Cross River. The tidal range in the Cross river however shows a general decrease away from the Calabar Harbor and into the Cross River, and is hardly noticeable in the area around the project site. The mean tidal level at the Harbor is approximately 0.498m above the mean sea level, with mean spring range of 0.55m and a mean neap range of 0.42m. The tidal movement is characterized by semidiurnal pattern comprising two unequal high tides and low tides over a daily cycle of approximately 23 hours. Due to the very low tidal range in the study area the tidal movement is unlikely to mix the water significantly, and any vertical salinity stratification that may develop in the water column will remain. The Cross River is one of the major lagoon systems in Nigeria. It is an extremely important ecosystem and, apart from high levels of biological productivity, it plays various important ecological roles such as transportation of nutrients and organic material to marine system through circulation (FAO 2002).

The depth of the lagoon ranges between 1.15 – 7.5m along the north-south transect with an overall mean of 2.4m. Water depth, tends to decrease from west to east.

4.5 Sediment Quality

4.5.1 Physico-chemical Quality

Bottom sediment constitutes the substrate of water bodies. As a habitat it provides living condition and serves as a source of food for organisms associated with it especially the invertebrate macro fauna. The physico-chemical characteristics of the lagoon sediment for two seasons are described below. There are no national regulatory standards relating to the chemical nature of sediment. A sediment survey was undertaken during the wet and dry season.

Results of physico-chemical and heavy metals analyses of sediment samples collected along the proposed project route are presented on **Tables 4.6 and 4.7,** both respectively for physic-chemical and heavy metal analyses.

- ***pH and Conductivity***

The sediment's pH values ranged from 6.8 to 8.3 in the wet season and 6.1- 8.0 in the dry season while the electrical conductivity of the sediment samples ranged between 166.4 and 350.1µS/cm in the wet season and 160.2 – 340.0µS/cm in the dry season.

- ***Cations and Anions***

The cations analysed include sodium, potassium, magnesium and calcium. Calcium ion recorded the highest concentrations among the cations analysed and had mean values of 155.0mg/kg and 156.9mg/kg in the wet and dry seasons respectively. This was followed by sodium ions with a range of 103.1– 192.8mg/kg in the wet season and 107.6 – 200.5mg/kg in the dry season. Magnesium recorded the lowest mean concentrations of 52.3mg/kg in the wet season and 55.6mg/kg in the dry season. Cation concentrations in the sediment samples were generally higher in the dry season than the wet season.

Among the anions, sulphate had the higher concentration than phosphate with mean values of 32.2 and 32.6mg/kg in the wet and dry seasons respectively. Phosphate recorded concentrations with a range of 0.02- 0.06mg/kg in the wet season and 0.02- 0.66mg/kg in the dry season.

- ***Total Organic Carbon (TOC)***

Total organic carbon content of the sediment samples ranged from 2.5 to 3.7mg/kg in the wet season and 2.0 to 3.5mg/kg in the dry season. No significant variation is observed in the concentration of TOC recorded in both seasons.

- ***Heavy metals***

The heavy metals analysed in this study include iron, lead, zinc, copper and nickel. The summary of the results obtained from the analyses are presented in Table 4.6. The sediment samples from the study area recorded low concentrations of heavy metals profile with lead (Pb) going undetected, nickel being undetected at some sampling stations. Iron (Fe) concentrations had the highest recorded values, ranging between 890.6 and 1850.0mg/kg in the wet season and 900.5 and 1889.9mg/kg in the dry season. Zinc had mean values of 23.1mg/kg and 22.7mg/kg in the wet and dry seasons respectively while the same for copper were 3.7mg/kg and 3.5mg/kg. Nickel ranged between 0 to 2.11mg/kg in the wet season and 0 to 1.98mg/kg in the dry season.

Table 4.6: Summary of Physico-chemical Results of Sediment Samples from the Study Area

Sample Code	pH		Electrical Conductivity		TOC		Total Nitrogen		Phosphate		Sulphate		Sodium		Potassium		Magnesium		Calcium	
	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
Min	6.8	6.1	166.4	160.2	2.5	2	4.6	4.1	0.02	0.02	19	20	103.1	107.6	57.6	60.2	43.2	45.5	107.5	110.3
Max	8.3	8	350.1	340	3.7	3.5	7.5	7	0.6	0.66	49.6	45	192.8	200.5	196.5	200	62.8	73.4	230.5	244.5
Mean	7.5	7.2	254.9	238.0	3.0	2.7	6.0	5.6	0.2	0.2	32.2	32.6	143.0	150.3	103.3	106.7	52.3	55.6	155.0	156.9

Source: CRSG EIA (PGM Fieldwork) 2015

Table 4.7: Summary of Results of Heavy Metals in Sediment Samples from the Study Area

	Iron (mg/kg)		**Lead (mg/kg)**		**Zinc (mg/kg)**		**Copper (mg/kg)**		**Nickel(mg/kg)**	
	Wet	**Dry**	**Wet**	**Dry**	**Wet**	**Dry**	**Wet**	**Dry**	**Wet**	**Dry**
Min	**890.6**	**900.5**	**0**	**0**	**10.2**	**9.6**	**0.91**	**0.89**	**0.02**	**0.01**
Max	**1850**	**1889.9**	**0**	**0**	**34.6**	**31.1**	**10.28**	**8**	**2.11**	**1.98**
Mean	**1337.3**	**1272.1**	**0**	**0**	**23.1**	**22.7**	**3.7**	**3.5**	**0.6**	**0.5**

Source: CRSG EIA (PGM Fieldwork) 2015

4.5.2 Sediment Microbiology

The results of microbiological analyses are presented in **Table 4.8**. Total Heterotrophic Bacteria (THB) recorded the highest population counts in the sediment samples with mean values of 2.12 and 2.17cfu/g in the wet and dry seasons respectively. Fungal counts had mean values of 3.54 and 3.52 **x** 10^4 cfu/g in the wet and dry seasons. The percentages of hydrocarbon utilizers in the sediment samples for both dry and wet seasons are generally below 1% indicating low hydrocarbon contamination. The presence of both total and feacal coliforms indicate that the sediments of all the water bodies around the study area are contaminated with human faeces and are unfit for drinking. This is obviously due to the fact that the water bodies serve as the basic water source for the neighbouring communities especially for bath purposed. Potable water is expected to have a zero coliform (total and faecal) counts. Total coliform and feacal coliform counts had mean values of $2.97x10^3$ cfu/g and 1.96×10^2 cfu/g in the wet season and 2.43 **x** 10^3 cfu/g and 1.85×10^2 cfu/g in the dry season.

The microorganisms isolated from the soils include *Escherichia coli, Bacillus subtilis, Bacillus licheniformis, Lactobacillus bulgaricus, Clostridium butyricum, Micrococcus roseus, Staphylococcus aureus, Mycobacterium sp., Acinetobacter sp., Agromobacter sp., Arthrobacter sp, Pseudomonas aeruginosa, Streptococcus feacalis, Aspergillus niger, Aspergillus fumigatus, Rhizopus* sp, *Fusarium sp., Trichophyton rubrum, Trichophyton megnini, Trichoderma sp., Verticillium sp., Candida tropicalis, C. albicans, Penicillium sp*. *Saccharomyces sp and Cephalosporium spp.*

TABLE 4.8: MICROBIAL POPULATION (CFU/ML) IN SURFACE WATER SAMPLES ALONG THE PROPOSED PROJECT AREA

SAMPLE CODE	HETEROTROPHIC BACTERIA (X 10^8CFU/ML)		TOTAL COLIFORM (X 10^3 CFU/ML)		FAECAL COLIFORM (X 10^2 CFU/ML)		FUNGAL COUNT (X $10^4$6CFU/ML)		HYDROCARBON DEGRADING BACTERIA (X 10^3 CFU/ML)		HYDROCARBON DEGRADING FUNGI (X 10^2CFU/ML)	
	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	DRY
SW1	1.6	1.4	4.0	1.2	2.0	2.0	4.6	3.8	3.2	4.1	1.7	**1.2**
SW2	1.5	1.2	4.2	2.3	1.8	2.2	3.8	3.4	2.9	23.3	1.2	**1.3**
SW3	2.2	1.0	3.0	1.5	1.3	2.1	2.2	3.9	4.3	3.7	1.0	**1.1**
SW4	2.3	1.6	3.1	2.8	1.5	2.2	2.9	4.0	2.0	3.0	1.3	**1.2**
SW5	2.0	1.7	3.0	2.7	1.4	2.4	4.0	3.3	1.7	2.8	2.0	**1.2**
SW6	2.3	2.2	3.2	1.5	1.0	3.0	3.6	3.4	1.0	3.6	1.3	**1.3**
SW6	2.5	3.1	2.4	2.3	1.5	2.0	3.4	2.7	3.3	3.2	2.1	**1.3**

TABLE 4.8: MICROBIAL POPULATION (CFU/ML) IN SURFACE WATER SAMPLES ALONG THE PROPOSED PROJECT AREA

SAMPLE CODE	HETEROTROPHIC BACTERIA (X 10^{8}CFU/ML)		TOTAL COLIFORM (X 10^{3} CFU/ML)		FAECAL COLIFORM (X 10^{2} CFU/ML)		FUNGAL COUNT (X 10^{4}6CFU/ML)		HYDROCARBON DEGRADING BACTERIA (X 10^{3} CFU/ML)		HYDROCARBON DEGRADING FUNGI (X 10^{2}CFU/ML)	
SW7	2.2	3.0	3.5	1.9	2.8	1.6	4.3	3.4	3.1	4.0	1.4	**1.2**
SW8	1.8	2.5	4.0	2.4	3.0	1.4	5.0	3.5	4.0	3.6	2.0	**1.3**
SW9	3.1	2.6	5.0	3.1	1.7	1.5	3.6	4.3	4.6	2.1	1.9	**1.4**
SW10	2.9	3.8	1.3	2.4	1.3	1.3	2.9	4.1	2.6	42.0	1.4	**1.5**
SW11	1.8	1.8	1.7	3.3	2.0	2.2	3.1	3.6	2.9	1.0	1.2	**1.0**
SW12	1.6	2.9	1.8	2.3	2.2	2.0	2.7	3.3	3.6	2.2	1.2	**1.2**
SW13	1.3	1.6	2.0	3.0	3.2	1.3	3.4	3.4	4.4	1.7	1.5	**1.8**
SW14	2.2	2.3	2.2	2.2	2.4	1.5	2.7	3.1	4.1	2.0	1.3	**1.6**
SW15	3.0	2.2	2.0	3.3	2.5	1.4	4.1	3.0	3.5	1.9	1.3	**1.4**
SWC	1.7	2.0	4.1	3.1	1.7	1.4	3.9	3.6	3.0	2.0	1.8	**1.4**
SWC	2.6	1.9	3.2	3.0	3.4	2.0	3.2	2.2	3.0	1.8	1.2	**1.6**
MEAN	**2.12**	**2.17**	**2.97**	**2.43**	**1.96**	**1.85**	**3.54**	**3.52**	**3.19**	**6.25**	**1.51**	**1.32**

Source: CRSG EIA (PGM Fieldwork) 2015

4.6 Local Meteorology

An overview of the climate and meteorological data (relative humidity, temperature, rainfall and wind) of the study area are presented in the subsequent sections. Climatic and meteorological information described are primarily on literature/desktop research and climatic data information obtained for Cross River State. Some of the information was got from the NIMET station in the Margaret Ekpo International Airport, Calabar.

The study area falls within the equatorial hot/wet climatic zone. Due to its proximity to the coast, the on-shore winds considerably modify the effect of the equatorial climate. The project area (as in other parts of Nigeria) enjoys a tropical climate with distinct wet and dry seasons. Two seasons dominate this area; wet and dry seasons. The wet and dry seasons are associated respectively with the prevalence of the moist maritime south-westerly winds from the Atlantic Ocean and the dry continental north-easterly harmattan winds from the Sahara. The fluctuating boundary zone between these two air masses is called the (ITD) inter-tropical discontinuity. The ITD is essentially a moisture discontinuity since the two air masses it separates have broadly similar thermal characteristics but differ markedly in their moisture content.

The surface position of the ITD in Nigeria varies not only seasonally but also from day to day. (Ayoade, 1982). The ITD assumes its average northern most position close to 20^0N latitude outside northern Nigeria in August.

4.6.1 Rainfall

Table 4.9 shows the mean monthly rainfall data for Calabar. The months of May to October constitute the rainiest months with over 3000mm of rain while the rains in the months of December and January had the scantiest values including a record of 0.0mm and trace values. The mean annual rainfall for Calabar, recorded between 2004- 2014 is 3193.5mm. It is quite evident that rainfall amount and number of rainy days decreases from the coastlines towards the north. The frequency of rainfall is equally variable between the wet and dry seasons. The highest frequency is recorded in July with a value of 6233.9mm. The wettest year during this period was 2012, which had an average rainfall value of 4068.5mm while the driest year, on the other hand was 2004 with an average annual rainfall of 2136.1mm.

4.6.2 Temperature

Temperature is a dominant climate factor that varies from place to place over a period of time at given locations. The spatial distribution of temperature over the earth is influenced by; amount of insulation received, nature of surface, distance from water bodies, relief, nature of the prevailing winds and ocean current. Throughout the months of the year daytime temperatures will generally reach highs of around 34.7°C (May). At night the average minimum temperature drops down to around 21.7°C (January). Tables 4.9 and 4.10 show the average minimum and maximum temperatures of the study area, between 2004 and 2014.

Table 4.9 Average Rainfall Data (in mm) in the Study Area (2004 – 2014)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
2004	9.9	19.9	73.5	78.4	270.2	308.0	391.9	303.5	335.5	196.4	148.3	0.6	2136.1
2005	33.8	35.3	295.7	299.9	263.9	615.6	828.2	634.4	220.4	279.8	182.3	71.5	3760.8
2006	84.7	57.1	323.0	166.1	430.8	227.7	484.9	273.4	536.0	175.3	134.4	0.1	2893.5
2007	0.0	51.1	181.0	265.9	384.3	583.5	492.7	415.5	561.7	197.9	262.1	33.1	3428.8

2008	15.1	1.0	184.1	216.9	386.8	437.0	597.7	509.2	217.9	315.0	102.5	77.1	3060.3
2009	89.7	38.5	87.5	50.5	308.9	218.4	577.4	507.1	273.9	148.1	126.9	0.0	2426.9
2010	31.8	88.2	63.6	130.4	306.5	611.3	384.0	406.7	451.3	269.6	272.1	56.2	2983.5
2011	TR	153.4	123.1	208.8	340.9	388.6	648.6	573.7	251.8	519.9	325.2	43.8	3577.8
2012	32.6	376.7	36.0	99.9	439.4	398.8	637.1	861.3	619.4	410.2	126.5	30.6	4068.5
2013	141.0	83.7	231.4	286.9	466.9	458.6	477.0	411.1	340.4	306.2	220.9	81.1	3505.2
2014	24.8	61.6	366.2	245.0	332.2	220.0	714.4	410.3	501.5	255.0	136.8	19.3	3287.1
TOTAL	463.4	878.3	1965.1	2048.7	3930.8	4467.5	6233.9	5306.2	4309.8	3073.4	2038	413.4	

TR= Trace Source: NIMET, 2015

Table 4.10: Average Minimum Temperature in ^{o}C in the Study Area (2004 – 2014)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2004	23.4	24.4	25.1	23.9	23.6	23.1	23.1	22.8	23.4	23.4	23.3	23.5
2005	21.7	25.2	24.0	24.6	23.8	23.7	23.0	22.9	23.3	23.1	23.8	23.3
2006	24.6	24.2	23.5	23.7	23.6	23.4	23.2	23.3	23.2	23.3	23.6	23.1
2007	22.2	24.8	24.6	23.5	23.7	23.2	22.8	23.3	23.0	23.1	23.0	23.5
2008	22.2	23.5	24.2	23.5	23.5	23.6	22.7	23.2	23.4	23.0	23.6	23.4
2009	23.9	24.1	24.6	23.8	23.4	23.5	23.0	23.0	23.0	23.3	23.3	24.2
2010	24.3	25.0	24.7	24.4	24.5	23.5	23.3	23.0	23.0	23.4	23.1	22.6
2011	22.2	23.8	23.8	23.9	23.9	23.4	22.5	23.0	23.2	23.1	23.5	23.1
2012	22.5	23.6	25.1	23.9	23.4	23.4	23.1	22.9	22.9	23.5	23.7	23.4
2013	23.8	22.9	23.9	23.9	23.7	23.8	23.0	22.9	23.3	22.5	22.3	22.1
2014	22.6	23.2	22.6	22.6	22.9	22.7	22.2	21.9	22.1	22.1	22.4	22.3

Source: NIMET, 2015

Table 4.11: Average Maximum Temperature in °C in the Study Area (2004 – 2014)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2004	32.4	34.7	34.3	31.8	31.3	30.0	29.7	28.2	29.7	30.5	30.9	32.4
2005	32.6	34.0	32.4	32.5	31.2	29.1	28.0	26.7	29.0	29.5	31.3	30.8
2006	31.8	32.6	31.8	31.9	30.2	30.2	28.2	27.8	28.2	30.1	30.6	32.0
2007	33.1	33.7	33.2	31.1	31.2	29.1	28.5	28.1	28.7	29.5	30.4	31.5
2008	31.1	34.1	32.2	31.5	31.1	29.4	28.5	28.4	29.7	30.5	31.6	31.6
2009	32.3	32.8	33.3	32.1	31.6	30.2	28.5	28.1	29.7	29.9	31.4	33.1
2010	33.8	33.1	33.0	33.1	31.5	29.8	28.9	28.2	28.9	31.7	30.8	31.7
2011	32.2	32.0	33.0	32.0	31.5	29.6	28.8	27.6	29.1	27.8	31.7	32.7
2012	32.0	31.5	33.7	32.1	31.7	30.3	28.0	28.4	29.1	30.3	31.0	32.1
2013	33.0	33.0	31.9	32.0	31.6	29.8	27.9	27.5	28.8	29.9	30.6	31.3
2014	33.0	33.1	31.9	32.1	31.6	30.2	27.8	28.2	29.0	30.1	30.8	32.0

Source: NIMET, 2015

4.6.3 Wind

The most prevailing wind directions within the study area include the south westerly and the north-easterly winds.During the wet season, the dominant south – westerly (SW) wind blows from South – West direction into the hinterland, while during the dry season, the North- Easterly winds (NE) dominates, blowing from hinterland to the sea.

From the available data, it can be seen that the maximum monthly wind speed is 215.56knots in the month of June while the lowest is 21.35knots in the month of February. Details are shown in Table 4.12.

Table 4.12: Average Wind Speed in Knots around the Study Area (2004 – 2014)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2004	81.63	125.68	133.05	106.24	119.57	109.58	119.38	115.05	113.95	111.81	99.72	97.40
2005	104.55	136.89	101.54	101.45	102.75	109.66	89.87	79.49	75.52	93.14	93.90	90.20
2006	112.93	123.68	120.70	116.64	116.37	215.56	129.90	135.35	198.69	116.11	95.39	109.49
2007	113.00	140.99	134.13	99.90	72.23	94.25	71.49	67.94	57.31	85.61	70.25	99.57
2008	103.53	119.94	140.97	108.00	97.31	120.98	123.69	91.34	82.50	99.38	78.35	92.73
2009	124.82	125.23	134.52	134.64	114.33	129.11	103.12	117.57	106.87	111.94	90.51	113.71
2010	50.74	21.35	63.02	24.13	64.53	55.24	54.61	22.85	ND	ND	ND	ND
2011	29.32	25.14	42.38	38.80	27.40	ND	ND	ND	53.56	56.52	48.35	38.42

2012	50.87	56.17	63.56	62.13	26.21	64.39	55.34	67.77	58.04	58.11	52.19	47.00
2013	55.15	58.28	29.20	39.68	60.44	63.08	63.81	68.21	65.16	59.81	47.18	48.40
2014	56.56	57.56	55.55	53.54	60.85	66.27	65.37	69.81	60.350	56.69	52.23	49.67

Source: NIMET, 2015

4.6.4 Relative Humidity

This is an indication of the water vapour content in the atmosphere. High relative humidity is indicative of moist conditions while low relative humidity suggests drier conditions.

There is a marked diurnal variation in the relative humidity pattern of this area. It has an indirect relationship with temperature changes. The average monthly relative humidity for the project area is at its peak during the wet season rising up to 92% (August), while it falls in the dry season to 83% (February and March). Monthly average relative humidity values from 2004 to 2014 are shown in Table 4.13.

Table 4.13**:** Monthly Average Relative humidity in % around the Study Area (2004-2014)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2004	81	73	77	88	85	89	89	92	87	86	85	83
2005	67	82	85	83	85	90	93	92	90	87	86	86
2006	87	84	85	96	87	85	90	90	91	86	86	80
2007	61	83	81	87	86	86	88	89	91	89	86	86
2008	73	70	82	86	88	89	91	88	88	84	87	87
2009	85	84	82	84	84	87	92	92	89	89	87	84
2010	82	85	83	83	85	88	90	91	89	86	85	83
2011	76	85	83	83	84	90	93	93	90	88	84	84
2012	77	86	82	82	83	87	92	90	90	87	84	83
2013	80	83	87	84	84	89	92	91	91	88	88	87
2014	82	84	87	82	84	87	92	90	87	87	87	79

Source: NIMET, 2015

4.7 Air Quality Characteristics

4.7.1 Air Quality and Ambient Noise

Air quality survey was undertaken in September 2015 and January, 2016 using a digital hand-held Multi Gas Detector MultiRAE IR (Model No. PGM-54), while Casells Microdust pro880nm was employed for readings of airborne particulate matter. Air quality sampling was conducted within a 5-km buffer of the Project boundary.

The ambient concentrations of the major air pollutants NO_2, CO, Cl, SO_2, SPM, H_2S, and NH_3 measured in the study area are presented in Table 4.14.

Generally, recorded measurements in the study area indicated that the ambient air was quite polluted with these pollutant gases though with slight seasonal variations as most of the values recorded were well above the FMEnv regulatory limits for air quality standards.

- ***Nitrogen Oxides***

Nitrogen oxides (NO_2) are produced from natural sources, motor vehicles and other fuel combustion processes in the air to produce photochemical smog. NO_2 results when fuel is combusted at high temperatures and occurs mainly from motor exhaust and stationary sources such as electric utilities and industrial boilers. Studies have shown that man or animal exposure to $N0_2$ concentration above 0.563ppm may cause pulmonary diseases and increased susceptibility to bacterial infection (ACGH, 1995). Values of NO_2 levels recorded around the study area ranged between 0.03-0.42ppm in the wet season and 0.04-0.48ppm in the dry season. The values at most sampling points were above the FMEnv regulatory limit (0.04 – 0.06ppm) for human exposure. These high values may very well be attributed to vehicular and generator emissions at built up areas and highways while the lower values at some sampling points where the values were less than the FMEnv regulatory limits can be attributed to the absence of vehicles and generating sets as they are located in the bush.

- ***Sulphur Oxide***

Sulphur Oxide is produced from the combustion of sulphur-containing fuels, smelting, and manufacture of sulphuric acid, incineration of refuse as well as production of elemental sulphur. The gas is known to be a harsh irritant, and is capable of aggravating asthma, bronchitis and emphysema. It can also cause coughing and promote impaired functions in the human system. Also, exposure to $S0_2$ at concentration above 13.0ppm could stimulate mucus secretion and eye infection in man and other animals (ACGH, op cit). It also has debilitating effects on man, animals and the flora as atmospheric $S0_2$ is oxidized to form sulphuric acid. Sulphuric acid may be incorporated into rain or dry-deposited as fine droplets causing acidification of soils and surface water. This is also known as acid rain.

Recorded values ranged between 0.05 and 0.71ppm and 0.06- 0.73ppm for the wet and dry seasons respectively. Just like in NO_2 above, values at most sampling points were higher than FMEnv limits (0.01 – 0.1ppm) for air quality pollution while a few sampling points located in the bush areas devoid of much human activities were lower than the FMEnv limits.

- ***Hydrogen Sulphide***

Hydrogen sulphide (H_2S) is a toxic, odorous and corrosive gas, which is rapidly oxidized to SO_2 in the atmosphere. Its presence in the atmosphere could result from storage tank and process vents. Exposure to concentrations in excess of 500 ppm can be fatal. Although FMENV regulatory limits for H_2S are not available, the recorded values of H_2S in the study area ranging between 0.45- 0.66ppm for wet season and 0.46- 0.66ppm for the dry season did not exceed the fatal value of 500ppm.

- ***Carbon monoxide (CO)***

Carbon monoxide is a colorless, odorless, and tasteless gas that is slightly less dense than air. It is toxic to humans and animals when encountered in higher concentrations. Its sources include incomplete combustion of petroleum products in generating sets and vehicles. In the atmosphere, it is spatially variable. The results showed that the concentrations of CO in the study area ranged between 0.7 - 30.95ppm in the wet season and 0.77-32.2ppm in the dry season with some locations compliant with FMEnv regulatory limits of 10ppm -20ppm while others overshot.

- ***Ammonia***

Ammonia is found in trace quantities in the atmosphere, being produced from the putrefaction (decay process) of nitrogenous animal and vegetable matter. The recorded level of NH_3 in the study area showed a range of 2.57 -33.05ppm in the wet season and 2.59-33.2ppm in the dry season. Values for both seasons were compliant with the FMEnv regulatory limits of 200ppm, although higher values were recorded in the bush areas where the likelihood of putrefaction of organic matter abounds.

- ***Chloride***

Chlorine (Cl_2) is a highly reactive gas. It is a naturally occurring element. Chlorine gas can be recognized by its pungent, irritating odor, which is like the odor of bleach. The strong smell may provide adequate warning to people that they are exposed. Cl_2 concentrations in the study area ranged between 0.22 and 0.9ppm in the wet season and 0.25-0.92ppm in the dry season. FMEnv limits for chloride were not available.

- ***Suspended Particulate Matter (SPM)***

Suspended particulate matter (SPM) comprises of light materials, solid and liquid matter of organic or inorganic composition (mostly dust and other particles generated from bush burning and other natural and anthropogenic causes). They are found suspended in the lower limits of the atmosphere (within the troposphere) and are carried by the prevailing wind system. The recorded values of SPM in the proposed project area ranged from 0.15 to 4.25ppm in the wet season and 0.18-4.44ppm I the dry season exceeding the FMEnv regulatory limit for SPM of 0.250ppm at most sampling stations and less in a few sampling stations for daily average of hourly values. Ambient concentrations of SPM above this limit in Nigeria may cause or aggravate respiratory problems such as cough and asthma. The sampling points with the higher values were observed in the built up areas and highways were natural and anthropogenic sources abound.

Table 4.14: Results of Air Quality and Noise Analyses around the Project Area for Wet and Dry Seasons

Sampl ing Statio	NO_2 (ppm)		SO_2(ppm)		H_2S(ppm)		C0(ppm)		NH_3(ppm)		Cl(ppm)		SPM(ppm)		Noise (dB(A))	
	Wet	**Dry**	**Wet**	**Dry**	**Wet**	**Dry**	**Wet**	**Dry**	**Wet**	**Dry**	**Wet**	**Dry**	**Wet**	**Dry**	**Wet**	**Dry**
AS1	0.33	0.35	0.45	0.47	0.56	0.58	30.95	32.20	3.00	3.66	0.51	0.57	1.95	1.99	65.4	65.6
AS2	0.30	0.32	0.55	0.58	0.55	0.56	30.0	30.9	3.21	3.25	0.76	0.78	1.01	1.22	75.6	75.0
AS3	0.42	0.48	0.49	0.48	0.45	0.46	24.50	26.45	3.40	3.64	0.49	0.54	1.25	1.30	59.0	59.5
AS4	0.09	0.02	0.70	0.07	0.64	0.66	10.85	1.08	2.60	2.66	0.35	0.42	0.00	0.19	20.1	20.5
AS5	0.05	0.07	0.05	0.07	0.51	0.56	4.96	5.00	2.57	2.59	0.25	0.30	0.12	0.10	19.4	20.0
AS6	0.05	0.05	0.08	0.07	0.48	0.50	6.10	6.25	3.10	3.35	0.30	0.31	0.15	0.18	24.3	24.8
AS7	0.04	0.05	0.10	0.06	0.50	0.51	1.61	1.05	10.75	10.87	0.72	0.70	0.25	0.29	28.5	29.0
AS8	0.03	0.04	0.71	0.73	0.60	0.58	1.00	1.05	24.85	24.89	0.80	0.82	0.01	0.22	25.8	25.9
AS9	0.22	0.40	0.60	0.62	0.66	0.61	2.45	1.29	20.90	20.95	0.75	0.77	0.91	0.95	20.3	20.8
AS10	0.01	0.03	0.05	0.06	0.65	0.62	2.51	2.50	3.11	3.17	0.55	0.58	0.22	0.44	31.0	32.1
AS11	0.04	0.05	0.02	0.09	0.59	0.61	1.20	1.10	3.25	3.29	0.42	0.44	0.19	0.19	24.0	26.4
AS12	0.09	0.10	0.10	0.01	0.49	0.51	1.20	1.22	29.57	29.70	0.30	0.32	0.30	0.33	32.8	33.2
AS13	0.06	0.07	0.09	0.01	0.48	0.49	1.00	1.50	33.05	33.20	0.29	0.31	0.24	0.26	34.5	36.0
AS14	0.08	0.09	0.54	0.05	0.62	0.63	1.54	2.11	2.71	2.75	0.22	0.25	0.95	0.92	24.0	24.9
AS15	0.06	0.08	0.68	0.06	0.64	0.65	1.21	1.61	2.92	2.94	0.78	0.82	0.11	0.17	30.5	22.0
ASC1	0.04	0.04	0.62	0.06	0.57	0.59	1.29	1.44	3.15	3.19	0.90	0.92	0.05	0.12	28.5	29.0
ASC2	0.6	0.09	0.42	0.07	0.53	0.55	0.70	0.77	3.31	3.33	0.88	0.90	0.21	0.24	20.0	25.0
Range	0.03-0.42	0.04-0.48	0.05-0.71	0.06-0.73	0.45-0.66	0.46-0.66	0.7-30.95	0.77-32.2	2.57-33.05	2.59-33.2	0.22-0.9	0.25-0.92	0.15-4.25	0.18-4.44	24.0-80.5	26.4-82.0
FMEnv Limits	0.04-0.06		0.01- 0.1		-		10- 20		200		-		0.250		90dB(A)	

Source: PGM Fieldwork, 2015

4.7.2 Noise

Nose pollution is a serious public problem that can easily disrupt a vital train of thought. Prolonged exposure to a noise level of about 85dB(A) usually results in loss of hearing (Time, 1968, SKC, 2000). NIOSH (1996) attributed hearing loss among workers to their exposure in the industries while Smoorenburg *et al*., (1990) identified prolonged equivalent daily exposures of at least 85 dB(A) as a contributing factor to increased blood pressure and hypertension. Loss of hearing due to exposure to noise can equally lead to tinnitus that is, buzzing in the ear while insomnia and tiring can also be caused by noise exposure. Occupational hearing loss is often being overlooked because it usually occurs insidiously without dramatic consequence such as bleeding, deformity, or death (Berger, 2000). However the Federal Ministry of Environment recommended 90 dB(A) as the standard noise exposure limit for Nigeria in an 8 hour working period (FMEnv, 1991).

The noise does not only disturb sleep, interrupt conversation, and create stress and annoyance in the general population; it also reduces the efficiency and output of workers (Sinha and Sridharan, 1999).

The ambient noise values recorded around the study area are within FMEnv limits per day from an 8-hour working period. The values recorded ranged between 24.0-80.5 dBA in the wet season and 26.4-82.0 dBA in the dry season. The measured noise levels along the proposed project area were mostly within natural background status of 20-60dBA, while some sampling points had raised values as high as 82 dBA in heavily built up areas. The contributing sources of the recorded noise levels include quirking birds, passing vehicles especially hooting of horns from vehicles and community inhabitant's activities.

4.8 Water Quality

4.8.1 Physico- chemical Characteristics

- ***pH and Alkalinity***

For this study, fifteen samples and two control samples were collected from the surface waters along the proposed road project route and analysed for their physico-chemical properties and heavy metal contents. Mean pH values of surface water revealed values lying within the range required by FMENV/ WHO (6.5 -8.5). The surface waters are all alkaline in nature. Alkalinity values for ground water and surface water revealed mean values of 218.7 mg/l and 214.5mg/l respectively for wet and dry seasons, slightly above the FMEnv/ WHO stipulated limits of 200mg/l.

- ***Turbidity, TSS and TDS***

The values obtained for turbidity ranged between 3.00 NTU and 9.2 NTU and 3.5NTU and 9.6NTU for wet and dry seasons respectively, with some values exceeding the FMEnv/ WHO limits of 5.0 NTU at some sampling stations. According to USEPA (2012b), Turbidity is a measure of water clarity, how much the material suspended in water decreases the passage of light through the water. Suspended materials include soil particles (clay, silt, and sand), algae, plankton, microbes, and other substances. These materials are typically in the size range of 0.004 mm (clay) to 1.0 mm (sand). Turbidity can affect the color of the water. Higher turbidity increases water temperatures because suspended particles absorb more heat. This, in turn, reduces the concentration of dissolved oxygen (DO) because warm water holds less DO than does cold water. Higher turbidity also reduces the amount of light penetrating the water, which reduces photosynthesis and the production of DO. Sources of turbidity include soil erosion, waste discharge, urban runoff, eroding stream banks, large numbers of bottom feeders (such as carp), which stir up bottom sediments, excessive algal growth etc.

Generally, the quantities of TDS and TSS are proportional to the degree of pollution. The mean values observed for TDS in the wet and dry seasons were 125.4mg/l and 78.1mg/l respectively, both less than the FMENV standards of 1000m/l while TSS values revealed values indicative of pollution with mean values of 7.18mg/l and 7.21mg/l for wet and dry seasons respectively.

- ***Electrical Conductivity***

Electrical conductivity is the numerical expression of the ability of an aqueous solution to carry an electric current. Electrical conductivity is connected to the presence of ionic species in solution. The mean values recorded for surface water samples in the wet and dry seasons were 364.5µS/cm and 360.2µS/cm respectively higher than the FMEnv/ WHO limit of 100 µS/cm.

- ***Total Hardness and Cations***

Hardness is the concentration of multivalent metallic cations in solution. Dissolved calcium and magnesium ions are the major sources of hardness in water whereas minor contribution is made by the ions of aluminium, barium, manganese, iron, zinc, etc. Increased hardness can decrease lather formation of soaps and increase of scale formation on hot water. Calcium and magnesium had mean values of 28.0mg/l and 23.4mg/l in the wet season and 30.0mg/l and 24.7mg/l in the dry season.

Total hardness values ranged between 18.4mg/l and 150mg/l in the wet season and 28.0mg/l and 155mg/l in the dry season. The values overshot the FMEnv values of 100mg/l at some sampling points, meaning that some of the surface water bodies along the proposed road project are hard while some others are soft.

- ***Dissolved Oxygen***

Dissolved oxygen (DO) is a measure of the amount of oxygen in water that is available for chemical reactions and for use by aquatic organisms. In the aquatic ecosystem, dissolved oxygen balance in water is important for the survival of certain microorganisms and higher organisms. Most of the oxygen in water is derived from the atmosphere by mechanical mixing (churning action of water as it flows). (CEES, 2010). Mean DO values recorded were 4.61mg/l and 4.88mg/l respectively for wet and dry seasons, both falling within the FMEnv/ WHO limit of 6.0mg/l.

- ***Nutrients***

Sulphates, phosphates and nitrates are essential nutrients for aquatic life and humans. Plants require inorganic phosphate while animals can use either organic or inorganic phosphate; and organic and inorganic phosphorus can either be dissolved in the water or suspended. Too little of these nutrients could be detrimental to both humans and aquatics and too much of which could create detrimental environmental conditions such as algal blooms.

All three nutrients were found not to exceed the FMENV/ WHO limits of 250, 5.0 and 50 mg/l respectively for sulphates, phosphates and nitrates, respectively, required for drinking water and surface water. This may mean that the risk of eutrophication in the surface water bodies is ruled out.

- ***Heavy Metals***

Heavy metal analysed include iron, lead, zinc, copper and nickel. Among these, lead, copper and nickel were undetected in the samples collected. Iron had mean values of 0.43mg/l for the two seasons, slightly above the FMEnv/ WHO limits of 0.3. Zinc was also detected with mean values of 0.36mg/l and 0.37mg/l for wet and dry seasons respectively and were less than the FMEnv/ WHO limits of 3.0mg/l.

Table 4.15: Summary of Results of Physico- chemical Properties and Heavy Metal contents of Surface Water in the Study Area

Parameters	Minimum		Maximum		Mean		FMEnv Limits
	Wet	Dry	Wet	Dry	Wet	Dry	Wet
pH	6.6	6.5	8.3	8.1	7.56	7.28	6.5-8.5
Alkalinity (mg/l)	155.5	185.2	300.5	305	218.7	214.5	200
Electrical Conductivity (µS/cm)	325	302.2	395	396.8	364.5	360.2	100
Salinity (mg/l)	0.25	0.3	0.62	0.67	0.41	0.42	
Turbidity (NTU)	3	3.5	9.2	9.6	6.0	6.4	5
TDS (mg/l)	25.5	29	196.3	100	125.4	78.1	1000
TSS (mg/l)	3.2	3.5	11.2	10	7.18	7.21	0
Phosphate (mg/l)	0.35	0.31	0.62	0.62	0.47	0.47	5.0
Nitrate (mg/l)	0.15	0.1	0.44	0.42	0.27	0.27	50

Sulphate (mg/l)	20.8	20.1	35.8	32.5	27.0	29.0	250
Total hardness (mg/l)	18.4	28	150	155	78.8	81.9	100
Calcium (mg/l)	13.2	20.4	39.2	39	28.0	30.0	
Magnesium (mg/l)	20.7	19.2	30.4	30.2	23.4	24.7	
Chloride (mg/l)	3.5	3.5	9.2	9	6.49	6.39	200
DO (mg/l)	2.8	3.8	6.5	6.2	4.61	4.88	6.0
Iron (mg/l)	0.1	0.19	0.9	0.79	0.43	0.43	0.3
Lead (mg/l)	-	-	-	-	-	-	0.01
Zinc (mg/l)	0.1	0.16	0.61	0.6	0.36	0.37	3.0
Copper (mg/l)	-	-	-	-	-	-	1.0
Nickel (mg/l)	-	-	-	-	-	-	0.02

Source: PGM Fieldwork, 2015

- ***Microbiology***

Natural waters usually contain large numbers of microorganisms which may make them safe or unsafe for consumption. Total coliforms are a group of bacteria that are widespread in nature. All members of the total coliform group can occur in human feaces, but some can also be present in animal manure, soil, and submerged wood and in other places outside the human body. Thus, the usefulness of total coliforms as an indicator of feacal contamination depends on the extent to which the bacteria species found are feacal and human in origin. For recreational waters, total coliforms are no longer recommended as an indicator. For drinking water, total coliforms are still the standard test because their presence indicates contamination of a water supply by an outside source (USEPA, 2012a). The results of microbial analyses obtained from surface waters around the project area are shown in Table 4.16.

Table 4.16: Microbial Population (Cfu/Ml) in Surface Water Samples Along The Proposed Project Area

SAMPLE CODE	Heterotrophic bacteria (x 10^6cfu/ml)		Total coliform (x 10^3 cfu/ml)		Faecal coliform (x 10^2 cfu/ml)		Fungal count (x $10^7$6cfu/ml)		Hydrocarbon Degrading bacteria (x 10^3 cfu/ml)		**HYDROCARBON DEGRADING FUNGI (X 10^3CFU/ML)**	
	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	**DRY**
SW1	3.4	3.6	2.1	1.9	2.4	3.0	2.4	2.8	1.7	2.0	1.2	**2.3**
SW2	4.9	5.0	2.8	2.0	1.5	2.0	2.2	3.0	2.1	2.2	1.7	**3.0**
SW3	3.0	3.3	2.8	1.7	1.4	2.3	2.9	3.2	2.6	3.4	1.6	**1.5**
SW4	2.7	3.3	2.5	2.3	1.7	3.2	2.5	3.2	2.1	2.4	1.5	**2.1**
SW5	4.6	4.0	3.1	2.0	1.1	4.8	4.2	3.5	5.1	3.9	3.9	**2.2**
SW6	5.2	4.6	3.2	1.8	1.5	3.6	3.7	3.2	6.1	4.0	3.6	**3.4**
SW6	4.4	3.9	3.1	2.1	1.2	4.0	3.3	4.0	4.0	3.9	4.1	**3.5**
SW7	4.7	4.4	3.1	1.6	3.1	1.1	4.6	3.8	3.7	4.3	3.8	**2.8**
SW8	3.3	3.8	3.8	2.6	3.4	1.0	5.2	4.4	4.2	4.4	4.0	**3.0**
SW9	3.0	4.0	2.0	3.0	1.2	1.2	3.8	5.0	3.5	3.9	3.9	**4.2**
SW10	4.4	3.6	3.9	2.8	1.9	1.8	3.3	4.6	3.2	4.0	4.4	**3.6**
SW11	3.8	4.0	3.4	3.8	2.1	2.0	2.9	3.9	3.4	5.0	3.2	**4.0**
SW12	3.9	3.8	3.3	2.5	2.4	2.1	2.0	3.0	4.0	6.1	4.2	**3.8**
SW13	3.0	3.2	3.4	3.3	3.0	1.8	3.0	3.7	5.1	5.6	3.5	**4.2**
SW14	2.8	4.0	3.6	2.9	2.3	1.0	2.2	3.9	4.4	6.0	4.2	**3.5**
SW15	3.9	2.9	3.0	3.6	2.9	1.4	4.2	2.9	3.8	4.5	3.9	**3.3**
SWC	4.8	3.2	3.6	3.6	1.9	1.7	3.8	3.3	4.0	3.9	4.4	**4.0**
SWC	5.6	3.7	3.9	3.2	3.6	2.5	3.0	4.2	3.9	4.0	2.8	**3.8**
MEAN	**3.87**	**3.8**	**3.1**	**2.56**	**2.06**	**2.24**	**3.31**	**3.61**	**3.71**	**5.00**	**3.81**	**3.36**

Source: PGM Fieldwork, 2015

Mean heterotrophic bacteria counts were 3.87 $x10^6$cfu/ ml and 3.8 $x10^6$cfu/ ml respectively for wet and dry seasons. Mean total colform counts were 3.1 $x10^3$ cfu/ ml for wet season and 2.56 $x10^3$ cfu/ ml for dry season while mean feacal coliform counts were 2.06 $x10^4$cfu/ ml and 2.24 $x10^4$cfu/ ml for wet and dry seasons respectively. Mean fungal counts were 3.31 $x10^7$cfu/ ml and 3.61 $x10^4$cfu/ml respectively for wet and dry seasons. Mean hydrocarbon degrading bacteria counts were 3.71 $x10^3$ and 5.00 $x10^3$cfu/ml for wet and dry seasons respectively while that for hydrocarbon degrading fungi were 3.81 $x10^3$ and 3.36 $x10^3$ cfu/ ml.

Predominant species of microorganisms isolated from the sediment samples include *Bacillus spp, Clostridium spp, Escherichia coli, Aspergillus niger, Fusarium spp, Rhizopus stolonifer, Aspergillus spp, Corynebacterium spp, Mucor spp, Escherichia coli, seudomonas aeruginosa, Trichoderma spp, Staphylococcus spp, Penicillium spp, Saccharomysec spp* among others.

4.9 Habitat and Flora

4.9.1 Habitats

The existing vegetation is largely secondary in nature and typifies a derived savannah with abundance of grasses and herbs and few clumped or scattered trees, especially in the swampy forest region. The vegetation (mostly grasses and herbs) appeared pale brown and withered during the dry season survey owing to their inability to withstand the harsh climatic condition whilst vegetation around the swampy forest was observed to be ever-green. The types and distribution of vegetation in the study area include freshwater swamp forest and grassland vegetation. It shall be noted that this mapping represents broad classifications of the dominant habitat types within this area. There is however a mix of the habitats identified within these areas. This is further described in the following sections.

The habitat types identified on the site include the following:

- **Grasslands**: Includes a number of subtypes depending on the density of the herbaceous species and succession;
- **Freshwater swamp forest;**
- **Wetland areas; and cultivated areas (Farmland).**

Vegetation Type	Road segments	Approximate kilometers	Key communities
Grassland	Ogoja –Boki	53	Otugwang, okworotung and Obudu
grassland	Yala	5	Okpoma, okuku

Fresh water/ swamp forest	Calabar - Oban	130	Calabar, Oban, Mfamosing, Akamkpa , Boki Obubra, Yakurr
Mangrove forest	Oban-Ikom,Bakassi	15	Oban, Mfamosing and ikom
Wetland	Yakurr - Obubra – Ikom	3	Yakurr, Obubra, ikom
Cultivated Areas	Calabar - Yala	175	Found throughout the stretch of the proposed road project

Source: PGM Fieldwork 2015

These are described in further detail in the following section.

- ***Mangrove / Brackish Swamp Forest***

Mangroves are salt-tolerant characteristic complex plant communities usually occurring in low lying swamp land associated with riverine and coastal areas caused by the influence of the sea. The mangrove (or brackish swamp) forest of Nigeria is the largest in Africa and third largest in the world after India and Indonesia (Macintosh and Ashton, 2003). Within the study areas, mangrove forests were identified along the edges of the Cross and Calabar rivers tributaries and extending to the north where this becomes grassland (derived savannah). The mangrove forest contains a mixture of salt water tolerant and fresh water plant specifies and is found to contain high species' diversity.

- ***Grassland***

The vegetation in the grassland areas is dominated by herbaceous species. The diversity of herbaceous species is higher during the wet season, while diversity and abundance were greatly reduced during the dry season. The vegetation survey characterised the grassland areas as follows:

- Grassland with low density of *anachadium occidentale* ;
- Grassland with low density of *Elaeis guineensis*;
- Grassland with low density of *Calotropis procera;*
- Secondary regrowth forest with few forest species;
- Grassland with few stands of *Acrostichum aureum* linking the *Rhizophora* spp stands;
- Grassland with few stands of *Chrysobalanus icaco*).

The grassland areas are considered to be derived savannah, as a result of the destruction of forest for agriculture and subsequent burning. This area is characterized with major grassland coverage with small areas of shrub species and smaller trees, including *Elaeis guineensis*.

Several tracks and roads have created through the grassland areas by pedestrian and vehicle access related to the gathering of wood for fuel. This has provided increasing better access for further exploitation of the trees in the area. The burning of the vegetation in the areas for cultivation further reduces the number of trees and shrubs and (if not used for cultivation) further contributes to the expansion of the grassland areas.

- ***Freshwater Swamp Forest***

The freshwater swamp forest area (occupying about 23% of proposed project site) has a high diversity of plant species during both the wet and dry seasons. Tree and shrub species diversity is high and the communities are largely protected from human activities by the swampy ground and difficulty in accessing these areas. As the soil in these areas is often water-logged, poorly aerated and nutritionally poor, plant species that grow here are characterized by their development of pneumatophores (specialized aerial roots that serve respiratory functions in poorly aerated soils). As expected, swamp forest was found to be less water-logged during the dry season and contained significant leaf litter on the forest floor.

- ***Cultivated Areas***

Areas that have been used for agriculture are also found within the study area and are largely devoid of natural trees and shrubs due to clearing of the land, sand-filling and planting with agricultural crops. Minimal numbers of natural species were observed in these areas and are considered to exist here as a result of natural re-seeding and succession on the cleared land. Furthermore, plantation agriculture is practiced as observed in large hectares of land (approximated 86km) cultivated and well-groomed with rubber, banana, cocoa and pineapples.

- ***Wetlands***

The Ramsar Convention on wetlands define the term wetlands as area of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tides does not exceed six meters (Smart, 1997). The existing Wetland close to this description on the proposed road project can be found in Yakurr and Ikom areas. The closest listed wetland is the Upper Orashi Forest. This was listed in April 2008.It is approximately 200km from from Ikom and Yakurr areas.

Free floating and submerged water wetland species were observed around and within the surface water bodies and inundated areas in these study aeas. They include; *Nymphaea lotus, Pistia stratiotes* and *Vossia cuspidata.* Some indicator fresh water species observed include; Alstonia sp., Dryopteris sp., *Anthocleista djalonenesis* and *Elaeis guineensis*. It shall be noted that artificial wetlands were encountered on the site as a result of human activities (e.g., vehicle tracks and sand mining). These contain water during the wet season survey but were observed to have dried up during the dry season.

- ***Disturbed Habitats***

There are areas in which habitats may be disturbed or removed for the construction of the Superhighway. However, this would only come to fore if economic costs and implications is given preference over environmental impacts. The construction of the Superhighway might lead to removal of some of the trees in the Oban group of forest reserves if the propose project should go through it rather than around it. See Table 4.17

4.9.2 Vegetation categories and structures

Tropical High Forest (THF), uneven-aged, semi deciduous or ever-green rainforests represents almost 30% of the land base in CRS. Most of this is considered to be the lowland forest.

Table 4.17: Percentage Distribution of Vegetative Categories in the State.

Categories	**Percentage occurrence**
Tropical high forest	29.7
Open forest	5.60
Swamp	2.40
Mangrove	4.41
Regenerating forest	0.07
Oil palm plantation	0.86
Rubber plantation	0.62
Gmelina plantation	0.47
Total	**100**

Source: PGM Fieldwork 2015

4.9.2.1 The Calabar-Oban axis

The Calabar – Oban axis is a hundred and ten kilometers (110km) stretch of land mass starting from Ikot Omin and terminating at the Oban Forests reserves. The vegetation around the Calabar area is grossly disturbed by anthropogenic activities such as road and building constructions, quarrying and logging activities.

The vegetation around the Oban area is evergreen and is regarded as the last stronghold of tropical rain forest in Nigeria (Eniang et al.2008). The area is noted for high species diversity (Reid 1989; Oates et al 2001. Eniang et al.2008) reported that despite this great diversity and richness, the area is prone to degradation through human activities, ranging from poaching, agriculture, and logging to unguided exploitation of Non- Timber forest products (NTFPs).

The vegetation types dominating this area are the fresh water Swamp Forest and the Lowland Rain forest. This forest type occurs around Calabar and Akamkpa where the influence of fresh water system is very noticeable. The forest floor of this ecotype is seen at some places as dissected into irregular mounds and ridges by numerous intricate narrow water channels. These channels are flooded at the peak of rainy seasons. The mounds / ridges or soils fragments are held together by roots of woody plants especially *Raphia hookeri*. The roots ensure soil stabilization and control of erosion within the forest.

- ***Floristic Composition***

There is an overlap and noticeable similarity profile revealed by the vertical arrangement, spatial distribution and floristic arrangement of this forest and those of the lowland rainforest ecotype. However, typical species of fresh water swamp dominate the area. The vegetation is rich in species diversity and the floristic composition is characterized by the following: *Raphia hookerii, Uapaca hendolotic, Elaeis guineensis, Pterocarpus santalinoides, Cleiostopholis patens, Anthocteista vogelii, Symphonia globulifera Mitragyna ciliata, Dalbergia ecastaphythm, Alchornea cordifolia, Ficus spp., Treculia africana. Rauwolfia macrophylla, Funtumia africana, Alstonia cinerria, Musanga necropolises, Albania spp., Klainedoxa gabonensis, and Irvingia gabonensis Necropolises, Albania spp., Klainedoxa gabonensis, and Irvingia gabonensis* occur in this ecotype mostly around the Old Netim - Oban area. The undergrowth, tangles and aquatic weeds encountered include *Psychortria vogeliana, Costus afer, Maranthodea Selaginella* spp.*, Nephroleptis bisserata, Ipomoea* sp.*, Diplarium sammantic, Ludivigia decurreas,* and *Centhotheca* spp. *Ancistrophythim secondifolia, Pandanus fascicularis* and *Cyrtosperma senegalensis* were common around this study area. While *Pandanus* spp. formed a difficult hedge along both banks of Calabar River, *Ancisstrophyllum secondifolia* formed impenetrable tangles in the forest. The density distribution of plant species within this forest type showed that *Raphia* spp. had the highest relative density.

Structure

The forest is fully mature and differentiated into three distinct strata, namely the upper, middle and the lower strata. The upper strata species are scattered all over the forest. They do not have a continuous canopy and their crowns are flat or spreading and very large.Their heights in most places range from 25 – 35 m. They include *Alstonia booneii, Piptaderiastrum africanum, Klainedoxa gabonensis* etc.The second canopy layer is completely closed with marked canopy contact. The close contact of the sclerophyllous leaves of species in this layer make penetration of light into the ground floor of the forest difficult. Species in this layer are between 15 – 22 m tall and include *Cleiostopholis patens, Raphia* spp.*, Anthocleista vogelii, Uapaca hendelotii, Musanga cecropoides*. The lowest strata is poor in species composition and occupied by herbs, ferns, grasses ,sedges and some lianas shrubs, These include *Maranthocloa congensis, Cyrtosperma senegalensis, Afromomum* spp.*, Costus afer and Diplazium sammantic.* It is noteworthy that this forest type is somehow undifferentiated in some areas in Calabar-Oban axis. In this area, a canopy (plate 7) of distantly separated and easily identifiable tree species is noticed (see Plates 1 and 2). In the gaps, dense tangles of shrubs and lianas practically form impenetrable vegetation closely held together. These completely cover and overhang the entire forest. In terms of Raunkaerian life forms, most of the plant species belong to the Phenerophytes. The helophytes and epiphytes were the least. This shows the woody nature of the forest. There is a serious and indiscriminate exploitation of the fresh forest water species. Restriction and strict laws on felling and logging is necessary in such areas

Plate 1: Evergreen forest (Oban)

Plate 2: Gmelina plantation in Mfamosing

Lowland Rainforest (Mixed tropical Rainforest)

The lowland rainforest formation is somehow the most dominant forest formation of the study area as it extends from Calabar - Oban. However, this forest is very discontinuous and in most areas are seen remnants of its own self or rainforest of several years. The stages of re-growth and maturity of this forest differ at different places along both sides of the proposed project area. In fact human activities have greatly transformed the structure and probably species richness of this vegetation type. This is reminiscent in the number of Gmelina and Rubber plantations, farmlands, oil palm bush that dot both sides of the route and the logging activities that go on where the forest is mature. The forest is very mature around Akamkpa, Mfamosing and Oban areas.

- ***Floristic Composition***

The forest around this study area is very mature and pristine. It has a distinct profile as revealed by the vertical arrangement and spatial distribution of individual plants. The floristic composition consists of species of transitional and wet series. The emergent trees of the uppermost layer are *Klainedoxa gabonensis, Symphonia globulifera, Alstonia booneii, Terminalia superba, Irvingia gabonensis, Chlorophora excelsa, Ceiba pentandra, Piptadeniasrtum africanum, Cynometra megalophylla, Cola* spp, *Lophira alata* and *Sterculia tragacantha*. These trees are very tall and spatially distributed with heights ranging from 28 m and above.The second layer is made up of several trees species and these include *Pycnanthus angolensis, Cleistopholis patens, Funtumia africana, Musanga necropolises, Anthologist vogelii, Elaeis guineensis, Mitragyna ciliata, Albizia* sp, *Fagara* sp*., Dichrostachys cinerea, Pterocarpus soyauxii, Alstonia booneii, Pentaclethra macrophylla, Xylopia ethiopica, Alchornea cordifolia, Tetraptera tetraplura, Harungana madagascariensis, Fiscus vogeliana, Baphia* spp*, Acio barteri* and *Chrysobalamus orbicularies.* Trees in this canopy layer have a highest range of 10 m to 27 m. Their crown merges form a continuous canopy. Associated with trees of this canopy layer are various shrubby lianas, lianas climbers and epiphytic species. These include *Chromolaena odorata, Clappertonia ficifolia, Psychortria vogeliana, Anthonatha macrophylla, Combretum racemosum, Nephroleptis bisererata, Landolphia* sp*., Ficus exasperata,* and *Lessampelos* spp., *Urena* spp*, Griffonia calyeine* and *Mussaeda* spp. (see Plates 3 and 4)

Plate 3: Secondary Rain forest (Akamkpa)

Plate 4: Thick canopy crowns (old Netim)

The lowest and ground floor is poor in species diversity. The vegetation on this layer (ground floor) is sparse and the floor is covered with leaves. The forest is reasonably penetrable and the canopies formed by the crowns of the tree species make the forest floor gloomy with isolated sun fleck penetrating through gaps in the canopy. Characteristic species include *Diplazium sammanti, Acanthus monotamus, Maranthocloa congensis, Maranthochloa sessilis, Costus afer, Selaginella* spp, *Centhoteca* spp, and saplings of woody trees like *Cleiostopholis patens* and *Elaeis guineensis.* The density distribution of trees in this forest type shows that *Elaeis guineensis* was the most dominant. Symphonia globulifera, C.patens and A. vogelii followed this.

- ***Structure***

The forest is fully mature with the vegetation properly differentiated into three distinct strata, namely the upper, middle, and the lowest strata as described above. However, where the forest is not fully matured (secondary forest) like on both sides of the forest profile does not show three distinct strata. Instead, two strata are clearly visible with an emergent stratum of trees, which are scattered all over the forest, and a secondstratum, which merges with the ground floor. The emergent in these areas are mostly *Picnanthus angolensis, Elaeis guineensis, Chlorophora excelsa* and *Musanga cecropiodes.* This forest is remarkably regular and uniform in structure, though the abundance of small climbers and young saplings gives it a dense and tangled appearance. In terms of the Raunkiaerian life forms, the life spectrum indicated that the mesophanerophytes, megaphanerophytes and microphanerophytes constitute the dominant life forms (about65%) and represented by herbaceous, shrubs and saplings of tree species constitute about

25%, while the ferns, epiphytes and palms constitute about 10%. Results of the dry and rainy season sampling of this forest did not show any changes in vegetation structure and profile. However, constant exploitation of this forest for timber definitely will change its species richness and composition. This will in the long run affect the structure of the forest.

Bush Fallow These bush fallow lands represent areas where farming and other severe exploitation have taken place years ago but have been abandoned and left to fallow for at least 3 years. Sometimes fallowing period can exceed 10 years depending on land availability.. Interjected by patches of farmlands is a fringe of bush fallow vegetation on both sides of the proposed road project from parts of Osomba to Mfamosing and extending to Oban. In some areas, regeneration of trees and shrubs species have occurred as well as visible signs and traces of agricultural practices such as mounds and ridges in areas with less than 3 years of fallow period.

Forbidden Forest

There is a practice in Osambo near the Oban Forest Reserve that the forest is a gift the ancestors and as such must not be burnt nor otherwise destroyed. The maintenance of such sacred or forbidden forests led to the preservation of the flora and fauna species therein. To affirm this, Bhagwat et al. (2005) conclude that sacred forest were richer in biodiversity than any other sites. They showed that threatened and endemic species were found in sacred taboo forests. However, this study does not assess the species richness within the forbidden forest (Plate 5) to compare with other forest around the study area.

