CHAPTER ONE

INTRODUCTION

1.1 Background

Roads play a key role in the socio-economic development of any nation. Development 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 network. In Nigeria, the need for the development and maintenance of efficient and adequate road infrastructure to meet the rapid increase in the traffic volume and to provide a fillip to the socio-economic development of the country is indeed evident. This may require debottlenecking of the road network through the construction and maintenance of roads and rehabilitation of degraded ones. While the justification of road development projects from socio-economic considerations cannot be overemphasized, the cumulative environmental consequences of such projects need to be brought to fore. In order to ensure environmental protection and safety of the population, vis-à-vis, the highway sector projects of such magnitudes, an Environmental Impact Assessment (EIA) which is mandatory in Nigeria as stipulated by Environmental Impact Assessment Decree No. 86 of 1992 of the Federal Ministry of Environment (formerly Federal Environmental Protection Agency (FEPA) is required. Similarly the multilateral aid agencies, including the World Bank require EIA as part of their conditions for project funding.

In a bid to alleviate the challenges of transportation in Ekiti State and in furtherance of the State Government efforts at improving the networks, transportation infrastructure and ease of movement of traffic within the state especially on the New Ado-Iyin Ekiti road, the Ekiti State Government through the Ministry of Works and Transportation (SMWT) has propose to construct a seven (7) kilometres New Ado-Iyin Ekiti road. Towards this end, Enpro Consultants was commissioned to undertake Engineering design of the proposed road. Furthermore, Envikare Associates in association with Rejov Resources Ltd and MOA Planners Ltd was contracted to conduct a comprehensive Environmental Impact Assessment (EIA) for the proposed road project.

In general, the number of cities and population of people have continued to increase in developing countries around the world. In addition, at the same time, environmental problems have increased in those cities. Thus, rapid urbanization presents one of the

most serious environmental and social challenges where pollution is widespread. Consequently, rural and urban populations are being exposed to high levels of toxic pollutants because of industrial growth. It is noteworthy that an EIA has an important role to play in addressing these environmental problems through its ability to contribute to environmentally sound and sustainable development. At the project planning level, EIA is the primary tool for integrating environmental considerations into project design and execution. In general, it is used to identify and quantify various potential impacts associated with the project activities. A successful EIA will also suggest effective mitigation measures to ameliorate any potentially negative impacts on the environment. In addition, it should be sensitive to local socio-economic, cultural, and ecological aspects. An EIA requires the recognition and application of local knowledge; hence, it focuses on key environmental issues identified early in the process through consultations with stakeholders in affected communities.

1.2 Purpose of EIA Study

There is a growing awareness that road development has major environmental impacts. Some of the major environmental impacts of road projects include damage to sensitive ecosystems, loss of productive agricultural lands, resettlement of large numbers of people, permanent disruption of local economic activities, demographic change, accelerated urbanization and introduction of disease.

The present comprehensive EIA pertains to the construction and dualization of the seven (7) kilometres of New Ado – Iyin road to a dual carriageway of two (2) lanes on each side. The EIA report provides an assessment of the potential impacts that the proposed project may have on the natural and social environments along the routes.

The EIA is based on extensive literature review, field sampling activities, data analyses, and consultations with people in the project area. The main purpose is to assess the potentially positive and negative environmental impacts of the proposed road as follows:

1. Delineation and analysis of relevant national, regional, and international environmental laws, regulations, and policies;
2. Description of the project, need, and alternatives;
3. Identification of potential environmental impacts using an appropriate methodology (e.g., checklists, matrices, networks, etc.);

4. Presentation of baseline (affected) environment in terms of relevant physical/chemical, biological, cultural, socio-economic, health and safety factors. Baseline data will be generated using a combination of field studies, maps, aerial photos, structured interviews and surveys, internet searches, and published literature and document searches;
5. Assessment of potential impacts on surface and groundwater quality, flora and fauna, drainage pattern and flooding, land use, air pollution, biodiversity and ecosystem, socio-economic and cultural aspects, and noise level
6. Prediction (qualitative and quantitative) of potential impacts using appropriate environmental exposure models;
7. Identification of significant positive, negative, direct, indirect, short-term, and long-term impacts. Identification of potential cumulative, avoidable, or irreversible impacts. Identification of data gaps for decision-making;
8. Assessment of potential cumulative impacts from the combined effects of disruptions in habitats, natural ecosystems, and landscapes;
9. Interpretation (assessment) of the predicted impacts based on institutional and technical considerations, as well as public concerns;
10. Identification and evaluation of mitigation measures for significant adverse impacts;
11. Selection of the proposed project based on comparisons of alternative plans by applying multi-criteria decision-making methodologies; and
12. Preparation of comprehensive and defensible EIA reports that includes environmental monitoring programs for determining baseline conditions and/or documenting actual impacts in the project areas.