Plate 5: Entrance into forbidden land (red cloth indicates warning)

- ***Floristic Composition***

Grasses, herbs and few stands of timber and tree crops characterize this Bush fallow vegetation type. The floristic composition consists dominantly of *Alchornea cordifolia,Clappertonia ficifolia, Milletia* spp*. Newbouldia laevis, Costus afer, Aspilia africana, Chromolaena odorata, Baphia nitida, Synedrella nodiflora, Sida acuta, Ipomoea involucrata, Calopogonium nucroides, Dissotis rotundifolia, Anthocleisa* *vogelii*, others are *Pueraria phaseoloides, Afromomum* spp., *Phyllantus* spp., *Acio barteri, Funtumia africana, Harungana madagascariensis, Psychortria vogeliana, Mussaenda* spp., *Mallotu oppositifolius, Smilax kraussiansa, Pentaclethra macrophylla, Griffonia* spp., *Anthonatha macrophylla, Hibiscus suratensis, Albizia regia.* Common tree species in this fallow vegetation, which emerged well over the other species, are *Chlorophora excelsa, Elaeis guineensis, Picnanthus angolensis, Alstonia booneii, Pentaclethra macrophylla, Anthocleissa vogelii* and *Ceiba pentandra*. The tree crops include *Psidium guajava, Mangifera indica, Artocarpus communis, Hevea brasiliensis, Spondias mombin, Eugenia* spp., *Citrus sinensis, Cola acumuminata* and *Dacroides edulis.* Common ferns andgrasses are *Selaginella* spp., *Diplazium* spp., *nephroleptis biserrata, Cyanodon dactylum, Axonopus compresus, Sporobtus pyramidalis* and *Pennisetum* spp. *Alchornea cordifolia, Harungana madagascariensis* and C*hromolaena odorata* dominated the bush fallow vegetation.

Structure

The vegetation of the Bush fallow areas is very open with the ground floor covered with herbaceous species. The overall height generally range from 1 m to 7 m high except for the emergent tree species like *Chlorophora excelsa* and *Elaeis guineensis* which range from 15 m to 20 m high. The Bush fallow vegetation is open and unstratified. The life form spectrum shows high incidence of nanophanerophytes, chanerophytes, hemicryptophytes and cryptophytes, indicating that the plant communities are unstratified and generally lack woody trees except for few and scattered (phanerophytes) stands of trees. These areas are thus degraded areas. The Bush fallow vegetation did not show much change during the two-season sampling.

4.9.3 Farmland / Plantations

Farmland and plantations ranging from 10 m2 patches to more than 50 hectares-areas traverses the proposed project route. However, these farmlands and plantations are concentrated around Mfamosing, Akin, to Oban and extending to Ekang. The types of farms and plantations observed during the dry season were also observed during the rainy season. These include Cocoyam farms, Cassava farms, Gmelina plantations Oil palm plantations, Banana and Plantain plantations, Rubber plantations and pineapple plantations.

 

Plate 6: Farmlands in the study area

Though most of these farms are smallholdings and may mainly serve for subsistence, some cassava farms and Palm plantations along km 54 to 80 km of the existing road. Most of these existing plantations cover over 10 hectares of farmland thus indicating their commercial status. Other crop plants identified in some of these farms are *Chrydophyllum albidium, Artocarpus communis, Dacroides edulis, psidium guajava and Cola acuminata*.

4.9.4 Vegetation around the settlements

Several communities exist from Ikot Omin, Ikot Effanga, Ikot Eneobong to Mfamosing, Akin, Osomba, Nko, Obubra and Oban. Economic tree crops dominate these communities. The different economic tree crops identified in these communities include *Cocos nucifera* (coconut), *Annona muricata* (sour sop), *Cola acuminata* (native cola), *Citrus sinensis* (orange), *Musa sapientum* (Banana), *Musa paradisiaca* (Plantain), *Dacroides edulis*, *Carica papaya* (paw-paw), *Spondias monbin* (Plum), *Psididium guajava, Chrysophyllum albidium, Persia americana, Eugenia* spp*., Azadirachta indica* and *Hura crepitans*. Also such vegetation as *Telfaria occidentalis, Pterocarpus soyanxii* and *Cucurbita moschata* were identified.

4.9.5 Nko (Yakurr) and Obubra Axis

- ***Mixed Tropical Rain Forest***

This is the most dominant forest formation of the study area. It goes on for about five kilometers (5km) stretch. However, this forest type is not continuous. In most areas, they are seen as remnants of its own self or rainforest of several years. The stages of re growth and maturity of the rainforest differ at different locations. To some extent human activities have greatly transformed the structure as well as the species richness of this vegetation type. This is seen in the number of oil palm bushes, plantations and farmlands.

- ***Structure***

The forest type shows two distinct strata which are clearly visible with an emergent stratum of trees, which merges the ground floor. The emergent trees in these areas are mostly *Picnanthus angolensis, Elaeis guineensis* and *Musanga cecropides*. This forest is remarkably regular and uniform in structure, though the abundance of small climbers and young saplings gives it a dense tangled appearance. In terms of raunkerian life forms, the spectrum indicated that the mesophanerophytes, megaphanerophytes and micronerophytes do constitute dominant life forms(over 70%) and are represented by herbaceous, shrubs and saplings of tree species constitute about 15% ,while the ferns, epiphytes and palms constitute about 15%.

Plate 7: Distinct canopy strata in study area

- ***Vegetation around farmlands/streams***

This vegetation type occurs along the paths to the Lekpoei River. The vegetation here exhibits structures of bush fallowing as well. They occur on the fringes of the stream routes on both sides at several intervals. These fallow lands represents areas where farming and severe exploitation have taken place many years ago. It is also interjected by patches of plantain, banana, cocoyam and cucumber plantations.

The vegetation along the stream route is basically; grasses, sedges, herbaceous annuals and perennials. Few shrubs and herbs also exist although they are constantly cut in a bid to keep the stream areas clean. While the species with high capacity to cope regenerate easily, opportunities for new weedy species are created due to constant slashing. The most occurring species found here are;*Axonopus compressus, Acroceras zizanoides, Pennisetum spp, Sporobolus pyramidalis, Cynodon dactylon, Centotheca Spp, paspalum orbiculare, Chrysopogon aciculatus, Eleusine indica, Sedges: Kylinga nemoralis, Kylinga* *erecta, Mariscus alternifololius, Cyperus digitatus, Bubibostylis spp.* Others include; *Mimosa peduca, Mimosa pigra, ipomea aquita, Ipomea involvcrata, Aspillia africana, Commelina spp, Richardia spp, Phyllantes spp and Chromolaena odorata* and *Hibiscus suratensis.*

- ***Structure of Vegetation around Farmlands/Streams***

The vegetation around here is very open with the ground floor covered with grasses and herbaceous species. The overall height generally ranges from 1m to 7m high except for the emergent tree species like *Chlorophora excelsa* and *Elaeis guineensis* which range from 15m to 20m high. The bush fallow is open and stratified. The vegetation in this ecotype has been very disturbed. The most dominant plant species are; *Mimosa pudica, Mimosa pigra* and *Panicum maximum*.

Farmlands and plantations occur on both sides of the proposed sides of the study area. However, these farms these are concentrated near the Lekpoei stream.The types of farms/plantations observed during the dry season are also observed during the rainy season. Crops cultivated include; *Colocosia esculentus, Manihot esculentus, Arachids hypogea, Anarchardium occidentale, Musa spp, Ananas comosus* and *Elaeis guineensis*.

Though most of these farms and small holdings and may mainly serve for subsistence. Some cassava, cashew and Oil palm plantations are fairly large thus indicating their commercial status. Other crop plants identified in these farmlands are *Chryosphyllum albidium, Artocarpus communis, Dacroides edulis, Psidium guajava and Cola accuminata*.

- ***Grassland***

The vegetation in the grassland areas is dominated by herbaceous species. The diversity of herbaceous species is higher during the wet season, while diversity and abundance were greatly reduced during the dry season. The vegetation survey characterized the grassland areas as follows;

- Grassland with low density of *Azadiractha indica*;
- Grassland with low density of *Elaeis guineensis*;
- Grassland with low density of *Calotropis procera;*
- Secondary regrowth forest with few forest species;

Plate 8: Derived savannah

Plate 9: Grasslands in study area

The grassland areas are considered to be derived savannah, as a result of the destruction of forest for agricultural purposes and subsequent bush burning. This area is characterized with major grassland coverage with small areas of shrub species and smaller trees but dominated by *Elaeis guineensis*. Several tracks and roads have created through the grassland areas by pedestrian and vehicular access related to the gathering of wood for fuel as well as lumbering activities. This has provided increased better access for further exploitation of the trees in the area. The burning of the vegetation in the areas for cultivation further reduces the number of trees and shrubs and (if not used for cultivation) further contributes to the expansion of the grassland area (Plates 8 and 9).

- ***Freshwater Swamp Forest***

The freshwater swamp forest area (occupying about 10% of this proposed project site) has a high diversity of plant species during both the wet and dry seasons. Tree and shrub species diversity is high and the communities are largely protected from human activities by the swampy ground and difficulty in accessing these areas. As the soil in these areas is often water-logged, poorly aerated and nutritionally poor, plant that occur here are characterized by specialized aerial roots that serve respiratory functions in the poorly aerated soils. The swamp forest was found to be less water-logged during the dry season and contained significant leaf litter on the forest floor.


Plate10 and 11: Secondary rain forest in the Dry and wet seasons respectively

- ***Cultivated Areas***

These are areas that have been used for agriculture found within the study area and are largely devoid of natural trees and shrubs due to clearing of the land, sand-filling and planting with agricultural crops. Minimal numbers of natural species were observed in these areas and are considered to exist here as a result of natural re-seeding and succession of the cleared areas. Crops predominantly cultivated are Cassava (*manihot esculenta),* Potatoes *(Ipomea batatas*), Cocoyam (*Colocosia esculenta),* Fluted pumpkin (*Telferia occidentalis*), Eggplant (*Abelmuschus esculenta*), Yam (*Discorea cayensis*), Mango (*magnifera indica*), Coconut (*Cocus nucifera*), Pepper *(Piper nigrum*) and Oil palm (*Elaeis guineensis*). (Burkhill, 1994)

Farming in these areas is mainly at a subsistent level. Although derivatives products from Oil palm are major source of income earning. Plantation system of cultivation is only practiced with the oil palm but abandoned farmlands (due to bush fallowing) also exist mostly along and around stream routes.

Plate12: Cultivated wetland around settlement

Plate 13: Abandoned farmland

4.9.6 Ikom Axis

This ecotype exist in the heart of Ikom town some three kilometers (3km) of the western flank of the Four-corners – Junction and terminates at the Ikom River. The vegetation of the area is generally a secondary type at a few places probably more than 30 years old and assumes a pristine nature. The vegetation is mostly disturbed and untended in some areas due to human interference such as farming, logging and dredging activities (Plates 15 and 16).

Floristic composition

The floristic composition of the study area is very diverse with a considerable variation in physiognomy, structure and girth size. Where forests exist, the distribution of trees show the scattering of the highest canopy of trees. In such areas, several species of shrubs, herbs, climbers and macrophytes are seen. The floristic composition include; *Gmelina gmelina, Elaeis guineensis, Raphia hookeri, Uacapa hendoletic ,Azadiracta indica and Alchonea cordifola*

Structure

The structure shows different strata and differentiates into upper and lower strata (Plates 16 and 17). The canopies are discontinuous and are flat, spreading and large. Their heights in some places range 25-30m.the canopies are hardly close with marked canopy contact which makes penetration of light easy. The lower strata has very little species composition and is occupied by herbs , shrubs, ferns, grasses and lianas shrubs. These include; *Maranthoclao congensis, Cytospermum senegalensis and Costus afer* the undergrowth tangles and aquatic weeds visible are; *Nephrolyptis bisserta, Ipomea Spp and centhotheca spp.*

Plate 14: Upper canopy

Plate 15: Lower Stratum in the Study Area.

Plate 16: Dredging activity

Plate 17: Vegetation around Ikom river bank

4.9.7 Boki axis

Vegetative structure

The study area is composed of low forests, dense woodlands and thickets alternate with opening into a derived savanna. In the Obudu Plateau above 1450m grasslands occur on gentler slopes and forest communities along water courses and steep slopes. However, the major vegetation sub types are lowland rainforest, montane forest, montane grassland and savanna. The altitude determines to an extent the floristic composition around Boki. The lowland rainforest occurs in the low lying areas of Okwango Park [located south east of Obudu Plateau]; montane elements are found on high ground and grasslands on the higher peaks of Obudu Plateau, Sankwala Mountains, peak of Afi Mountain Wildlife Sanctuary at Ashishie and Ikwette hills.

This is mainly virgin forest type as the vegetation lies thick and undisturbed for several kilometers. The height of trees here range 20-60m with *Elaeis guineensis* being the emergent tree.

The moist lowland forest/secondary forests dominate the lowland areas of Ikom, and Boki local government areas. As it is now, high forest, which used to be extensive is restricted to the forest reserves and typical dense rainforest vegetation is illustrated in Plates 18 and 19.

Plates 18 and 19: Vegetation Zonation in Study Area

Floristic composition

At the forest margins or in the areas disturbed by man, woody lianas usually form an almost impenetrable tangle. The secondary forests are distinguished from the high forest by their shorter height, smaller volume and reduced diversity of species. The widespread of *[Elaeis guineensis]* ,*Cocus nucifera, Cleoitstopholis patens, Ficus sp,Funtmia africana and Irvingnia gabonensis* indicate the secondary nature of forest even where they are quite dense.

The areas for agricultural expansion are largely within high forest savannas or climax secondary forest zones. They are largely within the level lands and in areas with high to moderately fertile soils.

4.9.8 Ogoja Axis

The general appearance of vegetation type in the southern guinea savannah is very similar (Clayton 1962, Hopkins 1965) and for the matured derived savannah, there may be no floristic difference. It is observed that *Andropogon gayanus* (northern gamba grass) and *A. pseudapricus* together with *Hyparrhenia spp*. (Jaragua grass) and *Pennisetum spp.* are the most abundant grasses of the southern guinea zone. The derived savannah contains less *Hyparrhenia* but allows more vigorous growth of the *Panicum spp.* (the guinea grasses) than in the guinea savannah zone. Along the riverine areas and in the forest clearings associations of *Pennisetum purpureum* (elephant grass), *Panicum maximum* (guinea grass) as well as *Andropogon tectorum* (southern gamba grass) can be observed in the forest - savannah transition fringes. Overgrazed fields are usually invaded by *imperata cylindrical* (spear grass) frequently associated with *Sida carpinifolia* (sida grass), *Splirabolusbolus pyramidalis* (wire grass). In western part, the derived savannah comprises of two major plants communities, *Danielia elaeis* and *Daniellia uapaca*.

In this region, the characteristic derived savannah is obscured by a mosaic of intermediate and transitional types which may indicate the nature of the original vegetation linking forest and savannah.

The great diversity of plant species occurring in repeated assemblages over the study areas was divided into two zones, made up of:

Most lowland forest Savannah mosaic type (Okworotung) - this is wooded Savannah with *Daniella Oliveri* and *Tamarindus indica* dominating. However, along the river valleys riparian forests are well developed; A mixture of vegetated wooded savannah and forests (Otugwang axis) – this is forest with oil palms and *Khaya senegalensis* dominating (Plates 20 1nd 21).

Plate 20: Wooded savanna

Plate 21: Derived Savanna

- ***Floral Composition***

The floristic composition of the study area is made up of trees, shrubs and grasses, and around the forest zone in the study area. The physiognomy is characterized by a predominance of shrubs and grasses with few trees. The shrubs are between 8m – 10m in height. Few species are deciduous while the vast majority is evergreen. This is attributed to the proximity to ever flowing streams which serve as major sources of water supply to plants. The predominant shrub is the *Parinari kerstingii*. Other common species are *Terminalia macroptera*, *Ximenia americana*, *Teminalia avicenniodes* and *Albizia zygia*. The grasses are tall with few species of average height; they also grow as tall as the shrubs reaching a height of about 2.5m. The predominant species of grasses is the *perilla frutescens* or purple mint (locally called Akintola) and also the *Pennisetum purpureum* (elephant grass) and the gamba grass. Vegetation canopy are low and shrubs are short to average in height measuring about 4m – 6m. The distribution varies across the area (Plates 22 and 23). There is a predominance of mahogany trees scattered across this area except those along the stream bodies which are mainly the oil palm (*Elaesis guineensis*). The trees form a low canopy with the shrubs. In other areas, both the trees and shrubs are scattered. Other tree species present are the *Tamarindus indica* (locally called Ajagbon or Awin), *Vitex doniana* (black plum). No species of climbers or woody climbers was found in this area.


Plates 22 and 23: Savannah Vegetation Zonation in Study Area

- ***Structure of Savanna Vegetation***

The life-form spectrum of the guinea savanna is dominated by the forest and the savannah. The forest consists of ever-green and semi- deciduous trees forming a closed canopy over an open, lower stratum of regenerating trees and a continuous herbaceous stratum of which grasses are near absent. The savannah consists of semi- deciduous trees forming a continuous herbaceous stratum dominated by grasses. The boundary between forest and savannah is often abrupt and less than 25 m wide.

Within the savannah zone, there are localized areas of forest vegetation, although they are frequently reduced in diversity and canopy height and probably provide an environment intermediate between savannah and the true forest. They take forms of small patches associated with shaded localities and continuous belts of forest alongside streams and springs.

- ***Vegetation Around Springs***

The vegetation around the springs mainly consists of fallow lands previously cultivated but has been dormant for at least five (5) years. The bush fallow lands represents areas where farming and severe exploitation have been taking place over time. The vegetation is interjected by patches of abandoned farmlands, grasslands and trees. The vegetative structure assumes a forest type but with changes in the structure and profile. However, constant exploitation for timber and other non-timber products has altered its species richness and compositions.

- ***Floristic composition of vegetation around springs***

Grasses, herbs and a few stands of trees crops characterize this bush fallow vegetation type. The floristic composition is dominated by *Panicum maximum, Andropogon gayanus, musa sapientum, Musa paradisica, Kola nitida, Gnetum africanum and Irvingna gabonensis.* Patches of *Discorea cayensis* and *Manihot esculentus* do exist as well.

- ***Structure of Vegetation around springs***

The vegetation of the spring areas is open and scanty. The floor is covered with herbaceous species of shrubs and legumes.

4.9.9 Biodiversity Statistics

The study areas have a very rich biodiversity. This is due to its natural endowment in varieties of plants and animals species found in the various occurring eco types, the checklist of economical trees are shown in Table 4.24. The floral biodiversity or species richness of the various vegetation types is calculated using the Shannon index of Diversity (Table 4.18 to 4.22).

Table 4.18: Calculation of Flora diversity of Calabar-Oban axis

Plant species	n_1	p_1	$\ln.p_1$	$(p_1.\ \ln p_1)$	% occurrence
Hevea brazilensis	820	0.2018	-1.60047	-0.3229	20.18
Gmelina aborea	648	0.1595	-1.83571	-0.2927	15.95
Manihot esculentus	343	0.0844	-2.47218	-0.2086	8.44
Ananas comosus	520	0.1208	-2.11361	-0.2236	12.8
Elaeis guineensis	640	0.1570	-1.85150	-0.2906	15.7
Magnifera indica	329	0.0809	-2.41911	-0.1957	8.09
Discorae cayensis	187	0.0460	-3.07911	-0,1416	4.60
Raffia hookeri	125	0.0307	-3.48349	0.1069	3.07
Chloromena odoratum	250	0.0610	-2.79688	-0.1706	6.1

Virgnia gabonensis	200	0.0492	-3.01186	0.1481	4.92
Total	**4062**	**1**		**2.10**	**100**

H=2.1

Source: PGM Fieldwork 2015

Using Shannon index of diversity

$H=\sum-(p_1.\ln p_1)$

Where p is proportion of individual species

n is total number of individuals

Hevea brazilensis has the highest percentage of occurrence level at 20.18% followed by *Gmelina aborea* with 15.95%. *Raffia hookerii* has the lowest level of occurrence at 3.07%

Table 4.19: Flora Biodiversity of Nko (Yakurr) and Obubra Axis

Plant species	n_1	p_1	$\ln p_1$	$(p_1.\ln p_1)$	%occurrence
Elaeis guineensis	1640	0.35	-1.05	0.367	35
Cocos nucifera	820	0.17	-1.778	0.302	17
Manihot esculentus	261	0.06	-2.81	1.686	5.5
Discoreae cayensis	363	0.08	-2.53	2.202	7.7
Kola nitida	250	0.05	-0.63	0.031	5.3
Oryzae sativa	648	0.13	-2.04	0.265	13.83
Psidum guajava	187	0.04	-3.12	0.124	3.9
Raffia hookerii	190	0.04	-3.12	0.124	4.0
Chromlena oderatta	125	0.03	-3.51	0.105	2.7
Theobroma cacao	200	0.04	-3.22	0.128	4.3
Total	**4684**				**100**

H =1.4

Source: PGM Fieldwork 2015

Where H is $=\sum-(p_1.\ln p_1)$

Where p is proportion of individual species

n is number of individual in the proportion

Table 4.20: Calculation of Flora Diversity Index for Ikom axis

Plant species	n_1	P_1	$\ln p_1$	$p_1.\ln_1$	% occurrence
Theobroma cacao	230	0.418	-0.872	0.3644	41.8
Colocasae esculentus	150	0.272	-1.301	0.03538	27.2
Telferia ocidentales	78	0.141	-1.958	0.2760	14.1
Anarchardium occidentale	30	0.30	-1.203	0.3609	5.46
Gmelina gmelina	16	0.29	-1,237	0.3587	2.90
Abelmuschus esculentus	16	0.29	1.237	0.3587	2.90
Kola nitida	12	0.21	-1.560	0.3276	2.17
Elaeis guineensis	19	0.19	-1.660	0.3154	3.44
Total	**551**				**100**

H =1.6

Source: PGM Fieldwork 2015

Where H is $=\sum-(p_1.\ln p_1)$

Where p is proportion of individual species

n is number of individual in the proportion

Calculation of Flora Diversity Index Boki axis

Table 4.21: Calculation Of Flora Biodiversity Index in the Study Area

SPECIES	N_1	P_1	$N P_1$	$-(P_1.LN P_1)$	% DISTRIBUTION
Chromolaena odorotta	87	0.0219	1.9053	0.08367	2.19
Elaeis guineensis	116	0.0292	3.3872	0.01031	2.92
Theobroma cacoa	1435	0.362	519.47	0.3677	36.1
Panicum maximum	1123	0.283	317.809	0.3571	28.3

Kola nitida	187	0.047	8.789	0.1436	4.7
Bambusa vulgaris	301	0.075	22.75	0.1942	7.5
Ocimum basilus	74	0.018	1.332	0.0723	1.8
Musa sapientum	105	0.0264	2.772	0.0959	2.6
Moringa oleifera	219	0.055	12.045	0.1595	5.5
abelmuschus esculentus	301	0.075	22.575	0.1942	7.5
Anarchadium occidentale	20	0.005	0.1	0.02649	0.5
TOTAL	**3968**	**1**		**1.70**	**100**

H =1.70

Source: PGM Fieldwork 2015

Where H is $=\sum-(p_1.\ln p_1)$

Where p is proportion of individual species

n is number of individual in the proportion

Table 4.22: Calculation of Flora Diversity for Obudu axis

PLANT SPECIES	N	P	LNP_1	P1*LNP1	% DISTRIBUTION
Elaesis. guineensis	1000	0.14	-1.97	0.28	14.43
Khaya. senegalensis	497	0.07	-2.66	0.19	7.17
Moringa . oleifera	396	0.06	-2.81	0.17	5.71
Panicum . maximum	782	0.11	-2.21	0.24	11.29
Discorea .cayenses	625	0.09	-2.41	0.19	9.02
Penissetum. purpureum	385	0.19	-1.66	0.32	5.55
Andropogon. Tectorum	500	0.07	-2.66	0.19	7.21

Andropgon. Gayanus	605	0.09	-2.41	0.22	8.54
Pipper. nigricans	592	0.09	-2.41	0.22	8.54
Azadiractha. indica	504	0.07	-2.66	0.19	7.27
	6926				**100**

h=2.35 source pgm fieldwork

4.9.10 Plant Pathological Studies

The vegetation in the study area is healthy. Although, a few cases of disease prevalence for example Sigatoka on Plantain *(Musa paradisica)*, rust on Raffia palm and Oil palm were visible. Leaf damage resulting from defoliation by insect larva such as caterpillar is however noticed. Disease symptoms and severity indices as well as causative agents are shown in the Table 4.23. The Oil and Raffia palm have the rust disease severity indices. Few populations of the arrowhead weed, *C.senegalenses* had the mildew disease. The musanga plant as well as the *Hibiscus esculenta* had moderate to severe infection as shown in the defoliation of the plants caused by insect larva. The plantain had moderate to severe infection of sigatoka disease and these affect the sizes of the bunch of the plants. The pathogens where however limited in their occurrence and do not pose any threat to the health of the ecosystem.

Table 4.23: Disease Indices in Study Area

PLANT SPECIES	DISEASE SYMPTOM	DISEASE SEVERITY INDEX	IDENTIFIED CAUSATIVE AGENT
1. FRESH WATER SWAMP FOREST			
Elaeis guineensis	Leaf rust	1	*Culvularia spp*
Alchornia cordifloria	Leaf spots	2	*Cercospara spp*
Musanga cercopoides	Defoliation	3	*Insect larva*
Raffia hookeri	Leaf rust	2	*Culvalaria spp*
2. AQUATIC MACROPHYTES			
Vossia cuspidate	Leaf spots	2	*Puccinica graminis*

Cytospermum senegalensis	Sooty mildew	2	*Ergsiphe spp*
3. FARMLANDS			
Manihot esculenta	Cassava mosaic disease	1	Virus
Musa paradisica	Sigatoka	3	*Mycospharella musicola*
Ipomea batata	Leaf spots	2	*Cercospora spp*
Musa sapientum	Sigatoka	2	*Mycospharella musicola*
Saccharum officinarum	Leaf rust	1	*Culvularia spp*
Hibiscus esculenta	Defoliation	2	Insect larva

SOURCE: PGM FIELDWORK 2015

Key:

Infectious index	Description
0	No infection
1	Very light infection
2	Moderate infection
3	Severe infection

Table 4.24: Checklists of Economic Plants in the Study Areas

SCIENTIFIC NAME	COMMON NAME	LOCAL NAME	USES	CONSERVATION STATUS	PROPAGATION METHODS
Elaeis guineensis	Oil palm	*Mbi*	Food/,fodder/timber	Not threatened	Seeds
Manihot esculentus	Cassava	*Iwa*	Food, fodder	Not threatened	Stems cutting
Piper nigricans	Pepper	*Isu*	Food	Not threatened	Seeds
Arachids hypogea	Groundnut	*Ifit*	Food/fodder/ erosion control	Not threatened	Seeds
Virgnia gabonensis	Bush mango/ Ogbono	*Nsing*	Food	Not threatened	Seeds/ grafting
Hevea brazilensis	Rubber	*Eyag*	Timber / plastic making	Not threatened	Stems
Colocasia esculentus	Cocoyam	*Ikpong/Mbit*	Food	Not threatened	Culms
Musa paradisica	Plantain	*Ukom/Egime*	Food /fodder	Not threatened	Culms/ suckers
Musa sapientum	Banana	*Mboro/ Asuri*	Food/ fodder	Not threatened	Culms/ suckers
Discorea cayenesis	Yellow yam	*Bia/ Udia/ Ayu*	Food	Not threatened	Tubers
Discorea alata	Water yam	*Ayu akai / Ebre*	Food / medicinal	Not threatened	Tubers
Bamboosa vulgaris	Chnese bamboo	*Nnyanyanga*	Timer / fodder	Not threatened	Culms
Ananas comosus	Pineapple	*Mbi mbakara*	Food /ornament	Not threatened	Suckers
Theobroma cacao	Cocoa	*Koko*	Food	Not threatened	Seeds
pennisetum purpureum	Elephant grass	-	Fodder/ medicinal	Not threatened	Runners
Gmelina gmelina	¤ Gmelina	-	Timber	Not threatened	Seeds/ stems
Chromolena oderatta	Awolowo	*Acha iwa*	Medicinal	Not threatened	Stems
Citrus sinensis	Orange	*Sokoro*	Food/ medicinal	Not threatened	Seeds
Cocos nucifera		*Isip mbakara / mbang mbakara*	Food / timber	Not threatened	Seeds
	Aloe vera		medicinal	Not threatened	Culms
Raffia hookerii	Raffia palm	-	Palm wine/ timber	Not threatened	Seeds
Anachardium occidentales	Cashew	-	Food, fuel	Not threatened	Seeds
Garcinia cola	Bitter cola	*Effiat*	medicinal	Not threatened	Seeds
Tetrapleura tetraptera	-	*Uyayak*	Food/ medicinal	Not threatened	Seed

SCIENTIFIC NAME	COMMON NAME	LOCAL NAME	USES	CONSERVATION STATUS	PROPAGATION METHODS
Citrullus colosynthiS	Egusi	*Ikon*	Food	Not threatened	Seeds
Hibiscus esculentus	Okro	*Etighi*	Food/ medicinal	Not threatened	Seeds
Gnetum africana	-	*Afang*	Food	Not threatened	Stems
Alchonia cordefolia			Fodder / medicinal	Not threatened	Runners
Terminalia spp	-	*Okono*	Demarcation / medicinal	Not threatened	Culms
Magnifera indica	Mango		Food/ medicinal	Not threatened	Seeds
Astonia boonei	Stool wood	*Eto urung*	Timber / fuel	Not threatened	Stems
Solanum macrocapon	African eggplant	*Nnya*	Food / medicinal	Not threatened	Seeds
Amaranthus hybridus	African spinach / greens	*Inyang afia*	Food / medicinal	Not threatened	Seeds
Tarilum triangulare	Water leaf	*Mmong mmong ikong*	Food / medicinal	Not threatened	Stems
Moringa oleifera	Moringa	-	Food/ medicinal	Not threatened	Stems

Source: PGM Fieldwork 2015 /IUCN 2004

4.9.12 FAUNA

A combination of sampling techniques were used and included identifying major ecosystem types to identify associated fauna, collecting and preserving representative fauna specimens (e.g. insects), analysis of tracks, faecal samples, nest type, feeding site, bird noise, shell types and interviews with local communities. Fauna species recorded in the study area included; mammals, reptiles, amphibians, birds, insects and mollusks.

The rainforest of southeastern Nigeria are among the richest anywhere in Africa ,with very high species diversity in many taxonomic groups and numerous endemic species and subspecies, the region is widely recognized as a biodiversity 'hotspot' of global significance. Habitat diversity is also high, ranging from mangrove swamps in the Cross River estuary to montane vegetation in Obudu plateau. However, the forests and their wildlife within this region are subject to intense and growing pressure from the surrounding human population, and in particular from hunting for the commercial bush-meat trade. Table 4.27 shows wildlife diversity and their relative abundances while Table 4.28 highlights the checklist of wildlife in the study area.

4.9.12.1 Boki – Ogoja Axis

Primates in the Study Area

Studies in the Cross River National Park Okwangwo Division, indicates the presence of 18 primates species [out of 23 in the country] in 11 genera [4 families]. This translates to over 78% of primates species in Nigeria. However, in a recent survey by Obot [1996], the populations of these primates were found to be low and highly dispersed due primarily to hunting pressure.

TABLE 4.25: Primates of the Cross River National Park

SCIENTIFIC NAME	COMMON NAME
CERCOPITHECIDAE	
Cercocebus albigena	**GRAY –CHEEKED MANGABAY**
ercocebus torquatus	**RED –CAPPED MANGABAY**
Cercopithecus erythrotis	**RED EARED MONKEY**
Cercopithecus aethiops	**GREEN [TANTALUS] MONKEY**
Cercopithecus nictitans	**PUTTY NOSED MONKEY**
Cercopithecus mona	**MONA MONKEY**
Cercopithecus pogonias	**CROWNED MONKEY**
Cercopithecus preussi	**PREUSSI'S PUENON**
erythrocebus patas	**PATAS MONKEY**
Mandrillus leucophaeus	**DRILL**

SCIENTIFIC NAME	COMMON NAME
Papio Anubis	**Dog Faced Baboon**
GALAGIDAE	
Euoticus elegantulus	**Needle-Clawed Galago**
Galago alleni	**Allen's Galago**
Galago demidowll	**Demidoff's Galago**
LORISIDEAE	
Arctocebus calabarensis	**ANGWANTIBO**
Perodicticus potio	**Potto**
PONGIDAE	
pan troglodytes	**Chimpanzee**
Gorilla gorilla	**Gorilla**

Source: CRSG EIA (PGM Fieldwork) 2015

With fewer than 300 estimated gorillas left, the Cross River gorilla is one of Africa's most endangered primate species. Until recently, they faced relentless hunting pressure and with their remaining habitat still being eroded by agriculture and fire, the small sup-populations that remain are increasingly slaughtered. Although a number of protected areas have been established to safeguard the Cross River gorilla, many still lack fully effective management.

Recently, the state government plans to use gorilla- based tourism as a tool to promote conservation of wildlife species. This is one of the conservation strategies adopted by the Afi Mountain Wildlife Sanctuary.

The Wildlife Conservation Society has supported gorilla research in this region since 1996 and is actively working in all three sites where they are known to occur in Nigeria including the Afi Mountain Wildlife Sanctuary, the Mbe Mountains and the Okwangwo Division of Cross River National Park.

Within the past three years sightings of prime species like gorillas, chimpanzees, drill monkeys, mix groups of Mona monkeys, red eared guenon, putty nosed has been recorded, and evidence of fresh gorilla activities less than 2 days old was recorded simultaneously in two sectors of the sanctuary thus, supporting the possibility of more than one group of gorillas in the sanctuary. [AMWS newsletter, vol.1 no.4]

A serious threat in recent times is the frequent occurrences of bush fires as in February, 2007. The bush fire on Afi Mountain Wildlife Sanctuary was first noticed at Olum and Buanchor axis of the mountain in the third week of February, 2007. However, the inferno was reported to have spread to other areas at

Boje and Irruan, leaving behind unquantifiable destruction of valuable forest resources including protected wildlife, forest products, water sources and farm crops. [AMWS, newsletter, vol.1 no.4]

Another dangerous trend in recent times is the incidence of fish and water poisoning and the use of dangerous chemicals [known in local parlance as 'arata bomb'] to hunt cane-rats, porcupine, duikers, bush babies and squirrels.

Avifauna

Obudu Plateau, a western extension of the Bamenda highlands in Cameroon, represents the best example of montane fauna and flora in Nigeria. The plateau is frequently shrouded in cool mist which accounts for the profusion of epiphytic orchids, mosses and ferns which enrobe the trees and climbers this special environment harbors about 60 species of birds found nowhere else in Nigeria [Dyer, 1996].

In December 2007, the Wildlife Conservation Society [WCS] discovered the second major Barn Swallow roost in Cross River State, at Butatong, a village close to the Cross River National Park [Okwangwo Division]. The first was at Ebbaken-Boje, a small village close to the Afi Mountain Wildlife Sanctuary and only about 20km from Butatong.

The European Barn Swallow *Hirundo rustica* is a migratory bird from Europe and parts of Asia that flies thousands of kilometers southward to spend the northern winter [during the non-breeding season] in sub- Saharan Africa, stopping and resting in Boki en route to South Africa. It is identified by its red throat and forehead, black breast band and deeply forked tail. Its normal average body weight is 20 grams, but by the time it reaches Nigeria it only weighs about half its normal weight. Many Palearctic migrants like Barn Swallow leave their breeding grounds in Europe and Asia and fly long distances to their wintering grounds in Africa to avoid harsh climatic conditions and often drastic changes in their food resources during the cold, freezing winter back 'home' and return after conditions improve. Wintering grounds of Palearctic migrants have high conservation importance because they are critical to the survival of the species. Some Palearctic migrants like the Barn Swallow congregate over small areas where they winter and are therefore vulnerable to any adversity.

The Boje roost is estimated to hold about two million Barn Swallow, and as many as four million birds in 2005/2006 (Plate 24). It is reputed to be the largest in Africa. The discovery of the Boje roost generated a lot of international and local interest that resulted in the launching of a project to protect the roost and its birds as well as help the local people develop alternative protein sources to reduce hunting pressure on the swallows. As it is now, as many as 200,000 Swallows may be killed annually for food at Boje [AMWS, Newsletter vol.1 no.4; 13-14].

Plate 24: Swallow Birds Roost on Oil Palm trees

Plate 25: entrance to the Cross River National park

4.9.13 Calabar – Oban-Nko axis

The inventory of invertebrate fauna was diverse and consisted of forest dwelling Species dominated by ants, beetles and millipedes. Many genera and species of Arthropods were recorded. Ants, flies, butterflies and grasshoppers were a common Feature within the study area. Some species of bugs, dragon flies and damselflies were also encountered. The mollusca fauna was represented by the presence of the giant African land snail, *Archachatina marginata suturalis* and the garden snail, *Limicolaria aurora.* Freshwater periwinkle, *Tympanotonus fuscatus* were also predominant in the study area.

Most of the mammals are crepuscular, feeding in the early hours of the day or just before dusk. Rodents and pottos dominated the mammalian class. Forest dwelling species in the swamp area and, seed and insect-eating species in the developed area dominates the avifauna of the study area. The bird species recorded by sighting, nests observation, interviews with hunters and call sounds include the white egrets, kites, swallows owls and hawks. Different species of reptiles and amphibians were also noticed. Prominent among these were *Agama agama* (common lizards), monitor lizards, Gecko, frogs and Snakes. The pelican, petrel and albatross are migratory birds as their abundance mainly depends on movement of fishes.

According to the hunters, most of the large animals are cryptophagus and nocturnal. The most common genera of mammals existing in abundance in the area of study are the rodents which are as well a ready source of protein and income to the artisanal hunters hence, the tendency of being easily exploited. The hides and skins of the bigger mammals such as the Antelopes are used in making talking drum and foot wears.

However, this wildlife constitutes a problem to the cultivated farmlands. The squirrel and porcupine cause severe damage to the economic crops, while seed eating birds do reduce maize yield in a farm. Taboos in the areas also suffered a setback with the arrival of the carbide head lamps and torchlights as only the glow of animals' eyes are seen, with little or no time for the hunter to identify the animal species. Some hunters explained that even though they could identify some animals' species by the colors of their eyes, some have similar eyes colors and it is often a quick decision thus, often resulting in accidental killing of totem animals.

Another limitation is the use of wire traps. Snares and traps which are non-selective in their catches often trap juveniles, mature males and females as well as forbidden species of animals.

4.9.14 Forbidden animals in the study area

Eleven animal species were mentioned as forbidden, either for reasons of culture, taboo, religion personal dislike or on health grounds. These include; Python, Leopard, yellow backed Duiker, Alligator, Boar, Elephant, Monkey, Snail, tortoise, Lynx, Red backed- Duiker and the Bush baby.

Common names	Scientific names	Conservation status	Abhorring Communities
Leopard	*Panthera pardus*	Near threatened	All Ejagham speaking areas
Yellow backed Duiker	*Cephalophus sylvicator*	Threatened	Oban, Ogoja, Mfamosing
Alligator	*Crocodylus suchus*	Near threatened	
Wild Boar	*Sus scrofa*	Least concerned	Personal grounds
Elephant	*Luxodonta africana*	Endangered	Throuhgout Cross River state
Mona Monkey	*Cercopithecus mona*	Endangered	Throughout Cross River State
Snail	*Achatina marginata*	Least concerned	Personal grounds

Tortoise	*Geochelone Elegans*	Least concerned	Boki
Lynx	*Lynx pardinus*		All Ejagham speaking areas
Red backed Duiker	*Cephalophus rufilatus*	Threathened	Oban, mfamosing, Ogoja
Bush baby	*Otelemur crassicardatus*		Throughout Cross river state
Python	*Python sabae*	Least concerned	Personal grounds
Cross river Gorilla	*Gorilla gorilla dielhi*	Critically endangered	Throughout the state

i. Leopard (*Panthera pardus*)

The animal is regarded as a symbol of Mgbe, the deity of Ejagham tribe. It is therefore forbidden to hunt it. Any hunter who kills a leopard by accident would abandon his hunting expedition for the day. The animal will be taken home with its face covered for fear of the women seeing its face. It will be taken to the Mgbe hall where the animal will be butchered and the bile publicly removed and buried. The skin would be kept and used for chieftaincy coronation and the meat shared among households. The hunter is not allowed to sell the meat.

***ii.* Yellow-backed Duiker (*Cephalophus sylvicator*)**

This species is of significant value to the Ejagham people. It is used for re-naming ceremonies. The Ejaghams believe that if a child was not given the right name, he or she will fall sick frequently until a new naming ceremony is to be performed, the skin and meat is used as a sacrifice.

***iii.* Python** *(Python sabae)*

The Ejaghams uphold a traditional taboo that forbids the killing of python. The reason is that the bile of the python is extremely poisonous. Thus, any hunter that kills the python will have to sacrifice a goat. In addition, the python is brought to the village square where the bile is removed in the presence of the villagers and destroyed in order to be sure that no one would have access to it for negative use.

iv. Red-flanked Duiker (*Cephalophus rufilatus*)

This species is used when the son of a deceased person cannot afford domestic animals for burial. He would be required to present the species for rituals.

v. Elephant (*Luxodonta africana*)

Some households within the community forbid their pregnant women from eating elephant meat because they believe that any pregnant woman who does would deliver a baby which looks like an elephant.

Rare and Protected Animal Species

Animals that are labeled "rare", "threatened" or "endangered" are protected by law. Most nations have promulgated laws that protect conservation -reliant species which for example, forbids hunting, restricts land development or creating perseveres. Some animal species are protected from hunting, poaching and trading because their numbers are small and the produce no surplus harvest. For example, the Gorilla (*Gorilla gorilla)*, has a gestation period of nine months and nurses its young ones for over six years. A loss of a mother or a baby therefore is critical to the already depleted population of these species.

Nigeria is a signatory to international laws and a member of bodies such as CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) which discourages illegal trans - border trades on endangered animal and plant products such as Ivory of Elephants, hides of yellow Antelopes etc.

The Cross River State National Park was created in 1988 to provide a safe haven for endangered species found in the State. The Park is located in Cross River State, Nigeria. There are two sections, Okwango, established in 1991, and Oban established in 1988. The park has a total land mass of 4,000km^2, most of it consisting of primary moist tropical rain forest in the north and central parts, with mangrove swamps in the coastal zones. It has been listed a biodiversity hotspot, only second to the Amazon Basin forest in the world. The park has the oldest rainforest in Africa. The park is home to sixteen endangered species of primates which include the chimpanzees, drills and (in Okwango) Cross River Gorillas although another primate, the gray-cheek mangabeys seem to have gone extinction in the area.

The division is mostly covered with lowland rainforest. Typical tree species include *Berlinia confusa*, *Coula edulis*, *Hannoa klaineana*, *Klainedoxa gabonensis*, African mahoganey and red ironwood. About 1,568 plant species have been identified, of which 77 are endemic to Nigeria. These include 1,303 flowering plants, 141 lichens and 56 moss species. Torben Larsen collected almost 600 species of butterfly in the Oban division in 1995, and estimated that there may be 950 species in total in the division.

Although the park has been poorly explored, over 350 bird species have been recorded. It is one of the two parts of Nigeria where Xavier's greenbul is found. Other species unusual in Nigeria include bat hawk, Cassin's hawk-eagle, crested guineafowl, grey-throated rail, olive long-tailed cuckoo, bare-cheeked trogon, lyre-tailed honeyguide, green-backed bulbul, grey-throated tit-flycatcher and Rachel's malimbe. 42 species of snake have been counted. There are at least 75 mammal species, including the African buffalo, the endangered African forest elephants, common chimpanzee, Preuss's red colobus and Sclater's guenon and the highly endangered drill.

Both division of the park are threatened by illegal logging, slash and burn farming and poaching.

4.9.15 Soil fauna

The contributions of the soil microfauna (protozoa and nematodes) to the rhizosphere ecological functions cannot be underplayed. The microfauna in the rhizosphere play an important role in the release of nutrients available to plants, accumulation and stabilization of soil organic carbon, hormonal effects on roots and microbial diversity and functional stability, multi trophic interactions above the ground and bioremediation of contaminated soils. The abundance of termites, crickets and earthworms in the study area is clearly visible by the numbers of tiny burrows and pore spaces present near creeks and water logged areas. Termite mounds are also most occurring although they are easily preyed on by hermit crabs, where soil textures are very soft. The cricket mounds can easily be mistaken for fresh agricultural grounds. These mounds occur at an average of 6mounds/10m^2.

Other predominant soil microfauna include; spiders, soldier ants, earthworms, beetles and beetle larva. Most of these microfauna feed on decaying plant material and debris although centipedes, soldier ants and larger species of spiders feed on other soil microfauna. However, the larger members of this fauna group such as the ground squirrel and wild rabbit help to produce good soil structure through their burrowing and casting.

4.9.16: Macro fauna

The abundance of termites and ants are clearly visible by the numbers of termites and ant hills. Some of the termites' hills are over a meter tall. Crickets' mounds appear occasionally where soil texture is very soft. These mounds could be mistaken as nearly cultivated agricultural sites. The crickets' mounds occur at average of a mound per quadrat. Other macro faunal organisms present are; spiders, slugs, soldier ants beetles and caterpillars. These animals burrow into the soil thereby aiding soil aeration and drainage. In addition, some organic materials pass through these burrows. Most macro fauna consume decaying plants materials and organic debris but centipedes, soldier ants and spiders mainly feed on micro faunal organisms.

4.9.16. Macro fauna biodiversity

Seven species of termites where found in the grasslands. Their total abundance was 584m^2 while biomass was at 1.6gm^{-2}. The dominant trophic group was the soil feeders, mastotermes, (560m^2 and 1.4 gm^{-2}) although the wood feeders, nasutitermes, (24m^2 and 0.2gm^{-2}) were not properly estimated due to their arboreal nature of nesting. Only three of the seven species of the soil feeders constructed epigeal nests (mounds).

Plate 26: Showing Termite hill in study area

The abundance of Tse Tse fly (*Glossina morsitans)* in the study area explains the reason for the neglect of the derived (Hursey and Slingenbergh (1991) savannah area in livestock rearing and development. These biting flies are the vectors of the disease Trypanosomiasis which is fatal to man and grazing herds. The Tse Tse fly lives in the trees and shrub covers.

Table 4.26: Wildlife diversity and Relative abundance

ANIMALS	N_1	P_1	LNP_1	$-(P_1*LNP_1)$	% DISTRIBUTION
PORCUPINE	235	0.117	-2.145	0.251	11.20
SWALLOW	487	0.231	-1.147	0.265	23.13
FRUIT BAT	35	0.017	-4.074	0.069	1.70
KITES	87	0.088	-2.430	0.211	8.90

GRASS CUTTER	385	0.182	-1.704	0.301	18.23
MONKEYS	265	0.125	-2.080	0.260	12.60
DEER	116	0.055	-2.900	0.990	5.51
DUIKER	74	0.035	-3.352	0.180	3.52
BUSH PIGS	20	0.0010	-4.711	0.042	1.00
HAWKS	301	0.142	-1.952	0.280	14.30
TOTAL	2105	1		2.83	100

H=2.83 Source: PGM fieldwork 2015

Where H is $=\sum-(p_1.\ln p_1)$

Where p is proportion of individual species

n is number of individual in the proportion

Relative abundance of porcupines

$H^1= -\ln n_1/N$

Where n_1 = the number of individuals in species

S = total numbers of ll individuals

H^1 = the relative abundance of each species

= ln 235/2105

= - 2.192

Table 4.27: Checklist of wildlife in the study area

COMMON NAMES	NATIVE NAMES	IDENTIFICATION	CONSERVATION
GREY DOVE	*Ibiom (efik)*	Sighted/ sound/ habitat	Common
KITE	*-akwukwo ino (efik)*	Sighted/sound	Common
HAWK	*Akwukwo ino (efik)*	Sighted/sound	Common
EAGLE	*Nturu ukpum (efik)*	Nest / feathers	Rare
GORILLA	*Nyuk (ejagham)*	Sighted/ sound/droppings	Common
PIGEON	*Mbumunkuku(Efik)*	Sighted/nest	Common
LION	*Mgbe (ejagham)*	Hunters report	rare
CROCODILE	*Nyip (ejagham)*	Sighted	Common
OWL	*Nkurikut (efik)*	Nest	Common
DEER	*Nsun (ejagham)*	Hunters report	Common
CANE MOUSE	*Eku (efik)*	Sighted	Very common
SQUIRREL	*Adua (Efik)*	Sighted	Very common

COMMON NAMES	NATIVE NAMES	IDENTIFICATION	CONSERVATION
SHREW	*Usine (efik)*	Sighted/nest/smell	Very common
GRASSCUTTER	*Mmoniyan (ejagham)*	Sighted/nest	Very common
YELLOW ANTELOPE	*Ngu (ejagham)*	Hunters report	Common
MONKEY	*Msum (ejagham)*	Sound/hunters report	Common
PIGMY HIPPOPOTAMUS	*Ekpri isantim (Efik)*	Hunters report/ foot print	Common
BUSH PIGS	*Ngumi (Ejagham)*	Hunters report	Common
ELEPHANT	*Nche (ejagham)*	Hunters report	Not common
SKUNK	*Ogbeh (ejagham)*	Sighted	Common
WARTHOG	*Ngumi (ejagham)*	Hunters report	Common
PORCUPINE	*Nyob (Ejagham)*	Hunters report	Common
CIVET	*Nki (ejagham)*	Hunters report	Common
LEOPARD	*Mgbe (ejagham)*	Hunters report	Rare
TORTOISE	*Nkwoi (ejagham)*	Sighted/ nest	Common
TURTLE	*Nkwoi ayip (Ejagham)*	Eggs	Common
MONITOR LIZARD	*Erung (ejagham)*	Eggs	Common
CROCODILE	*Ofiom (efik)*	Foot prints	Common
AGAMA LIZARD	*Ekpok (efik)*	Sighted	Very common
SNAKE LIZARD	*Edeindin (Efik)*	Sighted	Common
ALLIGATOR	*Nyip (Ejagham)*	Nest	Common
COBRA	*Nyoyog (Ejagham)*	Hunters report	Common
VIPER	*Ofoh (ejagham)*	Hunters report	Common
PARROT	*Inim (ejagham)*	Sighted	Common
TERMITES	*Okung (ejagham)*	Sighted	Very common
CRICKETS	*Idiang (efik)*	Sighted	Very common
SOLDIER ANT	*Osiang (ejagham)*	Sighted	Very common
SUGAR ANTS	*Nnuene akwa (efik)*	Sighted	Very common
EARTH WORM	*Utung (efik)*	Sighted	Very common
GIANT MANTIS	*Atikorikor (efik)*	Sighted	Very common
DRAGON FLY	*Atat ukpa (efik)*	Sighted	Very common
BUSH FOWL	*Assasa (efik)*	Tracks / eggs	Common

Source: PGM FIELD WORK 2015/ IUCN

4.9.16 Aquatic Biology

4.9.16.1 Planktons

The plankton community is a mixed group of tiny plants and animals floating, drifting, or feebly swimming water mass. The plant planktons compose the phytoplankton and the animal planktons which are the zooplankton. As primary producers, the phytoplankton are at the base of all biological production, through the process of primary photosynthetic productivity.

The phytoplankton of an aquatic ecosystem is central to its normal functioning. While they constitute the starting point of energy transfer, they are highly sensitive to allochthonously imposed changes in the environment (Khattak et al, 2005). Thus, the species composition, biomass, relative abundance and temporal distribution of this aquatic biota are an expression of the environmental health or biological integrity of a particular water body. These estuaries have been described as one of the richest inland fisheries resources in Nigeria, contributing one of the highest quotas of fish production (Moses, 2000) and that 90% of Nigeria's total marine/ brackish output comes from this study area. Moses (1999) had earlier reported that this estuary is Nigeria's richest source of shrimp fishery, producing the world's best quality of shrimps. However, although the estuary has been noted for rich aquatic biodiversity, (Moses 1999, Asuquo et al, 1998), little documented information exists by the way of baseline data on algal communities, which are essential tools in the assessment of the biological integrity of the area.

Phytoplankton and zooplankton composite samples were collected by dragging 55 μm plankton net on the surface of the water body for 5-10 minutes attached to a slow moving boat. Plankton filtered from such catch was washed into 1.5litre polyethylene bottles and were fixed immediately with 4 drops of 5% hexamine buffered formalin to preserve these organisms. (Parsons et al, 1984)

4.9.16.2 Planktons of the Cross River estuaries

Studies on the species composition, relative abundance, spatial distribution and diversity of phytoplankton assemblages in the Calabar river estuaries were carried out in the wet and dry season across all sampling stations. A total of 85 species of 34 genera, belonging to 5 families were observed. Bacilliarophyceae (diatom) was the most abundant phytoplankton family, constituting 64.5% of algal density, followed by chlorophyceae (Green algae) with 19.84%, cyanobacteria (Blue-green algae) with 13.69% while Euglenophyceae (Green flagellates) and Dinophyceae (Dinoflagellates) recorded 0.88% and 1.09% respectively, of total plankton abundance for the wet season.

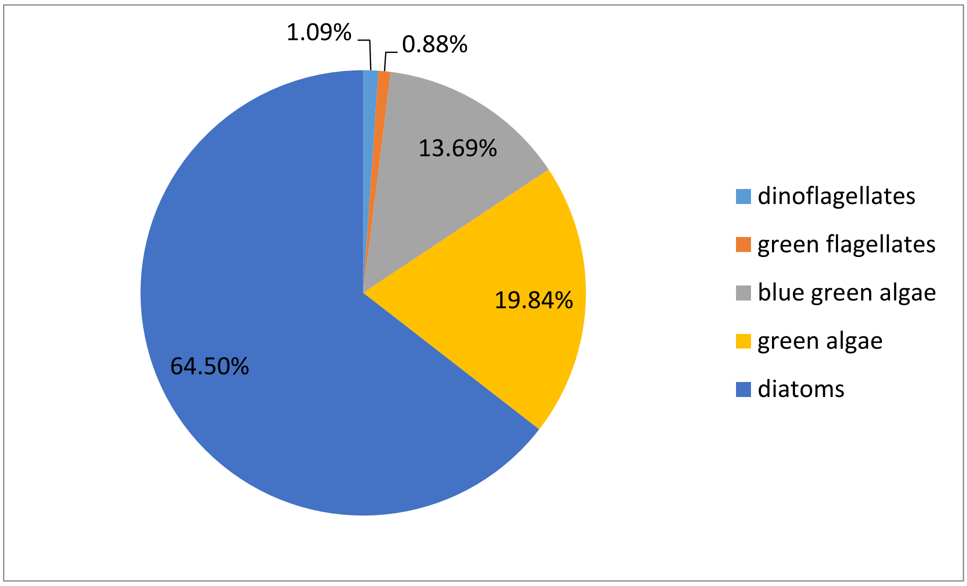

Figure 4.4: Percentage Abundance of Phytoplankton in the Study Area (Wet Season)

In the dry season, Phytoplankton studies showed the following results; diatoms 50% (centrales 38.5% 15 species , pennales-11.5% - 8 species) as the dominant group followed by the blue green algae 22%(8 species), dinoflagellates 10% (4 species), and green flagellates 18%(9 species) see Figure 4.4 to 4.5. This is as a result in reduction in water as well as oxygen volume in the water bodies. In all 34 species recorded at the 15 stations studied. Total number of species recorded per station ranged 14-23. The key species in terms of abundance were *Aulacoseira granulate* Ehrenberg (Ralfs) and *Aulacoseira granulate var.angstissma* Muller.

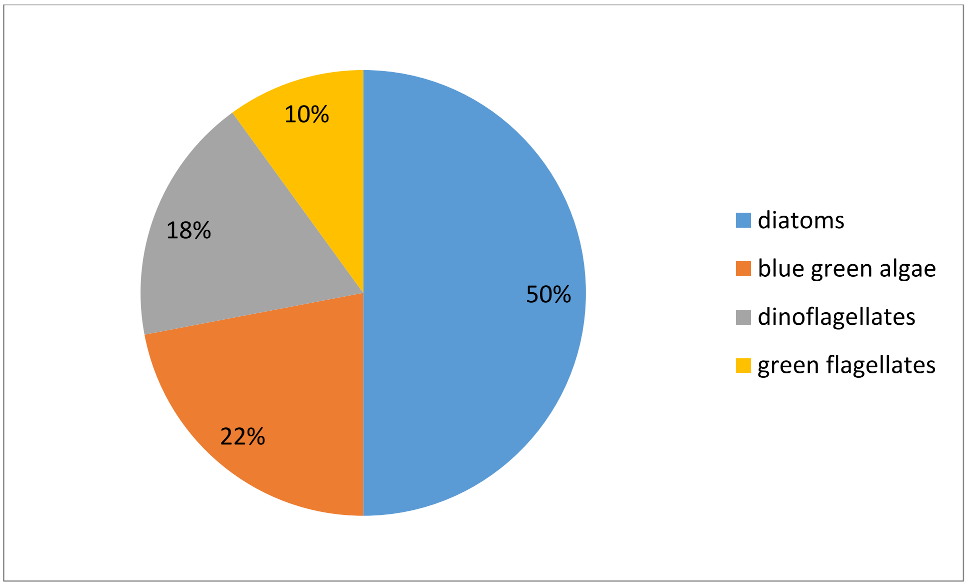

Figure 4.4: Percentage Abundance of Phytoplankton in the Study Area (Dry Season)

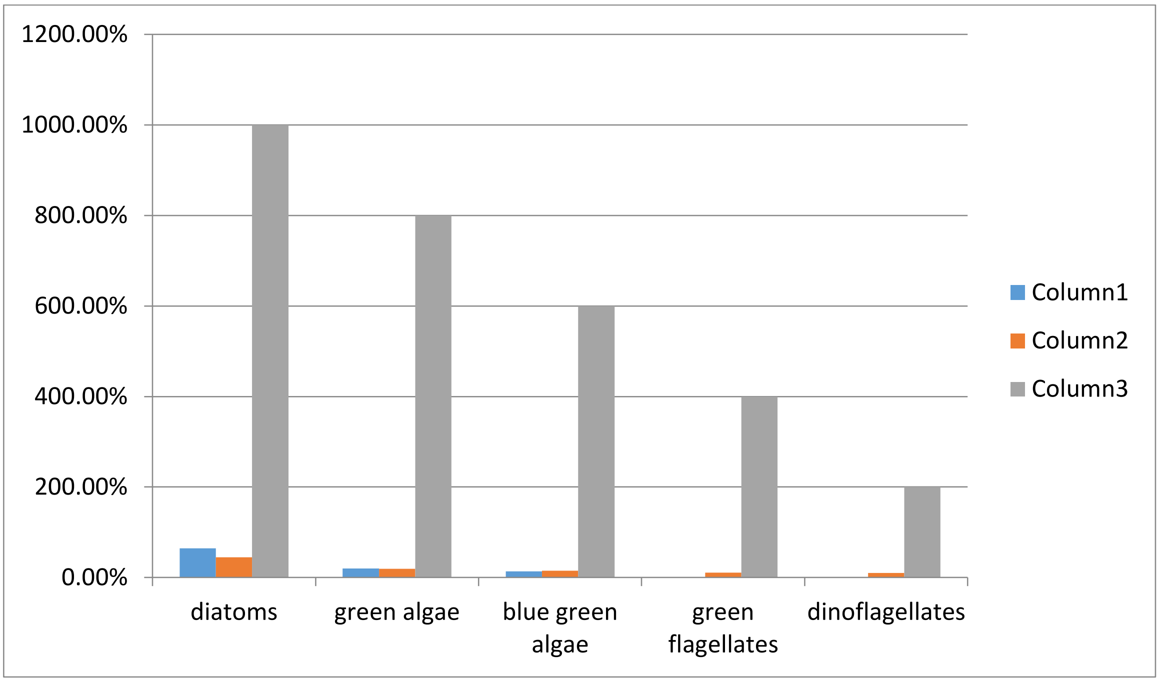

Figure 4.5: Spatial Distribution of Phytoplankton Communities in the Cross River Estuaries (Wet Season)

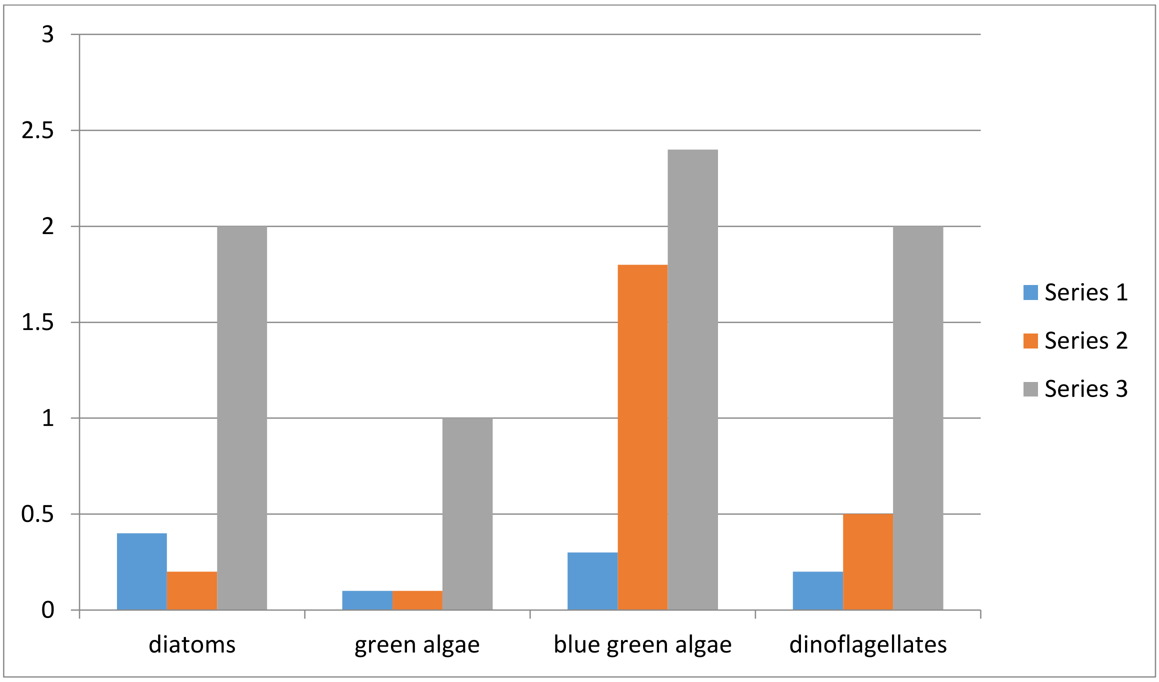

Figure 4.6: Spatial Distribution of Phytoplankton Communities in Cross River estuaries (Dry Season)

4.9.16.3 Zooplanktons

The zooplankton community of the surface water within the Ikot Eneobong, Ikot Omin areas was mainly arthropods and rotifers. A total of 18 species/forms were recorded at the 15 stations studied in the dry season. Species diversity ranged from 1.00 to 1.20 for juvenile stages while zooplankton abundance ranged between 1.20 and 1.60. *Diaptomus sp and Nauplii larva* of Copepods were the key species found in terms of occurrence and abundance. Bivalve larva represented the juvenile forms in this regard.

The arthropods were made up of cladocera, Conchostraca, Ostracoda and Copepoda. *Bosmina longirostris* and *Bosminopsis dietersi* were prevalent among the cladocerans. The Ostracoda was represented by *Parastenocypris sp, Stenocypris sp* and *Cypridopsis*. The *Cyclopoids* were dominant among the copepods. The Rotifera were represented by five families and eleven species dominated by members of the family Brachionidae. (*Brachionus fulcatus, Brachionus tripos, Keratella tropica, Ceptialodella, Tricocerca, Kelicotia, Lepadella ovalis, Lecane lutia, Anuraeopsis fissa).* The Rotifers recorded 48.5%, juvenile stages had 23.1% and copepods had 28.4%. The juvenile stages were represented by seven forms namely: copepod eggs, Rotiferan egg, and Bivalve larva, Megalop larva of barnacle, Nauplil larva of Copepods and Zoea larva.

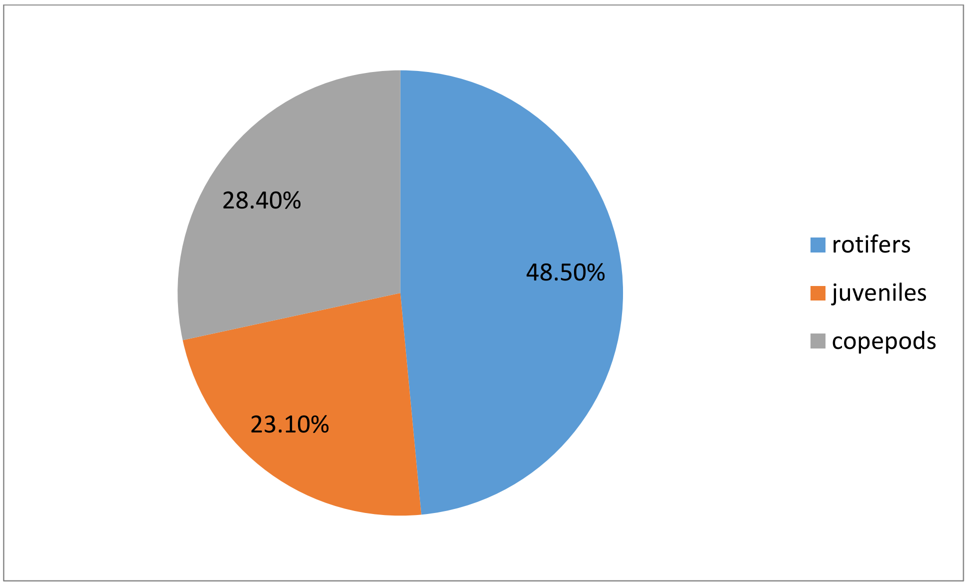

Figure 4.7: Percentage Distributions of Zooplanktons Phylum and Juvenile Stages in Study Area (wet season)

In the dry season, the same three groups recorded as crustaceans 50% (Calanoid copepods,4 species,-25%, cyclopoida,2 species- 12.5% and cladocerans, 2 species 12.5%), juvenile stages recorded 37.5% and rotifers recorded 12.5%(2species). This juvenile stages were represented by six forms namely: megalop larva of barnacle, nauplii larva of copepods, bivalve larva, gastropod larva,zoea larva. A total of 15 species /forms were recorded at the 15 stations studied in the dry seasons. Total number of species recorded per station ranged from 5-12. *Acartia clausii, Giesbrecht, Cyclops strenus Fisher, and Diaphnia* *sp*.were the key species recorded in terms of occurrence and abundance. Nauplii larva of copepods and bivalves larva represented the juvenile forms in this regard

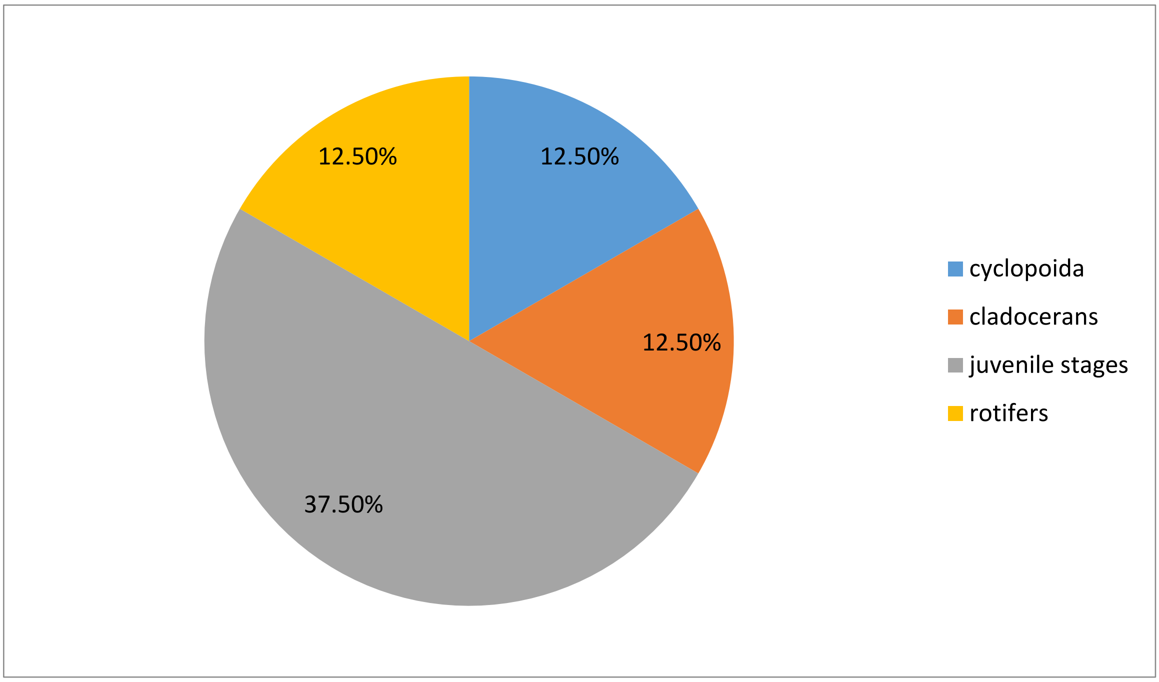

Figure 4.8: Percentage Distribution of Zooplanktons Phylum and Juvenile Stages in Study Area (Dry Season) Source: PGM Fieldwork 2015

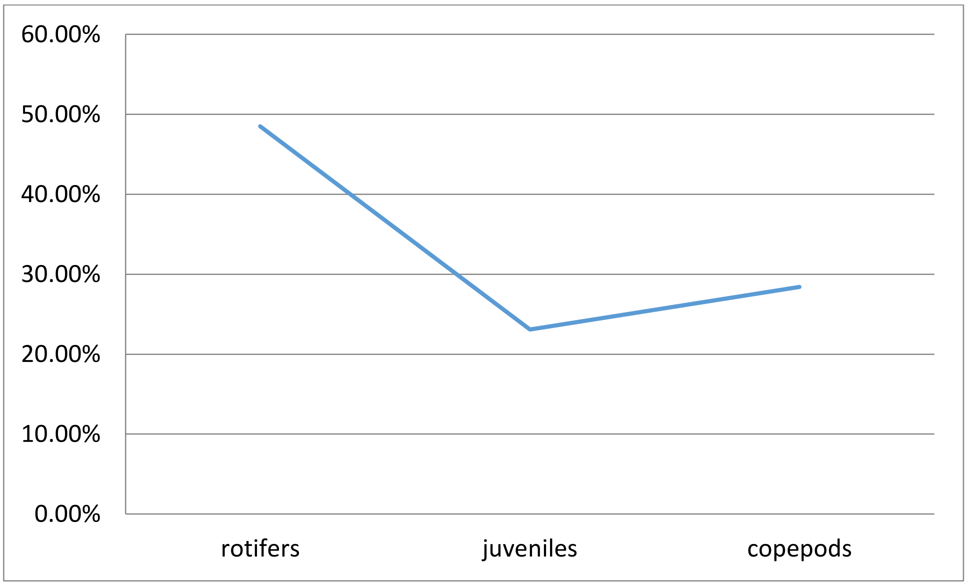

Figure 4.9: Spatial Distributions of Zooplanktons Phylum and Juvenile in the Cross River Estuary Source: PGM Fieldwork 2015

4.9.16.4 Benthic Fauna

Macro benthic samples were collected at each sampling station in the study area. A 0.1 m^2 grab was lowered from an anchored boat into the bottom of the Calabar River. One hundred and fifty nine (159) species were identified in the study areas in the wet season. A result of the benthic macrofauna analysis indicates that a total number of 10 taxa were identified in the samples. The fauna include members from the group molluscs (gastropods and bivalves), arthropods and polychates. *Pachymelina aurita and Macoma Cumana* formed bulk of the species abundance.

Percentage abundance by major taxonomic key showed that 34%of the benthic composition was gastropods, while bivalves recorded the highest percentage of 56% and the arthropods and annelids represent 10%. *Pachymelina aurita recorded* the highest number of occurrence during the wet season sampling while *Nereis lamellose* recorded the lowest number of occurrence. The presence of *polychaetes Nereis s*pp. within the study area indicates a high level of organic enrichment.

The benthic macrofauna of the study area is numerically dominated by the gastropods species. It is predominantly in all stations. The anthropogenic inputs may have contributed immensely to the low diversity of the benthic macrofauna of the study areas.

Shellfish such as oysters (*Crassostrea sp.)* are exploited as the increase in salinity level permits their settlement on the mangrove proproots. However, their abundance was low. Periwinkles are also exploited by hand picking. The distribution *Littorina litorea* species of periwinkles is usually clustered but on the average counts ranging between 20 and 1000m3 was obtained for wet season period and 120-1300m3 for dry season. The low abundance of periwinkles could be attributed to higher flood level during the wet season and also the intense exploitation of over the years by the host communities.

4.9.16.5 Fish

The abundance of fish across two seasons (dry and wet) was determined through fish catch surveys. Fish from the study site were sampled using gill nets (mesh size: 9 inches length: 6m), cast nets (mesh size: 9 inches), hook (size: 2inches and lines by the local fishermen. The fish species were identified to the taxonomic level using Idodo-Umeh (2003) and species were counted for number of individuals. The fish species were identified, sorted and frequency of occurrence were recorded in-situ. Further identification was completed in the laboratory using FAO literature (1988, 1994). A total of thirty one (31) countable individuals were recorded from 8 families during the wet season survey (see Tables 4.28 and 4.29). These include families Clupeidae, Cichlidae, baridae, Muglidae, solidae, Elopidae and Latidae.

TABLE: 4.28 Fish Species recorded in the study area (wet season)

S/N	FAMILY	SCIENTIFIC NAME	COMMON NAME	LOCAL NAME	ABUNDANCE	% ABUNDANCE
1	Clupeidae	*Ethmalosa fimbrita*	Bonga	Ibat	1	3.0
2	Cichlidae	*Sarotherodon melanotheron*	Tilapia	Asat	2	6.0
3	Baridae	*Marine catfish*	Catfish	Inagha	8	27.0
4	Muglidae	*Mugil cephalus*	Flat mullet	Iyak ikpok	5	16.0
5	Soleidea	*Synatura iustinica*	Sole fish	Awere nwerre	3	10.0
6	Clupeidae	*Synatura lusitinica*	Sardine	Ekpai	7	22.0
7	Latidae	*Tilapia zili*	Tilapia	Akwe	2	6.0
8	Elopidae	*Elos machnata*	Rayfin	Akpan atta	3	10.0
	Total				**31**	**100**

Source: PGM FIELD WORK 2015/ IUCN

A total of thirty four (34) countable individuals were observed from 10 families during the dry sampling period as shown in the table below.

Table 4:27 Fish species recorded in the study area (dry season)

S/N	FAMILY	SCIENTIFIC NAME	COMMON NAME	LOCAL NAME	ABUNDANCE	% ABUNDANCE
1.	Clupeidae	*Ethmalosa fimbriata*	Bonga	Ibat	3	8.8
2.	Cichlidae	*Sarotherodon melanotheron*	Tilapia	Asat	2	5.8
3.	Drepanidae	*Drepane africana*	Spadefish	_	4	11.6
4.	Sciaenidae	*Sciaenops ocellatus*	Croaker	Abat	2	5.8
5.	Polynemidae		Threadfin	Edeng	1	3..1
6.	Aridae	*Arius heudeloti*		_	3	8.8
7.	Baridae	*Chrysichtys nigrodigitatus*	Catfish	Inagha	8	23.4
8/	Elopidae	*Elops lacerta*	Rayfin	Akpa atta	1	3.1

9	Clupeidae	*Sardinella madernsis*	Sardine	Ekpai	9	26.1
10.	Cichlidae	*Tilapia zilli*	Tilapia	Akwe	1	3.1
	TOTAL				**34**	**100%**

Source: PGM FIELD WORK 2015/ IUCN

- ***Fish Stock Assessment***

To establish the present state of the fish stock information on the most prevalent commercial species caught in the area is pertinent. The most dominant and prevalent species fished during the survey were Sardine *(Sardinella madernsis),* Spadefish *(Drepane Africana)* and Catfish (*Chrysichthys nigrodigitatus)* as presented in Table 4.28.

Table 4.28 Indices of Preponderance (IP) Indicating the dominant species caught in the River.

S/N	SPECIES	INDEX OF PREPONDERANCE (IP)
1	*Drepane Africana*	20.5
2	*Arius heudeloti*	1.62
3	*Parachana Spp*	0.05
4	*Sardinella madernsis*	40.27
5	*Chrysichthys nigrodigitatus*	9.22
6	*Liza Spp*	1.69
7	*Sciaenops ocellatus*	1.92

Source: CRSG EIA (PGM Fieldwork) 2015

The percentage composition of the catch by weight gives the indices of preponderance (IP), which indicate the degree of effective contribution of each species to the overall catch in the area during the study period. Index of preponderance is a weighted assessment involving both number are biomass of fish caught in the area. The fishing communities along the proposed road project are Ikang (Akpabuyo), Esighi (Bakassi), Atimaka (Ikom), Loekpei (Yakurr)

4.9.16.6 Aquatic Macrophytes

These include aquatic plants that are large enough to be apparent to the naked eyes. They grow in or near water and could be emergent, submergent or floating. Aquatic macrophytes were observed on the water body and swamp close to the proposed Road Project site. The species of aquatic macrophytes identified is presented in Table 4.29 *Nymphaea lotus* (rooted aquatic macrophyte with floating leaves) was common during the wet season. Among the free floating macrophytes were *Vossia cuspidata, Pistia* *stratiotes, Ceratophyllum demersum* and *Salvinia molesta.* The macrophytes observed on the bank included *Dissotis erecta, D. rotundifolia, Acroceras sp., Aeschynomene indica, Commelina sp* and *Cyrtospermum senegalense.* These macrophytes are not halophytes, thus indicating that the salinity level in the water around the study areas is very low.

Table 4.29: Aquatic macrophytes on water body and swamp in the Study Area

S/N	Scientific Name	Common Name	Family	Habitat
1.	*Acroceras sp*		Poaceae	Bank type
2.	*Aeschynomene indica*	Indian jointvetch	Fabaceae	Bank type
3.	*Ceratophyllum demersum*	Certophyllum	Ceratophyllaceae	Free floating
4.	*Commelina sp*	Commelina	Commelinaceae	Bank type
5.	*Cyrtospermia senegalense*	Swamp arum	Araceae	Swamp type
6.	*Dissotis erecta*		Melastomataceae	Bank type
7.	*Dissotis rotundifolia*		Melastomataceae	Bank type
8.	*Nymphae lotus*	Water lily	Nymphaeaceae	Floating leaf type
9.	*Pistia stratiotes*	Water lettuce	Araceae	Free floating
10.	*Salvinia molesta*	Salivinia	Salvinaceae	Free floating
11.	*Vossia cuspidata*	Hippo grass	Poaceae	Free floating/Bank type

Source: PGM FIELD WORK 2015/ IUCN

A decline in a macrophyte population may indicate water quality problems. Such problems may be the result of excess turbidity, herbicides, or Salinization. Controversy, overly high nutrient levels may create an overabundance of macrophytes which may in turn interfere with water body processing. The macrophyte population was good indicating that the water body may not have excessive turbidity, herbicides or Stalinization as well as not having high nutrient levels.

A number of fishing gears are used by the artisanal fishing fleet, including nets (most common in the Bakassi area) and hook and line (not so common in the Bakassi area). For marine fishing there is abundant beach seining, which can require 30-50 people to bring in the net depending on the catch. Other gears taken out to sea are mainly set gillnets and cast nets. In the estuaries hooks and traps are also used as well as nets and fishing vessels observed during the survey were mainly propelled by human paddling or poling although some had small outboard motors.

The fuel for the boat engine is usually bought from filling stations at Calabar and there is currently no subsidy for this. Another point of note specific to the artisanal fishing communities of the Bakassi area, and South South Nigeria, is that they include a lot of migratory fishermen from other, neighbouring countries. At the fishermen focus group conducted for Esigi community, for example, most fishermen present reported to be from Cameroun originally and no indigenous fishermen were part of the group. Despite claiming to be from Cameroun originally, however, they have mixed with the local people, due to the fact that they marry into local communities.

4.10 Socio-economic

Introduction

The socio-economic survey collated baseline socio-cultural, economic and infrastructure indices of the study areas, while the consultation process elicited responses on stakeholders concern and expectations from the proposed project.

Purposive sampling procedure was utilized to select individuals/groups that were sampled for the survey. In-depth interview session, Focus Group Discussion (FGD) sessions and participatory random walk activities were the primary data collection sources. Relevant published documents acted as secondary data collection sources and collated data were analyzed using descriptive statistics.

i. The objectives of socio-economic study in this EIA include;

To identify the aspects of the demographic, social, cultural and economic environment may be impacted, positively or negatively, by the proposed project activities both on the short, medium and long run.

To establish and gather baseline data on these aspects with a view to making such available for respective planning, management and development of proposed field activities; and

To recommend appropriate mitigation measures in consonant with the observed attitude, perception and behaviour of the stakeholders.

ii. Scope of Study

The study was conducted in twenty one communities in twelve LGAs of Cross River State. The study covered the socio-cultural resources of these communities, demographic issues including population size and growth, age and sex distribution, and adult literacy. Others were such indicators of the quality of life of the residents as quality of housing, access to potable water, availability of functional infrastructural amenities, livelihood activities and patterns, and income levels. Health facilities and their patronage, disease prevalence and disease vectors, water and sanitation, and nutrition were also studied. Additionally, the study discussed the perceptions, concerns and expectations of members and residents of this community.

Stakeholder Participation

Consultation is a major feature of the socio-economic component of the EIA process for any intended project, which in this case incorporates all individuals in the communities that may be directly or indirectly affected by the proposed project. Consultations were aimed at informing relevant stakeholders about the intentions / plans of project proponent. It also attempted to record the major concerns and views of all stakeholders and helps to minimise potential conflicts that could arise during project implementation.

Consultations, discussions and interviews (including questionnaire administration) were held with various stakeholders in the communities. A schedule of the FGDs, community meetings and key informant interviews is presented in **Table 4.30**, while evidences of such meetings and discussions are presented in the **Appendix** (Attendance)**.**

Table 4.30: Schedule of Meetings and Interviews.

Communities Met	Date	Issues Discussed
Ikot Eneobong	16/06/2015	Traditional governance, belief systems, conflict management procedures, social structures, infrastructural network, livelihoods, environmental problems and community efforts at solving them, perceptions and concerns about the proposed project, suggested mitigation and enhancement measures, community, needs and development prospects.
Ikot Omin	17/06/2014	Developmental roles of women and the youth, conflict management procedures, infrastructural network, livelihoods, income levels and expenditure patterns, employment situations in households, teenage pregnancy in the community, perceptions and concerns about the proposed project, community, needs and development prospects.
Ikot Effanga	18/06/2015	Overview of the project and the EIA study, facilities in the school and students' performance, effects of the State government education policy on the school and students, school dropout/teenage pregnancy and youth, empowerment, adequacy of facilities and staff in the school

Table 4.30: Schedule of Meetings and Interviews.

Communities Met	Date	Issues Discussed
Mfamosing	18/06/2015	Traditional governance, belief systems, conflict management procedures, social structures infrastructural network, livelihoods, perceptions and concerns about the proposed project, community's needs and development prospects.
Oban	19/06/2015	Traditional governance, belief systems, conflict management procedures. Livelihood activities, income levels and expenditure patterns, employment situations in households, infrastructural network, development prospects and programmes, concerns about the proposed project, suggestions on impact enhancement and mitigation measures.
Nko	20/06/2015	Livelihoods, income levels and expenditure patterns, employment situations in households. Perceptions, concerns and expectations of women about the proposed project.
Ikom	22/06/2015	Social structures, infrastructural network, livelihoods and expenditure pattern, perceptions and concerns about the proposed project, council's needs and development prospects.
Eastern Boki	22/06/2015	Traditional governance, belief systems, conflict management procedures, social structures infrastructural network, livelihoods and expenditure pattern, perceptions and concerns about the proposed project, community's needs and development prospects.
Okworotung	22/06/2015	Overview of the project and the EIA study, facilities in the school and students' performance, effects of the State government education policy on the school and students, school dropout/teenage pregnancy and youth, empowerment, adequacy of facilities and staff in the school
Obudu	23/06/2015	Traditional governance, belief systems, conflict management procedures, social structures infrastructural network, livelihoods and expenditure pattern, perceptions and concerns about the proposed project, community's needs and development prospects.
Utugwang	24/06/2015	Overview of the project and the EIA study, facilities in the school and students' performance, effects of the State government education policy on the school and students, school dropout/teenage pregnancy and youth, empowerment, adequacy of facilities and staff in the school
Obung	19/10/2015	Traditional governance, belief systems, conflict management procedures, social structures, infrastructural network, livelihoods, environmental problems and community efforts at solving them, perceptions and concerns about the proposed project, suggested mitigation and enhancement measures, community, needs and development prospects.
Okuku/Okpoma	16/10/2015	Environmental problems and community efforts at solving them, perceptions and concerns about the proposed project, suggested mitigation and enhancement measures, community, needs and development prospects.
Ikang	19/10/2015	Traditional governance, belief systems, conflict management procedures, social structures, infrastructural network, livelihoods, environmental problems and community efforts at solving them, perceptions and concerns about the proposed project, suggested mitigation and enhancement measures, community, needs and development prospects.

Table 4.30: Schedule of Meetings and Interviews.

Communities Met	Date	Issues Discussed
IkotOffiongAmbai	20/10/2015	Social structures, infrastructural network, livelihoods and expenditure pattern, perceptions and concerns about the proposed project, council's needs and development prospects.
Etayip	12/06/2015	Environmental problems and community efforts at solving them, perceptions and concerns about the proposed project, suggested mitigation and enhancement measures, community, needs and development prospects.
Ojijor	12/06/2015	Traditional governance, belief systems, conflict management procedures, social structures, infrastructural network, livelihoods, environmental problems and community efforts at solving them, perceptions and concerns about the proposed project, suggested mitigation and enhancement measures, community, needs and development prospects.
Mgbagatiti	12/06/2015	Environmental problems and community efforts at solving them, perceptions and concerns about the proposed project, suggested mitigation and enhancement measures, community, needs and development prospects.
Enoghi	12/06/2016	Social structures, infrastructural network, livelihoods and expenditure pattern, perceptions and concerns about the proposed project, council's needs and development prospects.
Bokomo	13/06/2015	Environmental problems and community efforts at solving them, perceptions and concerns about the proposed project, suggested mitigation and enhancement measures, community, needs and development prospects.
Gakem	15^{th}/02/2016	Environmental problems and community efforts at solving them, perceptions and concerns about the proposed project, suggested mitigation and enhancement measures, community, needs and development prospects.

iii. Study Design

The study design entailed determining the study population that is regarded as the host communities. It also involved making decisions as to:

- Whether to obtain information at one point or several points in time
- The methods of data collection; and
- Whether questionnaires, if used, should be self-administered, or administered face-to-face using trained interviewers.

It was decided that (a) questionnaires would be used and administered face-to-face at one point in time by trained workers; (b) discussions would be held with focus groups, drawn from occupational sub-groups; (c) key informants would be interviewed; (d) observations and measurement of key community features would be undertaken by trained assistants; and photography would be liberally employed. In effect, this study belongs to the class described as passive-observational, in the sense that subjects have been studied in situ, without any form of experimental manipulation.

iv. Target Population and Sampling Procedure

The study area is twenty one (21) communities in twelve LGAs of Cross River State. Cross River state with a population of 2,892, 988 (NPC, 2006) is basically an agrarian economy. In the baseline data survey during data gathering, the following methodologies were used:

- Focused Group Discussions
- Questionnaire administration
- Participatory Rural Appraisal Technique
- Rapid Rural Appraisal Technique

Choice of respondents (groups and individuals) for the consultation activity and interview was by purposive sampling techniques based on the perceptions of the Village Head with regard to community stakeholders who can provide relevant informed opinion on the issues at stake. A total of four hundred (400) questionnaires were administered in the communities and three hundred and eighty two (382) of the questionnaires given were collated for interpretation.

Table 4.31: Surveyed communities and their respective LGAs

SN	Surveyed Communities	LGA
1	Ikot Eneobong	Calabar Municipality
2	Ikot Omin	
3	Ikot Effanga	
4	Mfamosing	Akampka
5	Obung	
5	Oban	
6	Nko	Yakurr
7	Ojijor	Ikom
8	Mgbagatiti	
9	Enoghi	
10	Bokomo	
11	Ikom	
12	Etayip	
13	Eastern Boki	Boki
14	Okworotung	Obudu

SN	Surveyed Communities	LGA
15	Obudu	
16	Utugwang	
17	Okuku Yala	Yala
18	Okpoma	
19	Ikang	Bakassi
20	Ikot Offiong Ambai	Akpabuyo
21	Gakem	Bakwarra

v. Data Collection Methodology

This study employed both primary and secondary data sources. The later comprised government records, maps, and information published in journals and books, while the former included pre-coded questionnaires, key informants, focus groups, direct observation, direct measurement, specially prepared data collection formats and participatory research. Although the questionnaires largely contained closed-ended questions for easy recording of responses, some open-ended ones were included to allow respondents freedom in structuring their responses. This permitted the researchers to obtain clearer insights into questionnaire items.

Data collected on various socio-economic parameters from all the communities were also analyzed using different appropriate tools. Some of these analytical techniques are presented below:

Two population projection models were used, linear and exponential, using the 2006 population census figures as the base year. The linear and exponential formulae used are presented below.

(a) *Linear Extrapolation Model*

$$\boxed{P_n = P_0 + na} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Where P_0 = the base population,

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

n = time elapsed in years.

(b) *Exponential Growth Model*

$$\boxed{P_n = P_0 (1 + r)^n} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

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:

$$\frac{\text{No. of Persons Under 20 or Over 64}}{\text{No. of Persons 20-64 yrs old}} \times 100 \qquad \ldots\ldots\ldots\ldots\ldots(3)$$

The *Sex Ratio* is expressed as:

$$\frac{\text{No. of Males in Group i}}{\text{No. of Females in Group i}} \times 100 \qquad \ldots\ldots\ldots\ldots\ldots(4)$$

The questionnaire survey involved sampling households within the community using a set of questionnaire.

vi. Field Study Strategy

The field study comprised the following operations:

Reconnaissance survey and consultation with the chiefs, council members, youth, women and other opinion leaders;

i. Pre-testing of questionnaires;
ii. Household listing;
iii. Field identification of households selected for interviews;
iv. Questionnaire administration and interview of key informants;
v. Focus group discussions; and
vi. Photography

4.10.1 Demographics

i. Population Size and Growth

Cross River State covers a total of 20,156sqkm land area and shares boundaries with Benue State to the north, Enugu and Abia States to the west, to the east by Cameroon Republic and to the south by AkwaIbom and the Atlantic Ocean. The Cross River, with a catchment area of 53,590 sq. km, delivers more sediment load to the coast, than the present Niger Benue drainage system.

The population estimates for Cross River state following the 2006 national census, as published by the National Population Commission (NPC), was 2,892, 988 (1,471,967 males and 1,421,021 females). Over the years the population of the state would have grown, determined by interplay of the demographic processes of fertility, mortality and migration.

Considering these population growth determining factors, NPC estimated that the population of Nigeria grows annually at 3.2% (NDHS, 2008). At this rate of growth (and using the exponential growth model), the projected population of the affected LGAs from 2006 to 2015 is presented in **Table 4.31**.

Table 4.32: Projected population of the Affected LGAs using 2006 Census figure

Year	Affected LGAs Projected Population											
	Calabar Municipality	Akamkpa	Obubra	Ikom	Boki	Etung	Ogoja	Akpabuyo	Bakassi	Bekwarra	Biase	Odukpani
2006	179,392	151,125	196,450	162,383	186,611	19, 668	171,574	271,395	*150,000	105,822	168113	192,884
2007	185,132	155,961	202,736	167,579	192,582	20,297	176,721	279,537	154,500	108,997	173,156	198,671
2008	191,056	160,951	209,223	172,941	198,744	20,946	181,902	287,923	159,135	112,267	178, 350	204, 631
2009	197,169	166,101	215,918	178,475	205,103	21,616	187,359	296,560	163,909	115,635	183, 700	210, 769
2010	203,478	171,416	222,827	184,186	211,666	22,307	192,979	305,457	168,826	119,104	189,211	217, 092
2011	209,989	171,951	229,957	190,079	218,439	23,020	198,768	314,621	173,891	122,677	194, 887	223,605
2012	216,708	177,453	237,315	196,161	225,429	23,756	204,731	324,059	179,108	126,357	200, 734	230, 313
2013	223,642	183,131	244,909	202,438	232,642	24,516	210,872	333,781	184,481	130, 147	206, 756	237,222
2014	230,798	188,991	252,746	208,916	240,086	25,300	217,198	343,794	190,015	134, 051	212, 958	244, 339
2015	238,183	195,038	260,833	215,601	247,768	26,107	223, 713	354,107	195,715	138, 072	219,346	251, 669

ii. Household Composition, Structure and Size

The household structure of the community parallels the patriarchal leadership structure of most Nigerian ethnic groups. Men are typically the head of Nigerian households; there are overwhelming more male (93%) heads of households than female (7%) in the Niger Delta region. The three different types of male-headed household structures are traditional (one husband one spouse), polygamous, and single male (male with no spouse, including widowers and males that have never been married). Traditionally, the male is responsible for all the major household decisions.

Focus group discussions and questionnaire analysis revealed a high marital status of the respondents; approximately 82% of the respondents were married while the remainder 18% are either living separated from their spouses or widowed. As in other climes and traditions, marriage is largely determined by the economic status of the adult male. It is normal as was observed to have both male and female members still unmarried. Similarly, although a higher percentage of households were found to be headed by males, compared to the female gender, it is also not uncommon to have an admixture of some household headed by females (female-headed households) as was observed amongst those interacted with in Ikot Eneobong, Ikot Omin, Ikot Effanga communities, all in Calabar Municipality.

The typical household unit in the study area has a head and several members. In many cases the head is the father and members include his wife, children and wards. The wards are often children of relations and, in some cases, friends. These are usually fed and generally catered for from the resources of the household. Members of the household are not necessarily related biologically. The household could also be composed of members who are not related but have agreed to live together under a common household head. This latter type of household group is not common in the study area.

The analyzed questionnaires also revealed that average number of children per married woman in the community ranges from 1-9 and translates to mean household size of 7 persons per household in the study area. Although an average household size of 6 persons have long been documented for the Niger Delta Region, considerable variations are to be found among the individual states, Local Government Areas and senatorial districts. To this extent and in general terms, household sizes are large in the rural communities (8 persons per household), even though several socioeconomic surveys of some urban communities in the Niger Delta have also revealed even as large if not larger households (average size ranges from 6-14)

Larger household size is a common phenomenon in most part of rural Nigeria, which is influenced largely by the culture of polygamy. Also, in contrast to the nuclear family model prevalent in the developed world, households are often composed of grandparents, sons and their spouses, children and other relatives, all tied together by bonds of kinship to form the household economic unit. Added to this fact is the observation that rural households in Nigeria are still very much associated with fertility/fecundity (NDHS, 1999). In fact, PRB (2006) had reported that while in most countries, e.g. Vietnam, 92% of women who had had two children said they did not wish to have an more children, in Nigeria, by contrast, that figure was only 4%.

The sex ratio is the ration of males to females in a given population, usually expressed as the number of males for every 100 females. Gender statistics of the project-affected communities indicates a preponderance of males over females although the margin seems to be dropping off.

iii. Age and Sex Distribution

The proportion of children (ages 0-14-years) is about 38%, while the elderly (65 years and above) is about 3% in Cross River State. It is notable that the population of children in the state is more than a third of the total population. This makes it quite significant. The age distribution in most developing economies shows that the population of children is higher than that of any other group. According to the UNDP, this type of age distribution which is the norm in developing economies and reduces the values of both labour input and income per capita in these economies (UNDP, 2006). Apart from children and the elderly, those within 15-64 years, who make up the potential work force, constitute about 59% in the state.

The sex ratio shows the number of males in a population to every 100 females in same population. In the whole of Cross River State the population of males is higher than females. The sex ratio is 101 (1.01:1) in Cross River State. The implication of this is that there are about 101 males to every 100 females in the state.

iv. Fertility, Mortality and Life Expectancy

During FGDs in the affected communities, groups interviewed indicated that factors which enhance fertility among them include general acceptance of the marriage institution, relatively early sexual activity and marriage, and polygamy. Fertility is best measured by the Total Fertility Rate (TFR) which is an indication of the total number of children a woman is estimated to have in her reproductive life time. Existence of precise estimates of the TFR values for the state could not be ascertained and no values were available, but the National Bureau of Statistics (NBS) estimates the value for South South geo-political region is 4.6 while the national average is 5.9 (Annual Abstract of Statistics, 2006).

These values of TFR show that the rate of fertility in the South South states is lower than the national average. Another measure of fertility is the Crude Birth Rate (CBR) which the NBS estimates at about 7 per 1000 in Cross River State (The Nigerian Statistical Fact Sheets on Economic and Social Development, 2006). These rates indicate that, relatively, the region does not have high fertility.

Available mortality measures include the Neonatal Mortality Rate (NMR), Infant Mortality Rate (IMR) and Under Five Mortality Rate. The NMR, IMR and Under Five Mortality Rate for the South South states are 53 per 1000, 120 per 1000 and 176 per 1000, respectively. The national averages are NMR 48 per 1000, IMR 100 per 1000 and Under Five Mortality Rate 201 per 1000 (Annual Abstract of Statistics, 2006). The NMR and IMR indicate that there are more deaths among neonates and infants in the South South states than what obtains generally in Nigeria. However, Under Five Mortality is lower in the South South states than the average in Nigeria.

Accurate determination of birth rates and death rates for the study area is difficult due to the absence of appropriate records. However, information from questionnaire interviews and focus group discussions indicate birth rate slightly above 5%. Estimated number of deaths in the last one year was put at about 12 persons of whom more than 50% were children in most communities surveyed. Death was blamed mostly on malaria, diarrhoea and respiratory diseases amongst children below five years of age; and largely malaria, cholera, typhoid fever, piles, hypertension, hepatitis and unclassified (old-age) illnesses amongst the adults coupled with the lack of medical attention for the sick. Maternal deaths were said to be common in the communities. This is obviously due to the lack of trained midwives and maternity facilities in the Primary Health Care centre located in the study area. Similarly, data on life expectancy in the community are unavailable; however, information from focused group discussions and interviews revealed that men live above 40 years and women 45 years of age.

The World Health Organization (WHO) in its World Health Statistics 2006 estimated that life expectancy for male in Nigeria is 42 years and 47 years for women.

v. **Adult Literacy Level and Education**

The adult literacy rate determined by the proportion of population aged 15 years and above that has completed a normal course of primary education and can read and write in the English language, was obtained for Cross River State as 86.6% (NBS, 2010). Comparatively, there were slightly more illiterate females than males and nearly half (44%) of the adult population attained secondary level education. This level of literacy among household members indicates that there is a literate pool of labour that could provide useful services for the proposed project.

The adult literacy rate determined by the proportion of population aged 15 years and above that has completed a normal course of primary education and can read and write in the English language, was obtained for Cross River State from the National Bureau of Statistics (NBS 2011). The level of adult literacy in the State is 82.2%. This is slightly higher than the 78.7% adult literacy rate in the South South geo-political zone and much higher than the national rate of 57.9%.

Table 4.33 reveals the position of Cross River state within the comity of the Niger Delta states.

Table 4.33: Education Status Across Niger Delta states

STATE	Adult Literacy (%)	Attainment of Primary School (%)	Attainment of Secondary School (%)	Attainment of post secondary education (%)	No. of Jobs in Sector 2000 (Teachers)
Abia	84.1	39.6	43.6	16.8	7276
Akwalbom	76.3	54.4	44.4	8.3	13,683
Bayelsa	78.7	38.8	49.3	11.9	3,515
Cross River	82.2	44.6	42.8	12.6	11,425
Delta	77.4	37.9	43.6	18.5	15720
Edo	69.7	49.3	38.8	11.9	10959
Imo	79.3	46.1	42.7	11.2	14,145
Ondo	78.8	45.0	44.2	10.8	12342
Rivers	79.9	33.3	49.5	17.1	4,011
The Region	78.7	43.3	43.2	13.5	95076

Source: Niger Delta Regional Development Master Plan (NDDC 2006)

In spite of being higher than the regional and national averages, this prevailing level of adult literacy in Cross River State was considered low and attributed to inadequate staffing, lack of instructional materials and poor state of facilities in public schools, particularly those in the rural areas. All of these factors were identified in both primary and secondary schools in the area. Generally, low literacy levels would tend to negatively affect the quality of the workforce.

At interviews with primary teachers in some of the communities, school dropout rate was said to be low and was estimated at between 5% and 7% per class.

vi. **Migration**

There exist record on migration in the study area, however, it was possible to examine and determine the trend and pattern via interviews and FGDs. FGDs revealed that there is high immigration in the area and this is traceable to the presence of fertile land for agriculture and the peaceful nature of the people of the area. Higher stranger elements were also visible in the study area though mostly from Igbo speaking states. However, there were also indications that some household members had relocated over the years for various reasons. The most common reasons for relocation were marriage, school and work, and the most affected age groups were those between 10 and 44 years. Those who relocated went mostly to cities in Nigeria, like Port Harcourt, Abuja and Lagos.

4.10.2 Ethnography/Culture, Language and Belief Systems

The people of the study area give the region different traditions and customs that are unique to the area. Traditional dress for men consists of loincloths and a white long-sleeved shirt with a broad hat. Some men also carry a walking stick. Women usually wear wrappers or a blouse, and head scarf.

The study area epitomises the nation's linguistic and cultural plurality and it is important to note that, in spite of the diversity of dialects, all the ethnic groups in the state have a common linguistic root -Bantu.

There are three major language groups in Cross River State - Efik, Ejagham and Bekwara.The culture of the different ethnic groups in the State bears striking similarities. Each rhythm and dance expresses the inner feelings of the people which relate to particular events, festivals, or simply their way of life. Dances in the study area include: Ekpe, Nkwa, Obon, Udoiminyang, Abang, moninkim, Acharbor, Onat Ekertedi, Ayita, Udiang Otichui and many others. Traditional festivals relating to farming activities are observed in Biase, Yarkurr, Obubra, Ogoja, Etung, Obubra and Boki local Government areas. These festivals are observed annually to celebrate the rich harvest of the season.

Music and dance are common in the people’s culture and are played during festivals as well as social occasions. Common instrument use in the area includes Obam, Mgbe, Atam, Obon, Bekarim, Awaribo, Obashi and Enya-Atu. Other traditions include inter-village cultural dance, age-grade meetings, burial ceremonies and communal farming.

Boki people are known for male and female circumcision. In July 2000, female genital mutilation was made illegal by the government of Cross River State in an attempt to stop violence and abuse against women. The penalty for such actions is a fine of up to 10,000 naira or a prison sentence up three years.

The study area is also known for its traditional African markets days, such as in Okundi, Ntamarte, Kakwagom, Wula and Katchuan.

The Efik, Ekoi, Ibibio, Okele, Igede, Eche, Yala, Yakurr, Ejagham and Bette are the indigenous and dominant groups in the study area. There is also the Yakurr/Agoi ethnic group in Yakurr LGA. Further up the core northern part of the state are several sub-dialectical groups, among which are Etung, Olulumo, Ofutop, Nkim/Nkum, Abanajum, Nseke and Boki in Ikom, Etung and Boki LGAs. Also, the Yache, Ukelle, Ekajuk, Mbube, Bette, Bekwarra and Utugwang people are found in Ogoja, Yala, Obudu and Obanliku LGA's. There are, however, several other residents in the area who are strangers. Local sources indicated during FGDs that these residents include mostly Hausas, Yorubas, Igbos, Ogonis and Urhobos, among others. They are mostly fisher traders, public/civil servants and farmers, estimated at between 15% of the population across the communities. The major language of communication in all the communities is English. English is spoken in both its formal and pidgin forms. Most residents are able to communicate in Pidgin English.

The marriage institution is accepted and revered in all the communities. Marriages are contracted between adult males and adult females; there are no accounts of either same sex or juvenile marriages. Monogamy and polygamy are practiced but local sources say that polygamy is on the decline. The marriage process involves two basic stages, the knocking of door stage and the traditional marriage ceremony proper. The stages involve the intending couple, their parents and relations, friends and well wishers. Parents and relations, however, play more prominent roles in the first stage than other parties. Drinks and gifts are usually presented by the groom’s family to the bride’s family during these meetings (in both stages). There are no known marriage restrictions on the basis of religion or culture in any of the communities.

The family is recognized as a very important social unit and both nuclear and extended families exist in the communities. The typical nuclear family is headed by the father, with the mother and children. The extended family includes members who are not biological off spring of the parents but relations. A nuclear family where the father was dead could be headed by the mother if the children are juveniles or by the eldest son if he is a grown man and able to bear the financial responsibility of taking care of the family. The extended family is always headed by a male member.

Considering that all the communities are used to nonindigenous residents, members can communicate in Pidgin English and they do not have either cultural nor religious restrictions on marriage, the communities in some way have an accommodating social attitude. This attitude could be valuable for the proposed project, given that itinerant workers and camp followers would be attracted to the communities during construction, and this kind of social attitude would foster healthy cross cultural exchanges. This can also help in some way to limit conflicts that arise when people of different cultural backgrounds live together, thereby, reducing the potentials for tension and social upheavals during the project.

4.10.3 Social Organisations

Community social organizations exist in all communities of the study area, with the ultimate aim of community development. Prominent are the Women groups and the Youth Associations which organize routine sanitation exercises and negotiate members' enrolment in employment slots. Apart from the ubiquitous credit and thrift societies which exist to ensure availability of revolving funds for members' economic advancement, these communities also boast of cooperative groupings. Also important are the age-grades and church based societies. Not much community development activities have been achieved by these social groupings because of the depressed economic situation in the area. However, there is a high level of cooperative tendency which cause the people to speak with one voice and bear allegiance to their groupings of affiliation.

The socio-cultural groups play very significant roles in the maintenance of law and order in all communities, and they also provide a sense of belonging for the average indigenous resident. In traditional Efik communities like the surveyed area, the „ekpe" group is responsible for the maintenance of law and order, and is strictly charged with execution of all community laws, on both the indigenous and non-indigenous resident and also the casual visitor. Membership of the „ekpe" cultural group, is very common and popular among males in the communities. Among Efik males generally, membership of „ekpe" provides a strong cultural identity.

i. Roles of Women and Youth in Community Development

The women and youth groups play important roles in the communities, and serve to bring their members together as well as intervene in their welfare. The women's primary role is to advice the CDU and council of Chiefs on matters concerning women in the communities. During the survey it was noted that culturally women could not, lead the communities, head the key organs of traditional administration, seat or participate with the men in taking community decisions. They had their separate meetings and their decisions were transmitted to the CDUs and traditional councils. This cultural inhibition is a clear indication of gender inequality in the communities. Gender inequality across Cross River State was captured by the use of the Gender Empowerment Measure (GEM) which is an indicator of the opportunities women have in any socio-economic environment. GEM measures gender inequality in the three areas of political participation, economic participation and control of economic resources. The GEM value for Cross River State is quite low at 0.25, higher than the Niger Delta regional average of 0.22, but at par with the national average (Cross River Facts, 2009).

The youth on the other hand, have become a strong force in the communities. Their roles basically include ensuring internal and external security, enforcing law and order and development planning. Youth leadership, especially the President and Secretary are regularly invited to community meetings with the traditional councils and CDUs, where decisions about development and security are taken. They are also responsible (with the CDU) for liaison with companies and other organizations that have any business in the communities.

4.10.4 Political Administration

There are well-recognized leadership structures that oversee the political administration of the study area. There are two (2) levels of political organization in the study area:

i. The Formal Government
ii. The Traditional Administration

At the formal government level, the study area is under Calabar Municipality, Akampka, Obubra, Etung, Biase, Ikom, Boki, Bekwarra, Obudu, Yala, Bakassi and Akpabuyo Local Government Areas (LGAs) of Cross River State. The leadership organization is such that the executive, legislative and judiciary functions of the modern government are well integrated.

The traditional administration is headed by the village heads. The village heads are assisted by tittle men also referred to as chiefs who are responsible to them. The village heads function to ensure peace and justice in the area and also exercise administration and judicial authority over their community. Figure 4.13 illustrates the traditional hierarchy in the area

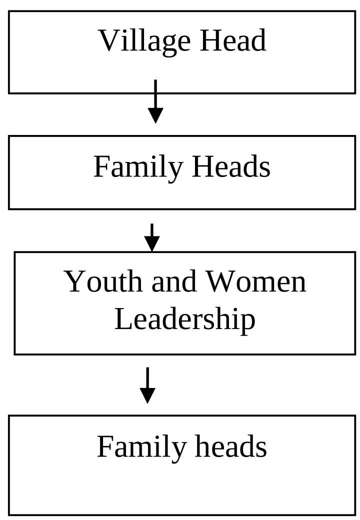

Fig. 4.13: Traditional Hierarchy, in descending order, in the study area.

The traditional heads are elected from eligible males. Eligibility is determined by age (minimum of 35 years) and standing/integrity. Additionally, the candidate must come from particular families, considered royal families. Occupants hold office for life except deposed by the community. They could be deposed by the community if they are believed to be working against the community's interest, if he commit a heinous crime or became incapacitated by ill health. The Chiefs are appointed by their respective compounds to oversee the affairs of the compounds and represent them in community matters. They also have the role of advising the village head. Chiefs are also all adult males and they remained in office for life, except removed by their compound.

The roles of these organs of society are clearly defined and there were no indications of role conflicts. These organs could play significant roles in information dissemination and community mobilization before, during and after the proposed project.

4.10.5 Tourism

Successive government in the state strived in making the state a tourism hub of the West African coast via the Tinapa resort project. The study area offers both its visitors and interested indigenes many centres of attraction. The outstanding ones are Obudu Cattle Ranch in Obudu, Old Residency Museum in Calabar, Agbokin Waterfalls in Ikom, Etanpim Cave in Odukpani LocalGovernment Area and Mary Slessor's Tomb, Calabar, Cross River National Park and Kwa Falls in Akamkpa local government area, Obubra Lake in Obubra and the Calabar Cenotaph in Calabar.

These are some festivals that take place in the study area;

- The Cross River State Christmas Festival – 1 December to 31 December annually
- The Cross River State Carnival Float – 26th and 27th December yearly
- The Yakurr Leboku Yam festival – 28 August annually
- The Calabar Boat Regata

The Cross River State Christmas Festival is an event that will rival any festival event in Africa, with over 30 days of endless fun, carnival, games, cultural display, art exhibition, and pageant and music performance. Another r Interesting Festival in the study area is AnongBahumono Festival which holds in Anong Village, during which different cultural dances are showcased, including Ikpobin (acclaimed to be the most entertaining dance in the state), Ekoi, Obam, Emukei and Etangala Dances.

4.10.6 Life Style and Practices

Practices raised and discussed during FGDs and interviews included, drinking of alcohol, cigarette smoking, use of hard drugs, prostitution, teenage pregnancy and child labour. Residents confirmed that the use of spirits and alcoholic beverages is quite rampant among them. Most residents, of both genders, had been drinking since their teenage and several since they were children. Cigarette smoking is also quite common among teenage and adult males. Most respondents also believe that some of the youth smoke hemp.

Teenage pregnancies, on the other hand, are experienced quite commonly in all the area. Child labour, another of the social vices, is not common. Children usually assisting their parents in farming and running their shops. This type of work does not attract any salaries or wages and also does not stop the children from attending school.

Respondents expressed fears that the proposed project would further encourage some of these vices if itinerant workers and camp followers take up residence among them. Drinking, smoking, use of hard drugs, teenage pregnancies and prostitution were particularly mentioned by residents.

4.10.7 Religion

Residents of area are mostly Christians. There are various Christian denominations with worship places spread across the community. Christian denominations in the community include Cherubim and Saraphim, Church of God Mission, Jehovah Witness, Living Faith Church and Christ Assembly. The main Christian festivals of Christmas and Easter are celebrated across the communities.

The famous Duke Town Church is also located in the area. The church is established by the Presbyterian Church Missionaries, and it is one of the oldest churches in Nigeria. Mary Slessor, a Scottish missionary whose memory is cherished in the town for her role in the movement to abolish the killing of twins, lived in Calabar from the late 19th century until her death in 1915 and inside the church is the tomb of Mary Slessor.

Traditional worship practices are carried out by few adherents mostly the elderly and major communal deities and shrines are located in the study area. 84% of the residents are Christian adherents, while 13% and 3% are Moslems and traditional worshippers respectively.

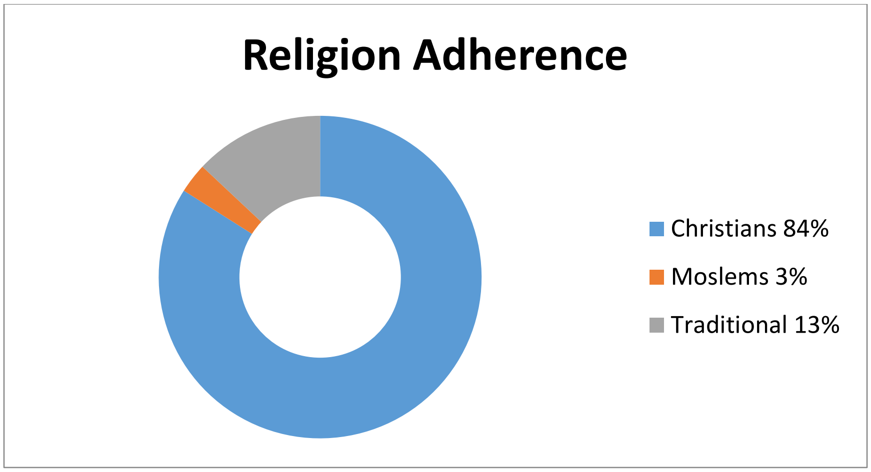

Figure 4.14: Religion adherence in the area

According to sources in the communities, some of the communal shrines and sacred places are located in the area. The people are willing to relocate their shrines and other sacred places should the proposed super high needs to use its present location as route. They also added that sacrifices must be offerd to achieve the aforementioned.

The main traditional festivals celebrated in the area are ‘Ekpe’, ‘Akata’ and ‘Obon’ among the Effiks speaking communities, Yala/Yache, Ukelle and Bekwarra. Ekpe is celebrated any time in the year as decided by the priest. It is marked with masquerade dances.

Among the Effik, Akata is celebrated yearly between October 1st and the first week of January. Movement is restricted during this period and late nights are voided because the dances are done at night and non-initiates should not see the dance. Any male who does must be initiated, and any female who does will die as the appeasement requirements are expensive and cumbersome and most people are not able to go through with them. It is believed that the masquerade reveals secrets in the community. Obon is also a masquerade dance performed when a member dies or when there is a mysterious death in the community. Anyone entering into the community when the dance is being performed must avoid an encounter with it.

Socio-cultural demands and the demands of living with people from different backgrounds have helped shaped society’s moral codes and norms. This condition has given rise to prohibition of some perceived harmful practices with a view to ensuring security of life and property and fostering harmonious co-existence and habitation. These prohibited practices include desecration of shrines and places of worship, committing suicide, having sexual intercourse with a married woman who is not one's wife and cannibalism. The communities expect all residents to abide by the society's moral code. Residents generally abide by these restrictions because the communities enforce them and they also believe that violation attracts dire consequences. These may lead to banishment or warrant performance of expensive appeasement and cleansing rituals on offenders.

There are no communal restrictions on religious beliefs and worship. Residents are at liberty to pursue their religious beliefs and interests.

4.10.8 Conflict and Security Management

The study area is part of the Niger Delta region which has experienced several conflicts with violent outcomes. In particular, there was the issue of militancy in the region, before the Federal Government granted amnesty to militants who would agree to lay down their arms. The conflicts that gave rise to militancy involved the youth more than any other groups. Many of them have become violence prone and even social misfits. The youth will be a group to watch and also dialogue with in the course of the proposed road project.

It is important to note that conflicts do not always have violent outcomes; in fact there are many conflict situations which are resolved on a daily basis. In the study area, such nonviolent conflicts also arise and there are traditional ways of resolving them. The study area has various organs of society traditionally involved in resolving conflicts. These organs include the social organizations to which household members belong like the women organizations, the compound chiefs and the various Development Unions. However, at the apex of the traditional conflict resolution process in the area is the traditional leadership. Their decisions on intra communal conflict issues are usually binding on all parties.

There are police posts scattered in the area though more is needed in terms of man power and equipment to check increase in crime rate and other vices expected to increase with immigration in the area. Local sources revealed during the study that there are no existing violent intra community conflicts in the area. Most surveyed communities have vigilante group which provide security of lives and properties in the area. The vigilante group is manned by the youths and also retired service men from the area.

4.10.9 Quality of Life

i. Settlement Pattern and Housing Conditions

The communities have the characteristics of both linear and nuclear settlement. The linear characteristics derive from the concentration of houses along the main streets and lanes in the settlements. Their nuclear characteristics derive from the clustering of houses. Houses are built in clusters which in some cases may identify family lineages and kindred groups. Spacing between houses is not definite and could range from one or two metres to about six metres.

The houses are quite diverse in their design and construction materials. Some houses have modern designs and they are built with utilities like kitchen, toilet and bath, in-house. These modern houses are also constructed with semi-permanent materials like zinc, wood and roofed with corrugated iron and aluminium sheets.

Table 4.34: Quality of life attributes

Quality of life attributes	Proportion (%)
Waste Disposal (Refuse)	
Government Waste bin	30.0
Dumping in the bush/Farmland	70.0
	100.0
Waste Disposal (Sewage)	
Water closet	8.0
Pier Toilet	92.0
	100.0
Sources of Water for Domestic Use	
River/Stream	
Rain	64.0
Bore hole	5.0
	31.0
	100.0
Energy Source for Household Cooking	
Firewood	
Kerosene	50.0
Cooking gas	35.0
	15.0
	100.0
Energy Source for Household Lighting	
Kerosene	
Public electricity	46.0
Private electricity generator	30.0
	34.0
	100.0

iii. Sources of Energy Available to Households

The available sources of energy for cooking household meals and for lighting in the communities are kerosene, firewood and electricity.

Most households about 50% use firewood to cook their meals while 35% uses kerosene. For lighting, a significant proportion of households about 46% depend on their kerosene lamps, while 30% rely on the public light provided by PHCN in the area and 34% uses private power generating set to augment the public light in the area.

iv. Livelihood Activities

The economy of the community was highly private sector driven. There is a high level of dependence on natural resources for livelihood sustenance. The land and natural water bodies inhabited by fishes, shrimps crabs, oysters and periwinkles provide major source of livelihood to the people of the area. In essence farming and capture fisheries remain the most important economic activities in the surveyed communities. In Ikom community fishing is a male dominated enterprise and although some female fishing may take place in shallow parts of the water, women essentially dominate the gathering of periwinkles and crabs etc. from the shallow swamps. The women also exploit the mangrove forest for firewood and other non-timber forest produce (mushroom, wild fruits and vegetables etc.). They also process fish (drying or smoking). The major female activity is however marketing of products.

The identified activities are mainly primary production activities like farming, fishing, hunting and tapping and production of palm wine. Commerce and provision of services like petty trading, artisanship practices and employment in the civil/public services were also identified. The largest proportions of household members in the area are engaged in farming, fishing and next to these are the proportions of household members engaged in trading. Artisanship practices inclusive of electrical repairs, boat building, tailoring. Civil service employees in the communities are limited mostly to teachers, LGA workers, state civil servants and health workers.