The need for EIA of road projects may be seen in the context of sustainable development to:

- ensure that environmental concerns are explicitly addressed and incorporated into the project decision making process;
- anticipate and avoid, minimize or offset the adverse significant biophysical, social and other relevant effects of development proposals;
- maintain eco-system and conserve bio-diversity;

- protect the productivity and capacity of natural systems and the ecological processes which maintain their functions;
- promote development that is sustainable and optimizes resource use and management opportunities.

1.3 Project Justification

Road reconstruction is one of the strategic priorities of the economic, social and political development in every country. In Nigeria, the need for road construction and upgrading is urgent because of the bad quality of our roads and increasing traffic density since the most important mode of transportation is by road. Thus, any road construction or rehabilitation has the potential to facilitate the movement of people and goods, as well as provide vital services. The old Ado – Iyin road had become a death trap because of its unsafe, winding and undulating alignments which had caused series of fatal accidents on the route most especially at Akonasan ditch where vehicles always fell inside; hence the state government cannot helplessly watch citizens' lives and properties lost to the road. The state government appreciates the importance of good road network to the state economic development. Good road network will not only ease the stress of commuters but will also enhance the marketability of farm produce which is the mainstay of most of the people of the state.

1.3.1 Value of Proposed Project

In general, road infrastructure projects in Ekiti State are considered major investments that will support the local economy, upgrade living standards and well being of the entire population in the area. Accordingly, the proposed road construction is at an estimated cost of N8.9 Billion represents a significant investment for the state. This amount includes the cost of front-end engineering design (FEED), detailed design and engineering (DDE), civil/structural works, etc

1.3.2 Sustainability of Proposed Project

The sustainability of the proposed project will depend on some factors, including the personal involvement of the Executive Governor and senior government officials within the state as well as the community of the project area involvement. In addition, the implementation of the project by experienced contractors will certainly facilitate its sustainability.

1.4 Project Overview

The project involves road construction and rehabilitation through the widening and improving the pavement of the present roadway by grading and paving with asphalt surfacing and the construction of the new portions built on new alignments where significant disturbance to village properties and people would otherwise occur. In general, the project will involve some civil works, vegetation (bush) clearing, earth (soil) movement, topographic leveling, alignment and re-alignment of road segments, creation of road pavement, coal tarring, etc with potential environmental impacts. The works will be hosted and founded on surface and the near-surface earth.

1.5 *Project Location*

The New Ado-Iyin Ekiti road is located within co-ordinates (expressed in the Universal Traverse Mercator (UTM) coordinates of Zone 31 using Minna datum) 843938.98mN, 744303.40mE and 947353.86mN, 738942.67mE. The topography along the highway route which stretches through a distance of about 7km is gently undulating. It starts from the junction of Government house at Fajuyi in front of Adunni Olayinka house in Ado Ekiti, passing through Bank road and Ekiti State Pavillion and terminates at Iyin Ekiti. It traverses Ado Ekiti Local Government Area, and Ifelodun/Irepodun Local Government Area of Ekiti State and transecting or outlying some and rural settlements (Figures 1.1-1.3). The topography along the highway is gently undulating. The Satellite image in Figure 1.3 shows the location of the New Ado-Iyin Ekiti road.

Fig. 1.1: Map of Nigeria showing Ekiti State in its National setting
Source: Ekiti State Ministry of Lands, Housing and Urban Development. Ekiti State, 2019