The livestock are kept in the homestead and they consist of a few heads of goat and some birds (especially chicken). There are no proper managed fish farms in the area. In Ikom community, most indigenous residents operate natural ponds owned by their extended families. Incomes from these farming/fishing and allied livelihood activities vary depending on the scale of operations, local sources estimate that an average fisher man/woman earns between N200, 000 and N300, 000 annually from an investment of between N30, 000 and N50, 000.

In the Ikom axis, Artisanal fishing and gathering of sea products like periwinkles and other crustaceans.is a major livelihood activity in which men, women and children are engaged. Women and children, however, dominate the gathering of sea products. Wooden boats and canoes equipped without board engines (between 25 Hp and 45 Hp engines), nets, hooks, traps, floaters, machetes and axes are used.The use of out-board engines is limited to a few who can afford the cost, the vast majority use canoes without engines. Among the fisher folk are those who own and rent equipment for others to use, those who own their own equipment and those who basically function as assistants to others during fishing expeditions. The reward system practiced locally among resident fisher folk ensures that proceeds from any catch are shared and portions are left for all those who participate in the expedition, the equipment and the equipment owner. This makes sure that entrepreneurship, investment and labour are duly rewarded. Fishing in the area is most lucrative in the dry season months from about October to April. The catch is generally reduced and expeditions are less during the rainy season. In this season the high water level and flood waters in the communities and bushes hamper fishing in the rivers and creeks. The average fisher folk, if healthy, is able to go out fishing several times in a week. Fishing households are able to earn between N15, 000 and N50, 000 monthly. The investment varies, depending on the type and number of equipment employed. A good canoe and the accompanying equipment would cost about N150, 000 and one fitted with an outboard engine of 25 hp to 45hp would cost between N350, 000 and N500, 000. The usual catch includes tilapia, catfish, mudfish, electric fish, shrimps, and cray fish, among others.

Hunting, production of palm oil and tapping of palm wine are important primary production activities in the communities. Significant quantities of palm oil are produced and sold at the various markets in the area. The production of palm wine is common in all the communities. Hunting is still being done by a few young and physically strong adults. The animals they catch include rodents, monkeys, bush pig and antelope.

Apart from farming and fishing, trading in palm oil, plantain, garri, vegetablesetc had also been a significant livelihood activity in the study area.

Most of the farm and products intended for sale are dried (smoked) and transported to markets, especially in Calabar. The market day varies from one community to another and during this market period goods are sold and bought by the traders. A wide variety of goods including food stuff, electronics and household wares are sold in the communities.

The markets apart, there is considerable daily sales of goods in the communities. This type of selling is conducted from a variety of places. Some are petty traders who can only afford to sell a few things like sweets, biscuits, bread, fruits, etc from table tops usually located in the front of their houses. Some others can afford to rent proper shops and sell from such places. This latter group usually have larger shop space and also stock more goods. There are also traders that tend to sell a wide variety of items like clothing, shoes and bags, electrical fittings, alcoholic and non-alcoholic beverages and stationery, among others. Some of the traders in this latter category include Hausas and Igbos. Many of the indigenous petty traders are women. Traders deal with a wide variety of goods and also operate on different scales and so their incomes are also very varied. The indications from their responses during interviews are that their monthly incomes are as varied as between N10, 000 to N30, 000.

Residents commonly engage in more than one livelihood activity. Engaging in multiple livelihood activities provides household members complementary sources of income. In many cases it is an indication that each of these activities only provides a subsistence income. It is expected that the proposed road project will significantly affect farming and fishing activities in the communities.

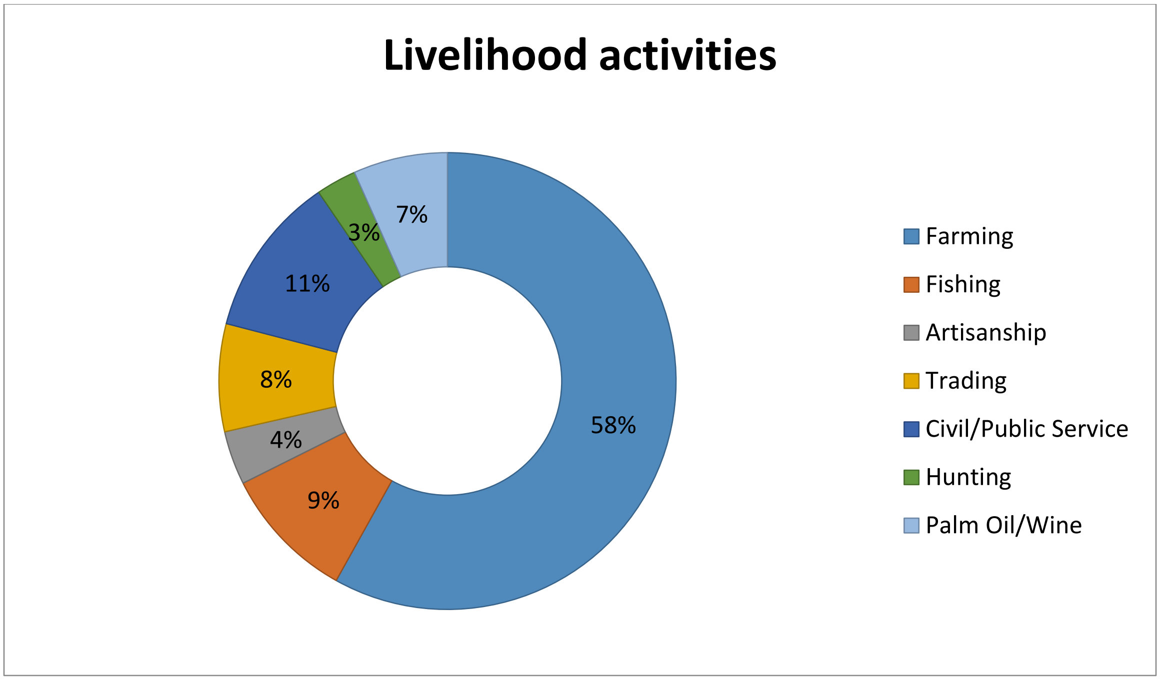

Figure 4.15: Livelihood Activities

v. Employment Situation in Households

Unemployment was experienced in several households in the communities. Results obtained from the discussion and interview sessions indicated that about 40% of households across the communities had one or two unemployed members. Unemployment was determined as being ready and looking for work but unable to secure one in the last 6 months preceding this study. Only household members who were 15-64 years and not full time students were considered. In its 2011 Annual Socio-Economic Report (NBS, 2011), the NBS estimates the level of unemployment among different groups in the country. Among the uneducated (those who have never attended school) the rate of unemployment is 19% in the urban areas, 22.8% in the rural areas and the composite is 22.4%. Among those whose only education is primary level the rate is 15.5% urban, 22.7% rural and 21.5% composite. Among JSS graduates it is 16.6% urban, 36.9% rural and 33.4% composite while among SSS graduates it is 13.9% urban, 22.5% rural and 20.1% composite.

The age distribution shows that among 15-24 year olds, unemployment rate is 33.5% in urban areas, 38.2% in the rural areas and 37.7% composite, and among 25-44 year olds it is 16.3% urban, 24.1% rural and 22.4% composite. For those aged 45-59 years and 60-64 years the rates are 12.5% and 18.0% in urban areas, 19.6% and 22.1% in rural areas, and 17.8% and 21.4% composite, respectively. The sex distribution of unemployment is 16.9% among males in urban areas, 25.1% among those in rural areas and 23.5%

composite, and 17.2% among females in urban areas, 26.1% among those in rural areas and 24.3% composite.

vi. Household Income Levels and Expenditure Patterns

Discussions and interviews held in project impact communities in the twelve LGAs estimated the average household monthly nominal income levels, presented in **Table 4.35**.

Table 4.35: Estimated Household Monthly Income Levels

	Estimated Monthly Averages	
	Mean Income (₦)	Modal Income Range (₦)
Calabar Municipality	25,000	10,000-30,000
Akamkpa	18,000	10,000-20,000
Obubra	20,000	18,000-22,000
Ikom	20,000	18,000-22,000
Boki	20,000	18,000-22,000
Obubra	20,000	18,000-22,000
Bakassi	18,000	10,000-20,000
Akpabuyo	20,000	18,000-22,000
Bekwarra	20,000	18,000-22,000
Biase	18,000	10,000-20,000
Odukpani	18,000	10,000-20,000
Ogoja	20,000	18,000-22,000

The estimated mean household monthly income in the communities in Calabar Municipality LGA is about N25, 000 and the modal income bracket is N10, 000-N30, 000. In the Akampka and BakassiLGAs communities, the estimated mean monthly household income is N18, 000 and modal bracket N10, 000-N20, 000. Households in the communities in Obubra, Ikom, Boki, Obudu, Ogoja and Akpabuyo LGAs are estimated to have a mean monthly income of N20, 000 and a modal income bracket of between N18, 000 and N22, 000.

The major items of expenditure in the households are food, health care, and education, purchase of household items including utilities (kerosene, petrol, etc), transportation and clothing (see **Figure 4.16**).

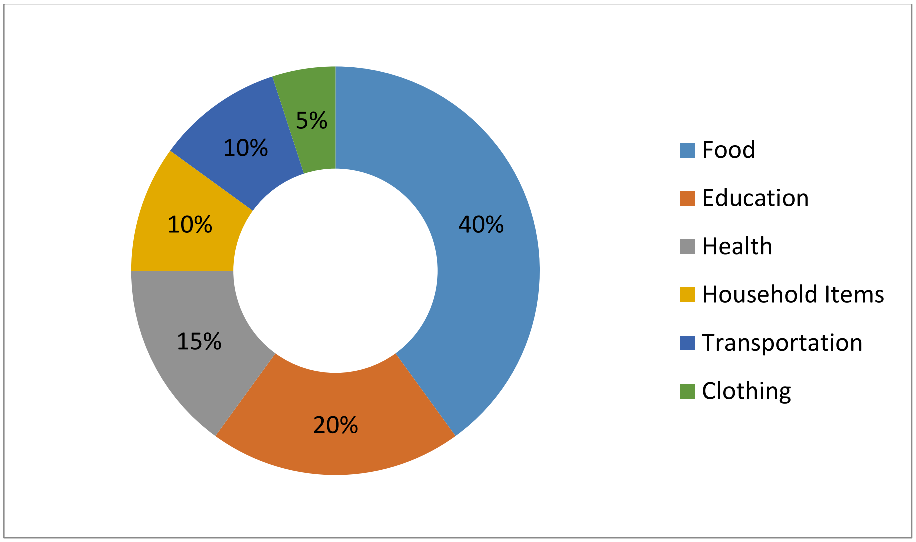

Figure 4.16: Household Expenditure Pattern

The major food items are mainly those that are not grown locally, beef and also beverages. Expenditure on health care by households is quite significant because most households take their sick members to Calabarin order to access functional orthodox health care facilities. Apart from these household members also spend considerable sums of money on drug purchases from drug stores ('chemists') in their communities. In order that children and wards have access to good education, parents and guardians pay various sums for their children to be educated in public and private schools outside their communities and LGA, especially in Calabar.

Transportation costs are incurred mainly in accessing health and education facilities outside the communities. Households also spend considerably on purchase of kerosene for their lanterns and cooking stoves, and on petrol for their private generators. Expenditure on food, education and health accounts for 75% of total household expenditure. Community sources across the study area generally affirmed that for most households, expenditure on food, accessing higher education services outside their communities, obtaining health care, purchase of household items, transportation and clothing account for between 80% and 90% of their monthly earnings.


Plate 27: Delapidated Calabar-Bakassi Road in Atignbo community


Plate 28: A Failed portion of the existing Ikom-Calabar Road in Obubara community

4.10.10 The Economy

i. Natural Resources and their Exploitation for Sustenance

Communities across the study area are endowed with a lot of natural resources. These resources have been exploited by generations of residents, and have kept and sustained the continuous human settlements in the entire area. The resources are the water bodies, the forest and the land mass. Water bodies in the study area include the rivers, creeks, ponds and wetlands especially in the Akpabuyo, Bakassi and Ikom axis of the area. The forests are home to a number of resources including timber, firewood, economic trees like the raffia and oil palm trees, and various wild animals. The timber is useful in building their houses. The timber also supports canoe building and repairs activities that take place in Akpabuyo, Bakassi and Ikom. The forests in most of the communities have various economic trees which are exploited for their products. Notable among these are 'bush mango' (from where 'ogbono' is obtained), oil palm that produces palm oil and raffia palm which produces palm wine. Additionally, the forests are home to various animals that residents hunt for food.

The land provides for the physical development of the communities including housing and infrastructure. It also supports the growing of a variety of crops like plantain, cassava and vegetables in the communities.

ii. Natural Resource Conservation Practices

All the communities in the proposed project area have had traditional practices which they have employed to conserve their natural resources. These practices are quite similar. They entail prohibition of physical entry and exploitation of resources in designated areas. The Cross River State Government through its Forestry Act has already promulgated laws against indiscriminate logging, farming and hunting in reserved areas such as the Cross River State National Park which is home for vulnerable and extinct plants and animal species. Certain forests have been revered because they house shrines of local deities or because they are evil forests (cemeteries reserved for the burial of people who die of uncommon ailments and from causes considered abnormal by society, like suicide as well as lands in disputes). Resources in these forests are usually not exploited by the public. This restriction allows for reproduction, regeneration and general growth of natural resources. Additionally, cutting down and use of economic trees in their productive life as firewood is prohibited in some of the communities.

4.10.11 Land Ownership and Tenure

Land ownership in Nigeria is regulated by the Lands Use Act Cap 202 Volume 11 Laws of the Federation, 1990. The law states that all land within a state is held in trust for the people by the Governor and will be allocated to the people for urban, residential, commercial, agricultural use etc. Land located in rural areas is under the control of local government authorities.

Under traditional land tenure, communal lands were held in trust for the community by a traditional ruler who gave permission to prospective users. At the same time, some lands are held by families and passed down to subsequent generations through inheritance. The 1978 Land Use Decree, however, placed lands in the hands of the State. With these differing and overlapping land tenure arrangements, ownership of land is often unclear.

Land in all the project communities is primarily owned by families. Ownership rights over lands are handed down from one generation to another within the extended family. Such inherited land is put to any use as desired by the owner(s). These are the lands on which family members build their houses and are allocated farm lands for cropping. Land could be bought from owners who were willing to sell. Apart from the family, the communities also owned some lands. Most of the lands in the communities on which the road project will be constructed are owned by different families.

Any intentions to obtain land for corporate or industrial use should be initiated through the various Community's Development Associations and various Council of Chiefs which are in the best position to offer proper guidance concerning ownership. This condition is important whether the required land is owned by a family or community.

As described above, women and widows have the weakest rights under land tenure systems and are therefore more vulnerable to changes resulting from the Project, where their homes or access to farmland and forests may be lost. This group should not be overlooked when planning for physical and economic resettlement.

4.10.12 Infrastructural Base

i. Available Infrastructure and Their Functional Status

Available infrastructural framework of the study area is dominated by social amenities. The social amenities consist mainly of education, water supply and electrification facilities while the physical amenities comprise mainly of jetties and telecommunications facilities.

Public access to the project affected communities in the tweleve LGAs is by road, additionally, telecommunication services from GSM service providers are received in many of the communities, although these services fluctuate in some of the area. These physical infrastructural amenities have been provided mostly by the state government.

Education facilities in the LGAs consist mainly of public primary, junior and senior secondary schools. The infrastructures in many of the schools are inadequate. The students' desks and chairs are broken and insufficient, class rooms are also insufficient, and some of their ceilings, windows, doors and floors are broken. The schools do not have decent utilities like toilets and they also do not have equipped libraries and laboratories. The student teacher ratio in the public primary schools is high, as much as 50:1. Teachers in the secondary schools are not enough to cover all the subject areas, and subjects like Mathematics, Physics, Introductory Technology, Agricultural Science, English and Home Economics are often taught by teachers who did not study these as core subjects in the universities. The schools have over the years depended mostly on National Youth Service Corp members for teachers.

The cumulative effect of these inadequacies is a lack of interest in schooling among many children in the area. Parents who are interested in their children being properly educated and who can afford the cost send their children to schools outside their communities and the LGAs, after they complete their primary education. Many of these children end up especially in Calabar and Port Harcourt as wards of their relations. Several of those left in the villages end up marrying, becoming farmers or assistants to other fisher folks on their fishing expeditions or get pregnant and drop out of school. Local sources estimated that between 5% and 7% of children of school age are not in school because of truancy or have dropped out.

There is generally a dearth of functional orthodox health facilities in the entire study area. Perhaps the only one that can be considered functional and patronized by a significant number of residents is the General Hospital in Calabar and the University of Calabar teaching Hospital in Calabar. The basic problem with most health facilities in the area are inadequate staffing, broken down and unmaintained equipment and lack of drugs. The situation is such that households generally do not have confidence in them and would rather ‘consult’ drug stores or take their members requiring medical attention to Calabar.

Public water and electrification are very much dysfunctional in the communities. Several water bore holes have been constructed in the communities but most of them are not working largely because the water produced is deemed unfit for consumption by communities’ residents, usually because of colouration. Similarly, most of the communities have electrification facilities but do not have electricity because there are no functional transformers. Some of these transformers break down often and maintaining them has been a major problem for these communities.

ii. Transportation

The main means of transportation among communities in the study area is by road with the use of cars, motorcycle and bicycles. The people in Ikom also travel to neighbouring Cameroun by water using boats.Most households have access to motorcycles and bicycles which they used to go about their daily business, especially farming.

iii. Recreational Facilities

The people’s relaxation and recreational activities involve visits to acquaintances, drinking in groups (men/youth) and various group discussions. There are also a few eateries which also serve as alcoholic drinking parlours and viewing centres. A few hotels exist in the area. There is a Government/public football field by the Local Government Council secretariat and in some public schools for football enthusiasts who visit either to play or watch others play. Inter community, wards/ clans football novelty and competition matches often hold at this centres. Local Government Council and political elite/ office holders sponsor some of these events.

Communities	**Transportation network**	**Education**	**Health**	**Water Sanitation**	**Telecommunication**
Ikot Eneobong	Yes	Yes	Yes	Yes	Yes
Ikot Omin	Yes	Yes	Yes	No	Yes
Ikot Effanga	Yes	Yes	Yes	Yes	Yes
Mfamosing	Yes	Yes	Yes	Yes	Yes
Obung	Yes	Yes	No	Yes	Yes
Oban	Yes	Yes	Yes	No	No
Nko	Yes	Yes	Yes	Yes	Yes
Ojijor	Yes	No	Yes	Yes	No
Mgbagatiti	Yes	Yes	Yes	No	No
Enoghi	Yes	Yes	Yes	Yes	Yes
Bokomo	Yes	Yes	Yes	No	No
Ikom	Yes	Yes	Yes	Yes	Yes
Etayip	Yes	Yes	Yes	No	Yes
Eastern Boki	Yes	Yes	Yes	Yes	Yes
Okworotung	Yes	Yes	Yes	No	No
Obudu	Yes	Yes	Yes	Yes	Yes
Utugwang	Yes	Yes	Yes	No	No
Okuku Yala	Yes	Yes	Yes	Yes	No
Okpoma	Yes	Yes	Yes	Yes	No
Ikang	Yes	Yes	Yes	Yes	Yes
Ikot Offiong Ambai	Yes	Yes	Yes	Yes	Yes
Gakem	Yes	Yes	No	No	No

4.10.13 Vulnerable Groups

The World Bank (ref: World Bank Glossary of Terms): Vulnerable groups "denotes a condition characterized by higher risk and reduced ability to cope with shock or negative impacts. It may be based on socio-economic condition, gender, age, disability, ethnicity, or other criteria that influence people's ability to access resources and development opportunities. Vulnerability is always contextual, and must be assessed in the context of a specific situation and time".

IFC PS Requirements (ref: IFC PS1 Guidance Note GN48): "There may be individuals or groups within the project's area of influence who are particularly vulnerable or disadvantaged and who could experience adverse impacts from the proposed project more severely than others. Large-scale projects with a large area of influence and multiple Affected Communities are more likely to expose these individuals and groups to adverse impacts than smaller-scale projects with site-specific issues. Where it is anticipated that the project to be financed will impact one or more Affected Communities, the risks and impacts identification process should use accepted sociological and health methods to identify and locate vulnerable individuals or groups within the Affected Community population, collecting data on a disaggregated basis. Using this disaggregated information, the client should assess potential impacts, including differentiated impacts, on these individuals and groups and propose specific (and if necessary separate) measures in consultation with them to ensure that potential impacts and risks are appropriately avoided, minimized, mitigated or compensated."

Some groups in these communities have been identified as potentially vulnerable to the likely impacts of the proposed project. Their vulnerability derives from a number of different factors, including inability to cope with certain envisaged changes in the society and economy. A key vulnerable group is the adolescent youths. Within this group it is also possible to differentiate between the adolescent male and the adolescent female. For the male adolescent there is the tendency to abscond or drop out of school to seek casual employment at the project site. This temptation to drop out of school is re-enforced by the state of educational institutions, particularly the poor staffing which makes schooling uninteresting. The adolescent male will be faced with a situation of giving in to peer-pressure and groups that encourage truancy and school dropout, if these groups come into these communities with as itinerant workers or camp followers.

The adolescent female on the other hand is faced with managing her sexuality in an environment where there will be considerable exposure to sexual excesses, activities and the continuous advances by older and more experienced working class males whose income would be an effective instrument to lure the girls. Again with this group there will be the likelihood of school dropout and teenage pregnancy. Teenage pregnancy had in some societies led to stigmatization of the girls. Many of the teenage mothers may not be able to return to complete their schooling or embark on any academic pursuits, even after they would have given birth to their babies.

Another vulnerable group is the elderly. This study has showed that this group constitutes a significant population in area. In any economy, the elderly usually require special attention which includes health care and welfare, but the required facilities for provision of these social services are not available across the study communities.

Among residents of the project impact communities there are many uneducated and unskilled. They derive their livelihood entirely from exploiting the land and forest resources in and around their communities. Their vulnerability lies in the fact of their rigid dependence on exploiting their immediate environment for sustenance. Anything that affects the environment will also affect their livelihood, and without skills they will not have many alternatives.

Given that family lands in these communities are managed by males and are also allocated mostly to male descendants, female family members and widows will inadvertently be at the mercy of the males to obtain land to pursue their economic activities. Additionally, widows and single mothers will have an uphill task providing for their households in an environment where there are construction workers who earn salaries higher than what generally obtains in the community.

Physically and mental challenged persons are also another set of vulnerable group in the area. Most surveyed communities in the area have cases of physically/mentally challenged individuals, majority of whom do not attend schools. No government or non-governmental organization (NGO) assistance has ever been offered to them, and their families/kindred who do not have enough to cater for them. This group of persons is however not discriminated against since they are familiar faces who reside with their kith and kin, so their minor excesses may be tolerated. They are however cautioned and restricted when they get involved on occasion.

Socio-economic Indices Interrelationships

Socio-economic baseline situations in these communities have significant multispectral links. In **Table 4.36**, key socio-economic conditions, their sectoral links and implications, as identified in the study, are summarised.

Table 4.36: Socio-Economic and Health Indices Linkages

Key Environmental Factors	Associated Sectors and Conditions	Socio-economic and Health Outcome	Required Intervention	Monitoring Indicators
Poor Infrastructural Framework.	**Water**-lack/limited access to safe potable water. **Education**-lack of facilities and materials. Inadequate staffing. **Health**-lack of access and equipment. Inadequate staffing. **Transportation**- lack of safe motorized boats and access roads between communities.	Incidence of diarrheal diseases and other forms of water borne diseases; Poor diagnoses and inadequate health intervention; Incidence of avoidable deaths. Poor academic performance; lack of interest in schooling; low student enrolment; poor school attendance; increased unemployment and miscreant behaviour. Lack of access to functional facilities for residents. High cost of goods traded in the communities because of transportation costs.	Provision of safe potable water in all settlements; rehabilitation of existing water facilities. Improved staffing and regular training of education and health staff and provision of equipment (laboratories, libraries, diagnostic equipment) in education and health facilities. Provision of public transportation facilities.	Number of treated bore holes provided in the communities. Number of subject areas for which there are adequate trained teachers in the public schools. Increased school enrolment. Functional laboratories. Functional public library. Number of essential medical equipment (eg X-ray and ECG) and Personnel to man them in the hospitals and health centres.
Domestic Waste and Sewage Management; and Indoor Air Pollution.	**Housing**-Poor design (no provisions for utilities). Poor construction materials (use of non durable walling materials).	Pollution of the rivers and physical environment as sewage and waste are discharged into the	Regulate and enforce use of water closets or covered pit toilets in houses, by LGA.	Number of properly designed houses approved and construction monitored by LGA.

Table 4.36: Socio-Economic and Health Indices Linkages

Key Environmental Factors	Associated Sectors and Conditions	Socio-economic and Health Outcome	Required Intervention	Monitoring Indicators
		environment; harm to aquatic life; health problems for humans. Indoor pollution from smoke (stoves and lamps); spread of respiratory problems.	Regular sanitary inspection by LGA health inspection staff. LGA approval by of only properly designed houses with durable construction materials and with proper and adequate location of utilities like toilet, bath and kitchen.	
Problems Feeding Household Members.	**Agriculture**-Use of rudimentary techniques in fishing and farming.	Low farm yield. Similarly, no mechanized, industrial or large commercial farming. Much physical strain with health implications; low household incomes.	Introduce agric. extension services, and proper aquaculture to the communities. Encourage teaching of agric. science in secondary schools by introducing more subject teachers. Enforcement of CBN laws about micro credit and lending to agric. sector.	Coverage of extension services.
Gender Equality	**Public Administration**-traditional practices that limit women's participation in communal decision making.	Limited opportunities for women.	Without requiring a change in composition of traditional decision making bodies, certain offices in the CDC can be reserved for women like those of CDA Vice Chairman or Secretary. This will facilitate their participation in communal decision making.	Number of women playing prominent roles in CBOs, and number of women in the CDC.

Table 4.36: Socio-Economic and Health Indices Linkages

Key Environmental Factors	Associated Sectors and Conditions	Socio-economic and Health Outcome	Required Intervention	Monitoring Indicators
Human Capital Development.	**Technical Education**-lack of facilities. **Micro Finance**- Poor access to credit; non availability of venture capital. **Employment**-existence of high unemployment rates in the communities.	Inadequate technical manpower and limitations on the economy (very few skilled workers); limited employment opportunities; low investments; stifling of entrepreneurial ability; low living standards.	Introduce, equip and staff technical education unit within existing schools. Enlighten business persons about the importance of financial services in growing their business. Identify and eliminate bottle necks in the lending process.	Number and utilization of credit for start up ventures, and to grow existing investments.

4.10.14 STAKEHOLDERS ENGAGEMENT

i. Introduction

Stakeholder engagement is a two-way process of communication between the project proponent (Cross River State Government) and its stakeholders. It is a key aspect of the EIA process, allowing stakeholders to express their views about the project. It involves sharing information and knowledge, seeking to understand the concerns of others and building relationships based on collaboration, thereby allowing stakeholders to understand the risks, impacts and opportunities of a project in order to achieve positive outcomes.

The underlying principles for stakeholder engagement are as follows:

- Inclusive of all the relevant groups within the community, including the vulnerable and marginalized;
- Culturally appropriate (i.e. using appropriate materials and local languages where possible, etc.);
- held in venues that are accessible to all groups, eg women, people with disability and other vulnerable groups;
- free of external manipulation, interference, coercion, or intimidation;
- In-depth exchange of views and information constituting 'free, prior and informed consent'.

This section focuses on stakeholder engagement activities that have been carried out to date in support of the Project EIA process.

ii. Stakeholder engagement requirements and approach

The stakeholder engagement process followed the requirements of the Nigerian Environmental Impact Assessment Act No 86 (1992). To fulfil the requirements for stakeholder engagement described above, the Project developed a plan for engagement with stakeholders through the Project life-cycle.

The plan included the following key steps:

- Identification of stakeholders and mechanisms for their engagement (meetings, letters, press releases, etc);
- development of project information for dissemination including community presentation using A0 posters and a Background Information Document (BID); and
- identification of where in the EIA cycle certain stakeholders should be contacted and how.

The four stages of the stakeholder consultation plan are as follows:

- Scoping

- EIA Study;
- EIA Disclosure; and
- Project Execution (Construction and Operations).

The publication of a written notice for national newspapers is an additional requirement associated with disclosure, announcing the submission of the EIA to the Federal Ministry of Environment. This will be done once the EIA has been submitted.

This chapter specifically relates to stakeholder engagement completed during scoping and the EIA study.

iii. Stakeholder Identification

The overarching purpose of the stakeholder identification process is to establish which organisations and individuals may be directly or indirectly affected, positively or negatively, by the project. Stakeholder identification is an on-going process requiring regular review and updates.

Field tools were developed to facilitate community consultation meetings, focus group discussions and key informant interviews. Specific questions and guides were produced for facilitators to ensure a wide range of opinions and issues were captured during discussions. These field tools can be adapted as stakeholder engagement progresses through the lifecycle of the project.

Household survey questionnaires were also developed and training provided to all facilitators in the use of field tools.

Plate 29: Stakeholders engagement.

A- Yala LGA Secretariat.
B- B-Ikot Offiong Ambai.
C- C and D-Obung Community.

iv. Format of Meetings

The majority of community meetings were held in English and Pidgin English. Meetings involved the following activities:

- Registration process to record the number of participants;
- Presentation of the project in the most appropriate format including details of the project and EIA process, potential impacts identified during scoping and the grievance mechanism;
- Distribution of Background Information Documents (BIDs); and
- Evaluation process to gain feedback regarding the meetings.

v. Outcomes

Many stakeholders consulted had heard of the Project via the state owned radio station and other media outlets. Groups and traditional authorities were accepting of the project and willing to work with the State Government. This was due to the hope of economic prosperity, employment for the communities, improved road networks, development and so on.

vi. Communities' perceptions/concern on proposes project

The series of consultations held gave a profound insight into the mindset of the host communities and the landlords of the proposed project. While expressing delight at being considered to host the proposed project; they needed clarification with regard to the exact nature of the proposed project. The people of the area expressed the following fears and concerns;

- Physical and Economic Displacement /Loss of Livelihoods: Due to the need for land to build the super high way, stakeholders were concerned about issues related to resettlement and compensation. Fear of losing homes, access to fishing and land for agricultural activities was a key issue as many rely on fishing and agriculture for subsistence use. Traditional leadership was also concerned about royalty payments. They have raised concerns over issues that have arisen from resettlement in the Niger Delta and are worried that a similar scenario could play out here. They believe that government/companies have forcibly evicted residents from their homes in the Delta without adequate compensation.

- In-Migration / Social Issues: Due to poor public services such as health care, stakeholders fear that increased pressure on their services will exacerbate heath issues. Specific mention was also made of increased traffic and fears of public safety. It was also stated that in-migration will impact on their community traditions and may result in increased crime and prostitution.

- Cultural Heritage: There was particular concern over the impact on the Point of No Return site and associated future cultural tourism opportunities. Many villagers expressed concern over the relocation of graves and sacred sites that would need to take place in order for the Project to go ahead.

- Environment and Livelihoods: Affected communities are already considering impacts to the environment including water / fisheries, pollution, noise and traffic. They are worried about how their livelihoods will be affected. Many rely on fishing and farming and are concerned that with relocation and the building of a super high way, they will be unable to access the creek, sea or farmland as they used to and how they will then be able to support and provide for their families.
- Employment: Those employed in formal employment residing in the area are rare. Whilst many villagers welcome the economic opportunities that the road project will bring, they are concerned that many of the jobs will not be sourced locally and that those who are employed will be engaged in temporary work.

vii. Communities' Expectations

Expectations of the communities consist mainly of human capital development and development of infrastructural facilities. They basically include the following;

- Creation of employment opportunities for residents of the communities.
- Empowerment of community members through skills acquisition, award of contracts and provision of scholarships.
- Payment of compensation for loss of property to the communities.
- Infrastructural development in communities, including provision of potable water, electricity, functional orthodox health care facilities, renovation and equipping schools, and erosion control projects.

Plate 30: Community and Opinion leaders meeting in Nko Community

Plate 31: Consultation with stakeholders in Ikom

Plate 32: Consultation in pictures.
A: Etayim Community. B: ObuduCommunity.
C and D: Consultation with selected stakeholders in Ikom .
E and F: A cross section of participant during consultation in Calabar

4.11 Health Conditions

i. Health Facilities and Services

The study area has both orthodox and non-orthodox health care providers and facilities. The orthodox facilities comprise health centres and health posts while the none-orthodox comprise mainly traditional birth attendants (TBAs). The functional orthodox facilities provide first aid and treatment for minor ailments, as well as immunization services for children and women of child bearing age. The antigens they give include BCG, OPV, DPT, Measles, TT, YF and HBV.

Apart from the orthodox facilities, there are drug stores (chemists) located in some of the communities. There are also hawkers (individuals who carry drugs, especially malaria drugs, analgesics, antibiotics and various creams and balms) hawking drugs from one settlement to another. The number and distribution of these was not determined during the study.

In all the study communities in the twelve LGAs, there are TBAs and those who provide herbal remedies. About 40% of the TBAs across the study area had attended a training programme organized by the Cross River State and Federal Government, aimed at improving their practice by teaching basic procedures intended to make their operation more hygienic and safer. In most cases, these groups do not offer their services on a full time basis. Those who practice treatment with herbs in particular, offer advice on herbs and roots within the environment which they believe bring relief to certain ailments. The number and distribution of these was also not determined during the study.

Plate 33;

A: Boat use for transportation in Ikom. **B: A sign post of a health facility in Ikom**

C: Garri processing in Obubra **D: Restaurant in Nko community**

ii. Utilization of Health Services

Patronage of available orthodox and non-orthodox health care service providers in the study communities across the twelve LGAs is presented in **Table 4.37**.

Table 4.37: Patronage of Health Services in the Study Communities.

Available Health Care Service Providers	LGAs/Frequency									
	Calabar Municipality (%)	Akamkpa (%)	Obubra (%)	Boki (%)	Odukpani (%)	Biase (%)	Akpabuyo (%)	Bakassi (%)	Bekwarra (%)	Odukpani (%)	Ogoja (%)
Hospitals/Health Centres	52.0	40.0	33.0	41.0	22.0	30.0	44.5	19.8	35	40	50
Chemists/Drug Stores	30.0	34.0	38.0	29.0	43.0	29.0	30.1	36.0	35	30	32
Traditional Birth Attendants (TBAs)	8.0	12.0	12.0	15.0	25.0	22.0	11.2	12.0	8	14	9.0
Herbalists/Traditional Medicine Practitioners	4.0	7.0	8.0	7.0	3.0	14.0	5.2	27.1	14	8	5.0
Churches/Spiritual Healing Homes	6.0	7.0	9.0	8.0	7.0	5.0	9.0	5.1	8	8	5.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

In these communities many of the women prefer to give birth under the care of TBAs. Staff of the Health Centres noted that even when some of the women attend ante natal clinic in the orthodox facilities, they prefer to give birth with TBAs, and they attribute this to preference for the traditional body massage given by TBAs after child delivery. Utilization rate of the Health Centres is quite low at 52%, 42%, 38.%, 38%, 22% 30.0%, 44.5% and 19.8% by the communities in Cababar Municipal, Akampka, Obubra, Boki,Odukpani, Yala, Akpabuyo and Bakassi LGAs, respectively. The major problem with these facilities is that they are mostly not functional; equipment and drugs are not available, and staff are inadequate. Additionally, access to health centres located outside most of the settlements is hampered by the cost and time spent in getting to their locations. It was noted during the study that most residents have lost interest in services provided at the Health Centres. The services of herbalists and spiritual healing homes are not too popular with residents in the communities.

Given these conditions and the level of patronage of drug stores, it is possible to deduce that many residents indulge in self-medication.

iii. Water and Sanitation

The sources of water used in households in the study area include water from the surrounding streams and creek, rain water and water from public and private bore holes. Residents of the communities had traditionally used water from the streams and creeks and rain water for domestic purposes. In the past few years, however, some public and private water bore holes have been built in some of the communities for the purposes of providing households with water. Apart from Calabar that have public pipe borne water, the other surveyed communities mostly source their drinking water from boreholes with no official water potability test.

Households in the communities indicated that the majority of them, 78% use public and private boreholes, while 5% and 17% use pipe borne water and stream water respectively. In the twelve LGAs many households avoid the use of rain water as a result of their belief that rain water is being polluted by gaseous emissions and dust from activities in and around their communities. For this reason also, the use of rain water is mostly limited to washing of cloths and other things and not for cooking.

Although most households do not have access to safe potable water, there is no indication that they do not have sufficient water. At interviews they indicated that hygienic practices of washing of hands (especially before and after meals, and after use of the toilet), washing of cloths to keep them clean and taking regular daily baths are taught and practiced in households across communities in the twelve LGAs.

iv. Waste Management Practices

Waste disposal practices in the twelve LGAs are quite similar. Refuse are mostly disposed in the surrounding land and disposal bins provided by the state government (especially in Calabar Municipality). Generally, two methods of sewage disposal practiced are use of pier system toilets and water closet toilets.

It is notable that the common refuse and sewage disposal practices in communities across the study area are not modern, hygienic or safe. Most of these wastes eventually end up in the water bodies around the area or are carried downstream and deposited in other communities. Although those that are easily bio degradable (including sewage), decompose and also provide nutrients for plants and fishes they are still sources of pollution and constitute a health hazard. Those that are not easily degradable (especially metals and plastics) are always visible and obvious pollutants and litter around the environment.

v. Nutrition

The average household in the study area is able to provide two meals daily for its members. The meals consist predominantly of carbohydrate and protein. Commonly available sources of protein are fish and sea foods, especially periwinkles, oysters, prawns and crayfish. These proteins are always available in the soups with which garri (the staple and most common food) is eaten. Other foods eaten include yam, rice, cocoa yam, sweet potato and beans. Although during interviews several residents complained about the nutritional value of the meals they are able to provide for their households, it did not seem from medical records in the few communities where there are functional orthodox health facilities that malnutrition was a common ailment in the communities.

Plate 34:
A: Food Processing in Ikot Enebong
B: Eastern Boki central weekly market
C and D: Typical Housing type in the area

vi. Prevalent Diseases and Disease Vectors

Interviews in household and with health workers in the proposed project communities in the twelve LGAs revealed that the most frequently reported diseases are malaria, diarrhoeal diseases and respiratory tract infections (RTI).

Disease vectors identified in the area are presented in **Table 4.38**. The most common is mosquito which transmits plasmodium responsible for causing malaria in humans. Others are house flies and rats. The environment around the project communities in the twelve LGAs provides the necessary breeding grounds for these disease vectors.

Table 4.38: Common Disease Vectors in the Study Area

Disease Vector(s)	Common Habitat	Parasite(s) Transmitted and Disease(s) Caused
Mosquito (*Anopheles* and *Culex*).	Stagnant water, swamps, bushes.	Plasmodium causes malaria.
House fly and Latrine fly (*Muscadomestica*and *Fanniacanicularis*).	Toilets, refuse heaps and dumps.	Diarrhoeal diseases.
Tse-tse fly (*Glossina sp*)	Bushes.	Trypanosoma, causes sleeping sickness.
Rats	A variety of places including houses (especially where fish is smoked, bushes, drains, swamps).	A variety of diseases including lassa fever, although there was no report of lassa fever in the period before and after the study.

vii. Public Health

The occupational mainstay of the people is farming and fishing. Table 4.39 shows the attendant health risks which the community members are exposed to.

Table 4.39: Occupational Health Risk in the Study Area

S/N	Health risk	Ranking (1-10)	Predisposing Factor
1	Insect bite	10	Fishing/ working in the swamps.
2	Canoe/Boat mishap / Drowning	10	Use of small canoe/boats for fishing/ Transport
3	Matchete cut	5	Farming and palm wine tapping
4	Needle injury	5	Fishing net mending.
5	Myalgia/ Rheumatism	9	Farming/ work fatigue, exposure to Cold
6	Opportunistic infection	5	Farming injury and lack of medical care
7	Snake bite	10	Farmig/ working in the swamps

Ranking: 1(very low) – 10(very high), based on degree of risk.

Source: Fieldworks, 2015

HIV/AIDS Prevalence and Awareness

There is relatively high prevalence of HIV/AIDS among the population. According to the national sentinel study on HIV/AIDs (2005), Cross River States have a prevalence of 6.1-8.0% **(Figure 4.17).** The prevalence rate in Cross River state is higher than the national average (4.4%) and corresponds to the higher tier of prevalence in Nigeria. The sentinel study suggests that there is a rising epidemic in rural areas and calls for an increase in rural area intervention. It is noted however that a good amount of awareness education and advocacy on the disease and its prevention is ongoing and from interviews, these are beginning to yield the desired results.

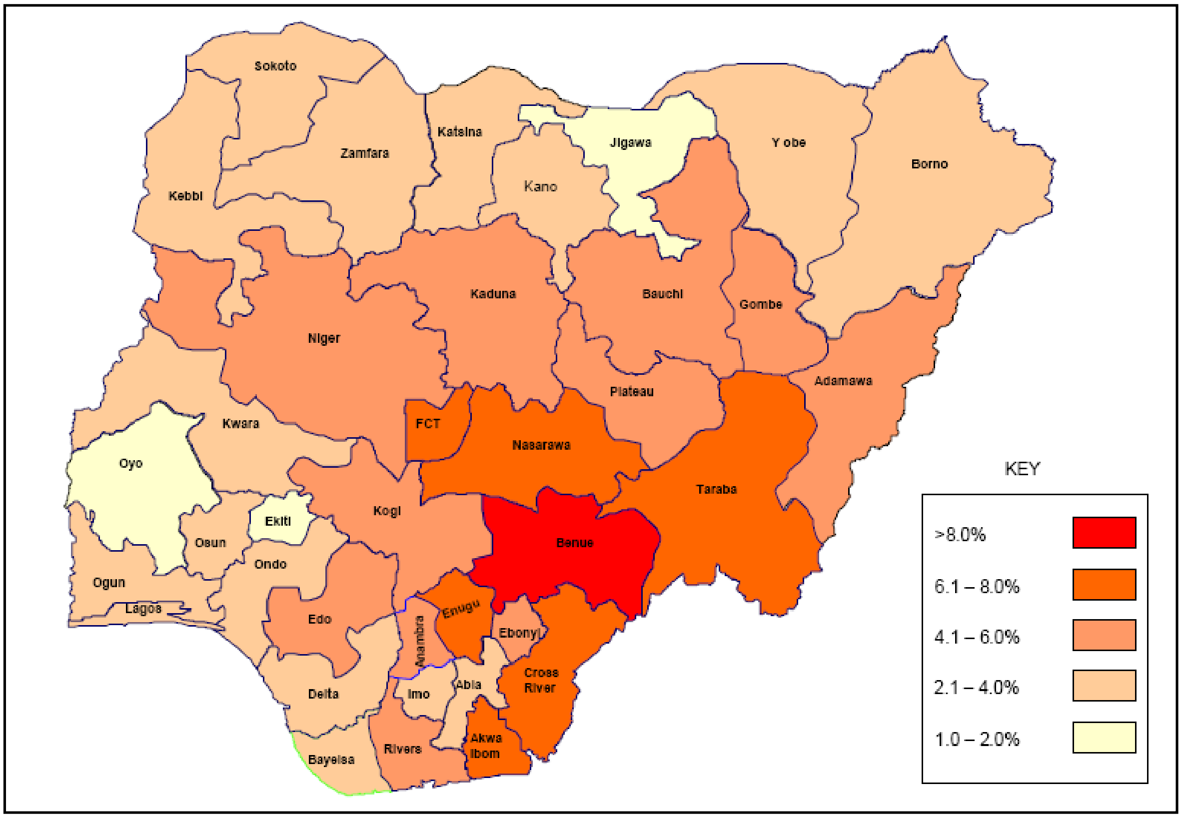

Figure 4.17: HIV/AIDS Prevalence in Nigerian States

Knowledge, Practices and Behaviour on Sexually Transmitted Infections (STIs) and General Health

Previously called venereal diseases (VDs), sexually transmitted infections (STIs) or Sexually Transmitted Diseases (STDs) are diseases primarily transmitted by sexual contact. They can be classified according to the causative agents (bacteria, viruses, chlamydia, parasites and fungi). Its incidence is increasing globally with both poor socio-economic and socio-cultural factors playing significant roles besides other factors such as industrialization and urbanization, labour migration, ignorance and contraception.

Table 4.40 shows unmarried respondents engaged in sexual activity. From this table, 55.7% had sexual rel ationship with persons they were not married to, while 44.3% did not.

Table 4.40:Extra-Marital Partners

Extra-Marital Partners		**Total**
Yes	No	
55.7%	44.3%	100.0

Table 4.41: Awareness of Sexually Transmitted Infections (STIs)

AWARENESS OF SEXUALLY TRANSMITTED		Total
Yes	No	
100.0	0.0	100.0

Table 4.42: Those who Contacted STIs

Ever contacted STIs		Total
Yes	No	
29.0%	71.0	100.0

This project is likely to have a double – pronged effect on the communities. On one hand, it will improve the socio-economic status of the people thereby riveting their attention from sexual activities. On the other hand however, improved economic status could precipitate change in lifestyle leading to high intake of alcohol and increased sexual encounters.

Table 4.43 Where STIs were treated

Where STIs were treated			
Doctor	Nurse	Chemist	Hemp and leaves/Self Medication
8%	11%	29%	52%

The most important tool in prevention/control of STIs is health education which undoubtedly these communities can largely benefit from. The objective of health education is to create awareness of the problem and to motivate people to develop the right attitude to sex. Early diagnosis and early treatment of sick persons will eliminate the reservoir of infections from the communities. Treatment however should be accessible and affordable; otherwise the people will resort to self-medication as seen above where 52% treated themselves via self-medication. Self-medication especially before or after exposure must be discouraged as this may lead to drug resistance.

Chapter 5

5.0POTENTIAL AND ASSOCIATED IMPACTS ASSESSMENT

5.1 Introduction

This chapter of the EIA report presents the methodology used to conduct the impact assessment. This methodology has been developed based on international best practice. The following approach is considered applicable to meet both Nigerian National Requirements, as well as that of financial institutions that have specific requirements for environmental and social performance, such as the Equator Principles Financial Inistutions (EPFI's) as well as Developmental Finance Institutions (DFIs) aligned to the International Financial Corporation (IFC) and the World Bank, should these be required for funding of the Project.

5.2 IMPACT ASSESSMENT METHODOLOGY

The impact assessment (IA) methodology follows the modified Leopold approach illustrated in Figure 5.1. The IA has been undertaken following a systematic process that predicts and evaluates the impacts the Project could have on aspects of the physical, biological, social/ socio-economic and cultural environment, and identifies measures that the Project will take to avoid, minimise/reduce, mitigate, offset or compensate for adverse impacts; and to enhance positive impacts where practicable. The stages of the IA process are described below and further explained in the subsequent sections.

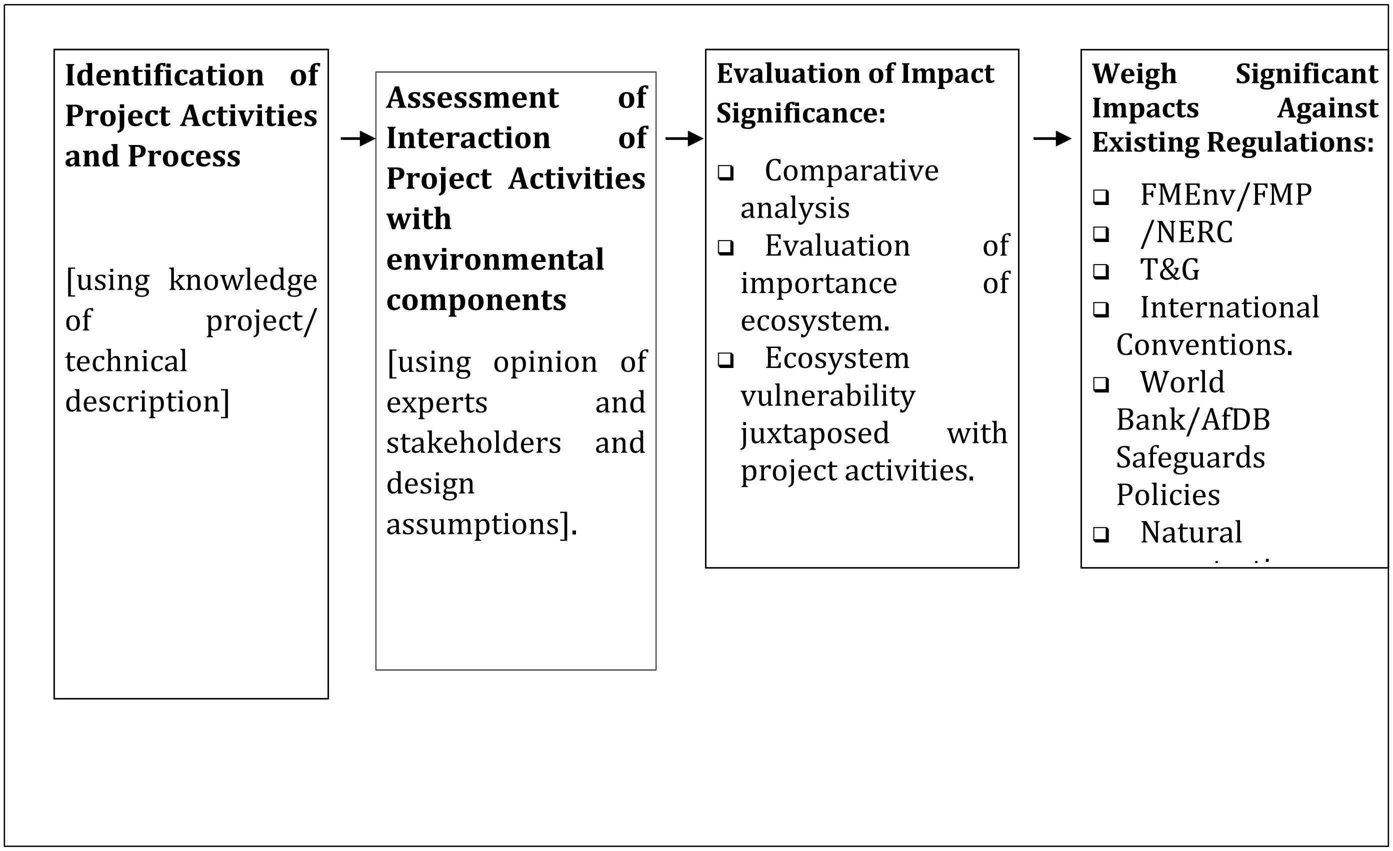

Figure. 5.1: Schematic Representation of Potential Impact Assessment Approach

5.2.1 Scoping

Scoping has been undertaken to identify the potential Area of Influence for the Project (and thus the appropriate Study Area), to identify interactions between the Project and resources/receptors in the Area of Influence and the impacts that could result from these interactions, and to prioritize these impacts in terms of potential significance. This phase is intended to ensure that the IA focuses on those issues that are most important for design, decision-making and stakeholder interest and also to identify data gaps and framework for further studies/assessment.

Scoping also has the benefit of identifying those impacts which are not likely to be significant and hence which warrant little or no further consideration or associated data gathering. Table 5.1 presents the resources/receptors considered in the scoping phase, together with the changes that might indicate a Project-related impact.

Table 5.1 Resource / Receptors and Impact Indicators Considered in Scoping

Resources/Receptors	Impact Indicators
Environmental	
Geology	Changes to geology, geomorphology, topography
Surface Water	Changes to water quality indices, (physicochemical properties, hydrocarbons, metals and hydrobiology); Effluent discharge
Fisheries	Changes in fisheries productivity
Wildlife	Changes to wildlife assemblages, impact on endangered and economic species, food chain effects
Air	Emissions of NOx, SOx, PM, CO, VOC, greenhouse gases (CO_2, CH_4, and N_2O), ozone and changes to ground level concentrations of pollutants
Noise and Vibration	Change in noise or vibration levels at sensitive receptors
Aesthetics	Physical presence of facilities, increased night time light
Sediments	Riverbed morphology, physical and chemical properties, benthic organisms
Social / Socio-economic	
Infrastructure	Improvement or pressure on existing urban/rural infrastructure including waste handling facilities; pressure on other social infrastructure, e.g. schools, health facilities, water supplies, etc
Economy	Change in macro and micro economy, employment, standard of living,

	occupation
Physical and Economic Displacement	Permanent displacement of communities within Project boundary; Temporary physical displacement from land based livelihood as a result of project activities
Cultural Resources	Physical disturbance of shrines, burial grounds, archaeological resources or other desecration
Transportation	Alteration of vehicular movements; pressure on existing roadways and traffic volumes
Community Health	
Influx of workers	Influx of workers and in-migration will change community profile and may affect community health and well-being (e.g. introduction of diseases)
Pollution Related Health Effects	VOC, CO, PM), contamination of surface waters and potable ground water, increased vibration and noise beyond regulatory limits, increased night time light beyond acceptable limits
Accidents/Fires/Explosions	Changes to rate of occurrence and severity of accidents/fires/explosions

5.3 Impact Assessment

Impact identification and assessment starts with scoping and continues through the remainder of the IA Process. The principal IA steps are summarized in Figure 5.2 and comprise:

- Impact prediction: to determine what could potentially happen to resources/receptors as a consequence of the Project and its associated activities.

- Impact evaluation: to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource/receptor

- Mitigation and enhancement: to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts.

- Residual impact evaluation: to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

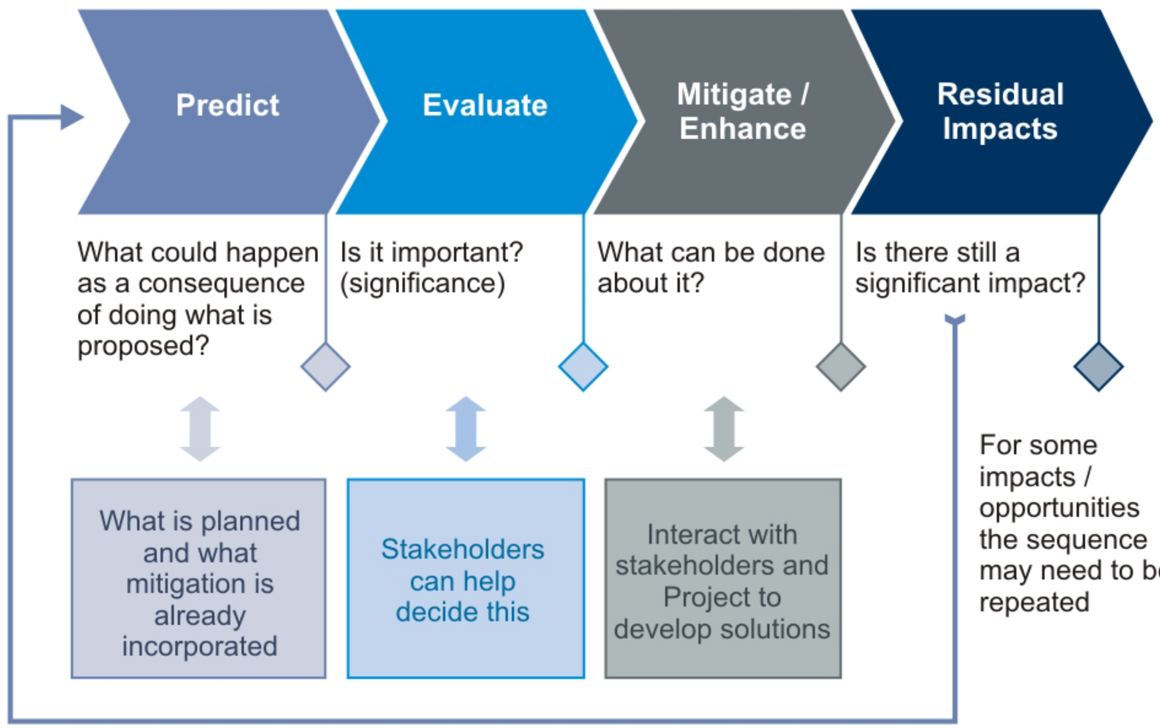

Figure 5.2 Impact Assessment Process

5.3.1 Prediction of Impacts

Prediction of impacts is essentially an objective exercise to determine what could potentially happen to the environment as a consequence of the Project and its associated activities. This is essentially a repeat of the process undertaken in scoping, whereby the potential interactions between the Project and the Baseline environment are identified. In the impact assessment stage, these potential interactions are updated based on additional Project and Baseline information. From these potential interactions, the potential impacts to the various resources/receptors are identified, and are elaborated to the extent possible. The diverse range of potential impacts considered in the IA process typically results in a wide range of prediction methods being used including quantitative, semi-quantitative and qualitative techniques.

5.3.2 Evaluation of Impacts

Once the prediction of impacts is complete, each impact is described in terms of its various relevant characteristics (e.g., type, scale, duration, frequency, extent). The terminology used to describe impact characteristics is shown in Table 5.2.

Table 5.2 Impact Characteristic Terminology

Characteristic	Definition	Designations
Type	A descriptor indicating the relationship of the impact to the Project (in terms of cause and effect)	Direct Indirect Induced
Extent	The “reach” of the impact (e.g., confined to a small area around the Project Footprint, projected for several kilometres, etc).	Local Regional International
Duration	The time period over which a resource / receptor is affected	Temporary Short-term Long-term Permanent
Scale	The size of the impact (e.g., the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc)	[no fixed designations; intended to be a numerical value]
Frequency	A measure of the constancy or periodicity of the impact	[no fixed designations; intended to be a numerical value]

The definitions for the type designations are shown in Table 5.3. Definitions for the other designations are resource/receptor-specific, and are discussed in the resource/receptor-specific chapters.

Table 5.3 Impact Type Definitions

Designations (Type)	Definition
Direct	Impacts that result from a direct interaction between the Project and a resource/receptor (e.g., between occupation of a plot of land and the habitats which are affected).
Indirect	Impacts that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment (e.g., viability of a species population resulting from loss of part of a habitat as a result of the Project occupying a plot of land).
Induced	Impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project (e.g., influx of camp followers resulting from the importation of a large Project workforce).

The above characteristics and definitions apply to planned and unplanned events. An additional characteristic that pertains only to unplanned events is likelihood. The likelihood of an unplanned event occurring is designated using a qualitative scale, as described in Table 5.4.

Table 5.4 Definitions for Likelihood Designations

Likelihood	Definition
Unlikely	The event is unlikely but may occur at some time during normal operating conditions
Possible	The event is likely to occur at some time during normal operating conditions

Once an impact's characteristics are defined, the next step in the impact assessment phase is to assign each impact a 'magnitude'. Magnitude is a function of some combination (depending on the resource/receptor in question) of the following impact characteristics:

- Extent
- Duration
- Scale
- Frequency

Additionally, for unplanned events only, magnitude incorporates the 'likelihood' factor discussed above.

Magnitude essentially describes the intensity of the change that is predicted to occur in the resource/receptor as a result of the impact. As discussed above, the magnitude designations themselves are universally consistent, but the definitions for these designations vary on a resource/receptor-by resource/ receptor basis, as further discussed in each of the resource/receptor specific chapters. The universal magnitude designations are:

- Positive
- Negligible
- Small
- Medium
- Large

In the case of a positive impact, no magnitude designation (aside from 'positive') is assigned. It is considered sufficient for the purpose of the IA to indicate that the Project is expected to result in a positive impact, without characterising the exact degree of positive change likely to occur. In the case of impacts resulting from unplanned events, the same resource/ receptor-specific approach to concluding a magnitude designation is utilised, but the 'likelihood' factor is considered, together with the other impact characteristics, when assigning a magnitude designation. In addition to characterising the magnitude of impact, the other principal impact evaluation step is definition of the sensitivity / vulnerability / importance of the impacted resource/receptor. There are a range of factors to be taken into account when defining the sensitivity / vulnerability / importance of the resource/receptor, which may be physical, biological, cultural or human. Other factors may also be considered when characterizing sensitivity/vulnerability/importance, such as legal protection, government policy, stakeholder views and economic value. As in the case of magnitude, the sensitivity/vulnerability/importance designations themselves are universally consistent, but the definitions for these designations vary on a resource/receptor basis. The universal sensitivity/vulnerability/importance designations are:

- Low
- Medium
- High

Once magnitude of impact and sensitivity/vulnerability/importance of resource/receptor have been characterised, the significance can be assigned for each impact. Impact significance is designated using the matrix shown in Figure 5.3.

		Sensitivity/Vulnerability/Importance of Resource/Receptor		
		Low	Medium	High
Magnitude of Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

Figure 5.3 Impact Significances

The matrix applies universally to all resources/receptors, and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity/vulnerability/ importance designations that enter into the matrix. Box 5.1 provides a context for what the various impact significance ratings signify. It is important to note that impact prediction and evaluation take into account any embedded controls (i.e., physical or procedural controls that are already planned as part of the Project design, regardless of the results of the IA Process). An example of an embedded control is a standard acoustic enclosure that is designed to be installed around a piece of major equipment. The avoids the situation where an impact is assigned a magnitude based on a hypothetical version of the Project that considers none of the embedded controls.

5.3.3 Context of Impact Significances

An impact of **negligible** significance is one where a resource/receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be ‘imperceptible’ or is indistinguishable from natural background variations.

An impact of **minor** significance is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small (with or without mitigation) and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards.

An impact of **moderate** significance has an impact magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.

An impact of **major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of IA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

5.3.4 Identification of Mitigation and Enhancement Measures

Once the significance of an impact has been characterised, the next step is to evaluate what mitigation and enhancement measures are warranted. For the purposes of this IA, PGM has adopted the following Mitigation Hierarchy:

• **Avoid at Source; Reduce at Source**: avoiding or reducing at source through the design of the Project (e.g., avoiding by siting or re-routing activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity).

• **Abate on Site**: add something to the design to abate the impact (e.g., pollution control equipment, traffic controls, perimeter screening and landscaping).

• **Abate at Receptor**: if an impact cannot be abated on-site then control measures can be implemented off-site (e.g., noise barriers to reduce noise impact at a nearby residence or fencing to prevent animals straying onto the site).

• **Repair or Remedy**: some impacts involve unavoidable damage to a resource (e.g. agricultural land and forestry due to creating access, work camps or materials storage areas) and these impacts can be addressed through repair, restoration or reinstatement measures.

• **Compensate in Kind; Compensate Through Other Means**: where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g., planting to replace damaged vegetation, financial compensation for damaged crops or providing community facilities for loss of fisheries access, recreation and amenity space). The priority in mitigation is to first apply mitigation measures to the source of the impact (i.e., to avoid or reduce the magnitude of the impact from the associated Project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

Residual Impact Evaluation

Once mitigation and enhancement measures are declared, the next step in the IA Process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation and enhancement measures.

Management and Monitoring

The final stage in the IA Process is definition of the management and monitoring measures that are needed to identify whether: a) impacts or their associated Project components remain in conformance with applicable standards; and b) mitigation measures are effectively addressing impacts and compensatory measures and offsets are reducing effects to the extent predicted. A Register of Commitments, which is a summary of all actions which the Project Proponent has committed to executing with respect to environmental/social/health performance for the Project, is also included as part of the EIA report. The Register of Commitments includes mitigation measures, compensatory measures and offsets and management and monitoring activities

5.4 SCOPING

Introduction

Potential environmental impacts have been identified through a systematic process whereby the activities (both planned and unplanned) associated with the Project have been considered with respect to their potential to interact with environmental and social resources or receptors. Scoping of potential impacts has been undertaken in two stages:

- First, potential interactions between project activities and environmental receptors have been identified; and

- Second, taking into consideration the information gathered on the extent and nature of project activities, and the existing condition/ sensitivities of the baseline, these potential interactions have been prioritized in terms of their potential to cause significant impacts.

The approach taken and results for each stage are presented below.

Potential Interactions

Environmental and social parameters considered during the Scoping Phase of the Project are provided in Table 5.5 below.

Table 5.5 Environmental and Social Parameters Considered within the Scoping Phase

Physical Environment	Ecological/ Environmental Management	Social Context
Coastal Processes and Sedimentary Regime	Environmental Designations and Protected Species	Demographics and Vulnerable groups
Estuarine Water and Sediment Quality	Coastal Ecology	Socio-Cultural Institutions and Social Cohesion
Geology, Soils and Land Quality	Terrestrial Ecology	Natural Resource use and Land Ownership Patterns
Surface Hydrology, Groundwater and Water Quality	Air Quality (includes climate change) Noise and Vibration Waste Management	Livelihoods and Micro-economy Social Amenities, Infrastructure and Cultural Heritage Community Health

Key Potential Impacts

The following are key impacts identified during Scoping and are evaluated further in this EIA report

Impacts to the Physical Environment

Changes to the physical environment can impact upon biological communities and the ecosystem services that they provide. Table 5.5 presents how the physical environment could potentially be changed and receptors impacted

Potential Impacts on Geology, Soils and Land Quality	
Development Phase	**Potential impacts**
Construction	
Excavation and filling	Excavation of large areas within the site footprint may lead to impact on the sites natural topography and soil structure Accidental spills may lead to impacts on soils and land quality (e.g. Fuel and lubricant storage areas, re-fueling stations; maintenance areas; waste storage areas and plant and equipment holding areas). This may be especially prevalent during high rainfall periods
Operation	
General road usage	Future site operation may lead to impacts to soil, surface hydrology and or groundwater beneath the site from the release of contaminants from spills from accidented tankers and other heavy duty vehicles carrying large volumes of hazardous substances such as hydrocarbons

Potential Impacts on Surface Hydrology, Groundwater and Water Quality	
Development Phase	**Potential impacts**
Construction	
Excavation and filling and piling works	Site operations during construction phase, primarily the extensive excavation proposed, may change the surface hydrology, and thus impact the water quality and groundwater beneath the site. Potential areas of concern are the areas for culverts and bridge constructions

Operation

General road usage	Future site operation may lead to impacts to soil, surface hydrology and or groundwater beneath the site from the release of contaminants from spills from accidented / derailed tankers and other heavy duty vehicles carrying large volumes of hazardous substances such as hydrocarbons. Large areas of pavement might restrict the ability for the groundwater to be replenished which may lead to subsidence

Impacts to the Environment

Table 5.6 below presents how the environment, including biological communities and species could potentially be impacted, and in some cases, impacting the ecosystem services that they provide.

Table 5.6 Potential Impacts on the Environment and Biodiversity

Potential Impacts on Terrestrial Ecology	
Development Phase	**Potential impacts**
Construction	
Excavation	Excavation of large areas within the site footprint may lead to direct loss of terrestrial habitat and some fauna.
Clearing	The clearing and preparation of the area for the development of the road and hard standing storage areas will result in a direct loss of vegetation and habitat for terrestrial fauna.
Road construction	The construction of the road facilities will lead to a direct and permanent loss of area for the establishment of terrestrial habitats and species
Construction equipment and	An indirect effect on terrestrial faunal species could occur relating to the construction activity such and noise and the increase in human activity

Materials	
Operation	
General road usage	An indirect effect on terrestrial faunal species could occur relating to the continued operational activity such and noise and the increase in human activity
Potential Impacts from Noise and Vibration	
Development Phase	**Potential impacts**
Construction	
Excavation and filling and piling works	• Potential disturbance to birds in the area through construction noise and vibration; • Noise from construction plants and vehicles could cause nuisance impact.
Operation	
General road usage	Noise from vehicles could cause nuisance impact
Potential Impacts on Air Quality	
Development Phase	**Potential impacts**
construction	
Infrastructure works (truck and machinery movements	Fugitive dust; • Emissions of nitrogen oxides (NOx) and other chemicals, and particulates (PM_{10} and $PM_{2.5}$) from construction vehicles and mobile plant and potential subsequent impact on human health; • Inefficient use of energy with implicit carbon dioxide emissions; and • Use of paints and solvents with high VOC content
Operation	

General road usage	Emissions of NOx and other chemicals, PM_{10} and $PM_{2.5}$ from operational vehicles and subsequent impact on human health; • Fugitive emissions of hazardous dusts with potential impact on human health and sensitive ecosystems
Potential Impacts from Generation and Management of Waste	
Development Phase	**Potential impacts**
Construction	
Construction	Generation of solid wastes during construction which may contribute to increased waste volumes going to landfill; • Potential contamination of water and ground through negligent handling, storage and disposal of wastes; • Increased volumes of traffic to take waste off the site; and • Potential for reuse of waste inert materials in other activities on site
Operation	
Operation	Any waste produced during operation may contribute to increased waste volumes going to landfill; • Potential contamination of water and ground through negligent handling, storage and disposal of wastes; and • Increased volumes of traffic to take waste off the site.

Impacts to the Social Environment

The communities within the Project zone of influence are predominantly farming villages which also engage in limited subsistence farming, as well as legal and illegal sand mining activities along the route, and petty trading. Table 5.7 presents how these local communities might be impacted by the Project, for example, through changes in land use, resettlement, and impacts on social amenities or fisheries.

Table 5.7 Potential Social Impacts

Potential Impacts on Local Demographics, Especially Vulnerable Groups	
Development Phase	**Potential impacts**
Construction	
General construction	Potential change in the size of the local population, its ethnic make-up and religious make-up.
Operation	
General road usage	Potential change in the size of the local population, its ethnic make-up and religious make-up.
Potential Impacts on Socio-Cultural Institutions and Social Cohesion	
Development Phase	**Potential impacts**
Construction	
General construction	The large number of outside workers required could have a negative impact on social and cultural values among the local residents; and
Potential Impacts on Local Livelihoods and Micro-economics	
Development Phase	**Potential impacts**
construction	
General construction	• Potential positive impact on the local economy as workers will need to stay in the local area during construction of the road. • Disturbance of farming and other local livelihoods

Operation	
General road usage	Indirect employment benefit from supplementary service industry; and • Potential economic growth in the local area
Potential Impacts on Natural Resources and Land Ownership Patterns	
Development Phase	**Potential impacts**
Construction	
General construction	Removal of access to the forests within the footprint. Farmlands and fisheries in the project foot print and their associated income streams to the local population
Operation	
General Operation	Removal of access to the forests within the footprint. Farmlands and fisheries in the project foot print and their associated income streams to the local population

Potential Impacts on Local Social Amenities, Infrastructure and Cultural Heritage	
Construction	
General community Infrastructure	Influx of workers and in-migration could place pressure on the already limited social infrastructure e.g. schools, health facilities, village roads, water supplies, etc
Roads and traffic	• Increased local traffic and delays due to increased construction plant and vehicles moving to and from site; and • Potential impacts to local residents from the development of a road that was not previously there, including increased dust from traffic

	on roads near residential areas
Cultural Heritage	Destruction/removal of sacred forests, shrines, graveyards and other sites of cultural importance as well as potential secondary impacts on the point of no return (PONR)
Operation	
General community Infrastructure	Presence of construction workers and in-migration could place pressure on the already limited social infrastructure e.g. schools, health facilities, village roads, water supplies, etc
Cultural Heritage	Destruction/removal of sacred forests, shrines, graveyards and other sites of cultural importance as well as potential secondary impacts on the Point of No Return (PONR)
Potential Impacts on Community Health	
Development Phase	**Potential impacts**
Construction	
General Construction	Issues during the construction of ports are common to those of most large infrastructure and industrial facilities. These issues include exposure to dust and hazardous materials that may be present in construction materials waste, hazardous materials in other building components (e.g. PCB and mercury in electrical equipment), and physical hazards associated with the use of heavy equipment
Operation	
General Operation	Specific occupational health and safety issues relevant to the superhighway operations primarily include the following:

	• Physical hazards; • Exposure to organic and inorganic dust; and • Exposure to noise

All of the above key impacts identified during Scoping and are evaluated further in this EIA report.

Cumulative Impacts

An assessment of cumulative impacts requires consideration of other plans or projects that may act in combination with the proposed project to cause environmental and social impacts. Cumulative impacts can result from individually slight but collectively significant activities taking place over a period of time. Consideration of other plans or projects in a cumulative impact assessment is usually restricted to those plans or projects occurring at the same time, those that have been consented but not yet completed, or those that are under consideration by the determining authority. No other projects have been identified in the assessed Project's area of influence during Scoping or subsequent phases of the impact assessment process; thus, no cumulative impacts are discussed in this EIA report.

Table 5.8: A summary of Analysis of Impacts

No	Project Activities	Project Phase	Nature of Impact	Permanency of Impact	Magnitude of the Impact	Duration of Impact	Overall impact
			Direct indirect	Reversible irreversible	H M L N	L M S	
1.	Changes in hydrology	Construction	Direct	Reversible	L	S	X
2.	Soil erosion	Construction	Direct	Reversible	M	M	Xx
3.	Air quality issues from construction works.	Construction and in road operations	Direct	Reversible	M	L	Xx
4.	Noise pollution	Construction and in road operations	Direct	Reversible	M	L	Xx
5.	Water quality in the areas of rivers	Construction	Direct	Irreversible	H	L	xxxx
6.	Disposal of waste construction wastes	Construction	Direct	Irreversible	M	M	Xx
7.	Oil spills concerns	Construction	Direct	Irreversible	L	M	Xx
8.	Borrow pits and associated issues	Construction	Direct	Reversible	H	L	xxxx
9.	Stone products from quarries works	Construction	Direct	Reversible	H	L	xxx
10.	Water sources impacts	Construction	Direct	Reversible	L	S	xxx
11.	Construction deviations	Construction	Direct	Reversible	M	M	xxx
12.	Impacts on vegetation and forest areas	Construction	Direct	Reversible	M	M	xxx
13.	Camp site	Construction	Direct	Reversible	M	S	
14.	Management of cut to spoil in which, cut to spoil is sometimes deposited in swamps, forests on used for reclaiming sites.	Construction	Direct	Reversible	H	L	xxxx
15.	Disturbance to the public (noise, workers etc).	Construction	Direct	Reversible	M	S	Xx
16.	Public Health, Human Safety and Environmental Management	Construction	Direct	Reversible	L	S	X
17.	Road safety	Construction	Direct	Reversible	M	L	xxx
18.	Physical Cultural Resources	Construction	Direct	Irreversible	H	L	xxxx

Table 5.8: A summary of Analysis of Impacts

No	Project Activities	Project Phase	Nature of Impact	Permanency of Impact	Magnitude of the Impact	Duration of Impact	Overall impact
			Direct indirect	Reversible irreversible	H M L N	L M S	
	issues that can be lost through earthworks etc						
19.	Waste management Concerns especially solid and effluent in the camp site.	Construction	Direct	Reversible	M	L	xxx
20.	Occupational Safety and Health concerns for the work force	Construction	Direct	Irreversible	S	S	X
21.	HIV/AIDS	Construction	Direct	Irreversible	L	S	X
22.	Gender Mainstreaming	Construction	Direct	Reversible	M	M	xxx
23.	Lost cultivation Opportunities	Construction	Direct	Reversible	M	L	xxx
24.	Uptake of land Areas	Construction and Operational phases	Direct	Irreversible	L	L	X
25.	Interference with National Park	Construction and Operational phases	Direct	Irreversible			
26.	Induced uncontrolled urban sprawl	Operational phase	Direct	Irreversible			

Table 5.9: Summary of Environmental Impacts

SN	Project Component	Activities	Impacts
1.	Route Surveying and mapping	Clearing of roadside vegetation and marking of km chainages	Visual intrusion from paint markings and anxiety on the part of the communities.
2.	Clearing and construction of the road pavement will lead to flooding of low lying areas.	Construction Works	Siltation and flooding of low lying areas
3.	Earth works and clearings	Clearing of vegetation and cutting of areas to attain the required alignments	Soil erosion implications are likely to be generated
4.	Creation of coffer dams for construction of a Bridge across the rivers	Creation of coffer dams for bridges Reconstruction will involve filling of sections of the rivers at the crossing point.	Siltation, impact on water quality and impacting on water
5.	Clearing, grabbing and earth works	Earth works will likely take up parts of the farms and rubber and palm plantations along the route	Lost revenue to the farms and plantations owners
6.	Earthworks will generally generate dust that affects visibility and general air quality levels	Air quality Concerns	Respiratory effects on the health of the workers, reduced visibility in work sites
7.	Land and Property Expropriation Impacts	Surveying and evaluation of properties and lands	Loss of agricultural lands, impacts on crops and grazing areas
8.	Extraction of construction materials (sand, murram etc)	Clearing of over-burden and vegetation materials	Creation of borrow Pits
9.	Construction works across built up sections of the highway	Construction works across these sections will affect traffic flow and even diversion to allow for machine Works	Creation of deviation routes that will likely take up land; Construction works will likely cause traffic holdings to allow smooth flow across such sections.
10.	Operation of plant and equipment as well as activities of the project work force.	General operations of the equipment and workers	Noise pollution from equipment and the workers which will be a nuisance
11.	Earth works and clearings	Clearing of vegetation and cutting of areas to attain the required alignments	Generation of cut to spoil materials
12.	Construction of roadside drains and discharge channel	Creation of roadside drainage channels along the road sections	Hindered access to homesteads due to the depth of the ditches created along the road.
13.	Mobilization of workers	People searching for job opportunities likely to flock to the area	Influx of people in search of jobs
14.	Public health and human safety in the project	Some materials for use in the project may likely be hazardous as well some bye-products are likely to be a potential risk to the health and safety of the workers; and .Numbers of people working on project likely to grow to about 600 workers.	Concerns on health and safety of the workforce are likely to arise.
15.	Storage and dispensing of Fuel	Operations of the fuel/diesel pump facility	Concerns over oil/fuel spillages from fuel pump areas and workshop areas of the project.
16.	Generation of waste from the	Operations of the camp site are like	Pollutions and disease concerns. Putting

Table 5.9: Summary of Environmental Impacts

SN	Project Component	Activities	Impacts
	camp site and sites where works are undertaken	to generate office and domestic waste of varying degrees. Waste in terms of solid waste such as polythene bags, effluent waste etc.	in place waste collection bins in strategic positions in the compounds
17.	Influx of people in search of jobs can generate a number of social concerns on the project.	The youth unemployment is estimated at 60% and information about job prospects on the project will likely draw a number of people from near and far	HIV/AIDS and STI/ STD incidences Will likely rise from the estimated 1.3% for the two districts
18.	The project will employ an estimated 400-600 workers and a majority being men	Workers will be needed in most of the manual and machine based project activities and most of these will be done largely by women	Potential arginalization of a few women who may gain employment in the project **(Gender Mainstreaming)**
19.	Road Safety	Construction based activities will likely involve a number of equipment and construction fleet on the road.	Incidence of accidents will likely rise
20.	Asphalt plant operations	Processing of asphalt through heating.	Generation of bad odours and cause atmospheric pollution
21.	Safety of workers	Exposure to different project work environment	Accidents and related work risks
22.	Generation of waste from the camp site and sites where works are undertaken	Operations of the camp site are like to generate office and domestic waste of varying degrees. Waste in terms of solid waste such as polythene bags, effluent waste etc	Pollutions and disease concerns. Putting in place waste collection bins in strategic positions in the compounds
23.	Storage and dispensing of fuel	Operations of the fuel/diesel pump facility	Concerns over oil/fuel spillages from fuel pump areas and workshop areas of the project.
24.	Earthworks	Disruption of public utilities (water, electricity and water lines)	Interruption in delivery of public services such water and electricity supply
25.	Clearing, grabbing and earth works	Earth works will likely impact on the roadside vegetation	Potential loss of useful trees such as oil palm, mangoes and bananas

Keys:

x:	-	Very low
xx:	-	low
xxx:	-	Medium
xxxx:	-	High
xxxx:	-	Very High

H:	-	High
M	-	Medium
S:	-	Short

5.5 Positive Impacts

These can be summarized as follows:

- Reduced accidents and congestion on the existing Calabar – Ogoja highway and in town centres along the highway as traffic will have been diverted outside the town centres;
- Reduced noise levels from trucks across the town centre from heavy transit traffic;
- Potential of stimulating development along the route of the superhighway; and

5.6 Potential Negative Impacts

Key negative impacts of the project include:

5.6.1 Impacts Relating to Surveying and mapping

The pre-construction activities will mainly be on a limited scale along the route, and will not pose any major issues of environmental concern. However, the marking of houses and properties during surveying will likely create anxiety amongst property owners with regard to properties and compensation rights.

5.6.2 Storm water concerns

Once the road is constructed, a total paved area of about 260000x30m^2 will be produced and this will be impervious to the water. If not well managed, the runoff generated can lead to flooding of low lying areas such as around Farm areas. This will be medium negative impact.

5.6.3 Erosion and Sedimentation

Soil erosion can be expected from areas where the soil is disturbed and exposed to runoff especially on roads that collect water and do not have enough side drainage to handle storm waters. Clearing of vegetation cover during clearing and grubbing of the road reserve and cut and fill operations for widening the road, construction of bridges, culverts and site drains, detours for collecting construction materials from quarries/borrow areas will expose soils during rainy seasons and may result in incremental soil erosion and sedimentation of river courses. Increased erosion during and after construction may lead to siltation of streams.

5.6.4 Degradation of Water Quality

Water quality in the rivers and streams is likely to be affected during construction and operational phases of the project through sedimentation from construction sites and general increase in Total Dissolved Solids and Total Suspended solids amongst others. This is likely to increase costs of water treatment as well general interruption of water supply process through impounding/diversion of water course. This is a very large negative impact on water supply process.

5.6.5 Impacts on Oban Forest Reserve

The project's principal impacts on the biological environment are mainly on terrestrial habitats. These are all summarized as follows.

5.6.6 Loss of farm and plantation Crops

A stretch of farm and plantation cropland which account for less than 20% of total land take that will be lost to the road. The farm and plantation will be cleared giving way for the road.

5.6.7 Land and property expropriation Impact

The road will pass through agricultural/farmlands, this implies, plans to establish the road will present land-uptake challenges for the entire 260km (260,000x50)m which will be needed by the road.

5.6.8 .Impact on water resources

The contractor will require substantial volumes of water for various construction purposes such as adjustment of moisture content of fill, road sub-base and base courses, and watering of haul routes to suppress dust. In addition, the water requirements at the base camps will be relatively high, although these will be much lower than those needed in connection with construction. It is probable that some of the contractors' water requirements will be met by abstraction from watercourses. Watercourses in the project area are mainly used for cattle watering purposes. From local inhabitants, during the dry season, a number of the watercourses which the road crosses tend to have reduced water flow; hence, possible continued water abstractions by the contractor(s) can reduce water availability and lead to possible conflicts with the communities.

5.6.9 Noise and Vibration Impacts

Noise and vibration result from construction activities in general but particularly from operation of heavy machinery. Other operations generating significant noise include concrete mixing plants, blasting in areas of rock excavation and stone crushing. Sustained noise levels during construction are expected to be much higher than the ambient noise level in the project area. Noise and vibration stemming from the construction can be featured by its suddenness, random, discontinuity and high intensity.

5.6.10 Soil Erosion/Siltation of Water bodies

The earthworks will expose land surface with the potential for erosion. Along the hilly areas, this phenomenon can be severe and render the already gullied landform at some sections worse. The runoff in turn, could transport sand, silt and clay and deposit the transported material along the low lying area, which have developed as natural watercourses for flood waters in the project catchment or into streams or tributaries of the rivers and also other smaller swamp areas. As these watercourses become silted up, their natural capacities reduce, leading to worse flood situation in the area. This has the potential to alter the drainage channel, affect water quality, and expose larger areas to flooding in nearby communities. The following mitigation measures are proposed to reduce erosion and siltation:

5.6.11 Disruption of the local economy

Activities characterizing the route of the road project and neighborhood are predominantly, agricultural, residential and commercial. The planned construction works will likely lead to loss of businesses and properties as well as, temporary disruption of public utilities and their services which may eventually lead to the disruption of the local economy. The accompanying stress will result mainly from the loss of landed assets, loss of income and livelihood, as well as the loss of peaceful enjoyment of one's property. Again another important source of "social disruption" is the loss of businesses. It is anticipated that businesses that need to relocate or have to take time off to partially reconstruct premises will lose some of their customers if they must close down to do so.

5.6.12 Land Excavation, Borrow Pits, Access Roads Construction and Campsites

Establishment of access routes, camp sites, stock pile material sites among others as well as the extraction of construction materials (borrow pits) all represent a large negative impact of the project. These land uptake activities all lead to erosion, loss of biodiversity and general interference with ecosystems as well as, disruption to normal social settings in the areas. These are **large negative impacts** though they will be restricted to the construction phases of the project.

5.6.13 Management of Cut to Spoil

The setting out of the road works and its general civil works is anticipated to generate huge Volumes of Cut to Spoil Materials that will need to be disposed of. This EIA cannot with certainty establish the quantities of such materials.

5.6.14 Social Conflicts and Crime Issues

The increased influx of workers is likely to lead to conflict over housing, water sources and related social services. These could also lead to increased crime rate in the areas among other negative behaviours. The thefts could include property of the contractor thereby impacting on the progress of the project. This is likely to be a large negative impact of long term nature.

5.6.15 Occupational Safety and Health (OSH) for the workers

There are a number of health and safety concerns relating to site preparation and construction, including injuries to workers and possible deaths of workers. It is important to note that, of recent, there has been increased incidence of death of workers on construction sites in the country! This is a serious negative impact to the safety and health of the workers.

5.6.16 Public Health and Human Safety at the Camp Site(s)

The project during implementation could introduce some hazardous materials (e.g. some soils stabilization chemicals etc) that could not be envisaged in this study. Such could include some construction and operation-phase inputs, by products and such other materials which can be of physical or chemical risks to human and the wider physical and social environmental settings.

5.6.17 Waste Management

An estimated labour force of about 400-600 workers is estimated to be recruited in this Project and such a large number of mobile work force is likely to generate large volumes of human and associated wastes such as polyethylene bags, water bottles amongst others. This is likely to be a large negative impact with potential far reaching cumulative impacts taking into account that, the project construction will take over 24 months.

5.6.18 HIV/AIDS Concerns

The weighted overall antenatal prevalence rate for HIV/AIDS in the project area is estimated to be about 6.0% with the figure being slightly higher in the urban/trading centres areas of the project (HIV/AIDS Survey Report 2005/06).

During construction of the project, there will be increased influx of people to the area leading to changes in social dynamics and these will affect the HIV/AIDS prevalence. Some of the likely negative social behaviours include increased consumption of alcohol which could lead to promiscuity amongst the workers and the community and subsequent increased in the prevalence of Sexually Transmitted Diseases (STDs) and HIV/AIDS. This represents a very large negative impact of permanent nature.

5.6.19 Gender Concerns

The Government of Nigeria's National Gender Policy seeks to ensure that, a gender perspective is taken in all development programs. Similarly, the government recognizes the importance of transport infrastructure in reducing poverty, promoting investment and human development, and strengthening the capacity to deliver social services of which women play a key role both as providers and recipients. While all persons in the Project area will be affected by the project; it is envisaged that women will bear a greater burden. The expected negative impacts on women include exposure to HIV/AIDS and STIs and increased sexual exploitation of young girls which will also lead to unwanted pregnancies, dropout from school and concerns of poor distribution of employment opportunities for the women. These are **large negative impacts.**

5.6.20 Disruption to services

Disruption of public utilities will likely occur where the superhighway crosses built up areas, especially the urban. It is therefore recognized that, the disruption is anticipated to occur during project implementation process. Some of these services will need to be relocated, in order to accommodate the widened road. Relocation is normally carried out by the service providers upon payment of relocation cost by CRMoW, and needs to be completed prior to commencement of the works, in order to avoid delaying the contractor. However, some interruption of service provision during relocation works is inevitable. Accidental damage to services by the contractor, during execution of the works, can also result in interruption to services and in some of the urban centres and is likely to affect large numbers of people adversely.

5.6.21 Management of Accidental Spills and Risks for Fires

There is very strong potential for environmental damage from the accidental spillage of petroleum products and chemicals on construction sites.

5.6.22 Increased road safety hazards during operation Impact origin and characteristics

The road itself will become inherently safer than at present, as a result of improvements in geometry. However, traffic levels are likely to increase following the completion of upgrading and average vehicle speeds will be considerably higher than at present over many sections. Pedestrians, and other forms of the NMTs as well as occasionally, the livestock are likely to continue to use the whole width of the road, rather than the hard shoulder, and it is inevitable that there will be an increase in accidents, particularly in rural sections, until people adjust to the changed conditions. It is also likely that there will be an increased number of vehicle-vehicle collisions, and that these will be more serious as a result of higher speeds.

5.6.23 Impacts due to Quarry development

The contractor(s) will require large quantities of stone for various construction activities on the road. Stones will require mainly for base course construction and surfacing aspects. Though the feasibility study has come with potential sites for the extraction of stone materials, this EIA has not undertaken detailed assessments on such sites. The process of stone extraction as well as establishing access routes can have adverse negative impacts on both bio-physical and social environment.

5.6.24 Atmospheric Pollution Resulting from the Asphalt Mixing Plants

The processing of asphalt can be a potential source of environmental and social concerns in terms of atmospheric pollution and energy consumption levels especially use of firewood that has detrimental environmental implications. This in itself is **a medium negative impact** of short-term nature.

Chapter 6

6.0 Impacts Mitigation/ Enhancement Measures

6.1 Introduction

This chapter is crucial because many of the impacts outlined in this report can be avoided or minimized through careful attention in the initial planning and design stage. Therefore, this report includes a discussion of the environmental considerations that were taken into account during planning and design of this project in order to incorporate all issues for avoiding or minimizing impacts, for capturing potential benefits, for compensating for residual impacts, and for impact management. In planning and design a balance against potential damage to environment need to be achieved.

Table 6.1: Summary of Environmental and Social Mitigation Measures

SN	Project Component	Activities	Impacts	Mitigation Measures	Results Indicators/ Reference Situation/ Baseline	Period	Surveillance		Cost (USD
							Responsible Entity	Frequency	
1	Route Surveying and mapping	Clearing of roadside vegetation and marking of km changes	Visual intrusion from paint markings and anxiety on the part of the communities.	Sensitization of the communities; Restricting surveying and markings to the road reserve; and Compensation for properties affected during the surveying process	Entire length of the road surveyed and marked.	During RAP and Feasibility studies	CRMoW	Every two months	Embedded in the works contract.
2	Clearing and construction of the road pavement will lead to flooding of low lying areas.	Construction works	Siltation and flooding of low lying areas	Designs to provide for adequate and appropriate culverts to facilitate discharge of flood waters in this lower section.	Road designs providing for appropriate culverts at this section of the road.	Constructio n	CRMoW	Construc tion	To be embedde d in the works contract
3	Earth works and clearings	Clearing of vegetation and cutting of areas to attain the required alignments	Soil erosion implications are likely to be generated	Disposal of excess to spoil in approved sites by the RE; Restricting works to designated areas; Bench terracing of hill tops to check soil erosion; Planting of vegetation	Approved dump sites for cut to spoil identified; Designs for the bench terrace areas in place; Areas with dump sites in place; and	During constructio n	Contractor	Continuo us	Embedde d in the works contract

Table 6.1: Summary of Environmental and Social Mitigation Measures

SN	Project Component	Activities	Impacts	Mitigation Measures	Results Indicators/ Reference Situation/ Baseline	Period	Surveillance		Cost (USD
							Responsible Entity	Frequency	
				on open/cleared surfaces	Soil erosion control measures instituted (areas planted with grass in place).				
4	Creation of coffer dams for construction of a Bridge across the rivers	Creation of coffer dams for bridges reconstruction will involve filling of sections of the rivers at the crossing point.	Siltation, impact on water quality and impacting on water	Siltation, impact on water quality and impacting on shall be filled in polythene bags to reduce loose soil materials getting into the rivers; and Costs for water works mitigation will be taken up by the CRMoW under payments for relocation of utilities.	Coffer dams in place and water quality clear or silt in sections of the dams; Culverts installed as per Engineers designs.	Construction	Supervising Engineer	Monthly	Costs in the works contract
5	Clearing, grabbing and earth works	Earth works will likely take up parts of the farms and rubber and palm plantations along the route	Lost revenue to the farms and plantations owners	Compensation for lost crops Notification of the farmers to harvest the crops in that part of the farms and plantations affected; Cleared crops can be used as mulch on the remaining parts of farms and	RAP report in place and covering crop costs; and Schedule of compensation for the crops in place.	Construction	Construction Supervising Consultant CRMoW	Continuous	Embedded in RAP Report

Table 6.1: Summary of Environmental and Social Mitigation Measures

SN	Project Component	Activities	Impacts	Mitigation Measures	Results Indicators/ Reference Situation/ Baseline	Period	Surveillance		Cost (USD
							Responsible Entity	Frequency	
				plantations					
6	Earthworks will generally generate dust that affects visibility and general air quality levels	Air quality concerns	Respiratory effects on the health of the workers, reduced visibility in work sites	Regular sprinkling of water to suppress dust; and Provision of PPEs to the road workers etc	Contractors dust suppression schedules in place; PPEs for the workers procured and worn by the workers	Constructio n	Supervising Consultant/ CRMoW	Continuo us	Embedde d in works contract
7	Land and Property Expropriation Impacts	Surveying and evaluation of properties and lands	Loss of agricultural lands, impacts on crops and grazing areas	Adequate, fair and prompt compensation of affected PAPs; Providing information early enough to the PAPs; and The RAP shall be made responsive to the needs of the PAPs.	The PAPs fully compensated and /or resettled by the project.	Three years	CRMoW	Monthly	Costs in RAP document
8	Extraction of construction materials (sand, murram etc)	Clearing of over-burden and vegetation materials	Creation of borrow pits	Leasing of borrow areas; Systematic opening of borrow pits while stockpiling overburden; Landscaping of borrow areas after works; Retention of 10% of	Agreements with landlords over borrow areas in place; Stockpiles of overburden materials from borrow areas in place; Number of fully restored	During constructio n and Defects Liability Period of the project.	CRMoW	Quarterly	Costs in Works contracts

Table 6.1: Summary of Environmental and Social Mitigation Measures

SN	Project Component	Activities	Impacts	Mitigation Measures	Results Indicators/ Reference Situation/ Baseline	Period	Surveillance		Cost (USD
							Responsible Entity	Frequency	
				the Contract sum till end of Defects Liability Period; Sequential restoration i.e. starting with unusable boulders and ending up with the over-burden; and Clearance by FMEnv / MMSD on satisfactory completion of restoration of borrow areas	and landscaped borrow areas in place; Certificate of satisfactory restoration of borrow areas issued by FMEnv / MMSD				
1.	Construction works across built up sections of the highway	Construction works across these sections will affect traffic flow and even diversion to allow for machine works	Creation of deviation routes that will likely take up land; Construction works will likely cause traffic holdings to allow smooth flow across such sections.	Compensate for the deviation routes; Restoration of the deviations after works on the highway; Involvement of the traffic police in regulating traffic flow across construction sections; and Employing flag persons to control traffic flow across sections	with landowners on the creation of deviations; Record of deviations created; Number of route deviations restored at the end of the project; and Number of flag persons employed to regulate traffic on the road	Constructio n phase	CRMoW/Su pervising Consultant	Continuo us	Embedde d in works contract

Table 6.1: Summary of Environmental and Social Mitigation Measures

SN	Project Component	Activities	Impacts	Mitigation Measures	Results Indicators/ Reference Situation/ Baseline	Period	Surveillance		Cost (USD
							Responsible Entity	Frequency	
				where works are being undertaken.					
2.	Operation of plant and equipment as well as activities of the project work force.	General operations of the equipment and workers	Noise pollution from equipment and the workers which will be a nuisance	Provide PPEs to the workers; Restricting workings to daytime; Contractor(s) to have in place Health and Safety plan for the project.	Record and number of PPEs purchased in place; Lists of workers using PPEs; and Contractor's Health and Safety plan in place.	Construction	CRMoW	Monthly	Works contract
3.	Earth works and clearings	Clearing of vegetation and cutting of areas to attain the required alignments	Generation of cut to spoil materials	Disposal of excess to spoil in approved sites by the RE; Restricting works to designated areas; Bench terracing of hill tops to check soil erosion; Planting of vegetation on open/cleared surfaces	Approved dump sites for cut to spoil identified; Designs for the bench terrace areas in place; Areas with dump sites in place; and Soil erosion control measures instituted (areas planted with grass in place)	During construction	Contractor	Continuous	Embedded in the works contract
4.	Construction of roadside drains and	Creation of roadside	Hindered access to homesteads due to the depth	Temporary access routes be provided to	Inventory/list of homesteads whose access will	Construction Period	CRMoW	Quarterly	Embedded

Table 6.1: Summary of Environmental and Social Mitigation Measures

SN	Project Component	Activities	Impacts	Mitigation Measures	Results Indicators/ Reference Situation/ Baseline	Period	Surveillance		Cost (USD
							Responsible Entity	Frequency	
	discharge channel	drainage channels along the road sections	of the ditches created along the road.	the homesteads; At the end of works, provide culvert access to homesteads after completion of works	be affected in place; Temporary access to homesteads in place; and Number of access culverts in place				in the works contract
5.	Mobilization of workers	People searching for job opportunities likely to flock to the area	Influx of people in search of jobs	Employing local labour Force likely to cause social conflicts and crime increase. Working with the Local Councillors (LCs) in the recruitment of workers; and Project to work closely with local enforcement agencies to curb crime	Number of local people employed in the project Meetings held with local authorities esp. LCs; Meetings held with the area law enforcement agencies	Continuous	CRMoW	Continuous	Embedded in the works contract
6.	Public health and human safety in the project	Some materials for use in the project may likely be hazardous as	Concerns on health and safety of the workforce are likely to	Putting in place, a plan for handling and management of any hazardous materials;	Measures on how to handle waste instituted;	Construction	Health Inspectors, FMEnv and CRMoW		

Table 6.1: Summary of Environmental and Social Mitigation Measures

SN	Project Component	Activities	Impacts	Mitigation Measures	Results Indicators/ Reference Situation/ Baseline	Period	Surveillance		Cost (USD
							Responsible Entity	Frequency	
		well some bye-products are likely to be a potential risk to the health and safety of the workers; and .Numbers of people working on project likely to grow to about 600 workers.	arise.	Designate specific areas for smoking; OSH plan for the Contractor be in place; Adequate facilities in place for the workers; Adequate and appropriate accommodation facilities be put in place; and Routine cleanliness of Contractor(s)facilities e.g. toilets etc.	Areas for smoking designated; An OSH plan prepared by the Contractor; and Accommodation for workers certified by the health inspectors				
7.	Storage and dispensing of fuel	Operations of the fuel/diesel pump facility	Concerns over oil/fuel spillages from fuel pump areas and workshop areas of the project.	Areas where fuels and lubricants are stored be paved and of standard types; Standby fire fighting equipment in place	Paved storage areas around the fuel pump; Firefighting equipment in place; Oil interceptor in place around such areas; Put in place standard oil interceptors in place; The facilities shall	Continuous	FMEnv/Supervising consultant	FMEnv/Supervising consultant	Integrated in the works contract

Table 6.1: Summary of Environmental and Social Mitigation Measures

SN	Project Component	Activities	Impacts	Mitigation Measures	Results Indicators/ Reference Situation/ Baseline	Period	Surveillance		Cost (USD
							Responsible Entity	Frequency	
					be for filling not servicing plant and equipment				
8.	Generation of waste from the camp site and sites where works are undertaken	Operations of the camp site are like to generate office and domestic waste of varying degrees. Waste in terms of solid waste such as polythene bags, effluent waste etc.	Pollutions and disease concerns. Putting in place waste collection bins in strategic positions in the compounds	Exercise good hygiene in the camp site through routine cleaning of toilets, compound and areas of project activities. Hazardous wastes such used oils, lubricants, old batteries and tyres be recollected by their suppliers	Number of employees dedicated to maintenance of camp site cleanliness and hygiene; Presence of waste collection facilities e.g. bins located in strategic places in the campsite. Copies of evidence of agreements with suppliers of tyres, batteries showing their commitment to pick the used items.	Continuous	Health Inspectors from the areas/ Supervising Consultant/FMEnv	Continuous	Integrated into the works contracts
9.	Influx of people in search of jobs can generate a number of social concerns on the	The youth unemployment is estimated at 60% and information about job prospects on	HIV/AIDS and STI/STD incidences will likely rise from the estimated 1.3% for the two	The project will procure the services of an HI/AIDS Service Provider to conduct awareness sensitization,	An HIV/AIDS Service Provider in place; HIV/AIDS and STI/STD sensitization programme	Continuous	CRMoW/Supervising Consultant	Continuous	35,000

Table 6.1: Summary of Environmental and Social Mitigation Measures

SN	Project Component	Activities	Impacts	Mitigation Measures	Results Indicators/ Reference Situation/ Baseline	Period	Surveillance		Cost (USD
							Responsible Entity	Frequency	
	project.	the project will likely draw a number of people from near and far	Districts	VCT services and administration of ARVs.	in place; Number of HIV/AIDS and STI/STD seminars held				
10	The project will employ an estimated 400-600 workers and a majority being men	Workers will be needed in most of the manual and machine based project activities and most of these will be done largely by women	Potential marginalization of a few women who may gain employment in the project (Gender Mainstreaming	It is suggested that, about 30% of the workforce will be allocated to women; There shall be gender sensitivity in allocation of tasks to encourage women involvement in the project; Conduct gender sensitization in the project; and Employment of a Gender/Social Specialist on the project to oversee gender issues in the project	Records showing that, 30% of the workers being; Gender sensitization programmes in place; and A gender Specialist to conduct gender sensitization recruited by the project.	Continuous	Supervising Consultant/ CRMoW	Continuous	30,000
11	Road Safety	Construction based activities will likely involve a number of equipment and	Incidence of accidents will likely rise	The project procures services of Road Safety campaigner to conduct sensitization	Road Safety sensitization/ campaigner in place	Quarterly	CRMoW/Supervising Consultant	Continuous	30,000

Table 6.1: Summary of Environmental and Social Mitigation Measures

SN	Project Component	Activities	Impacts	Mitigation Measures	Results Indicators/ Reference Situation/ Baseline	Period	Surveillance		Cost (USD
							Responsible Entity	Frequency	
		construction fleet on the road.		campaigns of safety aspects of the road be put in place					
12	Asphalt plant operations	Processing of asphalt through heating.	Generation of bad odours and cause atmospheric pollution	Asphalt plant to have in-built heating processes that emit minimal odours; Provide workers on the Asphalt plant with PPEs; and Regular cleaning of the area around the Asphalt plant	Regularly cleaned areas around the Asphalt plant; and PPEs for the workers on the Asphalt plant	Continuous	Supervising Consultant/ FMEnv	Continuous	Built in the contract sum
13	Safety of workers	Exposure to different project work environment	Accidents and related work risks	Provide workers with appropriate PPEs	PPEs in place	Construction	Supervising consultant	Continuous	Embedded in the works contract
14	Generation of waste from the camp site and sites where works are undertaken	Operations of the camp site are like to generate office and domestic waste of varying degrees. Waste in terms of solid waste	Pollutions and disease concerns. Putting in place waste collection bins in strategic positions in the compounds	Exercise good hygiene in the camp site through routine cleaning of toilets, compound and areas of project activities. Hazardous wastes such used oils, lubricants,	Number of employees dedicated to maintenance of camp site cleanliness and hygiene; Presence of waste collection facilities e.g. bins located in strategic	Continuous	Health Inspectors from the areas/ Supervising Consultant	Continuous	Integrated into the works contracts.

Table 6.1: Summary of Environmental and Social Mitigation Measures

SN	Project Component	Activities	Impacts	Mitigation Measures	Results Indicators/ Reference Situation/ Baseline	Period	Surveillance		Cost (USD
							Responsible Entity	Frequency	
		such as polythene bags, effluent waste etc		old batteries and tyres be recollected by their suppliers.	places in the campsite. Copies of evidence of agreements with suppliers of tyres, batteries showing their commitment to pick the used items.				
15	Storage and dispensing of fuel	Operations of the fuel/diesel pump facility	Concerns over oil/fuel spillages from fuel pump areas and workshop areas of the project.	Areas where fuels and lubricants are stored be paved and of standard types; Standby fire fighting equipment in place around such areas; Put in place standard oil interceptors in place; The facilities shall be for filling not servicing plant and equipment	Paved storage areas around the fuel pump; Firefighting equipment in place; Oil interceptor in place	Continuous	FMEnv/Supervising consultant	Continuous	Integrated in the works contract
16	Earthworks	Disruption of public utilities (water, electricity and water	Interruption in delivery of public services such water and electricity supply	CRMoW to liaise with utility providers	Modalities of payments for utility relocation in place.	Construction	supervising Engineer	Continuous	Embedded in the costs for works contract

Table 6.1: Summary of Environmental and Social Mitigation Measures

SN	Project Component	Activities	Impacts	Mitigation Measures	Results Indicators/ Reference Situation/ Baseline	Period	Surveillance		Cost (USD
							Responsible Entity	Frequency	
		lines)							
17	Clearing, grabbing and earth works	Earth works will likely impact on the roadside vegetation	Potential loss of useful trees such as oil palm, mangoes and bananas	Compensation for lost trees; Compensatory tree planting; Restrict works to only desired sections to minimize loss of vegetation.	Budget for roadside trees in place; and Number of trees planted	Continuous	Supervising Consultant/CRMoW	Continuous	10,000
18	TOTAL COST FOR EMP IMPLEMENTATION								175,000

Table 6.2: Summary of Social Impact Mitigation//Enhancement Measures

SN	Potential Impact	Proposed Avoidance and Mitigation and enhancement Measures	Responsible Agency
1.	Enhancing employment opportunities	• establish a recruitment policy which favours Nigerians and local residents with specific targets for women and other vulnerable • advertise criteria for skilled and unskilled jobs using local media • Support adult education for those with limited skills Support community projects	CRMoW Local and Women council Contractors CDOs
2.	Maximizing purchase of local goods and services	• Assess local and district capacity to supply goods and services • set procurement targets for , local suppliers and women • train local contractors to ensure future opportunities • build capacity of local contractors for small scale repair work	Contractors CRMoW Development Partner
3.	Maximize local skills improvement	Avail opportunities for development &, promotions for locals- both women and men • Support adult education to meet minimum Requirements	Development Partner Contractor
4.	Food insecurity due to increased prices and loss of land acquired	the recruitment and skills development policy to focus on the economically vulnerable groups provide improved seeds Ovoid displacement where possible	Contractors, CRMoW, District and local leaders, Women council, NGOS, Development partners
5.	Landless and limited access to housing and other services due to displacement	Compensate in kind and resettle those who are most vulnerable – orphans, widows and the landless	Contractors, Local government, NGOs
6.	Increased women and child poverty as they are abandoned by family head	Introduce joint account Involve LC, probation officer and NGOs Support community projects	CRMoW, Contractors, Local leaders, Women council, Development partners, NGOS
7.	Increase in spread of HIV/AIDS among host	Partner with local government and NGOs to deliver an HIV/AIDS awareness programme amongst employees contractors and communities. • Establish a community engagement plan to ensure on-going identification issues and concerns.	CRMoW, Contractors, Local leaders, Women council, Development partners NGOS

Table 6.2: Summary of Social Impact Mitigation//Enhancement Measures

SN	Potential Impact	Proposed Avoidance and Mitigation and enhancement Measures	Responsible Agency
		• Promote use of protective equipment and distribute condoms • Put in place effective Emergency health facilities, Train peer counsellors and volunteers. • Recruit a Welfare Officer or liaise organize workplace HIV/AIDs related activities	
8.	Increased risk of Malaria	minimise the creation of mosquito breeding areas - open ditches and stagnant water • educate all workers about the measures for mitigating malaria transmission, • Equip health centres around the construction sites and works camp	Contractors, Ministry of Health, Local Medical officers, Community health workers
9.	Health hazards and safe	For workers • health and safety training skills staff • compensation schemes • Provide protective wear • emergency health facilities at construction sites • Inform workers, visitors and contractors about potential hazards & endemic disease of the local landscape. • Routing traffic away from wetland areas, • Put in place dust and emission minimization, speed controls, and noise suppressors • Public toilets	Contractors, Ministry of Health, Local government
10.	Road accidents	A holistic approach focusing on educational and communication enforcement and engineering. • sustained education and communication campaign • Standardize helmets, safety belts and speed enforcers by FRSC	CRMoW, FRSC, Local leaders, NGOs, Contractors

Table 6.2: Summary of Social Impact Mitigation//Enhancement Measures

SN	Potential Impact	Proposed Avoidance and Mitigation and enhancement Measures	Responsible Agency
		• Equip hospitals and health centres quipped with an ambulance, stretchers and first aid kits • Work with National Transport Safety Council and Arrive Alive • Provisions for underground path, flyovers, signposts, humps and zebra crossing road bridge walkways for NMT and Pedestrians	
11.	Increasing accidents affecting women, children, elderly and PWDS	ensuring wide pavements to enable the improve mobility • raise awareness about white canes, raised zebra crossings • Providing clear road signs and education of the public about the deaf. • provision of bells, alarms, reflectors, and direction indicators at cross roads • Improve orthopaedic workshop with adequate materials to make equipment for all forms of disability • adequate lighting on the streets and subways • provide traffic and road safety education at the affected schools	CRMoW FRSC, Local leaders NGOs Contractors
12.	Increased Pressure on Social Infrastructure and Service Delivery (direct)	Support local government to improve community under the component of the social fund • Contractors provide own social infrastructure • upgrade and maintain community and feeder road	Contractors CRMoW Development Partners
13.	Interruption and blocking access to social services due to temporary closure of access roads	Informed communities in advance of any planned disruption to community infrastructure and services • Provide alternative arrangements in case of unplanned interruption, • providing an alternative potable source of water until the water supply can be reinstated • implement a grievance procedure that is easily accessible to community	Local leaders Contractors CRMoW

Table 6.2: Summary of Social Impact Mitigation//Enhancement Measures

SN	Potential Impact	Proposed Avoidance and Mitigation and enhancement Measures	Responsible Agency
14.	Introduction of negative subculture or social disorders due to anti-social activities	Employ local people • Develop an operations personnel works code of conduct. • Periodic training on community relations and culture • Drug and alcohol abuse prevention programme • Zero tolerance of bribery or requesting gifts from villages	Contractor and local authorities
15.	Increase in the social Ill	As above • Zero tolerance of bribery or requesting gifts from villages. • Zero tolerance of unlicensed prostitution; illegal sale or purchase of alcohol; sale, • implement a grievance procedure that is easily accessible to local villagers, • Awareness raising among local villages regarding the grievance procedure. • Appoint a permanent community liaison officer to interact with the communities	Contractor Local leaders CRMoW
16.	Increasing community and family conflicts	Even and transparent distribution of resources and benefits. • Introduce and encourage joint accounts for payments • Involve probation officer and LC to resolve family issues	Contractors, Local and women councils, Probation officers, NGOS
17.	Perceptions of Corruption and lack of community participation-	Maintain constructive relationship with the community through an elaborate communication strategy • .Monitor community attitudes to the project through community	Contractor CRMoW
18.	Contaminating waters sources due to flooding	Identify alternative sites or routes through protection of specific resources. • Divert the flow of surface water around the site • Develop a site drainage plan to reduce storm water flow water is discharged from the site.	Contractor

Table 6.2: Summary of Social Impact Mitigation//Enhancement Measures

SN	Potential Impact	Proposed Avoidance and Mitigation and enhancement Measures	Responsible Agency
19.	Soil erosion clearing of vegetation	Support tree planting activities on the bare hills Support soil and water conservation measures	Development partner Local government Contractor
20.	Fuelwood shortage and increase distance to collect firewood due to clearing of woodlots and Vegetation	Introduce fuel wood savings stoves Support tree planting	Development partner Local government Contractor

6.2 Positive Impacts

These can be summarized as follows:

- Reduced accidents and congestion on the existing Calabar – Ogoja highway and in town centres along the highway as traffic will have been diverted outside the town centres;
- Reduced noise levels from trucks across the Town centre from heavy transit traffic;
- Potential of stimulating development along the route of the superhighway; and

6.3 Potential Negative Impacts

Key negative impacts of the project include:

6.3.1 Impacts Relating to Surveying and mapping

The pre-construction activities will mainly be on a limited scale along the route, and will not pose any major issues of environmental concern. However, the marking of houses and properties during surveying will likely create anxiety amongst property owners with regard to properties and compensation rights.

Mitigation measures

• Sensitization and awareness programmes as part of the RAP which will likely address such concerns.

6.3.2 Storm water concerns

Once the road is constructed, a total paved area of about 260000x30m^2 will be produced and this will be impervious to the water. If not well managed, the runoff generated can lead to flooding of low lying areas such as around Farm areas. This will be medium negative impact.

Mitigation measures

• This is to be mitigated by installing culverts of appropriate diameters across such points. The Design Consultant is to take up this measure and integrate it into the overall project Design.

6.3.3 Erosion and Sedimentation

Soil erosion can be expected from areas where the soil is disturbed and exposed to runoff especially on roads that collect water and do not have enough side drainage to handle storm waters. Clearing of vegetation cover during clearing and grubbing of the road reserve and cut and fill operations for widening the road, construction of bridges, culverts and site drains, detours for collecting construction materials from quarries/borrow areas will expose soils during rainy seasons and may result in incremental soil erosion and sedimentation of river courses. Increased erosion during and after construction may lead to siltation of streams.

Erosion levels can also be monitored during the operation phase and remedial mitigation measures such as bank protection, slope stabilization especially at box culvert bridges can be improved by building gabion walls and concrete retaining walls as necessary. Tree planting can stabilize less steep slopes. Revegetation will be done where bare soil is created due to construction works.

6.3.4 Degradation of Water Quality

Water quality in the rivers and streams is likely to be affected during construction and operational phases of the project through sedimentation from construction sites and general increase in Total Dissolved Solids and Total Suspended solids amongst others. This is likely to increase costs of water treatment as well general interruption of water supply process through impounding/diversion of water course. This is a very large negative impact on water supply process.

Mitigation

The impact of the project on water quality is proposed to be mitigated through:

- The Contractor's Environmentalist shall be involved during the planning for bridgeworks in proposing the mitigation measures to be implemented alongside works activities.

- Supervision of implementation of mitigating measures is by a consultant appointed by CRMoW. Monitoring of compliance with mitigation measures will be carried out by CRMoW, FMEnv and the LGAs Environment Officers.

6.3.5 Impacts on Oban Forest Reserve

The project's principal impacts on the biological environment are mainly on terrestrial habitats and the Oban Forest Reserve. These are all summarized as follows. Destruction of habitat, due to increased accessibility to Oban Forest Reserve.

Mitigation Measures

- In addition, there shall roadside tree planting which will add to the aesthetics of the road and in a way, serve to compensate for the lost portion of the forest to the road and also to clearly delineate the road reserve; and

- Trees planted shall be protected from cattle and grazers/browsers through caging is recommended since the area is a cattle keeping zone.

6.3.6 Loss of farm and plantation Crops

Many stretches of farmlands and plantations will be lost to the road construction process. These farms and plantations will be cleared giving way for the road.

Mitigation Measures

- The farmers will be first notified to harvest their banana crop before clearance process;
- The farmers to be allowed to harvest their crops and also take them for mulching purposes; and
- The farmers will be compensated for their farms and plantation crops that will be lost to the road project and costs are being computed in the RAP study.

6.3.8 Land and property expropriation Impact origin and characteristics

The road will pass through agricultural/farmlands, this implies, plans to establish the road will present land-uptake challenges for the entire 260km (260,000x60)m which will be needed by the road. Since land is scarce in the project areas, land uptake will be a very large negative impact in both the direct and in direct dimension and could be mitigated through:

- Adequate, fair, and prompt compensation and resettlement of communities through the RAP process;

- Communicating to the PAPs early enough on the schedules of the project so that, they can adjust on a number of their plans as well as identify alternate schools for their children; and

- Furthermore, the RAP shall define mechanisms for the Resettlement of some of the PAPs as their needs my demand. The demands and needs of the PAPs may differ and therefore, the Resettlement process shall be responsive to the extent, possible to the prevailing needs of the beneficiaries/PAPS.

6.3.9 Impact on water resources

The contractor will require substantial volumes of water for various construction purposes such as adjustment of moisture content of fill, road sub-base and base courses, and watering of haul routes to suppress dust. In addition, the water requirements at the base camps will be relatively high, although these will be much lower than those needed in connection with construction. It is probable that some of the contractors' water requirements will be met by abstraction from watercourses. Watercourses in the project area are mainly used for cattle watering purposes. From local inhabitants, during the dry season, a number of the watercourses which the road crosses tend to have reduced water flow; hence, possible continued water abstractions by the contractor(s) can reduce water availability and lead to possible conflicts with the communities.

Mitigation measures

Water access related impacts can be minimized by requiring the contractor to make his own arrangements for water supply which will not affect the rights of others, and to provide an alternative supply if interference does occur.

6.3.10 Noise and Vibration Impacts

Noise and vibration result from construction activities in general but particularly from operation of heavy machinery. Other operations generating significant noise include concrete mixing plants, blasting in areas of rock excavation and stone crushing. Sustained noise levels during construction are expected to be much higher than the ambient noise level in the project area. Noise and vibration stemming from the construction can be featured by its suddenness, random, discontinuity and high intensity. The Contractor is required to strengthen the management and mitigate such sound sources resulting from the construction activities as material transportation, knocking, striking and shouting, etc. during the construction, by means of rational execution and intensified management. The influence area of vibration is within 20 meters from the roadsides. The heavy plant equipment shall not be permitted during the night near the residential quarters.

Mitigation Measures proposed will include:

- With regard to protecting people's health from environmental risk and pollution through a number of measures such as; routine sprinkling of water on dust surfaces to suppress dust, availing workers with Personal Protective Equipment (PPE) such as masks, helmets, hand gloves, boots and ear muffs;

- There are concerns with regard to noise from equipment which is likely to be a nuisance to the public and the nearby institutions. To address noise concerns, it is proposed that, the project could provide for screening off roadside residences through tree planting;

- Restrict construction in residential areas to day time hours to minimize disrupting sleep in the nearby communities;

- Trucks carrying fine construction materials (sand, lime, gravel and soils) that can easily be blown by wind shall be covered with tarpaulins; and

- All these concerns shall be addressed in the contractor's Health and Safety Programs which shall detail his/her plans of managing noise, dust and safety in the work force.

6.3.11 Soil Erosion/Siltation of Water bodies

The earthworks will expose land surface with the potential for erosion. Along the hilly areas, this phenomenon can be severe and render the already gullied landform at some sections worse. The runoff in turn, could transport sand, silt and clay and deposit the transported material along the low lying area, which have developed as natural watercourses for flood waters in the project catchment or into streams or tributaries of the rivers and also other smaller swamp areas. As these watercourses become silted up, their natural capacities reduce, leading to worse flood situation in the area. This has the potential to alter the drainage channel, affect water quality, and expose larger areas to flooding in nearby communities. The following mitigation measures are proposed to reduce erosion and siltation:

Mitigation Measures

- Proper storm water drainage facilities (culverts) have been designed at the under listed chainages areas to prevent any erosion that may contribute to the increase of suspended solids;

- Clearing of grass along the undisturbed sections will be implemented progressively. Clearing of the site will be restricted to the RoW and its associated servitude; and

- A suitable cover grass e.g. Cyanodon grass shall be planted along drainage channels to reduce scouring effect of water. Steep surfaces would also be kept under grass cover, or where applicable, such surfaces will be stone pitched to stabilize the slope and control erosion.

6.3.12 Disruption of the local economy

Activities characterizing the route of the road project and neighborhood are predominantly, agricultural, residential and commercial. The planned construction works will likely lead to loss of businesses and properties as well as, temporary disruption of public utilities and their services which may eventually lead to the disruption of the local economy. The accompanying stress will result mainly from the loss of landed assets, loss of income and livelihood, as well as the loss of peaceful enjoyment of one's property. Again another important source of "social disruption" is the loss of businesses. It is anticipated that businesses that need to relocate or have to take time off to partially reconstruct premises will lose some of their customers if they must close down to do so.

Mitigation Measures

- A comprehensive property impact survey have been conducted which indicates all affected properties within the ROW, their owners and possible replacement costs;

- In addition, a comprehensive resettlement plan has been prepared to ensure that project affected persons are appropriately compensated;

- Prior to the compensation process, the Project Affected Persons (PAPs) will be individually notified about the compensation amount to be paid;

- In case of disagreement on the compensation amount, the PAPs have the option of Appealing for Valuation review; and

- If the parties do not find a solution, the PAP may appeal to the law court for a determination.

6.3.13 Land Excavation, Borrow Pits, Access Roads Construction and Campsites

Establishment of access routes, camp sites, stock pile material sites among others as well as the extraction of construction materials (borrow pits) all represent a large negative impact of the project. These land uptake activities all lead to erosion, loss of biodiversity and general interference with ecosystems as well as, disruption to normal social settings in the areas. These are large negative impacts though they will be restricted to the construction phases of the project. The following measures are proposed as mitigations. These are:

- First and foremost, extraction of construction materials and campsites establishments shall be undertaken after due payment of compensation to the affected persons in terms of land uptake and potential crops loss;

- The Contractor's EMP shall detail measures to address environmental and social impacts of borrow pits and this shall be drawn in line with FMEnv Approval conditions for the project as well as the EIS for the project; In addition, the Contractor shall prepare stand-alone Project Briefs to cover issues of borrow pits and Project Briefs shall be approved by FMEnv;

- Access roads used during the construction phase shall be rehabilitated after completion of the work except where the community expresses need to retain such infrastructures for their use;

- Project Briefs for Borrow Pits shall be undertaken as per the FMEnv. The brief shall have a detailed decommissioning plan detailing how the contractor intends to restore the borrow pits after the completion of the project. The restored borrow pits at the end of the project have to be inspected and approved by the respective environment authorities and FMEnv at the end of the Defects Liability Period; and

- Some percentage of the contract sum (10%) shall be retained during its Defects Liability Period of 12 months. At the end of the Defects Liability period, payments of the 10% shall be pegged on among others, satisfactory restoration/rehabilitation of the environment. In particular, the Project Completion Report shall have a component on environment (Final Mitigation Report) prepared by the contractor and approved by FMEnv / MMSD before the Supervising Engineer can issue a certificate of Environmental Compliance, and

- A payment of royalties to the locals for now is left to the districts to provide evidence on how they will need to share the revenue from such meetings. The current system is that, trucks carrying construction materials (sand, clay, stones) are levied by the local governments in their check point areas

6.3.14 Management of Cut to Spoil

The setting out of the road works and its general civil works is anticipated to generate huge Volumes of Cut to Spoil Materials that will need to be disposed of. This EIA cannot with certainty establish the quantities of such materials. To mitigate cut to spoil concerns, the following mitigation measures are proposed:

- The cut to spoil materials shall be stored and used in borrow pit and other restoration activities;
- No dumping of such materials shall be encouraged along the road especially at the road reserve areas;
- The Contractor will have to acquire dump sites where the cut to spoil materials will be deposited. No dumping of such material shall be done in wetlands or other ecological sites; and
- There shall be consent with the local authorities to the effect that some of the act to spoil could be used in restoration of some sites in shall be done ecologically areas (wetlands/forests**).**

6.3.15 Social Conflicts and Crime Issues

The increased influx of workers is likely to lead to conflict over housing, water sources and related social services. These could also lead to increased crime rate in the areas among other negative behaviours. The thefts could include property of the contractor thereby impacting on the progress of the project. This is likely to be a large negative impact of long term nature.

The following measures have been proposed:

- In order to minimize the negative social behaviours, it is recommended that, where necessary and feasible, the local labour force from within the immediate communities shall be recruited to minimize housing pressures as well as, social conflicts in the communities;

- For purposes of recruiting the local labour force, the contractor shall work closely with are local council leadership to identify suitable persons for employment. In addition, the contractor needs to liaise with the local Chiefs on matters of local labour recruitment arrangements;

- The contractor shall put in place, a Project Labour Force Policy to address all matters relating recruitment and disciplinary measures for the workers; and

- The contractor needs to work closely with the existing law enforcement agencies in the areas of the project (Local Councils and the police) to help address potential issues of crime in the project.

6.3.16 Occupational Safety and Health (OSH) for the workers

There are a number of health and safety concerns relating to site preparation and construction, including injuries to workers and possible deaths of workers. It is important to note that, of recent, there has been increased incidence of death of workers on construction sites in the country! This is a serious negative impact to the safety and health of the workers.

- With regard to protecting people's health from environmental risk and pollution through a number of measures such as; routine sprinkling of water on dust surfaces to suppress dust, availing workers with Personal Protective Equipment (PPE) such as masks, helmets, hand gloves, boots and ear muffs. There are concerns with regard to noise from equipment which is likely to be a nuisance to the public institutions (e.g. school and health centres). To address noise concerns, the project shall provide some form of screening by tree planting and where noise nuisance may be of large impact, a barrier wall could be erected to seal off the road especially in school settings;

- Trucks carrying fine construction materials (sand, lime, gravel and soils) that can easily be blown by wind shall be covered with tarpaulins; and • The contractor's detailed and responsive OSH Plan shall be consistent with the Nigeria labor laws such as the Occupational Safety and Health laws, the

Workman's Compensation laws and other such relevant laws. Besides taking into account the national legal regime in such a Policy, such a Policy shall be consistent with ILO labor laws;

- It is important that, the contractor has on the site responsive Emergency Response Mechanisms e.g. a standby ambulance.

6.3.17 Public Health and Human Safety at the Camp Site(s)

The project during implementation could introduce some hazardous materials (e.g. some soils stabilization chemicals etc) that could not be envisaged in this study. Such could include some construction and operation-phase inputs, byproducts and such other materials which can be of physical or chemical risks to human and the wider physical and social environmental settings.

Mitigation Measures will include:

- This study recommends that, the Contractor shall of necessity, come up with a comprehensive plan for the management of any potentially hazardous materials in the various phases of the project;
- For purposes of the public health of the camp site dwellers, the Contractor shall designate some specific zones in the camp site as cigarette smoking zones. This implies, no smoking signs shall be posted on specific points in the campsite;
- The Contractor shall prepare an Occupational Safety and Health plan elaborating management of occupants' safety and health concerns with clear regulations of implementation, monitoring and reporting;
- There shall be adequate public facilities (toilets and bath shelters) for the workers;
- The office as well as workers accommodation shall be adequate
- Casual workers shall not be crumbed into small rooms and the office space shall spacious and well light; and
- There shall well define programme for routine cleanliness of public utilities in the camp site. Toilets, kitchen as well as the general compound area shall be well kept through grass cutting and sweeping.

6.3.18 Waste Management

An estimated labor force of about 400-600 workers is estimated to be recruited in this Project and such a large number of mobile work force is likely to generate large volumes of human and associated wastes such as polyethylene bags, water bottles amongst others. This is likely to be a large negative impact with potential far reaching cumulative impacts taking into account that, the project construction will take over 24 months.

Proposed mitigation measures will include:

- The Contractor shall have a clear plan on how to manage the project waste and general cleanliness in the camp site and the project generally;
- It is important to have in the camp site measures to recover and reuse some of the waste generated;
- separate toilet facilities for males and females and these be clearly marked with standard signs;
- There shall routine cleaning of the camp site and its associated facilities such as toilets and bath areas;
- The workers responsible for cleaning given areas like toilets shall be availed appropriate wear (hand gloves, boots etc for those scrubbing toilets);
- In addition, storage of used oils shall be undertaken is a facility specially designed to store hazardous waste. The facility shall be licensed by FMEnv. Transportation of used oils shall be undertaken by a FMEnv licensed transporter to a facility licensed by FMEnv for storage or disposal of such waste.
- For other hazardous waste such as old car batteries they shall be reexported to the suppliers for proper disposal measures rather than disposing them within the vicinity of the project;
- There shall clearly marked out containers for collecting used/waste oils and shall be picked and disposed off by the suppliers;
- Areas of servicing construction fleet shall be paved with provisions for managing accidental spills; and
- There is need to acquire a dump site for the disposal of any excess excavated soils and associated wastes that are not likely to be re-used in the road project. Such a site has to be approved by the RE and shall be in wetland or forest areas.

6.3.19 HIV/AIDS Concerns

The weighted overall antenatal prevalence rate for HIV/AIDS in the project area is estimated to be about 6.0% with the figure being slightly higher in the urban/trading centres areas of the project (HIV/AIDS Survey Report 2005/06). During construction of the project, there will be increased influx of people to the area leading to changes in social dynamics and these will affect the HIV/AIDS prevalence. Some of the likely negative social behaviours include increased consumption of alcohol which could lead to promiscuity amongst the workers and the community and subsequent increased in the prevalence of Sexually Transmitted Diseases (STDs) and HIV/AIDS. This represents a very large negative impact of permanent nature.

While Special Specifications in the Contract Documents may stipulate this need, it is of common concern that implementation has tended to be less effective than expected on some of the project. Clear ToRs on HIV/AIDS service providers have therefore been adapted for Nigeria and will be used to enrich the Contract Document

6.3.20 Issues of People with Disabilities of (PWDS)

CRMoW has prepared a policy statement and guidelines for mainstreaming concerns of PWDS and the elderly into its plans and activities. It is important that, the design of the project takes into account special needs for the PWDS and the Elderly. In addition, there shall be needs of NMT taking into account PWDs all integrated into the overall project design. Where ramps are needed, such facilities are provided to help the PWDs cross some areas on the planned road areas.

6.3.21 Road Safety

Just like many developing countries, road safety is increasingly becoming a major concern in Nigeria. Traffic accidents have killed on average over 2000 people in the past 5 years in Nigeria as a whole. The fatality rate therefore has been between 68.5 fatalities per 10,000 vehicles and 82.3 per 10,000 vehicles. It is noted that, road safety activities have not been effectively coordinated in some other construction projects.

6.4.22 Gender Concerns

The Government of Nigeria’s National Gender Policy seeks to ensure that, a gender perspective is taken in all development programs. Similarly, the government recognizes the importance of transport infrastructure in reducing poverty, promoting investment and human development, and strengthening the capacity to deliver social services of which women play a key role both as providers and recipients. While all persons in the Project area will be affected by the project; it is envisaged that women will bear a greater burden. The expected negative impacts on women include exposure to HIV/AIDS and STIs and increased sexual exploitation of young girls which will also lead to unwanted pregnancies, dropout from school and concerns of poor distribution of employment opportunities for the women.

These are large negative impacts which are proposed to be mitigated through the following measures:

- The contractor shall allocate a certain percentage (e.g. 30%) of jobs to be taken up women. To the extent possible, there shall be gender sensitivity in task allocation to the women;
- The contractor shall conduct gender sensitization to the work force on matters such as gender sensitive communication and on the gender sensitive conduct of workers towards women amongst others;
- There shall be gender sensitivity in the camp site with respect to facilities (toilets and bath shelters); and
- The contractor shall hire a Gender Specialist to help engender the project in line with the National Policy on Gender provisions.

6.4.23 Disruption to services

Disruption of public utilities will likely occur where the superhighway crosses built up areas, especially the urban. It is therefore recognized that, the disruption is anticipated to occur during project implementation process. Some of these services will need to be relocated, in order to accommodate the widened road. Relocation is normally carried out by the service providers upon payment of relocation cost by CRMoW, and needs to be completed prior to commencement of the works, in order to avoid delaying the contractor. However, some interruption of service provision during relocation works is inevitable. Accidental damage to services by the contractor, during execution of the works, can also result in interruption to services and in some of the urban centres and is likely to affect large numbers of people adversely.

Mitigation measures

It is recommended that:

- CRMoW shall liaise with all utility/service providers along the project road of all the planned road works/programme at the earliest possible time to enable them plan for the relocation of such utilities;

- Service providers and owners of the utilities shall provide detail information and location maps of their properties in the ROW to enable the contractor take the necessary precautions;
- A clause shall be included in the construction contract which requires the contractor to specify, in the detailed construction programme prepared during the mobilization period, the earliest dates on which construction works will commence in each town where services relocation may be required. CRMoW shall then notify the appropriate authorities of the relevant dates, and request completion of relocation works before those dates; and
- A clause shall be included in the construction contract which makes the contractor liable for any damage to services resulting from his or his subcontractors' actions. Any damage caused to services by the contractor or subcontractors shall be made good without delay at the contractor's cost.

6.3.24 Management of Accidental Spills and Risks for Fires

There is very strong potential for environmental damage from the accidental spillage of petroleum products and chemicals on construction sites. To minimize this possibility and related possible adverse effects on the environment from such spills, it is increasingly realized that, Contractor need to develop plans to deal with such possible emergency situations. Such plans shall include guidelines and measures for the reporting spills, training procedures, resource allocation and the supervision of containment and restoration procedures.

This EIA proposes some pertinent steps that could be put in place to address such concerns.

Mitigation Measures

- It is absolutely important that, spills greater than or equal to 100litres of flammable/combustible liquids or waste oil shall be immediately reported to the police 999 and the Fire Brigade. Emergency preparedness will include critical examination of each of the construction toidentify potential hazards;
- Hazardous compounds shall be stored in secure locked containers on site in secured enclosures. Compounds used in the curing of concrete, lubricants, and fuel for small equipment will be present on site and kept tidy especially after work;

- There is need for an internal alerting system in case of spills. This is because; timely and accurate reporting of accidental spills can help to ensure quick and efficient response. Alerting system/plan shall include clear and detailed information regarding sources and location of such risks;
- Principally, the purpose of such a response plan shall be to initiate an immediate response with trained personnel and equipment to clean up and ensure containment, disposal, and monitoring, including details regarding equipment and personnel allocation, are also presented; and
- Finally, the plan shall contain a commitment for restoring the contaminated site to its previous state before the accidental spill.

6.3.25 Increased road safety hazards during operation Impact

The road itself will become inherently safer than at present, as a result of improvements in geometry. However, traffic levels are likely to increase following the completion of upgrading and average vehicle speeds will be considerably higher than at present over many sections. Pedestrians, and other forms of the NMTs as well as occasionally, the livestock are likely to continue to use the whole width of the road, rather than the hard shaller, and it is inevitable that there will be an increase in accidents, particularly in rural sections, until people adjust to the changed conditions. It is also likely that there will be an increased number of vehicle-vehicle collisions, and that these will be more serious as a result of higher speeds.

Mitigation measures

- Drivers, pedestrians and livestock will gradually become accustomed to the increased traffic and vehicle speeds, and it is likely that the number of accidents will show some decrease after being at a relatively high level in the early months of operation;
- It is very difficult to see that any physical measures can be taken which will effectively reduce the accident rate, since the problems are essentially related to driver behaviour and level of competence. In the long term, better driver training and a requirement for higher standards of competence to be achieved before licenses are granted, together with the introduction of mobile police patrols shall be expected to have some effect, but it is unlikely that these will be introduced in the near future;
- Traffic signs shall be posted at accident prone sites; and maintained and supervised regularly by CRMoW officials; and

- On the other hand, the traffic police shall ensure the provision and observance of such safety measures and enforcement of traffic regulations.

6.3.26 Impacts due to Quarry development

The contractor(s) will require large quantities of stone for various construction activities on the road. Stones will require mainly for base course construction and surfacing aspects. Though the feasibility study has come with potential sites for the extraction of stone materials, this EIA has not undertaken detailed assessments on such sites. The process of stone extraction as well as establishing access routes can have adverse negative impacts on both bio-physical and social environment.

Mitigation measures

- The contractor will have to prepare a separate EIA together with a detailed Environmental and Social Management Plan (EMP) for approval by the FMEnv, prior to commencement of quarry operations.
- If an existing and operational stone quarry is used to supply the materials then it use will be a subject of an Environmental Audit.

6.3.27 Management of Cut to Spoil

The setting out of the road works and its general civil works is anticipated to generate volumes of cut to spoil materials that will need to be disposed of in the project.

To mitigate cut to spoil concerns, the following measures are proposed:

- First and foremost, dumping sites for the cut to spoil materials shall be approved by the RE and not anyhow and anywhere;
- Possibilities of re-use of the cut to spoil materials in the restoration of excavated areas especially the borrow pits shall be explored and this shall be done with approval of the RE. This option will reduce man agement challenges with reference to cut to spoil materials experienced on most of the road projects;
- The dumping of cut to spoil in wetlands or valleys under the authority of the communities shall not be allowed as this is a tendency where wetlands and valleys are to be reclaimed for use by the communities;

- No dumping of such materials shall be undertaken along the road the reserve areas of either the project or, other roads in the vicinity of the project;
- Where need be, the Contractor will have to acquire dump sites for the disposal of the cut to spoil materials; and
- Experience has shown that, sometimes the communities request Contractor to dump cut to spoil in some areas e.g. wetlands, valleys yet their long term objective is to reclaim such sites for their use. It is here stressed that, the RE shall therefore not allow such practices by the Contractor.

6.3.28 Atmospheric Pollution Resulting from the Asphalt Mixing Plants

The processing of asphalt can be a potential source of environmental and social concerns in terms of atmospheric pollution and energy consumption levels especially use of firewood that has detrimental environmental implications.

This in itself is **a medium negative impact** of short-term nature.

- To address such concerns, the asphalt batching plant with in-built measures to optimize asphalt processing with minimal emission of offensive odours;
- The workers on such a plant shall be provided with appropriate PPE to protect them from hot asphalt burns;
- Location of the asphalt plants shall take into consideration environmental and social considerations addressed in a Project Brief in line with the FMEnv and such sites shall be leased from the landlords; and
- The contractor shall ensure that work area around the asphalt plant is kept clean and all spillage of asphalt is routinely removed; and
- There shall be proper designs for the operational area for the Asphalt processing, its storage as well as for other inputs.

6.3.29 Potential Loss of Access Routes to Properties and Homesteads

The construction works for the superhighway will potentially cut off access to some of the properties including homesteads, churches and schools. In some cases, Contractor can cut such access routes leaving no alternate access for the communities and can be worse for the case of health and education institutions in case there are emergencies.

That can cause inconvenience to the occupants of facilities and the following measures are proposed:

- The Contractor shall reinstate access routes as soon as possible to reduce inconvenience to the occupants of such facilities;
- Arrangements for alternate routings/access to such facilities shall be explored for such affected areas/homes; and
- Where works are continuing on such access routes, the work areas shall be sealed off to avoid accidents for the road users.

6.3.30 Management of fuel pump facility

The project is expected to establish a fuel pump to supply fuel (diesel) for its plant and equipment fleet. This EIA proposes that, the Contractor puts in place some basic needs for the operations of the diesel fuel pump which shall include:

- The areas of bulk storage facilities such as underground tanks shall be sealed off from traffic;
- The area around shall be properly paved to allow natural discharge of storm water and any accidental spillages of oils and lubricants;
- The Contractor must put in place a standard oil interceptor which shall be regularly maintained so as to effectively manage accidental oil spills in the pump area;
- The Contractor shall put no smoking signs in and around the fuel pump area to check potential fires from careless cigarette smoking;
- There shall be metal guard rails placed around the fuel pump to protect it from accidental knocks by vehicles which come refueling;
- There shall buckets of sand and fire extinguishers in the pump area in case of any fire outbreak; and

The facility shall only be for fuel filling not servicing plant and equipment for the project. The servicing of plant equipment shall be restricted to specially designed places such as workshops and paved and roofed buildings for such purpose.

6.4 Further Commitments by CRSG

- The Contractor shall comply with legal obligations related to this project and shall use the National Environmental Standards as a guide for emission limits. In absence of any emission limits in the national standards, the contractor shall use other internationally acceptable standards for the limits;

- There has been public concern over the possible encroachment into the Oban Forest Reserve in view of the fact that, the Forest lies along the planned route of the superhighway. This has been largely avoided at the planning and design stages, diverting the road from Forest;

All displaced parties and other groups who will lose property shall be fairly and promptly compensated;

- The Contractor shall closely work with FMEnv, State Ministry of Environment and affected Local Government Councils and communities during the entire project implementation period in the implementation of the EMP;

- The contractor shall follow all the formalities related to development control and approval systems for this nature of projects;

- The Contractor shall fully rehabilitate campsites, borrow pits and road sides after project completion;

- A comprehensive programme shall be developed to facilitate sensitizations and training of workers and the general public on HIV/AIDS and STDs; and

- Leased lands that will be used for temporary works of the project shall be returned to the rightful owners after completion of the work

6.5 ADDITIONAL IMPACT ASSESSMENT & MITIGATION/ENHANCEMENT MEASURES

6.5.1 AIR QUALITY IMPACT ASSESSMENT & MITIGATION/ENHANCEMENT MEASURES

6.5.1.1 Introduction

This section presents an assessment of the potential air quality impacts associated with the proposed construction and operation of the Project. Potential key sources of air emissions and air sensitive receptors have been identified. Significance of potential air quality impacts has been assessed. Mitigation measures are recommended where necessary.

6.5.1.2 Air Quality Criteria and Performance Requirements

The air quality impact assessment was conducted with reference to the relevant international guidelines and local legislation, regulations and standards, which are discussed in the following sections.

6.5.1.3 Nigerian Ambient Air Quality Standard

The Federal Environmental Protection Agency's "Interim Guidelines and Standards for Industrial Effluent, Gaseous Emissions and Noise Limitations" provides guidelines and standards to ensure that industrial activities are compatible with a clean and safe environment in Nigeria. Chapter 3 of the Guidelines presents the national ambient air quality standards for Nigeria.

The air quality standards relevant to this air quality assessment are presented Table 6.3.

Table 6.3 Relevant Nigerian Ambient Air Quality Standards (a)

Air Pollutant	Time of Average	Limit
Particulates (in terms of PM10	Daily Average of 1-hour values 1 hour	250 µgm-3 600 µgm-3 (d)
Sulphur oxides (SOx) as Sulphur Dioxide (SO_2)	Daily Average of hourly values 1 hour	26 µgm-3 (0.01ppm (b)) 260 µgm-3 (0.1ppm
Non-methane hydrocarbons (NMHCs)	Daily Average of 3-hourly values	160 µgm-3 (c)
Carbon monoxide (CO)	Daily Average of hourly values 8-hours average	11.4 µgm-3 (10 ppm) 22.8 µgm-3 (20 ppm)
Nitrogen Oxides (NOx) as Nitrogen Dioxide (NO_2)	Daily Average of hourly values (range)	75.0 – 113 µgm-3 (0.04 – 0.06 ppm)

Source: Table 3.4 of the "Interim Guidelines and Standards for Industrial Effluents, Gaseous Emissions and Noise Limitations", Federal Environmental Protection Agency (1991). Translated Version

6.5.1.4 International Finance Corporation (IFC) Guidelines

To supplement the aforementioned local guidelines and criteria, the following recent IFC guidelines, relevant to the Study, are recommended:

- IFC General EHS Guidelines: Air Emissions and Ambient Air Quality;
- IFC General EHS Guidelines: Construction and Decommissioning;

The IFC General EHS Guidelines: Air Emissions and Ambient Air Quality requires projects with the potential or significant ambient air quality impacts to prevent or minimise impacts by ensuring that emissions do not result in pollutant concentrations that reach or exceed the relevant national legislated ambient quality guidelines and standards.

The IFC General EHS Guidelines: Construction and Decommissioning recommends measures for controlling fugitive dust from construction works and air emissions from the operation of diesel powered construction equipment. It does not provide any emission standards for specific air quality parameters.

6.5.2 SCOPE OF THE ASSESSMENT

6.5.2.1 Potential Air Quality Impact during the Construction Phase

The construction of the Project during the initial phase includes the following:

- Clearing of vegetation along the horizontal alignment;
- Cut and fill to change vertical road alignment, remove top layer and to facilitate the construction of road related infrastructure including drainage facilities such as bridges and culverts at specific sections of the alignment;
- Excavation of gravel sub layers and other fill materials;
- Construction of campsites involving the construction of temporary shelters, installation of water and electricity, paving or levelling to accommodate equipment and stores, etc;
- Blasting and mining of quarry at the quarry site (outside project site);
- Construction /setting up of water abstraction points along some of the rivers;
- Transportation of soil and construction materials from their sources
- Construction of road related infrastructure including bridges, culverts, parking spaces/bus bays, road furniture/signs;

- Application and compaction of base layer and sub base natural laterite gravel and sub grade layer of classified material to facilitate road paving and sealing processing;
- Road paving and sealing;
- Road signage;
- Construction of road shallers and road drainage systems, e,g. drainage off-shoots, stone pitching of side channels;
- Landscaping and rehabilitation of degraded sites including borrow pits and detours;
- Revegetation; and
- Decommissioning of project.

Construction equipment and activities will be the major sources of construction air quality impact that could impact human receptors. Fugitive dust emission is the key air emission of concern during the construction activities whereas nitrogen dioxide (NO_2), particulates (PM_{10}) and sulphur dioxide (SO_2) are the key air pollutants of concern associated with the emissions from diesel-powered construction equipment.

6.5.2.2 Potential Air Quality Impact during the Operational Phase

The key sources of air emission associated with the operation of the road development during the initial phase are expected to include those associated with the increase in vehicular traffic along the highway.

The road and associated loading/unloading will operate on a 24-hour basis. Key emission sources and air pollutants that are considered in the operational phase are will be vehicular.

6.5.2.3 Air Sensitive Receptors

The nearest air sensitive receptors that will potentially experience air quality impacts during the construction and operational phases of the Project are identified as the communities located along the road alignment. If the air quality impacts at these nearest air sensitive receptors are acceptable, those air sensitive receptors located further away will also be low and acceptable. It shall be noted that the structures within the ROW of the project will be acquired and therefore relocated or demolished, after due compensation, before the construction of the Project and hence they are not identified as air sensitive receptors in this assessment.

6.5.3 Baseline Conditions

As outlined in Chapter four air quality monitoring was undertaken during the rainy season (September) and the long dry season (January) in 2016. Sampling was undertaken within a 5km buffer area of the Project Site. Sampling locations are shown in Chapter four. All measurements were carried out during the day between hours 0900 and 1700. The sampling results show that the background concentrations of all the monitored pollutants were either not detected (shown as "0") or very low and below the Nigerian Ambient Air Quality Standard.

6.5.4 ASSESSMENT METHODOLOGY

A qualitative assessment of the potential impacts of predicted air emissions from the various construction and operational activities has been undertaken.

6.5.4.1 Assessment of Air Quality Impact During The Construction Phase

The site clearance and excavation works will cover approximately 780 hectares of land over the long-term (ie, 275 hectares during the initial phase and 505 hectares during subsequent phases). Project construction will also involve reclamation works, and construction of the road, including the light and internet facilities.

6.5.5 Potential Consequences

Site Clearance and Excavation Works

During site clearance and excavation works, vegetation with some building materials from abandoned houses and village structures will be cleared and disposed of. The excavated materials will be reused as far as possible onsite.

Materials handling, trucks movements within the work sites, wind erosion of the open bare area and stockpile of loose materials are the potential sources of fugitive dust emissions. Owing to the reuse of materials onsite as far as practicable, the truck trips required for offsite disposal of materials will not be many. Hoardings of 2.4m height will be erected along the boundary of the project material storage sites. Furthermore, dust suppression measures and good site practices recommended will be implemented during the construction works to minimize the fugitive dust emission. During the initial phase, the separation distance between the worksite boundary and the nearest community (village near the coastal line to the eastern Project site boundary (A5)) will be greater than 300 m. During subsequent phases, a minimum buffer distance of 100 m will be provided between the community and the Project boundary. With the implementation of dust suppression measures and good site practices, provision of sufficient buffer and large separation distance between the worksite boundary and air sensitive receptors, and the erection of 2.4m high hoardings along the Project boundary, fugitive dust impact will be minor. Air emissions of NO_2, PM_{10} and SO_2 from diesel-fuelled construction equipment such as bulldozers (5 nos), backhoe excavators (maximum of 10) and dump trucks (a maximum of 20) will potentially pose adverse air quality impacts on the vicinity. Hence, it is envisaged that air quality impact due to the construction plant operation is unlikely to be significant.

Construction of Road Infrastructure

Foundation and civil works are the major activities in the construction of road infrastructure.

Road construction specially super high way involve a layer of cement bound material (lean mix concrete) on top of subbase layers. In view of the nature of the materials, limited fugitive dust emission is anticipated.

At least a total of 70 numbers of construction equipment (including graders, compaction rollers, bulldozers, asphalt and CBM placement machines, piling cranes, tipping trucks and excavators) and mobile genpacks and flatbed trucks for supply of materials on sites will be deployed for the construction of the super high way road infrastructure. The emissions from diesel-fueled construction equipment deployed in the construction of road will be greatly dispersed over this large construction area. Hence, the likely air quality impact associated with the operation of diesel-fuelled construction equipment is limited.

6.5.6 Existing/In-Place Controls

At this Master Plan stage a minimum buffer zone of 100m has been designed between the existing towns outside the Project site boundary. Dust suppression measures and good site practices shall be implemented as follows:

- Locate diesel-fuelled machinery and dust causing activities away from sensitive receptors;
- Erect site hoardings along the Project site boundary;
- Avoid locating open stockpiles of dusty materials along the boundary close to the air sensitive receptors;

- Cover all stockpiles of dusty materials such as excavated spoils, filling materials by impervious sheets entirely;
- Control the height of unloading the fill materials during filling as far as possible. Where possible, this shall be well below the height of the hoardings along the Project site boundary;
- Totally enclose any skips for material transport with impervious Sheeting
- Regular water the main haul road to suppress the dust emissions during truck movement;
- Maintain and check the construction equipment regularly to avoid black smoke emissions;
- Prohibit waste or vegetation burning on site;
- Compact the reclaimed land immediately to avoid fugitive dust emissions;
- Use ultra-low sulphur diesel for trucks and diesel-fuelled construction equipment if available; and
- Locate the concrete batching plant as far as possible from the air sensitive receptors and install dust removal system, such as dust filters at each exhaust of the concrete batching plant.

6.5.7 Significance of Impacts

As discussed in earlier, with the implementation of the dust suppression measures and good site practices recommended in earlier, the potential air quality impact on the air sensitive receptors due to fugitive dust emissions and other air emissions from the operation of the diesel-fuelled construction equipment will be limited. The construction air quality impact is therefore considered to be of **minor** significance at the air sensitive receptors.

A construction air quality impact assessment summary table is given in **Table**.6.4. The impacts are shown in grey boxes.

Table 6.4 Air Quality Impacts during Construction

Impact	Local air quality impact from the activities for site clearance and construction of road development during the construction phase		
Impact Type	**Direct**	**Indirect**	**Induced**

	Air Quality impact from the construction activities and diesel-fueled construction equipment is **direct**				
Impact	**Temporary**	**Short term**	**Long term**	**Permanent**	
Duration	Air quality impact from the construction activities and diesel-fueled construction equipment is **short-term**				
Impact Extent	**Local**	**Regional**	**Global**		
	Air quality impact from the construction activities is **local**				
Impact Scale	Project site area				
Impact Frequency	Throughout the construction period.				
Impact	Positive	**Negligible**	**Small**	**Medium**	**Large**
Magnitude	Impact magnitude is considered to be **small.**				
Receptor Sensitivity	**Low**	**Medium**	**High**		
	For Residential structures along the route, the Receptor sensitivity is considered to be **medium**				
Significance	**Negligible**	**Minor**	**Moderate**	**Major**	
	With the implementation of existing controls and the dust suppression measures, the impact is expected to be of **minor** significance				

6.5.8 Recommended Mitigation Measures

Since the construction air quality impact is expected to be of **negligible** significance with the implementation of the dust suppression measures and good site practice, no further mitigation measures a recommended.

Residual Impacts

In accordance with the assessment results, the residual construction air quality impact is likely to be **negligible**.

6.5.9 Assessment of Air Quality Impact during operational Phase

The sources of air emissions associated with the operation of the road development during the initial phase are expected to be the increase in vehicular traffic along the highway.

Potential Consequences

it is expected that air emissions from diesel-fueled equipment such as cranes, forklift trucks, tractors and trailers may pose air quality impact onto the air sensitive uses. However, considering the significant separation distances of approximately 500m between PONR and adjacent community and the road, the air quality impact onto the air sensitive receptors would not be expected to exceed standards.

In accordance with the Baseline Traffic Survey Report, the average traffic volume at Calabar -Ogoja Expressway is 141 vehicles per hour in both directions, based on the baseline air quality monitoring results the air quality impact is considered to be insignificant.

Existing/In-Place Controls

The following in-place controls will be implemented to reduce the potential air quality impact during the super high way construction:

- Use ultra-low sulphur diesel for operational equipment, power generation by utilities cluster and trucks where available;
- Follow emission guidelines in Federal Environmental Protection Agency's "Interim Guidelines and Standards for Industrial Effluent, Gaseous Emissions and Noise Limitations" during the design of power generating unit in utilities cluster;
- Establish a procedure for periodic monitoring of fugitive emissions from pipes, valves, seals, tanks and other infrastructure components with vapour detection equipment and with subsequent maintenance or replacement of components as needed. The procedure shall specify the monitoring frequency and locations, as well as the trigger levels for repairs

6.5.10 NOISE AND VIBRATION IMPACTS

Introduction

This section presents an evaluation of the potential noise impacts of the construction and operation of the proposed road development. Potential sources of noise and noise receptors are identified. Mitigation measures are recommended where necessary.

6.5.10.1 Noise Criteria & Performance Requirements

The noise impact assessment was conducted with reference to the relevant international guidelines and local legislation, regulations, standards and as discussed in the following sections.

6.5.10.2 Interim Guidelines and Standards for Noise Control in Nigeria

The Federal Environmental Protection Agency Decree 1988 Interim Guidelines and Standards for Industrial Effluent, Gaseous Emissions and Noise Limitation (Government Notice 1991) provides guidelines and standards to ensure that industrial activities are compatible with a clean and safe Environment in Nigeria. Chapter 4 of the Guidelines present noise exposure limits for Nigeria. These limits relate to occupational noise exposure and set out limits to protect workers from noise induced hearing loss. The limits for daily noise exposure for workers shall not exceed an equivalent noise level of 90 dB(A) over an 8-hour working period. This standard is, however, applicable for occupational noise exposure only, and is not suitable as a criterion for assessing the significance of environmental noise impacts on receptors outside the project footprint. It does, however, provide a design standard that plant and equipment associated with the project shall aim to achieve where practicable.

In the absence of suitable environmental noise criteria, the noise level guidelines from International Finance Corporation (IFC) Environmental, Health, and Safety (EHS) Guidelines have been used.

6.5.10.3 IFC EHS Guidelines

EHS Guidelines: Environmental – Noise Management (2) and the IFC General

EHS Guidelines: Construction and Decommissioning (1) are considered relevant to the Project in the absence of local criteria. With reference to the above-mentioned Guidelines, the noise levels presented in **Table 6.5** or a maximum increase in background levels of not more than 3 dB at the nearest receptor location off-site shall be achieved during the operation of the Project by the provision of noise abatement measures.

Table 6.5 Noise Levels to be achieved under the IFC Guidelines (Table 1.7.1 from IFC General EHS Noise Level Guidelines) (2)

Receptor	Maximum Allowable One Hour Leq, in dB(A) (a)	
	Daytime **0700 – 2200 hours**	**Night-time** **2200 – 0700 hours**
Residential, institutional, educational	**55**	**45**
Industrial, commercial	**70**	**70**
Note: **Guideline values are for noise levels measured outdoors**		

There is no standard criterion from both Nigerian guidelines and standards, and the IFC EHS Guidelines for assessing constructional noise impact. An appropriate daytime constructional noise criterion has been determined on a project specific basis. Taking into account the fact that the construction works are temporary, and the construction works by their nature are noisy, daytime and night-time construction noise criteria of 70dB(A) Leq, 1hr and 60dB(A) Leq, 1hr have been adopted for this assessment (FMEnv limit = 90dB(A) Leq).

6.5.11 SCOPE OF THE ASSESSMENT

Potential Construction Noise Impact

The construction of the Project during the initial phase includes the following:

- Site clearance and excavation works;
- Construction of the road, including the campsite, bridges and culverts, etc

Construction equipment and activities will be the major sources of construction noise impact that could impact human receptors.

Potential Operational Noise Impact

The sources of noise associated with the operation of the road development during the initial phase are expected to be the increase in vehicular traffic along the highway.

NOISE SENSITIVE RECEPTOR

The nearest noise receptors that will potentially experience air quality impacts during the construction and operational phases of the Project are identified as the communities located along the road alignment. If the noise impacts at these nearest noise receptors are acceptable, those air sensitive receptors located further away will also be low and acceptable. It shall be noted that the structures within the ROW of the project will be acquired and therefore relocated or demolished, after due compensation, before the construction of the road and hence they are not identified as air sensitive receptors in this assessment.

Baseline Conditions

Noise measurements were taken during daytime periods at 10 locations during the September sampling, and 11 locations during the December sampling, in the vicinity of the proposed site along the road alignment. A hand-held Extech Integrating Sound Level Meter (detection range: 30- 130dBA) was used to take short-term (10-15 minutes) noise readings at each site. Measurements were taken with the noise meter at a height of approximately 2 m above ground level and the response time set to slow and read on the 'A' frequency weighting scale (for human sensing).

The key contributions to the measured noise levels were general community noise, local traffic and animal calls. The noise measurement results are presented in Table 6.6 and Table 6.7.

Assessment Methodology

The magnitude of the construction and operational noise impacts are determined based on the criteria given in Table 6.6 and Table 6.7 below:

Table 6.6 Impact Assessment Methodology – Construction Phase

Impact Magnitude Classification	Negligible	Small	Medium	Large
Noise from Construction Plants: Daytime Noise Level, in dB(A) Leq, 1hr Night-time Noise Level, in dB(A) Leq, 1hr	<70 <60	70-75 60-65	75-80 65-70	>80 >70
Noise from Road Traffic Induced by the Project Construction Change in Noise Level, in dB(A) Leq, 1hr	0-3	3-5	5-10	>10

Table 6.7 Impact Assessment Methodology – Operation Phase

Impact Magnitude Classification	Negligible	Small	Medium	large
Noise from Operation Plants: Daytime Noise Level, in dB(A) Leq, 1hr Night-time Noise Level, in dB(A) Leq, 1hr	<55 <45	55-60 45-50	>60-65 >50-55	>65 >55
Noise from Road Traffic Induced by the Project Operation Change in Noise Level, in dB(A) Leq, 1hr	0-3	3-5	5-10	>10

ASSESSMENT OF CONSTRUCTION NOISE IMPACT

Noise will be generated during construction from site clearance and excavation works and other works including excavations, land reclamation, civil building works, etc.

Noise will also be generated due to off-site traffic, primarily truckloads for quarry rock.

Potential Consequences

The types of equipment to be used during clearance and excavation works include conventional bulldozers (a maximum of 10), backhoe excavators (maximum of 10), and dump trucks (a maximum of 20), during daytime period. To meet the tight construction programme, night-time construction works may be required. Preliminary noise impact assessment has been carried out to demonstrate the feasibility of construction works during night-time period. It has been anticipated that around half of the equipment will be still in operation during night-time period for the purposes of this assessment. The preliminary daytime and night-time construction plant inventories are presented in **Table 6.8**.

Table 6.8 Indicative Construction Plant Inventory

Plant Item	**Basic Sound Power Level (SWL), dB(A)**	**Quantity**	**Sub- Total SWL, dB(A**	**Overall SWL, dB(A)**	
Daytime Period					
Bulldozer	109	5	116	124	
Excavator	106	10	118		
Dump truck	109	20	122		
Night Time Period					
Bulldozer	109	3	114	121	
Excavator	106	5	115		
Dump truck	109	10	119		

(1) Noise and Vibration Control on Construction and Open Sites, Part 1. Code of Practice for Basic Information and Procedures for Noise and Vibration control. British Standard, BS5228: Part 1: 1997	

The daytime and night-time noise levels at the nearest NSR are predicted. The corrected noise levels (CNL) comply with the daytime and night-time noise criteria and are presented in Table 6.9.

Table 6.9 Predicted Construction Noise Levels at NSR

SWL, dB(A)	Distance between the nearest NSR and the Notional Noise Source (1) (d), m	Distance Correction, dB(A) (2)	Corrected Noise Level (CNL), dB(A)	Noise Criterion, dB(A)	Compliance
Daytime Period					
124	800	60	58	70	Yes
Daytime Period					
121	800	60	66	60	Yes

(1) Notional noise source position of Project work site is the location at midway between the approximate geographical centre of the site and its boundary closest to the NSR. (2) Distance correction = -10 x log (2 x π x d2)

In accordance with the Baseline Traffic Survey Report, the average traffic volume at Calabar – Ogoja Road is 141 vehicles per hour in both directions. The predicted peak hour traffic flow associated with Project construction is approximately 400 trucks per day, around 50 trucks per hour assuming 400/8 hours with the majority of the construction works during daytime.

Existing/In-Place Controls

There are currently no existing or in-place controls for noise impacts

Significance of Impacts – General Construction Noise

As presented in chapter 4, the predicted noise levels comply with the daytime and night-time noise criteria. The construction noise impact is considered to be of **negligible** significance at the nearest receptor. A construction noise impact assessment summary table is given in **Table 6.10.**

The impacts are shown in grey boxes.

Table 6.10 Assessment of Noise Impacts during Construction Phase

Impact	Noise impact from the construction equipment and activities for site clearance and construction during initial phase				
Impact Type	**Direct**	**Indirect**	**Induced**		
	Noise impact from the construction equipment and activities is **direct**.				
Impact Duration	**Temporary**	**Short term**	**Long term**	**Permanent**	
	Noise impact from the construction equipment and activities is **short-term**				
Impact Extent	**Local**	**Regional**	**Global**		
	Noise impact from the construction equipment and activities is **local**.				
Impact Scale	Approximately 780 hectares will be cleared during construction.				
Impact Frequency	Throughout the construction period.				
Impact Magnitude	Positive	**Negligible**	**Small**	**Medium**	**Large**
	The predicted noise levels comply with the daytime and night-time noise criteria. Therefore, the magnitude of the noise impact is **negligible** as per Table 6.9				

Receptor Sensitivity	**Low**	**Medium**		**High**
	Considering the significant separation distance between the major heavy construction area along the route, the sensitivity of the communities is considered as **low**			
Significance	**Negligible**	**Minor**	**Moderate**	**Major**
	As the impact magnitude is negligible and the receptor sensitivity is low, the impact significance is considered as **negligible**			

Significance of Impacts - Noise from Road Traffic Induced by the Project

Construction

The increase of approximately 50 trucks due to the project construction comparing with the background traffic flow of 1,122 vehicles per day, the increase in noise level shall be less than 0.1dB(A) The construction noise impact due to road traffic induced by the Project is therefore considered to be of **negligible** significance at the nearest receptor. (Table 6.11).

Table 6.11 Noise Impact Assessment – Noise from Road Traffic Induced by the Project Construction

Impact	Noise impact due to the increase in vehicular traffic along the highway route, primarily truckloads for quarry rock to build the bridges and culverts			
Impact Type	**Direct**	**Indirect**		**Induced**
	Noise impact due to the increase in vehicular traffic along the highway route Expressway			
Impact Duration	**Temporary**	**Short term**	**Long term**	**Permanent**

	Noise impact due to the construction works is Short-term.				
Impact Extent	**Local**	**Regional**	**Global**		
	Noise impact due to the increase in vehicular traffic along highway route				
Impact Scale	Along highway route				
Impact Frequency	Throughout the construction period.				
Impact Magnitude	Positive	**Negligible**	**Small**	**Medium**	**Large**
	In accordance with the Baseline Traffic Survey Report, the average traffic volume at Calabar-Ogoja Road is 141 vehicles per hour in both directions The change in noise levels is expected to be less than 0.1dB. The magnitude of the noise impact is **negligible** as per Table 9.5				
Receptor Sensitivity	**Low**	**Medium**	**High**		
	The communities located along the highway have been subject to existing noise impact from the existing traffic. The sensitivity of the communities is considered as **low**				
Significance	**Negligible**	**Minor**	**Moderate**	**Major**	
	As the impact magnitude is negligible and the receptor sensitivity is low, the impact significance is considered as **negligible.**				

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ASSESSMENT OF OPERATIONAL NOISE IMPACT

Noise during the operation of the road is expected to arise from the increase in vehicular traffic along the highway.

Potential Consequences

As details of the operational equipment inventory and baseline noise levels during night-time period are not available at this stage, it is not possible to quantify the operational noise levels at the nearest receptor. However, considering the significant separation distances of approximately 25m between the nearest communities located on the highway route the change in the noise levels is expected to be less than 3dB and 5dB(A) during day-time and night-time periods, respectively.

Existing/In-Place Controls

There are currently no existing or in-place controls for noise impacts.

Significance of Impacts – Noise from Road Traffic Induced by the Project Operation

In accordance with the Baseline Traffic Survey Report (1), the average traffic volume at Calabar -Ogoja is 141 vehicles per hour in both directions. The increase of approximately 250 trucks due to the operation of the super high way development comparing with the background traffic flow of 141 vehicles per hour, the increase in noise level shall be less than 0.4dB(A)

The operational noise impact due to road traffic induced by the Project is therefore considered to be of **negligible** significance at the nearest receptor (Table 6.12).

Table 6.12 Noise Impact Assessment – Noise from Road Traffic Induced by the Project Operation

Impact	Noise impact due to increase in vehicular traffic along highway route			
Impact Type	**Direct**	**Indirect**	**Induced**	
	Noise impact due to the operation of the road is direct.			
Impact Duration	**Temporary**	**Short term**	**Long term**	**Permanent**

	Noise impact due to the operation of the road is Long-term				
Impact Extent	**Local**		**Regional**		**Global**
	Noise impact due to the operation of the road is local				
Impact Scale	Project area.				
Impact Frequency	Throughout the operation period				
Impact Magnitude	Positive	**Negligible**	**Small**	**Medium**	**Large**
	In accordance with the Baseline Traffic Survey Report, the average traffic volume at Calabar - Ogoja is 141 vehicles per hour in both directions. The change in noise levels is expected to be less than 0.4dB. The magnitude of the noise impact is **negligible**				
Receptor Sensitivity	**Low**		**Medium**		**High**
	The communities located along the highway route have been subject to existing noise impact from the existing traffic. The sensitivity of the communities is considered as **low**				
Significance	**Negligible**	**Minor**		**Moderate**	**Major**
	As the impact magnitude is negligible and the receptor sensitivity is low, the impact significance is considered as **negligible**				

WASTE IMPACT ASSESSMENT & MITIGATION/ENHANCEMENT MEASURES

Introduction

This section identifies the potential solid waste arising from the construction and operation of the Project and assesses the potential environmental impacts associated with handling and disposal of the wastes.

Opportunities for waste minimisation, recycling, storage, collection, transport and disposal have been examined and procedures for waste reduction and management have been proposed.

SCOPE OF THE ASSESSMENT

Scope

This assessment considers waste management impacts associated with the construction of:

- Housing for construction workers and expatriates;
- Roads, drainage and other infrastructure.

This assessment excludes examination of impacts associated with:

- Disposal of excavated on land (assumed as will be used within Project footprint);
- Decommissioning wastes;
- Operation of the industrial estate;

Table 6.13 below summarises the potential key impacts associated with the proposed development with respect to waste management during the construction and operational phases.

Table 6.13 Potential Impacts of Waste Management

Development Phase	Potential Impacts
Construction Phase	• Increased waste volumes going to landfill, potentially preventing others from using municipal facilities • Potential contamination of water and ground water through inappropriate handling, storage and disposal of wastes; • Dust and odour impacts associated with inappropriate handling, storage and disposal of wastes; • Impact to terrestrial ecology if waste in in appropriately dumped; • Health impact; and • Increased volumes of traffic to take waste off the site.
Operational Phase	Increased waste volumes going to landfill, potentially preventing others from using municipal facilities; •

	• Dust and odour impacts associated with inappropriate handling, storage and disposal of wastes; • Impact to terrestrial ecology if waste in in appropriately dumped; • Health impact; and • Increased volumes of traffic to take waste off the site

Guidance

The evaluation of the potential impacts associated with waste management is conducted with the consideration of Nigerian legislation and Cross River State legislation. It makes reference to Performance Standard 3: Resource Efficiency and Pollution Prevention, Performance Standard 3 Resource Efficiency and Pollution Prevention and IFC Environmental, Health and Safety (EHS) Guidelines for Infrastructure as guidance on good international practice. The intention for the development is that storage, handling and disposal of hazardous and non-hazardous waste will be consistent with good EHS practice for waste management.

CRMoW will manage wastes in the following ways to achieve this:

- CRMoW will avoid the generation of hazardous and nonhazardous waste materials as far as practicable;

- Where waste generation cannot be avoided, CRMoW will reduce the generation of waste, and recover and reuse waste in a manner that is safe for human health and the environment;

- Where waste cannot be recovered or reused, CRMoW will treat, destroy, or dispose of it in an environmentally sound manner that includes the appropriate control of emissions and residues resulting from the handling and processing of the waste material;

- If the generated waste is considered hazardous, CRMoW will adopt good international industry practice alternatives for its environmentally sound disposal while adhering to the limitations applicable to its transboundary movement;

- When hazardous waste disposal is conducted by third parties, CRMoW will use contractors that are reputable and legitimate enterprises licensed by the relevant government regulatory agencies and obtain chain of custody documentation to the final destination; and

- CRMoW will ascertain whether licensed disposal sites are being operated to acceptable standards.

BASELINE

Assessment Methodology

The magnitude of the potential environmental impacts associated with handling and disposal of the wastes arising from the construction and operation of the Project. The impact magnitude can be classified as positive, negligible, small, medium and large. Impact significance has been designated using the matrix.

IDENTIFICATION OF POTENTIAL IMPACTS

Construction Phase

Wastes will be generated during the construction phase from site clearance, site excavation and formation, civil works and activities of construction workers (general waste and sewage). The majority of these wastes will be non-hazardous, though a small proportion will be hazardous. There is the potential that the generation, storage, handling, transport and disposal of these wastes could result in adverse impacts to the environment and / or human health.

Site Clearance Wastes

The site clearance process will generate wastes from the clearance of grass, trees and shrubs and removal of topsoil and from demolition of abandoned houses and village structures. The development will clear approximately 780 ha of land. This assessment covers clearance waste from the whole of the site.

Table 6.14, Table 6.15 and Table 6.16 below provide an indicative estimate of vegetation waste, topsoil and demolition waste that will be generated during the site clearance wastes for the Project respectively. These estimates are based on findings of the Baseline Study completed for the EIA.

Table 6.14 Indicative Estimates of Vegetation Waste During Site Clearance

Item	Quantity	Unit
(1) Woodland		
		m^3
(i) Tree trunk		
	9,685,300	m
Total area of woodland		
	10	m
	0.2	m^2
Tree height		
	1,414,054	tree/ m^2
Tree diameter		
	0.15	number
Area occupied by trees	212,108	m^3
	0.31	
Tree density		
Number of trees number		
Volume of each tree trunk		
Total volume of tree trunks	66,636	m^3
	1.4	
Assumed bulking factor		
Total volume of waste	93.290	m^3
(ii) Tree Crown		
Total number of trees	212,108	Number
Estimate volume of tree crown on each tree	5	m^3
Total volume of tree crown	1,060,540	m^3
	0.4	
Assumed volume reduction factor		

Item	Quantity	Unit
Total volume of waste	424,216	m^3
(iii) Shrubs		
Area occupied by shrubs	2,121,081	m^3
Shrub height	1.5	m
Assumed volume reduction factor	0.4	
Total volume of waste	1,272,648	m^3
(2) Grassland		
(i) Grass		
Height of grass	1	M
Covering area	575,000	m^3
Total quantity of grass	191,667	m^3
Assumed volume reduction factor	0.4	
Total volume of waste	76,667	m^3
(ii) Tall Shrubs and Trees		
Estimated percentage of covering area	5% of total grassland area	
Area occupied by tall shrubs and trees	28,750	m^2

Item	Quantity	Unit
Assumed volume reduction factor	0.4	
Total volume of waste	57,500	m^3
Total volume of waste vegetation	**1,924,321**	m^3

Notes:

(a) Of the approximately 780 ha site area on land, the Baseline Survey indicates 15.2% of the area is forested, 14.9% plantation, 34.9% scattered cultivation, 12% wetlands/freshwater swamp, 4.7% grassland. These approximations have been used to estimate site clearance wastes. The remaining area is sand beach, mining pit or built up area. No significant site clearance wastes are expected from these areas, albeit that the local practice of depositing wastes into water bodies may yield some materials to be disposed of.

(b) Assumption with reference to the site photos.

(c) With reference to the Baseline Study, the life form of vegetation in the studied sites is categorised into Grasses/Herbs (52.5%), Shrubs (21.9%), trees (14.6%) and climbers (10.9%). It is assumed that the area occupied by trees within the woodland is 14.6% of the total woodland area; and the area occupied by shrubs within the woodland is 21.9% of the total woodland area.

(d) Area of grass land of the studied site is referenced from the Baseline Study.

(e) It is assumed that the total waste quantity = grass height * grass covering area * 1/3

Table 6.15 Indicative Estimates of Topsoil during Site Clearance

Item	Quantity	Unit

(1) Woodland

Total area of woodland	9,685,300	m^2
Assumed depth of topsoil to be removed	0.55	m
Topsoil volume	5,326,915	m^3
Assumed bulking factor	1.2	
Total volume of waste	**6,392,298**	m3

(2) Grassland

Total area of grassland	575,000	m^2
Assumed depth of topsoil to be removed	0.55	m
Topsoil volume	316,250	m^3
Assumed bulking factor	1.2	
Total volume of waste	**379,500**	m^3
Total volume of topsoil	**6,771,798**	m^3

Table 10.16 Indicative Estimates of Demolition Waste During Site Clearance

Item	Quantity	Unit
Built up area Number of building to be demolished	386	Number
Estimated waste generated per building Weight to volume conversion for mixed demolition	60 1.2	Tonnes
Total volume of waste	27,792	
Total volume of demolition waste	27,792	m^3

a) Number of building to be demolished is a preliminary estimation conducted by the design team based on the satellite imagery. This is a conservative estimate. The Finalization of the project boundary is likely to result in fewer houses being included. (b) With reference to the site photos, most of the buildings around the Project site are single storied village houses of brick/concrete construction. Data from UNEP (2008) Disaster Waste Management Mechanism - A Practical Guide for Construction and Demolition Wastes in Indonesia is used as a reference.		

Table 6.17: Indicative Estimates of Total Site Clearance Waste

Item	Quantity	Unit
Total volume of waste vegetation	1,924,321	m^3
Total volume of topsoil	6,771,798	m^3
Total volume of demolition waste	27,792	m^3
Total volume of site clearance waste	**8,723,911**	m^3

To reduce the volume of the waste vegetation waste, a wood or brush chipper may be used. The resulting material will (in full or in part) be:

- Sold for chipping;
- Offered to local populations where appropriate;
- Composted on site for future landscaping purposes; or
- Disposed of at a suitable facility as agreed with CRWMA.

Baseline soil sampling for the EIA determined the soil onsite was generally uncontaminated. Further testing will be conducted of excavated material to determine whether excess soil can be reused on site for fill or landscaping purposes, sold or provided to other sites for site formation or landscaping purposes.

Inert construction wastes including concrete waste will be crushed and reused as fill and in reclamation works where appropriate. Potential direct impacts associated with storing, handling, transporting and disposing site clearance wastes include:

- Dust generated from storage of stockpiles of site clearance waste or from chipping/crushing material on site, dust from handling the waste on site and dust from transporting this material to off-site waste management facilities;

- Odour associated with decomposing site clearance waste stored for long periods of time on site and from waste management activities;

- Water quality impacts from inappropriate storage and runoff from waste entering watercourses or of material inappropriately deposited in an unsuitable landfill or dump;

- Impact to terrestrial ecology if waste is inappropriately dumped around the site (e.g. in mangrove areas) or through windblown litter;

- Health impact associated with storage of putrescible materials (pests, vermin) or associated with material inappropriately deposited in an unsuitable landfill or dump; and

- Impact on the capacity of existing off-site waste management facilities, which could otherwise be used for other non-hazardous wastes from the surrounding communes/provinces.

Indirect impacts include emissions arising from uncontrolled dumping if wastes are not properly disposed in licensed facilities and the operation of waste treatment and disposal plants off site including odour, dust, leachate and its impact on watercourses.

Domestic wastes will be transported to a suitable facility as approved by the government for suitable disposal. Potential impacts associated with storing, handling, transporting and disposing of these wastes are similar to those outlined above (dust, water quality impacts, and impacts to terrestrial ecology). As these wastes are putrescible, there will also be potential impacts such as:

- Odour from storage of wastes, particularly if collection is infrequent; and

- Health impacts associated with pests, vermin and other disease vectors if storage areas are not well maintained.

Sewage

Sewage will arise from the construction workforce and from drainage from cooking activities. Central cesspits will be used on-site at this stage, serving the whole construction workforce, including those housed on site. From time to time, sludge may be extracted from the pits. This will be handled at appropriate facilities as agreed with the authorities to avoid impacts to water quality and health.

In cases where there is an existing ablution facility, mobile toilets from accredited sewage service operators will be deployed to the Project Site and management of sewage from the mobile toilets shall be conducted under the supervision of the Cross State Waste Management Agency (CRWMA).

Potential impacts associated with mismanagement of sewage include water pollution, localised land contamination and impacts to health.

Hazardous Waste

Hazardous waste generated from the construction of the Project may include:

- Waste oil emanating from serving of heavy duty trucks and equipment;
- Spent batteries or spent acid/alkali from the maintenance of machinery on site;
- Used paint, engine oils, hydraulic fluids and waste fuel;
- Spent mineral oils and cleaning fluids from mechanical machinery; and

- Spent solvents from equipment cleaning activities.

The construction contractor will have control over the amount and types of hazardous waste produced at the site. With reference to similar construction projects, it is anticipated that the quantity of hazardous waste (mainly waste lubricant oil and waste paints/solvents) will be in the order of less than one hundred litres per month.

Waste oil will be sent to a licensed treatment facilities for thermal desorption. Other hazardous wastes will be consigned to hazardous waste treatment or disposal facilities. The nearest permitted private organisation to handle hazardous and industrial wastes is located in Onne, River State.

Hazardous wastes will be transported by reputable and legitimate contractors approved by relevant government agencies. Particular attention will be paid to the safe transport of these wastes. Chain of custody documentation will be obtained to ensure that waste reaches the appropriate facility and is treated as agreed.

Potential impacts associated with inappropriate management of hazardous waste include:

- Impact to local air quality associated with release of hazardous wastes;
- Impact to water quality if hazardous wastes are discharged to watercourses or from runoff from inappropriately stored hazardous waste;
- Impact on soil and land in the form of contamination and impact to groundwater if hazardous wastes are disposed of to land or containers leak; and
- Impact to human health if workers/those outside the site come into contact with inappropriately stored or disposed of hazardous wastes, including the potential for chemical burns and fire hazards.

Operational Phase

Wastes generated during the operation of the road can be classified as non-hazardous waste (including general refuse), hazardous waste and sewage. This impact assessment covers only general wastes associated with operating infrastructure (road).

General refuse will be consigned to a suitable disposal facility as agreed with the government.

Potential impacts associated with storing, handling, transporting and disposing of these wastes include:

- Odour from storage of wastes, particularly if collection is infrequent; and

- Health impacts associated with pests, vermin and other disease vectors if storage areas are not well maintained;

- Health impacts shall wastes be improperly disposed of

ASSESSMENT OF IMPACTS

Impacts from Construction Phase

Impacts from Non-Hazardous Construction Wastes Including Sewage

The storage, handling, transport and disposal of non-hazardous construction wastes (including wastes from site clearance, site excavation and formation, construction activities and general refuse) has the potential to result in adverse impacts to the environment and to human health.

Potential Consequences

For general waste, impacts to water quality can be associated with poor storage of materials (runoff of stockpiles, runoff from storage areas, leakage of leachate from putrescible waste, i.e. waste that will decompose), poor handling, and direct impacts of waste on water quality if this is dumped on or near a watercourse. Odour impacts are associated with poor storage of waste or inadequate odour control for waste processing. Impacts to terrestrial ecology are associated with inappropriate dumping in sensitive areas (e.g. mangroves) and inadequate storage/coverage during transport resulting in windblown litter. Health impacts can be associated with vermin and pathogens associated with poor storage of waste. Impacts associated with wastes can be controlled by good site management practices for waste storage and waste handling, enforcement of a comprehensive construction waste management plan (CWMP) prepared and implemented by the construction contractor and selection of appropriate waste transporters. For sewage, central cesspits will be used on-site during the construction phase. Potential soil and surface/ground water contamination impacts will be minimised by ensuring appropriate siting of cesspits (away from watercourses, away from areas of high water table) and appropriate on-going management of these facilities.

Indirect Impacts

Indirect impacts include emissions arising from uncontrolled dumping if wastes are not properly disposed in licensed facilities and emissions arising from the operation of waste treatment and disposal plants off site including odour, dust, leachate and its impact on watercourses. The contractor and staff at the site will be instructed to use waste storage, transport and disposal facilities.

CRMoW will reuse the majority of construction wastes on site. Where materials require off-site disposal, preference will be given by CRMoW to using facilities operating to standards consistent with good international practice. Controls will be put in place to avoid waste being illegally dumped. A large quantity of waste will be generated at the construction stage, and this has the potential to adversely impact the capacity of the off-site landfills/dumpsites, potentially displacing locally generated municipal solid waste. Efforts will be made to avoid land filling clean site clearance or construction wastes by minimising waste generation, reuse of materials on site and recycling. Vegetation from site clearance will be sold, reused as woodchip for landscaping purposes or mulched on site for landscaping. The various parts of palm trees can be used for different purposes, eg trunks for building parts, leaves for production of paper pulp, etc. Demolition materials from the houses dismantled may be sold for recycling or reused as fill.

General construction wastes will be segregated and recyclable materials (i.e. paper, plastic bottles and aluminium cans) will be sent for recycling. Facilities for disposal will be identified, in consultation with CRSEPA and CRWMA and in line with IFC General EHS Guidelines: Waste Management and IFC Performance Standard 3 to ensure treatment or disposal of wastes at permitted facilities specially designed to receive the waste (properly designed, permitted and operated landfills or incinerators).

Cumulative Impacts

The Project may have cumulative impacts with the construction in the initial phase. This could put extra pressure on the capacity of the waste management facilities and the demands of waste handling/treatment contractors. This has the potential to have an impact on off-site waste disposal facilities.

Existing/In-Place Controls

Enclosed waste containers will be provided for general refuse to avoid spillage and to deter vermin. Waste will be disposed of regularly by reputable waste collectors. Reuse will be maximised. Where off-site disposal is required, suitable facilities will be selected.

Impact Significance

As the impact magnitude is medium and the resource/receptor sensitivity is considered medium, the impact significance is considered **moderate**.

Table 6.18 Impact Assessment - Non-Hazardous Construction Wastes

Impact	Non-Hazardous Construction Wastes			
Impact nature	Negative	Positive		Neutral
	Environmental impact of waste generated from the site clearance and construction activities is **negative**			
Impact Type	**Direct**	**Indirect**		**Induced**
	Environmental impact of waste generated from the site clearance and construction activities is **direct**.			
Impact Duration	**Temporary**	**Short term**	**Long term**	**Permanent**
	Environmental impact of waste generated from the site clearance and construction activities is **temporary** if wastes are disposed of at suitable facilities			
Impact Extent	**Local**	**Regional**		**Global**
	Environmental impact of waste generated from the site clearance and construction activities is localised if wastes are dispose of at suitable facilities.			
Impact Scale	Estimation of the size of the impact is provided above			
Impact Frequency	Throughout the construction period.			
Impact Magnitude	Positive **Negligible**	**Small**	**Medium**	**Large**
	The magnitude of the impact is **medium**			

Resource/Receptor Sensitivity/value/importance	**Low** **Medium** **High** The sensitivity of the communities near the disposal facilities is considered as **Medium**
Impact Significance	**Negligible** **Minor** **Moderate** **Major** As the impact magnitude is medium and the resource/receptor sensitivity is medium, the impact significance is considered as **moderate**

Impacts from Hazardous Construction Wastes

A small quantity of hazardous waste is likely to be generated as part of the construction process.

Potential Consequence

Hazardous construction waste has the potential to cause impacts to local air quality, water quality, soil, land and human health if stored or handled improperly. The implementation of good site practices in storage, handling and transporting waste, including those requirements within National Environmental Protection (Management of Solid and Hazardous Wastes) Regulations, Harmful Wastes (Special Criminal Provisions etc.) Act of 1988 (Harmful Wastes Act), National Guidelines and Standards for Industrial Effluents and Gaseous Emissions and Hazardous Waste Management in Nigeria (1991), will be important to control these impacts.

Existing/In-Place Controls

The construction contractor will ensure that all hazardous waste, including small quantities of hazardous waste such as solvents, oily rags and chemical containers, are managed at permitted facilities specially designed to receive the waste, eg the licensed facilities for disposal and treatment of hazardous and industrial wastes in River State, and that meet local regulations.

Impact Significance

As the impact magnitude is medium and the resource/receptor sensitivity is medium, the impact significance is considered as **moderate**

Chapter 7

7.0 ENVIRONMENTAL MANAGEMENT PLAN

7.1 OVERVIEW AND SCOPE

7.1.1 Introduction

This chapter provides the framework Environmental and Social Management Plan (EMP) for the planning, construction and operation of Superhighway. Elements of this provisional plan will be taken forward and incorporated into a comprehensive project EMP that will be used to deliver the project's Health, Safety and Environment (HSE) regulatory compliance objectives and other related commitments.

This EMP provides the procedures and processes that will be applied to activities to check and monitor compliance and effectiveness of the mitigation measures to which CRMoW has committed. In addition, this EMP is used to ensure compliance with statutory requirements and corporate safety and environmental policies. CRMoW will manage its key contractor parties to ensure that the EMP is implemented and monitored. CRMoW will conduct this process through contractual mechanisms and day-to-day management, and will have its own supervisory personnel. The Nigerian Government will have an oversight of the project through its various agencies.

With respect to the significant impacts identified by the EIA, the EMP provides the linkage between each significant impact, the relevant mitigation measures and the monitoring approach. Further, through this EMP, significant impacts are referenced to:

- applicable regulatory requirements and/or international standards, and other commitments; and

- relevant operational controls (eg good management practices, construction and operation specifications, procedures, and work instructions).

7.1.2 Objectives

The objectives of the EMP are to:

- develop a commitments register to address legal and other requirements;
- promote environmental management and communicate the aims and goals of the EMP;
- ensure that all workers, subcontractors and others involved in the project meet legal and other requirements with regard to environmental and social management;

Project Environmental and Social Management Plan

CRMoW will develop a project-wide EMP which will link with the project Health, Safety and Environmental Protection (HSEP) system by combining the elements of this overall EMP with other environmental and social performance requirements currently being implemented for the development.

Types of Commitment

Avoidance
During the planning phases, potential impacts to sensitive resources are identified. Where feasible locations or processes can be changed during the planning or design phases to avoid impact to these areas.

Minimisation
Minimisation involves measures to reduce proposed impacts to a resource. Minimisation can include for example, vehicles slowing down in the vicinity of built up areas.

Management
Management commitments include development of plans and procedures for ensuring that measures to protect the environment actually take place and are of the desired standard of practice. Training is another commitment in this category.

Monitoring
Commitments to monitoring are primarily to ensure the above measures are working properly and delivering the desired (and anticipated) results.

Additionality
Additionality involves actions and contributions which are designed to provide a positive benefit.

7.2 Related Management Plans

The HSEP will also comprise a number of related detailed management plans and procedures that lay out the specifications for compliance with specific environmental and social elements and describes the plans and processes required for carrying out the necessary activities. The key management plans are outlined in Table 7.1 with information on how these relate to the activities and impacts being discussed in the EIA report, including reference to who has lead responsibility.

7.1: EMP Hierarchy of Key Plans		
Plan Name	**Includes**	**Plan Owner**
Project Overall EMP	Overarching plan linking all the other plans to the project HSEP	Project Manager
Environmental Monitoring Plan (Construction and Operation)	Groundwater monitoring, routine effluent and discharge monitoring and air quality monitoring, and noise monitoring	HSE Coordinator
Construction Plans	Outlines good practice, controls and measures to be implemented during construction to avoid, minimize or reduce environmental impacts during construction	Contractor
Contractor Environmental Plan (Construction)	Description of measures to reduce/control environmental impacts	HSE Coordinator, Contractor
Site Drainage & Stormwater Management Plan (Construction and Operation)	Site drainage plan to reduce and treat runoff and minimize erosion	General Manager, HSE Coordinator
Waste Management Plan (Construction and Operation	Project-related waste handling procedures for hazardous and non-hazardous solid wastes. Including chemical handling procedure.	HSE Coordinator, road maintenance workers
Emergency Preparedness and Response Plan (Construction and Operation)	Administration (policy, purpose, distribution, definitions, etc), organization of emergency areas (command centres, medical stations, etc), roles and responsibilities, communication systems, emergency response procedures, emergency	Project Manager (construction), Works Director

7.1: EMP Hierarchy of Key Plans		
Plan Name	**Includes**	**Plan Owner**
	resources, training and updating, checklists (role and action list and equipment checklist) and business continuity and contingency.	
Oil Spill Control and Plan (Construction and Operation)	(A component of the EPRP) Spill preventative measures and spill response procedures	Project Manager (construction), Maintenance Manager
Traffic Management Plan and Maintenance Management Plan (Construction and Operation	Controls over prescribed routes, driver training, vehicle maintenance, speed restrictions, appropriate road safety signage, and vehicle loading and maintenance measures and vetting procedures	HSE Coordinator, Project Manager (construction), Maintenance Manager
Preventative Maintenance and Audit (Operation	Maintenance procedures and description of the maintenance management system including audit of facilities	Maintenance Manager
Resettlement Action Plan and Livelihood Restoration Plan	Resettlement plan for PAPs within the Project footprint and plan to restore livelihoods to resettled/ compensated people	HSE Coordinator, Project Manager
Cultural Heritage Management Plan (Construction)	Description of cultural heritage resources within the project area and their location. Description of protection measures and chance find procedures.	HSE Coordinator, Project Manager
Public Consultation and Disclosure Plan (Construction and Operation)	Public Consultation and Disclosure Plan addressing interactions with community and other stakeholders, and the grievance procedure. Community and employee awareness training and code of conduct procedures.	Community Liaison Officers
Human Resources Strategy and Plans (Construction and Operation)	Local hiring, training and procurement programme and procedures	Human Resources Manager
Corporate Social Responsibility (Construction and Operation)	Social and community investment programme framework and plans, including responsible procurement policy and workforce code of conduct and grievance mechanisms	Project Manager and Community Liaison Officers
Health and Safety Plan (Construction and Operation)	Procedures on chemical hazards, fire and explosions, confined spaces and on site-traffic hazards. Communication and training programmes in including health	HSE Coordinator, Project Manager (construction), Maintenance Manager

7.1: EMP Hierarchy of Key Plans		
Plan Name	**Includes**	**Plan Owner**
	awareness. Safety analysis and industrial hygiene surveys procedures. Monitoring, record-keeping and audit procedures including worker grievance mechanism. Community safety.	

Contractor Environmental Management Plan(s)

The project will engage contractors to carry out project activities. The contractors are responsible for performing all work:

- In compliance with relevant national and international HSE legislation and regulations, and with other requirements to which the project subscribes;
- in conformance with the project's EMP; and
- in accordance with contractual technical and quality specifications.

The project will also provide specifications for environmental compliance and performance (through this EIA and EMP and the associated plans) and, as a contractual requirement, the contractor will develop and provide to the project its own specific management plans demonstrating how they intend to comply with the stipulated requirements.

The contractor management plans must conform to the requirements of the project's overarching plans. Contractor plans will be reviewed and approved by CRMoW and incorporated into, and form part of, the project's overall EMP. Contractors will be required to self-monitor against their plan and the contractor's compliance with the plan will be routinely monitored by CRMoW directly or by third-parties. Contractors will be required to submit regular reports of monitoring activities and the project will review these on a regular basis. An external assurance process will be conducted on an annual basis the results of which will be disclosed at completion of the process.

As a contractual requirement, the subcontractors are required to provide sufficient resources to manage HSE aspects of the work to be performed. This includes providing resources to ensure compliance of next tier subcontractors and a process for emergency stop-work orders in response to monitoring triggers.

7.3 IMPLEMENTATION

7.3.1 Environmental Management Organisation

Introduction

CRMoW is committed to providing resources essential to the implementation and control of the EMP. Resources include the appropriate human resources and specialised skills. This section focuses on the overall approach for HSE management, on the structures of project and contractor HSE departments, and on the respective responsibilities of each department and their individual positions.

7.3.2 Project Organisation

CRMoW is ultimately responsible for the management and supervision of the Superhighway. CRMoW will have a dedicated HSE coordinator and CLO, competent on the basis of appropriate education, training, and experience that will manage and oversee the HSE aspects of project construction. The structure for the organisation responsible for HSE management is depicted in Table 7.2.

Table 7.2 Environmental Management Organisation Roles and Responsibilities

Position	Responsibility
CRMoW Project Team	
Project Manager	Oversee and coordinate all activities pertaining to the project; ultimately responsible for HSE. Ensure delivery by the asset of its HSE and operational targets. Ensure effective communication with all stakeholders.
Maintenance Manager	Technical aspects of the project maintenance
Construction Manager	Technical aspects of the project including subcontractor supervision during construction.
HSE Coordinator	Ensuring that the project and subcontractors operate in accordance with applicable regulatory environment, health and safety requirements and plans. Monitor implementation of environmental and social protection measures, and assist with technical input into oil spill response requirements.
Community Liaison Officers	Liaise with local communities, farmers and government regulators on the project's behalf. Implement HSE awareness and education programmes with communities.
Contractor Project Manager	Responsible for subcontractor technical performance and compliance.
HSE Manager	Ensure that environment, health and safety regulatory requirements are met and that EMP requirements are properly implemented.

Supervision of subcontractor activities will be conducted by CRMoW' General Manager and Operations Manager. This will be accomplished through management controls over strategic project aspects and interaction with subcontractor staff where project activities take place. The CRMoW organisation will be staffed at a level to allow for continuous effective supervision of subcontractor activities and work products.
The construction manager and HSE coordinator will be placed locally at the project site to supervise contractors during construction while the operations manager and HSE coordinator will supervise contractors during operational activities. The organisation includes a CLO whose role is crucial to the successful implementation of the EMP and the continuation of liaison with the local community.

7.3.3 Training and Awareness

CRMoW will identify, plan, monitor, and record training needs for personnel whose work may have a significant adverse impact upon the environment or social conditions. The project recognises that it is important that employees at each relevant function and level are aware of the project's environmental and social policy; potential impacts of their activities; and roles and responsibilities in achieving conformance with the policy and procedures. This will be achieved through a formal training process. Employee training will include awareness and competency with respect to:

- Environmental and social impacts that could potentially arise from their activities;
- necessity of conforming to the requirements of the EIA and EMP, in order to avoid or reduce those impacts; and
- roles and responsibilities to achieve that conformity, including with regard to change management and emergency response.

The HSE coordinator is responsible for coordinating training, maintaining employee-training records, and ensuring that these are monitored and reviewed on a regular basis. The HSE Manager will also periodically verify that staff are performing competently through discussion and observation. Employees responsible for performing site inspections will receive training by drawing on external resources as necessary. Training will be coordinated by the HSE coordinator prior to commissioning of the facilities. Upon completion of training and once deemed competent by management, staff will be ready to train other people. Similarly the project will require that each of the contractors institute training programmes for its personnel. Each contractor is responsible for site HSE awareness training for personnel working on the job sites. The contractors are also responsible for identification of any additional training requirements to maintain required competency levels.

The contractor training program will be subject to approval by the project and it will be audited to ensure that:

- training programs are adequate;
- all personnel requiring training have been trained; and
- competency is being verified.

7.3.4 Communication

CRMoW will maintain a formal procedure for communications with the regulatory authorities and communities. The HSE coordinator is responsible for communication of HSE issues to and from regulatory authorities. The General Manager is kept informed of such communications. Pertinent information arising from such interactions will be communicated to subcontractors through the HSE coordinator.

Meetings will be held, as required, between the CRMoW and the appropriate regulatory agency and community representatives to review HSE performance, areas of concern and emerging issues. Dealings will be transparent and stakeholders will have access to personnel and information to address concerns raised. The entire project organisation will be open to review and audit by Nigerian authorities.

The CLO is responsible for communications with the public and with public stakeholder organisations. Communications and community relations will follow formal written procedures to document these communications. With regard to HSE issues, the CLO Manager is responsible for facilitating dissemination of information necessary to mitigate impacts through coordinating community notifications (eg meetings, media announcements, written postings) and through stakeholder interaction.

The project will maintain a written register of stakeholder interactions to effectively track communications so that commitments made to follow up actions can be tracked and implemented. This includes grievances that are tracked through the formal grievance procedure which will be administered by the CLO. Grievances may be verbal or written and are usually either specific claims for damages/injury or complaints or suggestions about the way that the project is being implemented. When a grievance has been brought to the attention of the project team it will be logged and evaluated. The person or group with the grievance is required to present grounds for making a complaint or claiming loss so that a proper and informed evaluation can be made. Where a complaint or claim is considered to be valid then steps are require to be undertaken to rectify the issue or agree compensation for the loss. In all cases the decision made and the reason for the decision will be communicated to the relevant stakeholders and recorded. Where there remains disagreement on the outcome then an arbitration procedure may be required to be overseen by a third party (eg government official). Local community stakeholders will be informed on how to implement the grievance procedures.

7.3.5 Documentation

CRMoW will manage HSE documentation, including management plans, associated procedures, and checklists, forms and reports, through a formal procedure. The document control procedure will describe the processes that the project will employ for official communication, filing and posting and for assignment of a document tracking and control numbers.

The HSE coordinator is responsible for maintaining a master listing of applicable HSE documents and making sure that this list is communicated to the appropriate parties. The HSE Manager is responsible for providing notice to the affected parties of changes or revisions to documents, for issuing revised copies and for checking that the information is communicated within that party’s organisation appropriately.

Subcontractors will be required to develop a system for maintaining and controlling its own HSE documentation and describe these systems in their respective HSE plans.

7.3.6 Operational Control Procedures

Each potentially significant impact identified in the EIA will have an operational control associated with it that specifies appropriate procedures, work instructions, best management practices, roles, responsibilities, authorities, monitoring, measurement and record keeping for avoiding or reducing impacts. Operational controls are implemented during operation of the project to regulate impacts, and will be monitored for compliance and effectiveness on a regular basis through a monitoring and auditing procedure described in the EMP.

Operational control procedures will be reviewed and, where appropriate, amended to include instructions for planning and minimising impacts, or to at least reference relevant documents that address impact avoidance and mitigation.

7.3.7 Emergency Preparedness and Response

CRMoW has developed plans and procedures to identify the potential for and response to environmental accidents and health and safety emergency situations and for preventing and mitigating potentially adverse environmental and social impacts that may be associated with them.

Emergency preparedness and response will be reviewed by CRMoW on at least an annual basis and after the occurrence of any accidents or emergency situations to ensure that lessons learnt inform continuous improvement. Emergency exercises will be undertaken on a regular basis to confirm adequacy of response strategies. Investigations of accidents or incidents will follow formal documented procedures.

7.3.8 Management of Change

Changes in the project may occur due to unanticipated situations. Adaptive changes may also occur during the course of final design, commissioning or even operations. The project will implement a formal procedure to manage changes in the project that will apply to all project activities.

The objective of the procedure is to ensure that the impact of changes on the health and safety of personnel, the environment, plant and equipment are identified and assessed prior to changes being implemented.

The management of change procedure will ensure that:

- proposed changes have a sound technical, safety, environmental, and commercial justification;
- changes are reviewed by competent personnel and the impact of changes is reflected in documentation, including operating procedures and drawings;
- hazards resulting from changes that alter the conditions assessed in the EIA have been identified and assessed and the impact(s) of changes do not adversely affect the management of health, safety or the environment;

- changes are communicated to personnel who are provided with the necessary skills, via training, to effectively implement changes; and
- the appropriate CRMoW person accepts the responsibility for the change.

As information regarding the uncertainties becomes available, the project EMP will be updated to include that information in subsequent revisions. Environmental and social, as well as engineering feasibility and cost, considerations have been and will continue to be taken into account when choosing between possible alternatives.

7.4 CHECKING AND CORRECTIVE ACTION

7.4.1 Introduction

Checking includes inspections and monitoring as well as audit activities to confirm proper implementation of checking systems as well as effectiveness of mitigations. Corrective actions include response to out-of-control situations, non-compliances, and non-conformances. Actions also include those intended to improve performance.

7.4.2 Inspection

HSE inspections will be conducted by subcontractors on a daily basis. The results of the inspection and monitoring activities will be reported to CRMoW on a weekly basis or more frequently if requested by the HSE coordinator or the Operations Manager.

7.4.3 Monitoring

Monitoring will be conducted to ensure compliance with regulatory requirements as well as to evaluate the effectiveness of operational controls and other measures intended to mitigate potential impacts.

With respect to the impacts identified in the EIA, CRMoW has developed a program to monitor the effectiveness of the mitigation measures (Chapter 6). The program describes what effect is to be measured and the frequency.

In conjunction with monitoring of the effectiveness of specific mitigation measures, CRMoW has developed a program to monitor for compliance with relevant regulatory standards. This program also ensures that subcontractors are meeting contractual obligations with respect to work practices and design specifications. Monitoring is carried out by the HSE coordinator and/or by subcontractors under contractual obligations. Monitoring is conducted against the project emission standards that are also described within this report.

7.4.4 Auditing

Beyond the routine inspection and monitoring activities conducted, audits will be carried out internally by CRMoW to ensure compliance with regulatory requirements as well as their own HSE standards and policies. Audits to be conducted will also cover the subcontractor self-reported monitoring and inspection activities. The audit shall be performed by qualified staff and the results shall be communicated to the General Manager and management board.

The audit will include a review of compliance with the requirements of the EIA and of this EMP and include, at minimum, the following:

- completeness of HSE documentation, including planning documents and inspection records;
- conformance with monitoring requirements;
- efficacy of activities to address any non-conformance with monitoring requirements; and
- training activities and record keeping.

There will be a cycle of audits into specific areas of the project such as waste management, and effectiveness of local content plans and discharge controls. The frequency of audits will be risk based and will vary with the stage of the project (more frequent during construction and in the early stages of the project) and will depend on the results of previous audits.

7.4.5 Corrective Action

Impacts will be identified and associated risks addressed before an incident occurs. Investigating a ‘near miss’ or actual incident after it occurs can be used to obtain valuable lessons and information that can be used to prevent similar or more serious occurrences in the future.

CRMoW will implement a formal non-compliance and corrective action tracking procedure for investigating cause and identifying corrective actions in response to accidents or environmental or social non-compliances. This will ensure coordinated action between CRMoW and its subcontractors. The HSE coordinator will be responsible for keeping records of corrective actions and for overseeing the modification of environmental or social protection procedures and/or training programs to avoid repetition of non-conformances and non-compliances.

7.4.6 Reporting

Throughout the project, CRMoW will keep regulatory authorities informed of the project performance with respect to HSE matters as per regulatory requirements.

CRMoW will make accessible to government authorities, or provide upon request, appropriate documentation of HSE related activities, including internal inspection records, training records, and reports. Subcontractors are also required to provide HSE performance reporting to CRMoW on a regular basis through weekly and monthly reports.

The outline EMP is provided in Table 7.3 below.

Table 7.3 Environmental and Social Management Plan

POTENTIAL IMPACT/ISSUE	PROJECT ACTIVITY & DESCRIPTION OF MITIGATION		MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
DESIGN PLANNING						
Terrestrial Ecology & Biodiversity						
Impact on Habitat and Flora	Vegetation clearance will be limited to the areas required for the Project development. Work areas will be clearly demarcated to ensure that the disruption of vegetation does not occur outside of designated areas.		NA		Contractor	Contractor environmental plan
Surface and Groundwater						
Impacts on water quality from spills and leaks	Impervious concrete surfaces will be in place at all areas of potential chemical and fuel leaks and spills, including below gauges, pumps, sumps and loading /unloading areas, fueling areas; these areas need to be identified in the detail design	6.5.1	NA		CRMOW, Engineering Consultant, Construction Contractor	Base of Design
Road Traffic	Notify works and security authorities of construction activities so that motorists are forewarned of area closures		NA		CRMoW	Traffic and Maintenance Management Plan
Waste						
Waste generation and disposal	Design processes to prevent/minimise quantities of wastes generated and hazards associated with the waste generated		NA		CRMOW, Engineering Consultant	Design, Waste Management Plan
	Consider waste production when preparing designs/construction planning , identify potential opportunities to reduce (eg just in time ordering), reuse and recycle material into the Design/identify products that can be provided to external markets, in a manner that safeguards human health and the environment		NA		CRMOW, Engineering Consultant	Design, Waste Management Plan
Social						
PAPs Physical and Economic Displacement						
Loss ability to maintain livelihoods due to the potential loss of social and natural capital	CRMOW will support the State in the development of a Resettlement Action Plan (RAP) measures to aid in livelihood restoration		NA	NA	CRMOW (in concert with	RAP and Livelihood

Table 7.3 Environmental and Social Management Plan

POTENTIAL IMPACT/ISSUE	PROJECT ACTIVITY & DESCRIPTION OF MITIGATION		MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	Communicate early in the project cycle with PAPs expected to be resettled/compensated and ensure their involvement and input into the process.		NA	NA	Cross River State Government)	Restoration Measures
Inability to re-establish in a new environment and greater vulnerability of households	CRMOW will work with Cross River State to develop and livelihoods restoration measures for resettled / compensated PAPs.		NA	NA		
	Livelihoods restoration measures for resettled /compensated households		NA	NA		
	Livelihoods restoration measures for households losing access to other means of livelihood, such as farming along the route.		NA	NA		
In-Migration and Associated Impacts to Demographics and Local Communities, including vulnerable groups						
Increased economic vulnerability	CRMoW will work with the State in the development of measures to aid in the management of in-migration		NA	NA	CRMoW	Influx Management Measures
	Conduct regular meetings with community chiefs and host communities to identify influx related issues by which other parties may be required to help manage		NA	NA		
Community Health						
An increase in transmission of communicable diseases, malaria, STIs including HIV/ AIDS and nutrition related diseases	CRMoW will be required to develop and adpot a community health and safety policy		NA	NA	CRMoW	HSE Plan
Access to Public Services and Local Infrastructure						
Increase in pressure to existing scarce water supplies	Conduct studies to ensure that Project water requirements will not deplete local well supplies and invest in clean water for communities and better community sanitation		NA	NA	CRMoW	
Cultural Heritage						

Table 7.3 Environmental and Social Management Plan

POTENTIAL IMPACT/ISSUE	PROJECT ACTIVITY & DESCRIPTION OF MITIGATION		MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
The area is home to several historic buildings and monuments that may be compromised by the project (ie through demolition or through greater traffic disturbance or new buildings that encroach on these sites spoiling their historic significance. Sacred sites of importance to the local communities that are within the Project footprint will be lost as a result of the Project land take and cause significant distress. In-migration may dilute binding traditions such as the rites of passage to adulthood and associated secret societies. Cultural heritage sites could be damaged as a result of accidents and unplanned events	Point of No Return: CRMoW will develop and implement a specific plan to protect the Point of No Return that includes: 1) In the short term, working with the owners of the land that the PONR sits on to get the boundaries of the land delineated and fenced off so as to prevent any building of any sort near the monumemt. 2) In the longer term work with appropriate authorities and NGOs to support initiatives to protect and develop the site in a sensitive way for visitors		NA	NA	CRMoW	Point of No Return Management Plan
	CRMoW will work with the State in the development of measures to aid in the management of in-migration.					
	Identify all the historic buildings and monuments located closes to the routes that might be used for traffic to and from the Project site and for the transport of construction material. Steps will be identified to protect any building or monument that might be threatened. CRMoW will support Cross River State in the identification of the cultural sites on the Project site that require relocation as part of the RAP					
Socio-Cultural Institutions and Social Cohesion						
Socio-Cultural Institutions and Social Cohesion	CRMOW will support Cross River State in the RAP process of consultation with communities (host and resettled), traditional authorities and the government regarding selecting potential resettlement sites.				CRMOW (in concert with Cross River State)	
Occupational Health and Safety						
Occupational Health and Safety Risks	CRMoW will design an occupational health and safety management plan tailored to the needs of the project. This plan will set standards that will be met by all contractors and subcontractors.				CRMoW	HSE Plan

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
CONSTRUCTION								
Terrestrial Ecology & Biodiversity								
Impact on habitat and flora	Areas that are cleared for temporary facilities will be restored and revegetated. Ensure that any re-vegetation uses locally sourced and indigenous plants.		Minor		Video will be recorded of area prior to clearing; this record will be reviewed prior to revegetating to ensure back to original condition or better (i.e. no exotic species)	Before and after clearing	Construction Contractor	Contractor Environmental Plans
	Areas that will not have impervious surface or structures placed should remain vegetated, ensuring only native vegetation is used (removing any non-native or invasive species)				NA		CRMoW	Training Plans
Impact on terrestrial fauna	The Project will ensure that all workers are aware of the importance of ecological resources and how to protect them (including awareness-raising regarding illegal hunting and bush meat). This will be done through training and awareness raising campaigns. The training would also include instruction on how to reduce impacts on ecological				Regular monitoring and enforcement of vehicle speeds within Project area	Regular (weekly)	CRMoW	Traffic Management Plan

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	resources through construction approaches and techniques.							
	The Project will establish rules for equipment and vehicles to minimise disturbance to fauna. A speed limit shall be established and enforced				See air and noise sections		Construction Contractor	Construction Plans
	The Project will take measures to minimise dust, light, noise and vibration to reduce disturbance to animals during construction (see measures for air and noise impacts				NA		Construction Contractor	Construction Plans
	Reinstate temporarily affected areas immediately after completion of construction works, through on-site planting. Native species should be used				NA			Construction Plans and Schedule
	Relocate protected species if found during clearance works: a specialist trained in the identification of local species will conduct a sweep of areas just prior to clearance works. If protected species are found, they will							

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	be captured and relocated to suitable habitat outside the Project area							
Impact on freshwater taxa		Construction works should be programmed to minimse soil and excavation works in the rainy season	Negligible		NA			Construction Plans and Schedule
		Earth bunds or sand barriers should be provided on the construction site to properly direct stormwater to treatment facilities			NA			
		Refer to mitigation measures for water quality			NA			
Impacts on soil from destruction of soil resources and increased erosion	Develop and implement a site drainage plan to reduce runoff across the site and minimize erosion						CRMOW, Engineering Consultant	Site Drainage and Storm water Management Plan
	Rehabilitate and revegetate cleared areas on site that will not be developed further						Construction Contractor	Construction Plans
	Restrict preparation and clearing activities and vehicles using the site to						Construction Contractor	Construction Plans

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	demarcated construction and work areas, respectively							
	Implement site drainage plan monitoring of over land run-off and effectiveness of erosion control measures							
Surface and Groundwater								
Impacts on water quality site preparations, clearance and excavation works, and discharges	Develop response strategies for a coordinated response to an oil or fuel							
Impacts from accidental spillages								
	Develop internal organization roles and responsibilities;							
	Develop reporting requirements							
	Ensure adequate spill response resources							
	Properly trained personnel to conduct fuel and chemical handing according to formal procedures to reduce risks of							

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	accidental releases and fire and explosion hazards;							
	All spills will be immediately contained and cleaned up. The area will be properly washed and the wastewater will be conveyed to the on-site wastewater treatment plant for treatment; and							
	Contaminated areas will be remediated and post remediation verification will be carried out.							
Run-off from Construction Site	Prior to the commencement of the site formation earthworks, surface water flowing into the site from uphill will be intercepted through perimeter channels at site boundaries and safely discharged from the site via adequately designed sand/silt removal facilities such as sand traps .Channels will be protected against erosion through a combination of engineering designs and use of concrete, rock armouring and lining as required. Permanent drainage during the							

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	operation phase will be designed for heavy rainfall events							
	The surface runoff or extracted ground water contaminated by silt and suspended solids will be collected by the on-site drainage system and discharged into storm drains after the removal of silt in silt removal facilities such as stormwater ponds							
	Topsoil removed during clearing will be stored in specified areas. Stockpiled earthworks, during and after clearing will be placed as bunds at strategic locations in order to reduce sediment loadings to the storm runoff							
	Soil erosion caused by wind and rainstorms will be reduced by minimizing the land clearance area where possible, adding surface protection and conducting clearing progressively; Unprotected partially							

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	formed soil slopes will be temporarily protected by plastic sheeting, suitably secured against the wind, at the end of each working day							
	Appropriate surface drainage will be designed and provided where necessary Temporary trafficked areas and access roads formed during construction will be protected by coarse stone ballast or equivalent. These measures shall prevent soil erosion caused by rainstorms							
	Drainage systems, erosion control and silt removal facilities will be regularly inspected and maintained to ensure proper and efficient operation particularly following rainstorms. Deposited silt and grit will be removed regularly							
	Measures will be taken to reduce the ingress of site drainage into excavations. If trenches have to be excavated during the wet							

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	season, they will be excavated and backfilled in short sections wherever practicable. Water pumped out from trenches or foundation excavations will be discharged into storm drains via silt removal facility							
	Temporary and permanent drainage pipes and culverts provided to facilitate runoff discharge will be adequately designed for the controlled release of storm flows							
	Water used in ground boring and drilling for preparation or rock / soil slope stabilization works will be re-circulated to the extent practicable after sedimentation. When there is a need for final disposal, the wastewater will be discharged into storm drains via silt removal facilities							
	Measures will be taken to reduce the ingress of site drainage into excavations. If trenches have to be excavated during the wet season, they will be excavated and backfilled in							

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	short sections wherever practicable. Water pumped out from trenches or foundation excavations will be discharged into storm drains via silt removal facilities							
Wastewater and Sewage Discharge Discharge	During the work, portable chemical toilets and cesspits will be used							
Impacts to Traffic during Construction	Project vessel movement and activity shall observe standard navigational safety procedures and local communication protocols, to avoid conflicts with other vessels in the Project Area							
Air Quality								
Impacts to air quality from site clearance and excavation, road construction works, traffic and construction of infrastructure		Locate diesel-fueled machinery and dust causing activities away from sensitive receptors (including on-site workers						
		Avoid locating open stockpiles of dusty materials along the						

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
		boundary close to the air sensitive receptors						
		Cover all stockpiles of dusty materials such as excavated spoils, filling materials by impervious sheets entirely						
		Control the height of unloading the fill materials during filling as far as possible. Where possible, this should be well below the height of the hoardings along the Project site boundary						
		Totally enclose any skips for material transport with impervious sheeting						
		Provide wheel washing facility at each exit of the work site						
		Regular water the main haul road to suppress the dust emissions during truck movement;						
		Maintain and check the construction equipment						

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
		regularly to avoid black smoke emissions Prohibit waste or vegetation burning on site						
		Compact the reclaimed land immediately to avoid fugitive dust emissions especially during windy season						
		Use ultra-low sulphur diesel for trucks and diesel-fueled construction equipment						
		Locate the concrete batching plant as far as possible from the air sensitive receptors and install dust removal system, such as dust filters at each exhaust of the concrete batching plant						
Noise and Vibration								
Noise impact from the construction equipment and activities for site clearance and construction of initial phase including truck shipment of		Minimize night-time construction works and traffic						

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
quarry rock for construction								
		Only well-maintained equipment should be operated on-site						
		Regular maintenance of equipment such as lubricating moving parts, tightening loose parts and replacing worn out components should be conducted						
		Machines and construction plant items (eg trucks) that may be in intermittent use should be shut down or throttled down between work periods;						
		The number of equipment operating simultaneously should be reduced as far as practicable						
		Equipment known to emit noise strongly in one direction should be orientated so that the noise is directed away from receptors far as practicable						
		Noise impacts from activities (such as piling						

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
		activities) should be properly reduced by implementing control measures (eg erecting temporary noise barriers and deflectors) . Material stockpiles and other structures should be utilised to screen noise sensitive receptors from on-site construction activities						
		Noisy equipment (such as bulldozers, backhoes, rollers and drop hammer) should be located as far away from receptors as practicable						
		Transportation of materials on- and off-site through existing community areas should be avoided as far as practicable						
		Establish grievance mechanism for local community members to register noise complaints						
Waste								

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
Impacts related to the storage and segregation of wastes	Non-hazardous Wastes		Minor					
	Provide separate labelled bins/stockpiles/areas for recyclable materials deposit to encourage segregation and recycling and to avoid fly tipping;							
	Provide appropriate containers for the waste types generated (e.g. enclosed bins for putrescible materials to avoid attracting pests and vermin and to minimise odour nuisance);							
	Store general refuse/putrescible materials in enclosed bins or covered skips to minimise the occurrence of windblown litter, odour nuisance, leakage of waste, avoid attracting pests and vermin;							
	Provide sufficient containers to ensure waste does not overflow, and thus cause impacts to water courses							

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	Locate storage areas away from watercourses and sensitive habitats; and							
	If recycling centers are available, provide a contained refuse collection area and collect contaminated surface run-off to mitigate potential impacts to water. Enclose this where possible to minimise the potential for odour nuisance and the occurrence of windblown litter.							
Waste transportation, collection and handling	Storage hazardous wastes so as to prevent or control accidental releases to air, soil and watercourses;							
	Clearly label hazardous wastes (including providing information on chemical compatibility) and storage area;							
	Ensure storage area has an impermeable floor and containment, of capacity to accommodate 110% of the volume of the largest waste container; and							
	Ensure storage area has adequate ventilation							
	Non-hazardous Wastes							

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	Arrange for regular refuse collection (at least on a weekly basis) to minimise odour, pest and litter impacts							
	Enter into a contract with reputable waste collectors for collection of waste. As good practice, arrangements should be agreed with CRWMA before construction commences							
	Ensure information on chemical compatibility is provided to employees (proper handling. Containers, and to avoid improper mixing							
	Ensure transport is conducted to minimise spills, release and exposures to employees and public							
	Obtain chain of custody documents for all waste movements to ensure that wastes transported by licensed carrier to suitable final disposal facility; record quanities and types of waste produced and method of disposal							

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	Minimise windblown litter and dust during the transportation of waste by either covering the load on the trucks or by transporting the waste in enclosed trucks							
Waste treatment / disposal facilities	Ensure an approved hazardous waste collector is used; and							
	Ensure transport is conducted to minimise spills, release and exposures to employees and public.							
	Non-hazardous Wastes							
	Ensure refuse disposal arrangements (whether to the dumpsites nearby or to other facilities) are secured in advance of construction and approved by the CRMoW							
	Select facilities for disposal that are appropriately designed, permitted and operated and that have sufficient capacity for wastes. Due diligence investigations prior to disposal may be required; and							

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	Ensure facilities for disposal comply with the requirements of National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulations, National Environmental Protection (Management of Solid and Hazardous Wastes) Regulations, National Guidelines and Standards for Industrial Effluents, Gaseous Emissions and Hazardous Waste Management in Nigeria (1991), Harmful Wastes (Special Criminal Provisions etc.) Act of 1988 (Harmful Wastes Act), Environmental Protection Agency Law Cap L23, Laws of Cross River State of Nigeria, 2003; and IFC General HSE Guidelines: Waste Management and Construction & Demolition							
	Hazardous Wastes							
	Ensure disposal of hazardous wastes is to							

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	licensed hazardous waste facility							
	Records should be kept of transfers of hazardous wastes (trip tickets) to ensure appropriate disposal							
Sewage	Locate central cesspits on-site way from watercourses and away from area of high water							
	Disinfect the area around the central cesspits regularly; and							
	Identify appropriate sewage or wastewater treatment facilities for disposal sewage							
Social								
In-Migration and Associated Impacts to Demographics and Local Communities, including vulnerable groups								
Demographic change, increased pressure on essential servicers, risk of new diseases and increased transmission of existing diseases, increase in solid waste, impacts on ecosystems and biodiversity, pressure on availability of land based livelihoods and food security,	Collaborate with local and state government authorities and NGOs to stimulate the development of improved infrastructure and public services to manage increased pressure on these resources. Other measures will include implementation of sensitisation programmes regarding education and health issues and programmes for the management of biodiversity and natural resources							

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
impacts on traditional institutions and cultural heritage	Ensure all resettlement activities are designed to avoid or reduce incentives for opportunistic settlers							
	Support the local police to prevent illegal activities and land occupation in the area							
	Work with local administrations, community chiefs and community members to monitor trends in in-migration and motivations. Trends regarding local prices and local inflation, and its effect on levels of poverty will also be monitored.							
Livelihoods and Micro-economics								
Direct and indirect employment opportunities, development of local economy, inflation, disruption of farm lands and other impacts on livelihoods	Disruption to farming: CRMoW will provide information to farming communities regarding project activities and the requirement to keep away from operations for safety reasons. CRMoW will notify other users of the of the presence of any exclusion zones and mark these on nautical charts as cautionary advice to all users of the road.	Minor						

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	Employment: the Project will seek to employ people from local Communities where positions are suitable for their skills. CRMoW will inform communities about potential vacancies for skilled and unskilled work							
	The project will assess the potential goods that the community could supply to the Project and a list of local businesses in the project affected communities CRMOW's policy is to treat all procurement sources equally, and so local source will be considered as long as they are competitive with the goods from other sources.							
	Skills training: in recognition of the current skills shortage in the local area, CRMoW will seek opportunities to implement relevant training programmes to help improve the skills of workers from the local area.							
	Support to local businesses: as per policy, CRMoW will give equal consideration to local suppliers							

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
Community Health								
An increase in transmission of communicable diseases, malaria, STIs including HIV/ AIDS and nutrition related diseases	Adopt and enforce pre-employment health screening protocols for all Project personnel (direct CRMoW employees, contractors and subcontractors); and protocols will be reviewed annually to ensure they remain fit for purpose and will be updated as required.		Minor					
	Undertake health screening for Project personnel; screening for STIs will be voluntary but encouraged through education and awareness raising programmes							
	Provide awareness, counseling and testing (ACT) for all Project personnel, including voluntary testing for STIs and HIV/AIDS in pre-employment and on-going health screening. (Workers will not be denied employment or discriminated against in any way based on their HIV status							

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	Provide adequate referral and support for on-going treatment programmes for Project personnel found to have treatable conditions as a result of health screening							
	Develop and implement a Workforce Code of Conduct for all Project personnel that includes guidelines on worker-worker interactions, worker-community interactions, development of personal relationships with members of the local communities, alcohol consumption etc							
	Forbid illegal activities by all Project personnel, including the use of commercial sex workers, transactional sex, and the use and / or trafficking of illegal substances							
	awareness among Project personnel of sexually transmitted infections, communicable diseases (eg TB) and vector borne diseases (eg malaria), and							

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	other diseases as appropriate							
	Monitor the emergence of major pandemics through WHO alerts. If the WHO Pandemic Alert Scale reaches level 4, the Project will implement the relevant Emergency Response Plans							
	Provide malaria and vector control measures such as appropriate clothing (long sleeves), use of mosquito screens in worker accommodation, office space and other buildings and the provision of bed-nets at worker accommodation							
	Focus on preventing HIV via on-going information campaigns, condom availability and offering at least an annual health check and a free voluntary HIV test. One-on-one counselling prior to testing is recommended							
	Dust suppression techniques will be employed							

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	to reduce dust created by heavy trucks and machinery during construction							
	Work with the state and local government authorities to support their implementation of the influx management measures to ensure health issues resulting from in-migration are considered and managed							
Access to Public Services and Local Infrastructure								
In-migration is likely to result in increased pressure on health facilities and increases in the rate of transmission of communicable diseases	Establish on-site health clinic for workers, prepare an ambulance on site ready and equipped to take seriously injured staff to appropriate hospitals, and look for opportunities to invest in local health services to enable them to cope with increased access by migrant workers.		Minor to Moderate					
A likelihood of a further reduction in quality of education and a risk that children will be forced to drop out of school due to inflation	Seek opportunities to collaborate with local government and/or NGOs to improve local schools (infrastructure and equipment		Minor to Moderate					

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
Increase in pressures on existing pit-based sewage and waste and sanitation systems	During construction phase, heavy duty vehicles bringing materials to site should move at night where possible		Minor					
Cultural Heritage								
The area is home to several historic buildings and monuments that may be compromised by the project (ie through demolition or through greater traffic disturbance or new buildings that encroach on these sites spoiling their historic significance. Sacred sites of importance to the local communities that are within the Project footprint will be lost as a result of the Project land take and cause significant distress	CRMoW will undertake stakeholder engagement, including implementing its grievance mechanism to address stakeholder concerns and issues related to cultural heritage in a timely manner							

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
In-migration may dilute binding traditions such as the rites of passage to adulthood and associated secret societies. Cultural heritage sites could be damaged as a result of accidents and unplanned events								
Socio-Cultural Institutions and Social Cohesion								
Socio-Cultural Institutions and Social Cohesion	A Code of Conduct will be developed and enforced for project personnel and a grievance mechanism to allow communities to raise concerns over cultural insensitivities and /or conflicts		Moderate					
Community Safety and Security								
Potential for accidents to occur	Security personnel will patrol site area to prevent unauthorised access onto the site along with ensuring that protocols for accessing the site through gates are strictly enforced.							

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	Security personnel will regularly inspect boundaries to ensure that any breaches / damage to fences are repaired promptly to minimise site access.							
	Community grievances in relation to the conduct of security personnel and safety issues or activities are addressed in accordance with the Project's established Grievance Procedure							
	All security personnel will be trained in line with the 'International Code of Conduct for Private Security Service Providers' and on Project expectations and procedures for security behaviour and practices, on induction and then annually							
	Security personnel are screened prior to employment by means of detailed interviews and vetted in line with the 'International Code of							

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	Conduct for Private Security Service Providers' to avoid hiring those who have previously been involved in infringement or violation of human rights							
	Appropriate supervision is provided to ensure that established procedures are being applied by security personnel							
	Security arrangements are communicated to relevant stakeholders including workers and communities, without compromising the security of the Project							
	If unlawful or abusive acts are committed by security personnel immediate action is taken to prevent recurrence and report unlawful and abusive acts to public authorities.							
	In the event of use of government forces, there is agreement on the principles to be used and on an appropriate response prior to							

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	any incident being attended by government forces							
	As part of the stakeholder engagement activities, communities in the vicinity of the highway route will be informed about the risks and consequences of trespassing. Such engagement will start prior to the start of construction activities							
	Emergency response plans will be developed and will be communicated with the community as appropriate							
	CRMOW will work with local government to identify the impacts from influx of migrants to the area							
	The Project will undertake an awareness raising campaign regarding road and water vessel movements and risk. This will run throughout the duration of construction and during the initial years of highway operation. These sessions will be aimed at the							

Table 7.4 Environmental and Social Management Plan

POTENTIAL IMPACT /ISSUE	REQUIRED MITIGATION	RECOMMENDED MITIGATION	RESIDUAL IMPACT SIGNIFI CANCE	.	MONITORING	TIMING/ FREQUENCY	RESPONSIBLE PARTY	RELATED PLANS
	local population, including farmers and other road users and will include sessions also aimed at school children, as well as community events							
	Heavy duty vehicles bringing materials to site should where and when possible move at night wherever to reduce potential congestion							
Occupational Health and Safety								
Occupational Health and Safety Risks	CRMoW shall and will implement Health and Safety communication and training programmes to prepare workers to recognize and respond to workplace hazards		Moderate					

Table 7.4 Environmental and Social Management Plan								
POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
Operation								
Terrestrial Ecology & Biodiversity								
Impact on habitat and flora	Effects to flora and habitats primarily related to drainage and changes in surface and groundwater hydrology. See mitigation measures for water quality.		Minor	6.4.2	NA		CRMOW, Engineering Consultant	Site Drainage and Stormwater Management Plan; Groundwater and Potable Water Management Plan
Impact on terrestrial fauna	The Project will establish rules and ensure that vehicles to minimise disturbance to fauna, especially those which may be nocturnal or have specific migratory routes.		Minor		NA		CRMoW	Training Plans
Impact on terrestrial fauna	To reduce potential road kill, establish speed limit on the road. Also to the extent possible, plan paths that retain wildlife corridor, allowing movement of animals between disconnected habitats.				Regular monitoring and enforcement of vehicle speeds within Project area	Regular (weekly)	CRMoW	Operational Environmental Plans

Table 7.4 Environmental and Social Management Plan								
POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
Impact on freshwater taxa		Construction works should be programmed to minimize soil and excavation works in the rainy season	Negligible		NA			Construction Plans and Schedule
		Earth bunds or sand barriers should be provided on the construction site to properly direct stormwater to retention facilities			NA			
		Refer to mitigation measures for water quality			NA			
Impacts on soil from destruction of soil resources and increased erosion	Develop and implement a site drainage plan to reduce runoff across the site and minimize erosion						CRMOW, Engineering Consultant	Site Drainage and Storm water Management Plan
	Rehabilitate and revegetate cleared areas on site that will not be developed further						Construction Contractor	Construction Plans
	Restrict preparation and clearing activities and vehicles using the site to demarcated construction and						Construction Contractor	Construction Plans

Table 7.4 Environmental and Social Management Plan								
POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
	work areas, respectively							
	Implement site drainage plan monitoring of over land run-off and effectiveness of erosion control measures						Construction Contractor	Site Drainage and Stormwater Management Plan
Surface and Groundwater								
Impacts from discharges of wastewater, sewage and run-off	See Measures under Construction		Minor				CRMoW	Site Drainage and Stormwater Management Plan
Changes in hydrology	Ensure water use considers technologies and operational controls to minimize water use and abstraction (e.g. low-flow devices)		Minor		NA		CRMoW	Groundwater and Potable Water Management Plan
	Minimise soil compaction, maintain soil utility, and minimise erosion in undeveloped areas on the site through rehabilitation and re-vegetation							

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POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
	Develop and implement a groundwater monitoring programme to monitor water quality over the life of the Project				Monitor groundwater at local communities, both deep and shallow aquifers	Regularly over life of Project	CRMoW	Site Drainage and Stormwater Management Plan
Unplanned Events								
Impacts from auto crashes	Develop reporting requirements							
	All spills will be immediately contained and cleaned up and wreckages removed from accident sites along the highway							
	Develop an Emergency Preparedness and Response Plan (EPRP) that is commensurate with the risks of the facility which will include a fire/accident response plan supported by necessary resources and training							

Table 7.4 Environmental and Social Management Plan								
POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
	Provide advice on risks to community and to encourage children to keep away from							
	The road is designed to provide reasonable protection in the event of an explosion and all buildings should be designed with due consideration to pedestrian safety, including the provision of pedestrian bridges in built up areas				Regular audit			Emergency Preparedness Response Plan
	Provide advice on risks to community and to encourage children to keep away from the highway				Community engagement	Annually	CRMoW	Emergency Preparedness Response Plan
	The road is designed to provide recreational facilities at convenient intervals along the highway, This is to enable drivers to clear off the road, park and							

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POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
	relax when fatigued or need their vehicles fixed in the event of faults.							
Social								
In-Migration and Associated Impacts to Demographics and Local Communities, including vulnerable groups								
Demographic change, increased pressure on essential servicers, risk of new diseases and increased transmission of existing diseases, increase in solid waste, impacts on ecosystems and biodiversity, pressure on availability of land based livelihoods and food security, impacts on traditional institutions and cultural heritage	Collaborate with local and state government authorities and NGOs to stimulate the development of improved infrastructure and public services to manage increased pressure on these resources. Other measures will include implementation of sensitization programmes regarding education and health issues and programmes for the management of biodiversity and natural resources		Moderate		NA		CRMoW	Influx Management Measures
	Ensure all resettlement activities are designed to avoid or				NA	NA	CRMoW	Influx Management Measures

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POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
	reduce incentives for opportunistic settlers							
	Support the local police to prevent illegal activities and land occupation in the area.				NA	NA	CRMoW	Influx Management Measures
	Work with local administrations, community chiefs and community members to monitor trends in in-migration and motivations. Trends regarding local prices and local inflation, and its effect on levels of poverty will also be monitored.				NA	NA	CRMoW	Influx Management Measures
Livelihoods and Micro-economics								
Direct and indirect employment opportunities, development of local economy, inflation,	Disruption to farming: CRMoW will provide information to farming communities regarding project		Minor		NA	NA	CRMoW	

Table 7.4 Environmental and Social Management Plan								
POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
disruption of farm land and other impacts on livelihoods	activities and the requirement to keep away from operations for safety reasons							
	Employment: the Project will seek to employ people from local communities where positions are suitable for their skills. CRMoW will inform communities about potential vacancies for skilled and unskilled work Local procurement: The project will assess the potential goods that the community could supply to the Project and a list of local businesses in the project affected communities. CRMoWwill include local suppliers in their procurement process equally with other suppliers, as long as they are competitive with the				NA	NA	CRMoW	

Table 7.4 Environmental and Social Management Plan								
POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
	goods from other sources							
	Skills training: in recognition of the current skills shortage in the local area, CRMoW will implement relevant training programmes to help improve the skills of workers from the local area				NA	NA	CRMoW	
	Support to local businesses: CRMoW will provide support to local suppliers to help ensure they operate in line with the CRMoW Responsible Procurement Policy				NA	NA	CRMoW	Responsible Procurement Policy
Community Health								
An increase in transmission of communicable diseases, malaria, STIs including HIV/ AIDS and	Adopt and enforce pre-employment health screening protocols for all Project personnel (direct CRMoW employees, contractors and				NA	NA	CRMoW	

Table 7.4 Environmental and Social Management Plan								
POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
nutrition related diseases	subcontractors); and protocols will be reviewed annually to ensure they remain fit for purpose and will be updated as required							
	Undertake health screening for all Project personnel; screening for STIs will be voluntary but encouraged through education and awareness raising programmes Provide awareness, counseling and testing (ACT) for all Project personnel, including voluntary testing for STIs and HIV/AIDS in pre-employment and on-going health screening. (Workers will not be denied employment or discriminated against in any way based on their HIV status).				NA	NA	CRMoW	
	Develop and implement a				NA	NA	CRMoW	

Table 7.4 Environmental and Social Management Plan								
POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
	Workforce Code of Conduct for all Project personnel that includes guidelines on worker-worker interactions, worker-community interactions, development of personal relationships with members of the local communities, alcohol consumption etc.							
	Forbid illegal activities by all Project personnel, including the use of commercial sex workers, transactional sex, and the use and / or trafficking of illegal substances				NA	NA	CRMoW	
	Promote, as part of induction, awareness among Project personnel of sexually transmitted infections, communicable diseases (eg TB)				NA	NA	CRMoW	Workforce Code of Conduct

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POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
	and vector borne diseases (eg malaria), and other diseases as appropriate							
	Monitor the emergence of major pandemics through WHO alerts. If the WHO Pandemic Alert Scale reaches level 4, the Project will implement the relevant Emergency Response Plans				NA	NA	CRMoW	
	Provide malaria and vector control measures such as appropriate clothing (long sleeves), use of mosquito screens in worker accommodation, office space and other buildings and the provision of bed-nets at worker accommodation				NA	NA	CRMoW	
	Focus on preventing HIV via on-going information campaigns, condom				NA	NA	CRMoW	

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POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
	availability and offering at least an annual health check and a free voluntary HIV test. One-on-one counselling prior to testing is recommended							
	Dust suppression techniques will be employed to reduce dust created by heavy trucks and machinery during maintenance works				NA	NA	CRMoW	
	Work with the state and local government authorities to support their implementation of the influx management measures to ensure health issues resulting from in-migration are considered and managed.				NA	NA	CRMoW	
Access to Public Services and Local Infrastructure								
Access to Public Services and Local Infrastructure	Invest in educational supplies for schools		Minor		NA	NA	CRMoW	

Table 7.4 Environmental and Social Management Plan								
POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
	impacted by migrant workers families							
Cultural Heritage								
The area is home to several historic buildings and monuments that may be compromised by the project (ie through demolition or through greater traffic disturbance or new buildings that encroach on these sites spoiling their historic significance. Sacred sites of importance to the local communities that are within the Project footprint will be lost as a result of the Project land take and cause significant distress. In-migration may dilute binding	Invest in educational supplies for schools impacted by migrant workers families CRMoW will look for opportunities to provide support to cultural initiatives chosen by local communities				NA	NA	CRMoW	

Table 7.4 Environmental and Social Management Plan								
POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
traditions such as the rites of passage to adulthood and associated secret societies								
Cultural heritage sites could be damaged as a result of accidents and unplanned events					NA	NA	CRMoW	
Socio-Cultural Institutions and Social Cohesion								
Socio-Cultural Institutions and Social Cohesion	Community investment programmes to support informal community institutions and networks such as women's groups, youth associations etc will be implemented		Moderate		NA	NA	CRMoW	Health awareness training programme
	Sensitisation programmes for communities regarding the impacts of in-				NA	NA	CRMoW	

Table 7.4 Environmental and Social Management Plan								
POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
	migration, including conflict management and security under an IFC compliant In-Migration Management Plan.							
	Support the equitable representation of women in project-related decision making committees; conduct gender sensitivity training and implementation of gender sensitive guidelines for project personnel; and collaborate with NGOs and other stakeholders to support programmes which include empowerment of women and girls, gender based violence prevention programmes and skills training for men and women				NA	NA	CRMoW	Influx Management Measures

Table 7.4 Environmental and Social Management Plan								
POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
Community Safety and Security								
Potential for accidents to occur	Security personnel will patrol site area to prevent unauthorised access onto the site along with ensuring that protocols for accessing the site through gates are strictly enforced		Minor		NA	NA	CRMoW	Awareness Raising Campaign
	Security personnel will regularly inspect boundaries to ensure that any breaches / damage to fences are repaired promptly to minimise site access.		Minor		NA	NA	CRMoW	
	Community grievances in relation to the conduct of security personnel and safety issues or activities are addressed in accordance with the Project's				NA	NA	CRMoW	

Table 7.4 Environmental and Social Management Plan								
POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
	established Grievance Procedure							
	All security personnel will be trained in line with the 'International Code of Conduct for Private Security Service Providers' and on Project expectations and procedures for security behaviour and practices, on induction and then annually.				NA	NA	CRMoW	
	Appropriate supervision is provided to ensure that established procedures are being applied by security personnel				NA	NA	CRMoW	
	Security arrangements are communicated to relevant stakeholders including workers and communities,				NA	NA	CRMoW	

Table 7.4 Environmental and Social Management Plan								
POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
	without compromising the security of the Project							
	If unlawful or abusive acts are committed by security personnel immediate action is taken to prevent recurrence and report unlawful and abusive acts to public authorities				NA	NA		
	In the event of use of government forces, there is agreement on the principles to be used and on an appropriate response prior to any incident being attended by government forces.				NA	NA	CRMoW	
	Emergency response plans will be developed and will be communicated with				NA	NA	CRMoW	

Table 7.4 Environmental and Social Management Plan								
POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
	the community as appropriate							
	Influx management measures will be developed				NA	NA	CRMoW	
	Heavy duty vehicles bringing materials to site should where and when possible move at night wherever to reduce potential congestion				NA	NA	CRMoW	
Occupational Health and Safety								
Occupational Health and Safety Risk	The Project will monitor the implementation of occupational health and safety regulations by contractors through twice yearly audits by health and safety specialists. If contractors are found to be breaching the laws on occupational health and safety, it will result in the loss of the contract				NA	NA	CRMoW	

Table 7.4 Environmental and Social Management Plan								
POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
	CRMoWwill abide by Nigerian laws and regulations and ILO conventions when gaps are identified between national legislation and international standards. The Project will monitor the implementation and compliance to these standards by contractors and subcontractors, through twice yearly audit process						CRMoW	
	Workers will have contracts which clearly state the terms and conditions of their employment and their legal rights. All workers will be able to join trade unions of their choice and have the right to collective bargaining. Contracts will be verbally explained				NA	NA	CRMoW	

Table 7.4 Environmental and Social Management Plan								
POTENTIAL IMPACT /ISSUE	**REQUIRED MITIGATION**	**RECOMMENDED MITIGATION**	**RESIDUAL IMPACT SIGNIFI CANCE**		**MONITORING**	**TIMING/ FREQUENCY**	**RESPONSIBLE PARTY**	**RELATED PLANS**
	to all workers where this is necessary to ensure that workers understand their rights prior to any employment contract to be signed. The project will encourage contractors to have recourse to formal employments							
	CRMoW will put in place a worker grievance mechanism. The grievance mechanism will be publicly advertised by the Project in the workforce. It will be easily accessible by workers, free of retaliation and should allow anonymous complaints to be raised and addressed.				NA	NA	CRMoW	Worker Grievance Mechanism

7.5 Environmental Monitoring Planning

7.5.1 Overview

The monitoring programme for the present project will be undertaken to meet the following objectives. To:

- check whether the proposed mitigation and benefit enhancement measures have actually been adopted, and are effectively put into practice;
- provide a means whereby any impacts which were subject to uncertainty at the time of preparation of the EIA, or which were unforeseen, can be identified;
- provide a basis for formulating appropriate additional impact control measures; and
- provide information on the actual nature and extent of key impacts and the effectiveness of mitigation and benefit enhancement measures which, through the project's feedback mechanism, can improve the planning and execution of future and similar projects.

Compliance monitoring is usually given more emphasis in the case of road projects because most impact control measures are incorporated in the project designs and contract documents.

In such cases, the extent to which recommendations on such items as set out in the EIA are complied with plays a major part in determining the overall environmental performance of the project.

7.5.2 Project Monitoring Phases

7.5.2.1 Pre-construction Phase monitoring

Monitoring during the pre-construction phase of the project will be concerned with two aspects:

- Confirming that the appropriate environmental protection clauses have been included in the contract documents to allow control of actions by the Contractor which are potentially damaging to the environment; and
- Checking whether the project designs and specifications incorporate appropriate measures to minimize negative impacts and to enhance beneficial impacts.

7.5.2.2 Construction Phase Monitoring

Environmental monitoring during the construction phase will comprise two sets of activities.

Namely:

- Review of the Contractor's plans, method statements, temporary works designs, and arrangements relating to obtaining necessary approvals from the Engineer, so as to ensure that environmental protection measures specified in the contract documents are adopted, and that the Contractor's proposals provide an acceptable level of impact control; and
- Systematic observation on a day-to-day basis of all site activities and the Contractor's offsite facilities including quarry and borrow areas, as a check that the contract requirements relating to environmental matters are in fact being complied with, and that no impacts foreseen and unforeseen are occurring.

These activities will be fully integrated with other construction supervision and monitoring activities carried out by the construction supervision consultant. Primary responsibility for ensuring that an adequate level of environmental monitoring is carried out will lie with the Supervising Consultant/Resident Engineer (RE), as part of his duties connected with general site supervision. Actual monitoring on a day today basis will be carried out by the site staff from the construction supervision consultant, under the direction of the RE.

The majority of monitoring will comprise visual observations, carried out at the same timeas the engineering monitoring activities. Site inspections will take place with emphasis on early identification of any environmental problems and the initiation of suitable remedial action. Where remedial actions have been required on the part of the Contractor, further checks will need to be made to ensure that these are actually being implemented to the agreed schedule and in the required form. Monthly reports prepared by the RE should contain a section referring to environmental matters, which summarizes the results of site monitoring, remedial actions, which have been initiated, and whether or not the resultant action is having the desired result. The report will also identify any unforeseen environmental problems and will recommend suitable additional actions. Progress meetings with the Contractor will also include a review of environmental aspects. In addition to visual observation, it is particularly important that monitoring should also include limited informal questioning of people and local community leaders who live near to the project areas since they may be aware of matters which are unsatisfactory, but which may not be readily apparent or recognized during normal site inspection visits. Prior to the commencement of construction, the RE his/her Environmental Specialist will develop environmental inspection checklists for site use and it will facilitate systematic monitoring and recording. These may require modification in the light of site experience, and it is recommended that a review of their adequacy and ease of use would be carried out approximately 3 months after the commencement of works. It is proposed that, the monitoring program could be based on project EMP and FMEnv Approval conditions for the project as well as other national Specifications for road projects provided by CRMoW.

7.5.2.3 Environmental Monitoring Indicators

Some of the monitoring indicators amongst others to be monitored are:

- Soil erosion and sedimentation control measures put in place by the Contractor;
- Number of trees planted on the road reserve areas;
- Hectares of areas planted with grass as part of re-vegetation programme;
- Number of rehabilitated and graded sites at quarries, borrow pits, at steep slopes;
- Gender mainstreaming i.e. involvement of women in the project activities,
- HIV/AIDS Sensitization Programme put in place;
- Volume of spoil disposed into approved locations (which would be outside the road reserves);
- Dust suppression measures instituted and implemented by the Contractor;
- Traffic control measures put in place during construction phase of the project;
- Contractor noise control measures put in place and operationalized;
- Number of PAPs resettled and compensated;
- PPE procured by the Contractor; and
- Records of workers issued with the PPEs materials.

The monitoring program is to be based on EMPs and FMEnv Approval conditions for the project as well as on the Specifications for Roads that relate to Environment, Occupational Safety and Health, Gender and HIV/AIDS and other cross cutting issues.

Table 7.5: Summary of Environmental and Social Monitoring Framework

No.	Environmental/Social Issue	Monitoring Indicators	Agency/Entity Responsible for Monitoring	Monitoring Activities to be undertaken	Frequency of Monitoring	Unit Cost (USD)
01.	Preconstruction issues (Surveying etc).	Number of sensitization meetings held; Minutes of sensitization meetings; and Availability of a sensitization programme in place.	Resident Engineer and CRMoW	Checking records	Once each quarter	Embedded in EIA costs
02.	Land and property expropriation Impacts	RAP implementation schedule in place; Lists of PAPs paid off; and Records of PAPs in place.	Resident Engineer and CRMoW	Inspection of RAP documentation process	Quarterly	15,000 USD
04.	Soil erosion concerns through soils excavations for construction materials, clearance for access routes in the identified borrow areas and during earthworks.	Soil control measures such as levelling overhanging cliffs done; and Stockpiling of borrow over burden materials.	Resident Engineer	Site inspections and document reviews	Weekly	Embedded in the BoQs for the project
05.	Excavation of borrow pits and construction of access roads and camp sites	Copies of agreements between the Contractor and, landlords; Overburden stockpiles in place; Approvals for use of cut to spoil materials	CRMoW, Resident Engineer	Inspection	Monthly	Embedded in the BoQs for works contracts.
06.	Management of cut to spoil in which, cut to spoil is sometimes deposited in swamps, forests on used for reclaiming sites.	Record of areas where cut to spoil will be disposed available; Approval of the RE for such a site in place.	Resident Engineer	Inspections and document reviews	Quarterly	In the BoQs for the road project.
07.	Social conflicts and crime issues	Employment laws in place; Workers accommodation in place; Minutes of meetings with law enforcement agencies in place; and An HIV/AIDS service provider in place and offering services	Resident Engineer	Document reviews	Monthly	To be embedded in the project BEME/BoQs for the works.

Table 7.5: Summary of Environmental and Social Monitoring Framework

No.	Environmental/Social Issue	Monitoring Indicators	Agency/Entity Responsible for Monitoring	Monitoring Activities to be undertaken	Frequency of Monitoring	Unit Cost (USD)
08.	Occupational Safety and Health	PPES for workers in place; Agreements to send back the used materials to the providers in place; and Records of waste materials sent back to the suppliers in place. Clearly set out storage facilities in place.	Resident Engineer	Site inspections	Regularly	Costs are part of their roles in Local Governments.
10.	State of worker's camp site	Site Approval in place; Separate toilets in place; and Clearly labelled and legible "**NO SMOKING"** signs displayed in strategic areas in the camp site	Resident Engineer, Health CRMoW	Site inspections	Regularly	Will be part of the BoQs for the works contract.
11.	Tree planting	Number of trees planted	Forestry staff	Inspection of trees planted	Quarterly	10,000 USD
12.	Waste management concerns especially solid and effluent in the camp site.	Waste management strategies in place; Contractor's EMP with details on waste management articulated there in.	Resident Engineer and SLRA	Document reviews	Monthly	Embedded in the contract for works.
13.	Occupational Safety and Health concerns for the work force	PPEs in place and a Contractor.	Resident Engineer and Public Health Inspectors	Site inspection	Monthly	To be embedded in the BoQs for works in the Contractor rates.
14.	HIV/AIDS Interventions Mainstreaming	An HIV/AIDS service provider in place; HIV/AIDS intervention programme in place Reports of HIV/AIDS sensitization in place	Resident Engineer/ CRMoW	Records reviews	Monthly	15,000 USD
15.	Gender Mainstreaming	Gender service provider in place; Reports on Gender mainstreaming in place	Resident Engineer, CRMoW,	Records reviews	Monthly	15,000 USD
16.	Road safety issues accidents during construction	Road safety service provider in place;	Resident Engineer/ Ministry of Works-	Document reviews	Monthly	10,000USD

Table 7.5: Summary of Environmental and Social Monitoring Framework

No.	Environmental/Social Issue	Monitoring Indicators	Agency/Entity Responsible for Monitoring	Monitoring Activities to be undertaken	Frequency of Monitoring	Unit Cost (USD)
	of the road	Road safety campaign schedule in place; Reports of meetings with traffic police on matters of traffic control available; Contractor traffic control plan in place	Road Safety Division			
17.	Loss of access routes to properties and homesteads due to anticipated cuts and fills activities during road works.	Records of access routes to be reinstated in place; No. of access roads reinstated.	Resident Engineer	Site inspections and document reviews	Quarterly	Costs are embedded in BoQs
	Total Monitoring Costs					**75,000**

Major Costs related to environmental enhancement measures that require physical construction works have been estimated and included in the engineering designs and tender documents. The monitoring and capacity building costs are estimated and included in this report. Apart from the cost of relocation/compensation and the costs already included in the engineering cost estimate, the other costs of environmental mitigation measures and monitoring is estimated at USD 295,000 and this is estimate does not include the RAP costs.

These are summarized as follows:

No	**Environmental and cost mitigation areas**	Cost Estimate (USD)
01.	HIV/AIDS campaigns	35,000
02.	Road safety campaigns	30,000
03.	Tree planting	10,000
04.	Gender mainstreaming and monitoring	45,000
05.	EMP Monitoring costs (involvement of line agencies in monitoring etc)	75,000
06.	Capacity Building for CRMoW Environmental Unit	20,000
07.	Support to Road Committees	10,000
	Total EMP Operationalisation Costs	**225,000**

7.6 Institutional and Capacity BuildingResourcing and Responsibilities

7.6.1 Resourcing

The Community Affairs, Safety, Health, Environment and Security (CASHES) manager shall be responsible for all environment and socio-economic related matters throughout the project implementation to ensure compliance with regulatory standards as well as HSE guidelines. For effectiveness, the CASHES manager shall supervise the site HSE co-ordinator, site Engineers, site HSE Officer and Environmental officer and shall report directly to the managing director.

The CASHES manager shall also source for competent specialists on social and environmental issues to form part of the social and environmental monitoring team. These resource persons shall be approved by the proponent and shall be supervised by the CASHES manager.

The organogram showing the line of authority for the implementation of the ESMP guidelines is shown in **Figure 7.1**.

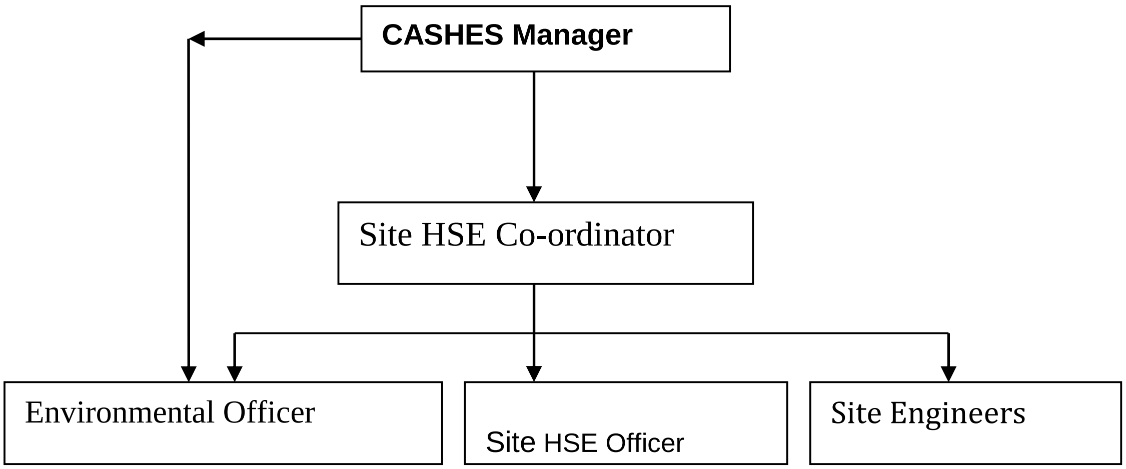

Figure 7.1: ESMP Implementation Organogram

7.7 Arrangements

7.7.1 Institutional Requirements

The institutional arrangements proposed for the successful mainstreaming of the environmental and social considerations will be as follows:

7.7.2 The Role of FMEnv

FMEnv will be responsible for review and commenting on the EIA reports. Once approved, FMEnv will issue an Approval, including potential conditions of approval for the proposed Bakassi –Ikom – Katsina Ala Superhighway. The Approval Conditions are then sent to CRMoW and its implementation will be under the oversight of the Environmental Specialist and the Sociologist in CRMoW's Directorate of Planning.

By mandate, FMEnv has the responsibility to monitor, supervise and coordinate environmental and social compliance of development projects nationally. They do this through regular field visits to the sites and collaboration with the districts and urban entities responsible for environmental and natural resources management.

The Role of CRMoW's Project Engineers

The Project Engineers will be responsible for ensuring that the environmental mitigation measures (ref: conditions of approval) identified in the project are taken up during implementation of the project.

7.7.3 The Role of the Design Engineer

The Design Engineer has the obligation to ensure that the mitigation measures are included in the Bidding document; including the Bill of Quantities and that a specific budget is allocated for implementing the mitigation measures.

7.7.4 The Role of the Contractor

Ultimately, the Contractor, in accordance with the Contract provision, will be accountable for the implementation of the mitigation measures and this will be monitored and supervised by CRMoW Environmental Unit. As such, the Contractor should also prepare his own EMP for each sub project.

In the schedule of works, the Contractor must include all proposed mitigation measures, and the Supervising Engineers should also ensure that the schedules and monitoring plans are complied with. This will lend a sense of ownership to the Contractor. Diligence on the part of the Contractor and proper supervision during both the construction and defects liability period are crucial to the success of mitigating impacts. The Contractor on their part will be responsible for planning, implementing and reporting on mitigation measures during the execution of the project works. The Contractor will also be required to apply standard quality assurance procedures in full compliance with the FMEnv EIA Approval Permit for this EIA.

7.7.5 The Role of CRMoW's Environmental Unit

CRMoW Environmental Unit shall be responsible for oversight, implementation of mitigation measures and general compliance of the project with the Environment Impact Assessment (EIA) Act 86 0F 1992 and related Regulations and Guidelines on environment. Furthermore, the CRMoW Environmental Unit will assume the responsibilities of ensuring that, the project facilities all comply with environmental and social requirements as shall be detailed in the contract documents as well as with other guiding contractual provisions and documentations. At the end of the construction, CRMoW will release the Environmental Restoration License as evidence that all the mitigation measures have been fully implemented by the Contractor.

7.8 Waste Management Guidelines

The four principles of waste minimization process (recycle, reduce, reuse and recovery) shall be adopted as applicable to ensure reduction of the volume or relative toxicity of liquid or solid waste. A large proportion of the excavated and/or drilled core materials shall be used for landscaping or other remedial works on site.

The handling, storage and disposal of all waste that will be generated during the project life cycle shall be in accordance with FMEnv's and the state's approved waste management guidelines. These guidelines are binding on all staff and contractors involved in the proposed project with respect to the:

- Emission or release of pollutants, exhaust and/or fugitive gases.
- Discharge or spill of effluents into surface water or land.
- Generation of noise and vibration.
- Solid waste.

Chapter 8

8.0 CONCLUSION

8.1 The EIA Process

This EIA for CRSG's proposed Calabar – Ikom – Katsina Ala Superhighway was undertaken in accordance with the Environmental Impact Assessment Act (Act No. 86 of 1992). The aim of the EIA process is to provide information for decision-making to contribute to environmentally sound and sustainable development. The overall EIA process is comprised of a number of key steps, namely:

- Screening;
- Scoping;
- Baseline data collection;
- Public participation;
- Impact assessment;
- Management plans; and
- Reporting and disclosure.

This draft EIA report provides a description of the EIA process followed to date. It also provides a description of the public participation process that was undertaken during the EIA whereby stakeholders were notified and consulted regarding the project and its anticipated consequences.

Baseline information on receptors and resources was collected during the EIA from available data sources, field surveys during the wet and dry seasons. A description of the existing environmental and socio-economic conditions is provided as a basis against which the impacts of the project can be assessed. The biophysical, social-economic and health impacts of the proposed project have been assessed and mitigation measures identified to avoid or reduce adverse impacts and enhance positive impacts. A register of mitigation measures and monitoring requirements is included in an outline EMP is provided in Chapter 7.

8.2 Summary of Impacts and Mitigation

Table 8.1 presents a summary of the assessment of potential impacts showing the magnitude of the potential impacts and the sensitivity or value of the receptors or resources that may be impacted. Significance ratings are provided for potential construction and operational phase impacts as well as key mitigation measures. Significance ratings of residual impacts are also provided.

8.3 Overall Conclusion

The findings of the EIA indicate that there are no issues of Major or Moderate significance that could not be mitigated such that the proposed project was not acceptable from an environmental or socio-economic perspective.

Social issues, particularly compensation/resettlement, potential for encroachment into the Oban Forest Reserve, accidents, noise and air pollution and impacts to local farmer were the only issues of Major significance identified in the EIA. The significance of all impacts could be reduced to Moderate or Minor significance provided that the mitigation measures and monitoring requirements outlined in Chapter 6 are implemented.

The EIA also identified some positive impacts associated with the proposed development including boosts to the local economy and potential employment opportunities for locals. These could be enhanced through giving preferential status to persons from the local community in relation to employment. The project will also work with local development NGOs to seek opportunities for community development projects.

Based on these considerations, the results of the impact assessment found no issues that would prevent authorisation of the Project, contingent that the safeguard measures described in the EIA and monitoring for potential environmental and social effects are implemented.

APPENDIX 1: MATERIALS AND METHODOLOGY

Baseline Data Acquisition Methods

Inspectors and Statutory Regulators

One representative each from the Federal and State Ministries of Environment, were present throughout the duration of the fieldwork. Their function was to ensure that environmental samples were collected and preserved (where necessary) according to recommended procedures and practices for environmental data collection as per industry guidelines and standards (Nigeria and international).

Quality Control/Quality Assurance (QC/QA)

QC/QA our programmes cover all aspects of the study, including sample collection and handling, laboratory analyses, generation of data and coding, data storage and treatment as well as report preparation. The quality assurance programme used in the fieldwork and laboratory analyses are in accordance with recommendations by FEPA (now FMEnv) (1991).

Sample Collection and Handling

Sample collection and handling were done in accordance to FEPA guidelines and standards as highlighted in the following paragraph:

Preparation for field work - In the preparation for fieldwork, glassware to be used were washed with detergent solutions, rinsed with tap water, then soaked in 1:3 nitric acid solutions for 24 hours to remove organic materials, washed again with tap water and rinsed with distilled water. Plastic containers were washed with detergents, rinsed with tap water, followed by distilled water. After drying, all the containers were rinsed with acetone to remove organic materials, and rinsed with distilled water.

Handling of Samples - Aluminium foils were used to contain soil and sediment samples. Water sampling equipment was rinsed with portions of the water to be sampled. Composite samples per sampling point were taken with thoroughly cleansed containers. Sterile wide-mouth polypropylene and Pyrex glass sample bottles were used. Samples for oil and grease were collected in clean and dry glass-stoppered bottles and were usually not completely filled to avoid losing oil when the stopper was inserted.

Sample identification

A permanent label was attached to each sample container and reflected specific sample identification details like project name, date, sample matrix, sampling point, sample number, depth, as the case may be.

Storage/Preservation

As samples could be subject to microbial degradation and transformation, they were therefore analysed at minimum time after collection. Since storage may be necessary for water samples to analyse physico-chemical parameters, they were stored in ice-chest as a cooling device and transported to the laboratory where they were refrigerated at 4 °C. Samples for heavy metal analyses were preserved with 1:1 nitric acid and oil and grease with 1 ml of 1:1 H_2SO_4 as soon as they were collected. Adherence to good preservation procedures ensured that errors were not introduced into the analytical process.

Fieldwork and Field Data Collection

Carrying out field calibrations of equipment and running distilled water blanks reduce errors that could arise from field measurements. Replicate samples were collected and used as checks of instrument performance. Field analytical operations were done in a defined sequence to avoid cross contamination of instruments. For example, conductivity was always determined before pH because concentrated electrolyte in the pH reference electrode may get into the sample and affect conductivity measurements.
The field data collection procedures used for this fieldwork are presented below:

Aquatic Environment

Methodology and locations of sampling station

In the hydrobiology studies, the physical features of the water bodies including their depth profiles, transparency, temperature and current velocity were determined. The biological resources studied were zooplankton, phytoplankton, benthos and fish.

Hydrobiology/Fisheries

Field sampling procedures

At each of the sampling stations, the methods listed in Table A1.2 were used for the indicated parameters. Replicate measurements were made where appropriate.

Table AA1.2: Methods employed for fisheries and hydrobiology studies.

S/No.	PARAMETER	METHOD
1	Sediment	Grab
2	Flow velocity	Current meter
3	Depth	Weighted line, meter rule and stop watch
4	Transparency	Secchi disc
5	pH	pH metre
6	Dissolved Oxygen	Winkler method
7	Temperature	In situ using mercury – in glass thermometer
8	Phytoplankton	55 micron plankton net
9	Zooplankton	55 micron two net
10	Benthos	Grab
11	Fish	Direct observation; structured and unstructured interviews.

Sediment samples were collected at every site where water samples were obtained. Grab was used to obtain sediment samples. These samples were transferred into sterile polyethylene medicine sachets. All sachets were appropriately labelled. The samples were preserved in ice chests and transported to the laboratory for analysis.

At each of the stations indicated above, the following hydro-biological measurements and samples were taken for analysis in the laboratory:

- *Water temperature (0 ℃);*
- *pH;*
- *Maximum depth (m);*
- *Stream velocity (surface water velocity);*
- *Phytoplankton samples;*
- *Zooplankton samples; and*
- *Benthic macro-invertebrate samples.*
- *Fish*

Surface water velocity was measured at the various sample locations using a buoy, a meter rule and a timer. The measurements were taken at the middle of the rivers channel. The depths of the river channel were determined using a calibrated pole.

Replicate samples of the biological resources were also taken at each station as outlined below:

Phytoplankton and Zooplankton

Phytoplankton and Zooplankton samples were collected 60cm below water surface using a 55μm mesh tow net with a diameter of 18cm. The net was towed at the specified depth for at least 5 minutes and at a speed of about 8km/hour at each surface water sample station. The concentrates of phytoplankton and zooplankton were emptied into polyethylene bottles and preserved in buffered 10% formalin solutions.

Benthos (Bottom Sediment)

Benthos (bottom sediment) samples for laboratory analyses were collected from river channel water. The sediment was collected using a Grab (0.0225m^2) and sieved using a 0.5mm mesh. The material scooped up from the bottom was first washed into a 0.5mm sieve and the residue along with all the recovered organisms transferred into a wide mouthed sample jar and preserved in 5% formalin into which was added Rose Bengal and transported to the laboratory. The samples were preserved in 5% formalin solution and stored in plastic containers.

Water Chemistry/Microbiology

A clean sampling bottle was used to collect surface water samples at the designated locations.

The following parameters were measured in the field (Fig. AA1.3): pH, Total Dissolved Solids (TDS), Dissolved Oxygen (DO) and Temperature were measured using a portable pH meter (Corning M-90 Checkmate Deluxe field system). Corning M-90 Checkmate Deluxe field system has probes for each of these measurements. Amber bottles of 250ml capacity were used to collect water samples for heavy and trace metals. These samples were acidified to pH of 2 in the field using concentrated nitric acid. All the other samples for physico-chemical measurements were transported to the laboratory in ice coolers.

Surface water samples were collected at the designated sampling points as in water chemistry. Water samples were taken and compounded into one sample. Sterile 20ml plastic containers with plastic screw caps were used to transport the samples.

Vegetation and Wildlife Studies

- *Vegetation Study*

A reconnaissance survey was conducted so as to have insight with the aim of selecting appropriate location, number; size, position and orientation of vegetation transect (VGT). Each VGT was demarcated into 100 metres by 10 metres (1000m^2) belt transect. Transects were established at intervals of 100 metres, alternating on right and left flanks of the proposed Project site and including as much as possible, all vegetation types within the proposed site.

Three (3) sampling areas were randomly distributed within each sampling area (VGT). They were situated along parallel straight lines which were at least 20 metres apart. One sampling plot was randomly chosen in *each axis for study. However, deliberate effort was made to locate the VSS at most stations where soil samples were taken.*

Within each transect, the associated vegetation was characterized using the segmented belt transect techniques (Oosting 1956; Odu 1985; Okpon 1998) to ensure maximum chances of finding most of the component species in the proposed site. Blocks of 5mx5m were laid on randomly chosen sides of each transect for detailed studies. Such alternately spaced observation points which cover the entire area as demarcated by these transects are generally more efficient statistically, than the contiguous or 100% assessment on smaller length of transect (Odu et al, 1985).

Among the parameters investigated in each VSS were floristic composition, community structure, relative density, percentage frequency of occurrence and pathological conditions. For each VGT there followed photographic records of representative segments.

Two hectares separated from each other by a distance of about 150metres in North and South directions of the study area were demarcated. These were studied to enumerate number of tree species, palms and ocular estimation of five tallest species (exclusive of palms and diameter at breast height (DBH).

After assessing the general condition and status of the vegetation, all the plant species were as much as possible, identified and listed on the field. The taxonomically difficult forms that could not be identified with certainty were collected with a secateurs (including the twig, flower, fruits, etc.) properly labeled and taken to the Herbarium, University of Uyo in black polythene bags for further keying and identification. All identification followed the keys of Hutchinson and Dalziel (1968), and Keay et al (1964) for trees, and Akobundu and Agyakwa (1998) for weeds.

- *Wildlife Study*

Wildlife survey was conducted in the same locations as in the vegetation studies and extended 2 kilometres beyond the acquired proposed project site into the adjoining bushes and swamps in all directions. This involved a series of conventional methods; both direct and indirect methods (Moshby, 1974; Dasmann, 1964; Sutherland, 2000; Davies, 2002) were used. The major objectives were to produce a comprehensive checklist of fauna present in and around the area and to determine their conservation status (prior to commencement of the project), against which future changes and magnitude of change in wildlife populations would be detected.

Critical habitats and microhabitats such as log, litter, forest undergrowth, crevices and burrows were painstakingly probed with the aid of long probes to dislodge any hiding herpeto-fauna and mammals (Heinen, 1992). To increase the chances of sighting wild animals or evidence of presence, the search was carried out radially along the different directions of the VGT. With respect to amphibians, Visual Encounter Surveys (VES), Dip-Netting (DN), Acoustic Encounter Surveys (AES), were applied, while pitfall traps with *drift fence was used for reptiles and ground running mammals such as rodents (in the way of Hayer et al, 1994; Rodel and Ernst, 2004; Nago et al, 2006 and Akani, 2008).*

Each Vegetation Transect Site (VGT) and adjoining forests or bushes or swamps were sampled for about two hours, five times (once in two days) during the sampling period, between 7am and 6pm local time. In each location, professional migrant hunters were engaged and were asked to identify areas of high fauna density, and to give descriptive account of the variety of animals known in the area. Colour plates of animals (Kingdom 1997) were eventually presented to them as aid for confirmation.

Invertebrates were also investigated and documented. They were observed to be in the study area and around the settlement close to the proposed site. All animals found to be present directly or indirectly using evidence of animals' presence or occupation such as footprints, burrows, carcass, skeleton, feathers and nests, remains of devoured tubers and fruits as well as vocalizations were identified to possible taxonomic levels. Field guides and keys such as Happold (1987) and Kingdom (1997) for mammals; Serle (1997) for birds, Branch (1988) for reptiles and Schiotz (1963) for amphibians.

Further information was obtained from various literatures.

Climate and Meteorology

Micro-climatic variables were measured during wet and dry seasons at different locations within the project area. The micro-climatic elements that were measured include temperature, rainfall, sunshine, relative humidity, clouds and winds. Data generated through field observation and measurements were supported with more comprehensive climatic data obtained from the Nigerian Meteorological Agency (NIMET) Station at Uyo. The latter establishes and maintains a large network of rainfall and meteorological stations throughout the country. Climatic data from Uyo meteorological station covers the project area as they are within the same climatic belt.

Gaseous Emission and Noise Studies

Sampling/measurement of the chemical constituents of atmospheric pollutants was determined at locations within the study area including the control station. Measurements were taken at a height of 1.5m above the ground. The instruments were held at a reasonable distance from the body. Equipment used were sensitive digital meters, appropriately calibrated to determine the following parameters: Nitrogen dioxide (NO_2), Sulphur dioxide (SO_2), Hydrogen sulphide (H_2S), Hydrogen cyanide (HCN), Chloride (Cl_2), Ammonia (NH_3), Carbon monoxide (CO) and Suspended Particulate Matter (SPM) (Table 4.1). During field measurements, considerations were given to the stability of the instruments, repeatability of results, availability of an open space with good configuration and meteorological factor of upwind and downwind directions.

Geology/Landforms

The geologic features/landforms in the project area were studied through physical examination and measurement in the field as well as laboratory analysis of sampled rock specimens. The basic field equipment include the GPS for coordinates determination; compass clinometer for measurement of bearings, foliation, strike and dip of outcrops where necessary; hand lens for insitu observation of the mineral components of the outcrops and geologic hammer for chipping off fresh rock specimens from outcrops for laboratory study. Photography of interesting rock features was made in the field with the use of A470 Cannon camera.

In addition, existing geologic maps and geologic reports of the area were adequately consulted. The laboratory studies involved analysis of relevant geologic and topographic maps, selection of the required rock specimens for thin sectioning and subsequent study with a petrographic microscope.

Hydrology/Hydrogeology

The field sampling exercise for the hydrology/hydrogeology component of this study involved measuring the depth and discharge of streams and rivers in the area and obtaining the static water level from wells or boreholes for the computation of the groundwater flow direction. A tape was used for depth and length measurement while the stop watch was used for timing. A standard mapping technique adopted employed a 12 channels GPS (Geographic positioning system) to obtain the station or sampling coordinates and the elevation (height above sea level) in the field. Hand auger and sediment grab were used to obtain sediments from land and river beds respectively for hydrological analysis in the laboratory. From the samples occurrence in the field and the general relations it has been possible to determine the (a) Recharge and discharge zone, (b) Hydraulic conductivity and (c) Flow direction of the surface / underground water. The discharged is worked out using the following formula:

Discharge = Velocity x Area = ms^{-1}

Area = Length x Average depth of the stream / River

Velocity = $\frac{Distance}{Time}$

Soil Studies

Soil Sampling

Composite soil samples were taken at depth of 0 to 15 cm and 15 to 30 cm at each sampling location in the proposed super high way project route. The samples were taken to the laboratory in labelled polythene bags for physical processing and chemical analysis.

Laboratory Analysis

The samples were air-dried, ground with wooden – roller and sieved through 2mm mesh. Soil pH was determined in 1:2 soil/water ratio. Particle size analysis was carried out by Bouyoucos (1951) hydrometer method. The method of Walkley and Black as outlined by Juo (1979) was used in the determination of organic carbon. Available phosphorus was determined by Bray and Kurtz (1945) No 1 method.

Exchangeable acidity was extracted with IM KCl solution and the acidity in the extract measured by titration with 0.01M NaOH. Exchangeable bases were extracted with neutral IM NH_4OAc, pH7.0; the potassium and sodium in the extract were determined by flame photometry, while calcium and magnesium were measured by versenate EDTA titration (Jackson, 1962). Total nitrogen was determined by the miro-kjeldahl digestion method (Jackson, 1962). Heavy metals were extracted from soil samples by digestion with a mixture of nitric and perchloric acid (Barnhnisel and Bertsch, 1982).

Water Sampling and Analysis

Water samples for physicochemical analysis were collected in one litre polyethylene bottles and stored in a cool box at approximately 4^oC until refrigerated. 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. The analyses of water parameters were as follows:

pH Unit

The pH was determined with a pH meter (Model: Mettler Toledo MP 220, England). The pH probe was first calibrated using buffer 7, then the probe was inserted into a beaker containing the sample. On reading the pH, there was a beep and the value displayed on the screen.

Dissolved Oxygen

Dissolved oxygen was determined spectophotometrically as follows: a reaction cell was filled to over-flowing with the samples and a glass bead added into it. Oxygen reagent 02 – 1k was added to it (5 drops i.e. 0.5 ml). Another 0.5 ml (5 drops) of oxygen reagent 02 – 2k was also added and mixed for 10 seconds. Lastly, 10 drops (1.0 ml) of oxygen reagent 02 – 3k was added, mixed and the dissolved oxygen value was read out in the Spectrophotometer at a wave length of 498nm.

Conductivity

This was determined by HANNA conductivity meter (Model: HI8733). The probe was rinsed and inserted into a beaker containing the sample. The value for conductivity was then read out from the digital display.

Turbidity

The turbidity in all samples was determined with a turbidity meter (Model: HANNA LP - 2000). The sample was placed in a sample bottle and inserted into the sample compartment in the turbidity meter. The read key was pressed and on reading the turbidity, a beep sounded.

Determination of Total Suspended Solids (TSS)

Whatman No. 1 filter paper was weighed and the initial weight noted. 100ml of the water sample was then filtered through the Whatman filter paper. The filter paper was then dried in an oven at 50°C and cooled in a desiccator. The filtered paper was then re-weighted and the final reading noted. The difference between the final and the initial readings represents the value of TSS. Please note that the weights were taken with the use of analytical balance.

Determination of Total Dissolved Solids (TDS)

This was determined by multiplying the conductivity value by a constant (0.7) i.e. TDS = conductivity x 0.7.

Determination of Biological Oxygen Demand (BOD) @ 20 – 25 °C

Two oxygen reaction cells/bottles were filled with the water sample and glass leads added to enable shaking. Another two oxygen reaction bottles each with inoculated nutrient salt solution were filled with the water sample and glass beads to also enable shaking. One bottle each of the pretreated sample and inoculated nutrient salt solution were used to measure the initial oxygen concentration (Result 1). The remaining pretreated sample and inoculated salt solution were incubated at 20°C for 5 days. After incubation, oxygen concentrations were measured in both bottles (Result 2). The oxygen concentration was determined by adding 5 drops of reagent BSB – 1k and 10 drops (1.0ml) of BSB – 3k was finally added and the solution placed into a round cell in the Spectrophotometer to read off the oxygen concentration.

Calculation of BOD – *Result 1 – Result 2 = BOD value in mg/l*

Determination of Chloride

Five millimeters (5 ml) of the water sample was palced in a test tube and 2.5ml of chloride reagent Cl -1 was added and mixed. Chloride reagent Cl – 2 was then added, shaken and allowed to stand for 1 minute before reading out the chloride concentration from the spectrophotometer at a wavelength of 460nm.

Determination of Nitrite

Five millimeters (5 ml) 5 ml of the water sample was placed in a test tube and 1 microspoonful of nitrite reagent NO_2 - AN was added and shaken to dissolve. A reaction time of 10 minutes was allowed before determination of nitrite concentration using a wavelength of 520 µm.

Determination of Nitrate

One (1) microspoonful of nitrate reagent NO_3 – 1A was placed in a dry test tube and 5ml of nitrate reagent NO_3 – 2A added to it, and mixed to dissolve. 1.5 ml of the water sample was added slowly and shaken to mix. This was allowed to stand for 10 minutes and inserted into a cell, the nitrate concentration was determined at a wavelength of 520 µm.

Determination of Ammonium

Five millimeters (5 ml) of the water sample was placed in a test tube and 0.60ml ammonium reagent NH_4 - 1 was added. 1 level microspoonful of ammonium reagent NH_4 $^{-2}$ was also added and shaken to dissolve. This was allowed to stand for 5 minutes. Ammonium reagent NH_4 - 3 was then added (0.4 ml) and allowed to stand for another 2 minutes before ammonium concentration was concentration was determined at a wavelength of 620 µm.

Determination of Phosphate

Five millimeters (5 ml) of the water sample was placed in a test tube and 0.5 ml of phosphate reagent P – 1A added to it and mixed. This was followed by the addition of 1 level microspoonful of phosphate reagent P – 2A. 5 minutes reaction time was allowed for colour development and then the phosphate concentration was determined on the Spectrophotometer at a wavelength of 420 µm.

Determination of Sulphate

About 2.5 ml of the water sample was placed in a test tube and 0.2ml of sulphate reagent SO_4 – 1A added and mixed. 1 level microspoonful of reagent SO_4 – 2A powder was also added and mixed. The solution was then tempered in a water bath at 40^{o}C for 5 minutes. 2.5ml of sulphate reagent SO_4 – 3A was added, mixed and the solution filtered using Whatman No. 1 filter paper. 0.4 ml of sulphate reagent SO_4 – 4A was then added to the filtrate and mixed, the solution was again tempered in a water bath for 7 minutes, transferred into a round cell and placed on the Spectrophotometer to read off the concentration of sulphate in the water. A wavelength of 520nm was used.

Determination of Calcium (Ca^{2+})

About 0.1ml of the sample was placed in a test tube using pipette and 0.5ml (5 drops) of calcium reagent Ca – 1 was added to it and mixed. 0.4 ml (4 drops) each of calcium reagents Ca – 2 and Ca – 3 were also added to the test tube and mixed. The sample was allowed to stand for 8 minutes to elicit colour development and then filled into a cuvette, placed in the Spectrophotometer to display the value of calcium and concentration in the sample. A wavelength of 520nm was used.

Determination of Magnesium

One millimeter (1 ml) of the water sample was placed in a reaction cell and mixed and 1.0ml of magnesium reagent Mg – 1k added to it. This was allowed to stand for 3 minutes reaction time and thereafter, mixed and placed in the spectrophotometer. Magnesium concentration was read at a wavelength of 568nm.

Determination of Potassium

Two millimeter (2 ml) of the water sample was placed in a reaction cell and mixed. 6ml of potassium reagent K – 1k was added and mixed and 1 level microspoonful of potassium reagent K – 2k also added and mixed to dissolve. The solution was allowed to stand for 5 minutes to elucidate colour development. Potassium value was read on the spectrophotometer at a wavelength of 690 nm.

Determination of Sodium

About 0.50 ml of sodium reagent Na – 1k was placed in a reaction cell and mixed. 0.50ml of the water sample was added to it and allowed to stand for 1 minute reaction time. The sodium concentration was then read off with the spectrophotometer at a wavelength of 420 mm.

Determination of Total Hardness

1ml of the water sample was placed in a reaction cell and 1ml of total hardness reagent H – 1k added to it. 3 minute reaction time was allowed before the total hardness was read out in the spectrophotometer at a wavelength of 450 nm.

Determination of Iron

Five millimeters (5 ml) of the water sample was placed in a reaction cell and 0.30ml of iron reagent Fe – 1 added, shaken and allowed to stand for 3 minutes. The iron concentration was then determined at a wavelength of 420 nm.

Determination of Manganese

Five millimeters (5 ml) of the water sample was placed in a test tube and 0.4 ml (4 drops) of manganese reagent Mn – 1 added to it and shaken. Manganese reagent Mn – 2 was also added (0.2ml) and the solution allowed standing for 2 minutes. Manganese reagent Mn – 3 was finally added and shaken. After 2 minutes, manganese concentration was determined at a wavelength of 520 nm.

Determination of Copper

Five millimeters (5 ml) of the water sample was placed in a reaction cell and 5 drops of copper reagent Cu – 1k was the added into it and shaken. A reaction time of 5 minutes was allowed before reading was taken in the spectrophotometer at 420 nm wavelength.

Determination of Zinc

The Zinc reagent Zn – K was placed in a reaction cell (5 drops i.e. 0.5 ml) and 0.5ml of the water sample was added to it. After 1 minute, zinc reagent Zn – 2k was also added (5 drops i.e. 0.5ml) and the reaction was left to stand for 15 minutes before reading off the zinc concentration with the spectrophotometer at a wavelength of 494 nm.

Determination of Lead

Five millimeters (5ml) of the water sample was placed in a reaction cell and 0.5ml of Lead reagent Pb – 1k was added and mixed. The concentration of Lead was determined at a wavelength of 620nm.

Determination of Cadmiun

About 1 ml of Cadmium reagent Cd – 1 was pipetted into a test tube and 10ml of the water sample added to it and mixed. 0.02ml of Cadmium reagent Cd – 2 was again added and mixed. Then finally, one (1) level microspoonful of Cadmium reagent Cd – 3 powder added and shaken to dissolve. A reaction time of 2 minutes was allowed before the Cadmium concentration was determined using the spectrophotometer at a wavelength of 560nm.

Microbiological Studies

Soil Samples

Soil samples were collected along transects at two depths of 0-15cm and 15-30cm respectively using the auger. Samples from different depths were specifically placed separately in sterile samples bags and transported immediately to the laboratory for analysis.

Water Samples

Samples of water were collected aseptically from surface water and borehole sources into sterile sampling bottles (Fig. A.1). In Vitro testing for bacteriological quality was carried out immediately at the point of sampling. Samples were transported in ice-boxes (temp. approx. 4^0 C) to the laboratory where they were further processed immediately for microbial load.

Health Impact Assessment (HIA)

This HIA was on three communities contiguous to each other (Ikwet, Ikot Ekeng Ntukuk and Ikot Ndue). Methods used to obtain the relevant baseline information from each community included Focus Group Discussion (FGD), key informant interviews and questionnaire administration. The questionnaire was a structured questionnaire with four major sectors (socio demographic variables, knowledge, attitude and practices (KAP) and behaviour on sexually transmitted infections (STIs), sources of water and Environmental Health. The data obtained are a sum of the analyzed questionnaire, interviews and information obtained from the Focus Group Discussion (FGD).

Socio-Economic Studies

APPENDIX 2: SAMPLE QUESTIONNAIRES

SOCIO –ECONOMIC IMPACT ASSESSMENT

IN-DEPTH INTERVIEW SCHEDULE FOR KEY INFORMANTS
– LOCAL STAKEHOLDERS
QUESTIONNAIRE NO ________________

NAME OF COMMUNITY: __________________ L.G.A ____________________

DATE OF INTERVIEW: ___________NAME OF INTERVIEWER: ____________

(A) PERSONAL INFORMATION

1. Name of Local Leader____

2. Type of Leader (e.g. Village Head, Women Leader etc):________________

3. Age (in years): below21;________21 - 40;____41 – 60; more than 60_____

4. Sex: Male;_________ Female ___________________

5. Ethnic background: ________________________________

6. Educational qualification: no formal education; ____functionally literate;__ primary;______ secondary;_________ tertiary_______________

7. Number of children: _________ male; ________female__________

8. Number of other dependants: ________ male; _______ female_________

   (excluding children)

9. Total No. of people in household: _____ male_____ female________

10. Residential Status:______ Tenant; ______ migrant; ____ indigene_____

11. (a) If tenant or migrant ____what is the name of your home village? _____

    (b) Distance of home village from here: less than 20km; ____
    b/w 20 - 50km;______ more than 50km.__________

    (c) Why did you move to this community (e.g. for employment)_____

    (d) Condition of living since settling here: same;_____ better;________

    worse; _______ I don't know_______

(e) For how long have you lived in this community________________

(f) Future plans:____ relocate in future; ____live permanently here; ___
I do not know (give reasons for answer) _______________________

(g) Relationship with other dwellers: Friendly; _____Not friendly; __
I don't know __

(B) COMMUNITY INFORMATION

12 Do indigenes and strangers live together in the community or separately? ______Give reason for your answer_________________

13 Have people from this community moved away in the last one year No; _____ Yes;___________ Yes, many;________ Yes, few:____

14 If yes, why do they leave and to where more often?____________

15 Which category of people usually move (e. g. youth, females etc.)_________Why do they leave? ______________________________

16 Name the major traditional gods of your community and locations of their shrines______________________________________

17 Name the major cultural festivals observed in your community and period of the year observed.______________________________

18 Name the cultural sites of importance to the people of this community:____ ____________________

19 In the last one year has there been any damage or destruction to any of these sites____

(C) INTRA AND INTER ETHNIC RELATIONS

20 Which of the following causes conflicts/clashes within this community and with neighbouring communities?

S/No	Causes of Conflict	Yes, very often	Yes, very rarely	No, not at all
1.	Land boundary			
2.	Water boundary			
3.	Fishing rights			
4.	Hunting rights			
5.	Access routes			
6.	Naming of establishments			
7.				
8.	Payment and sharing of compensation			
	Other (specify)			

21 How are the conflicts usually settled? Court; _____________Village Head/ Paramount Ruler;________ Families; _________Local Govt. Council;__________ Any other (specify).____________________

22 How are the guilty parties normally punished?______________________

23 What steps are normally taken to compensate parties that have been wrongly treated?____

24 Mention any recent conflict within the community! Who were those involved?; what was the cause of the conflict and how was it resolved?____ _____________________

25 Mention any recent conflict between members of this community and outsiders! Who were involved, what was the cause of the conflict and how was it resolved?

(D) ECONOMIC SCENARIO

26 What are the usual income-generation activities of the people in this community (see below). Also indicate the gender and generation mainly involved in each activity.

No.	Activity	Gender* M/F/B	Generation** C/Y/A/E
1.	Crop farming (list common crops)		
2.	Trading		
3.	Livestock rearing (list common ones)		

4.	Fishing		
5.	Hunting		
6.	Processing (garri, local gin, fufu, etc)		
7.	Handicraft (pottery, weaving, tailoring)		
8.	Collection of sea products (periwinkle, crayfish etc)		
9.	Collection of forest products (fruits, vegetables, firewood etc)		
	Artisanship (carpentry, blacksmith, bricklayer etc)		
10	Civil service/ teaching		
11.	Company worker		
12.	Other specify		
13.			

* M = Male; F = Female; B = Both sexes

** C = Children; Y = Youth; E = Elderly; A = Adult

27 List 2 most important income-generating activities for men __________

28. List 2 most important income-generating activities for women_________

29. List 2 most important income-generating activities for children________

30. List 2 most important income-generating activities for youth__________

31 List 2 most important income-generating activities for adults'_________

32. List 2 most important income-generating activities for the elderly____

33. What is your estimated monthly income (₦): less than ₦ 1,000; ____

₦ 1,000 to 10,000;____________ ₦ 10,000 to 50,000;________________

₦ 50,000 to ₦ 100,000_______More than ₦ 100,000________________

34. How much do you save monthly? ________ No savings; _______

less than ₦ 1,000; _________less than ₦ 5,000________ less than ₦ 10,000 _______ more than ₦10,000________

35. Where do you save your excess money? No savings; _______ in the house; ___________ "etibe" group; _____________ in the bank; __________ (Others specify) ____

36. How much is needed to start the business you are involved in (₦)_____

37. What form of loan/credit facility have you ever received for your business expansion? None; ________________ “etibe”; ____________ friends/relations; _________ Govt/NGO; __________ others (specify) ___________________________________

38. If you have not received any loan/credit facility, why/ Not necessary ; _________ I don’t know where to get one; _____________ I could not meet loan/credit conditions; ______ any other reason (specify) _________________________

E) INFRASTRUCTURE /HEALTH

39. Which of the following do you have in this community and what is the condition of the facility; if present?

S/No.	Facility	Availability Yes/No	Condition poor/fair/good	If not available, how far is the nearest facility (km)
1	Access road			
2.	Public transportation			
3	Local market			
4	Primary school			
5.	Secondary school			
6.	Dispensary/health centre			
7.	Electricity			
8.	Potable water supply			
9.	Others (specify)			

40. Which of the following types of houses is common in this community (Enumerator to note)?: mud and wattle thatch; _____ mud and wattle zinc; _____Earth block/Thatch; ______Earth Block/Zinc; ____ Cement Block/Zinc; ______Cement Block/Asbestos; _________Timber Wall/Thatch; ___________ Timber Wall/Zinc; ____

41. From which of the following sources is your water supply?

Rain, _______River______ Storm run-off; _______ pipe borne; _______ borehole; __________ well etc,

42. How is water from each of these sources treated before use?_________

43. How is solid waste disposed off?: Burning; _______ Burying; _____ Dumping; _____Throwing in running/stagnant water______________

44. How is human waste disposed off? Pit latrine; ________ defecation into water channels ________defecation into surrounding bushes; ________ pail systems; _______ pit toilet; _________VIP-ventilate latrines: ____

    Any other (specify) ___________________

45. What are the common diseases and pests found in this community (especially in the last 3 years)______________________________________

46. Specify any form of disease or pest that is found only in this community and not in neighboring ones. ___________________________

47. Why are the above diseases common in your locality? ______________

48. What has been done by the village or Govt. to reduce the presence of above mentioned diseases and pests? ______________________________

49. Where do people suffering from various disease normally go for cure?:

    Churches ____Native doctors ___Dispensary/Health centre/Hospital:__

50. Which of the above places are frequently visited for disease cure? ____

(F) STANDARD OF LIVING

Note (use 10 pebbles to differentiate b/w proportions)

51. What category of people are more common in your community? _____________ Landlords;______________ _tenants _________________

52. Do you consider most dwelling houses adequate in size for each household? Yes; ____ No.

53. What proportion of houses/households you have visited/known would you consider as having modern facilities/conveniences (e.g. cars, TV. Fan, motorcycle etc): none; ______¼; _____½;______¾; ______ all ______

54. What fraction of your income (e.g. ½; 1/3 ; ¾ etc.) do you spend on the following? Food;_____ clothing; _______ education;______ health care;_____ housing _____ transportation; _____ etc (specify) ________

55. What proportion of this community would you consider to be poor (e.g. ½; 1/3; etc)___________________

56. What do you think are the reasons for poverty in this community?____

57. What do you think is the proportion of functionally educated (can read and write) people in this community (e.g. ½; ¼ etc) _______________

58. What would you say is the proportion of jobless people in this community? (e.g. ½; ¾ etc)______________________________________

59. Which of the following 3 groups have the highest proportion of jobless people in this community?
The uneducated; ____________________

the partially educated (Primary and Secondary education);___________

the well educated (more than secondary education)________________

60. List 3 frequently eaten food items in order of importance (1)

(2) (3)

(G) ENVIRONMENTAL PROBLEMS

61. List the main environmental problems in this community (e.g. deforestation; erosion; flaring etc) and give perceived causes for the different problems.

	Environmental Problem	Causes
1. 2. 3. 4.		

62. How seriously do these problems affect your fishing and other income generating activities? Has little effect; _____ has serious effect; _______ has forced us to stop some activities. _________ (Please provide further information on any serious effect)________________________________

63. Do you catch more fish and other seafoods now than 1 year ago? Yes; ____ No. ___ (give reasons)____

64. List the common groups and organizations found in this community.________

____

65 Which are the 2 most important groups? ___________________________

66. Mention any project that has been undertaken by any of the mentioned groups in the community:

Over time	Of Recent (last 2 years)
1. 2.	

3.	

67. Has the government or any other organization embarked on activity to help reduce environmental problems in your community? Yes; _______ No;_____________

67. If yes what type of development programmes; Which organization; and what has been the impact?____

68. Are you aware of the plan to site the above named project in your community?____

68. Has the government or its representatives come to discuss with you?______________________

69. Are you in support of the project?---

70. State reasons for your answer.--- 70. Do company officials ever come to discuss their activities with your community? Yes, regularly; __________ Yes, occasionally; ________ no, not at all ________ if yes, what do they discuss? ____

73. How would you characterize the present relationship between the company and your community? Very good; _______ fair; ____ poor;______ hostile; ___what is the reason for the “chosen” relationship? _______________________________________

74. Has any of your communal land been taken over by the company without a formal request from the community Yes; _______No; ______ If yes, what proportion of your land has taken over? Over ½; _____ ¼ - ½; _____ over ¼; _____ a very small size; ____

75. Have there been any recent problem between the company and the community? Yes; ___ No;______ I don’t know;_______

76. If Yes, give details about the latest problem___________________________
____

77. What should be done by government and the company to ameliorate the effect of the take-over of your ancestral land?____
____

Thanks you for your assistance and God bless you.

SOCIO –ECONOMIC IMPACT ASSESSMENT

FOCUS GROUP DISCUSSION GUIDE

Name of Community__________________ AC:_____________________

Type of Group:____________ Male:___________ Female:_____________

List of Participants (b/w 8 – 10)

1	2
3.	4.
5.	6.
7.	8
9.	10.

Name of Moderator __________Name of Note taker _________Date_________

A. Community Characteristics

1. Composition of the community: How would you describe this community in terms of the proportion of the population by sex, age, religion, social status, migrant status and ethnic background? (use the table to record responses.)

Characteristic Proportion

	None	¼	½	¾	All		none	¼	½	¾	All
Age: Adults						Children/Youth					
Religion: Christian						Muslim					
Indigenes						Migrants					
Status: Better-off						Poor					
Gender: Male						Female					
Majority ethnic Group(_______)						Minority ethnic Group					

Record the consensus of opinion not the responses of one person.

* Indicate here if there is a proportion of the population that are traditional worshippers.

2. How would you rate the level of infrastructural development in this community?

   High __________ average _________ very low ___________

   Use the table below to indicate the type of facilities available and their condition:

Type of facility	Tick if present	Tick if functioning	Condition: Good/ poor	Any plan to Improve.
Access road				
Public transportation				
Local market				
Primary school				
Secondary school				
Dispensary/maternity				
Electricity				
Stable water supply				
Others:				

Record the consensus of opinion not the responses of one person.

* Indicate here if there is any plan by community or outside agency to improve the facility.

3. A) In the past one year, have you seen many people move out of this community to other places? Yes _____No _____ if yes, who is most likely to migrate? (Describe those most likely to migrate in term of sex, age, social status etc.)

   B). Why do people migrate out from this area?

4. In the last one year have you seen any changes in the people living in this Community?

   - In terms of number: ___ Yes, more people now; ___no change; __fewer people now

   - In terms of composition:___ yes, there are changes; ____no it is basically the same (by composition one is considering age distribution, presence/absence of migrants, etc.- describe how it has changed)

5. List the common social groups in this community:

6. A). How is the general health status of people in this community? Good;________ Just fair; _______ poor _______

   B) What are the common diseases affecting people here?

C) Are there any reasons for particular health problems here? (Probe to see if there are health problems caused by water pollution, oil spillage or other activities of oil companies).

7. A). How would you characterize this community in terms of cooperation and social harmony? Do people work together or are there cases of fighting between groups within the community? What are the likely causes of such conflict, if they occur?

B). In the case of conflict between groups within the community, how are such problems resolved?

D) Have there been any recent cases of conflict with groups outside the community? Yes; ___ No; _____ if yes, what were the causes?

E). How have such conflicts with outside groups been resolved?

B. Livelihood Activities of Local Population

8. Which of the following activities are practiced in this community? Indicate if women, men or both are engaged in each activity. Also indicate if each activity is declining or not

Activity	Gender M/F/B*	Tick if activity is threatened or declining	If threatened, give reasons
Crop farming			
Trading			
Livestock rearing			
Civil servant			
Fishing			
Hunting			
Gathering non-timber forest products			
Processing produce			
Marketing Produce			
Blacksmith, carpenter			
Crafts			
Selling food, snacks			
Hired labourer: Agricultural or oil company			
Other:			

* M = Males only engage in this activity; F = females only; B = both males and females engage in this activity.

9.A) Over the last 5 -10 years, have there been any changes in these activities?

Yes, improved; ___ Yes, declined; ___ No change ____

B) Which activities have improved?
Which has remained the same?

C) Why has there been a change, if any?

10 In the past one year, what changes have you observed in the above-mentioned activities?

Which has remained the same?

Why has there been a change (if any)

11. List the major crops grown here:

Which of these crops have been affected by the oil spill?

1. List your major agricultural problems?

13. Have there been any projects specifically to improve your farming activities in this community? Yes; ____ No _________ if yes, by which organization and what was done?

14. List the common fish breeds and other river/swamp produce harvested in your waters?

15. Which of the listed river produce are no more common (at least in the past 1year)?

16 Please itemize the various problems affecting volume of fish catch, especially in the last one year

C. Environmental problems

17 What are the major environmental problems in this community?

18. Which of the following resources have been affected by petroleum exploitation activities and how?

Resource	Effect
Land/soil Forest NTFPs Water Crop yield	

Livestock Health	

19. Are you aware of the plan to site the above named project in your community?____

20. Has the government or its representatives come to discuss with you?_____________________

21. Are you in support of the project?---

22 State reasons for your answer.---

23 Do company officials ever come to discuss their activities with your community? Yes, regularly; __________ Yes, occasionally; ________ no, not at all ________ if yes, what do they discuss? __________________________

24. How would you characterize the present relationship between the company and your community? Very good; _______ fair; ____ poor;______ hostile; ___what is the reason for the “chosen” relationship? _____________________________

25. Has any of your communal land been taken over by the company without a formal request from the community Yes; _______No; ______ If yes, what proportion of your land has taken over? Over ½; _____ ¼ - ½; _____ over ¼; _____ a very small size; ____

26. Have there been any recent problem between the company and the community ? Yes; ___ No;______ I don’t know;_______

27. If Yes, give details about the latest problem___________________________

28. What should be done by government and the company to ameliorate the effect of the take-over of your ancestral land?____
____

Thank you for your assistance and God bless you!

APPENDIX 3

CONSULTATION ATTENDANCE

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