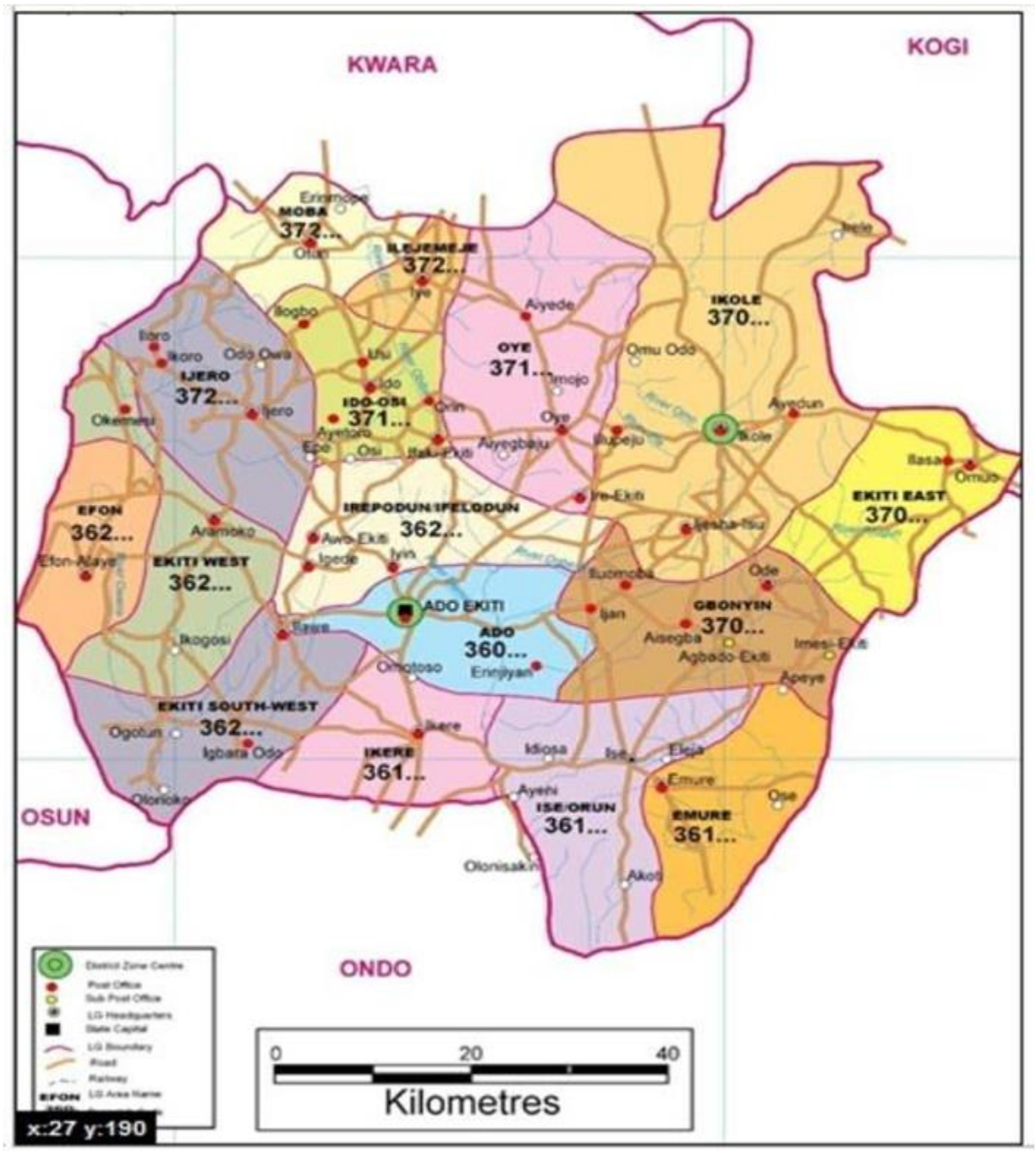

Fig. 1.2: Map of Ekiti State showing the Local Government Areas
Source: Ekiti State Ministry of Lands, Housing and Urban Development. Ekiti State, 2019

Fig. 1.3: Satellite Image showing the New Ado – Iyin Ekiti Road

1.6 *LEGISLATIVE POLICY AND INSTITUTIONAL FRAMEWORK*

The scope of work for this project involves development of roads and highways and related activities. The constitution of the Federal Republic of Nigeria confers jurisdiction on the Federal Government as well as Ekiti State Government to regulate the operations and development activities in this sector. These, together with applicable International conventions provide a basis for an EIA of the project. The development will take account of the following Nigerian laws and regulations, and international conventions that apply to the subject development:

1.6.1 National Legislations

- *Environmental Impact Assessment Procedural/Sectoral Guidelines for Infrastucture development projects (1995)* of the Federal Ministry of Environment Guideline.
- *Decree No. 58 of 30 December 1988: Federal Environmental Protection Agency Decree.*
- *Decree No. 86 of 10 December 1992: National Environmental Protection (Management Procedure on Environmental Impact Assessment) Regulations.*

- *Federal Highways Draft Bill 2001* It provides guidelines and standards for construction, maintenance and operation of highways,
- *Quarries Act 350 LFN of 1990*

(i) *Federal Environmental Protection Agency Decree No 58 of 30 December 1988* (as amended by Decree 59 of 1992 and further amended by Decree 14 of 1999)

The Federal Environmental Protection Agency (FEPA), now Federal Ministry of Environment (FME), was established by Decree No. 58 of 1988 (amended by the FEPA Decree 59 of 1992). The Agency has responsibility for the protection and development of the environment in general and environmental technology, including initiation of policies in relation to environmental research and technology.

(ii) *National Effluent Limitation Regulations 1991*

This Decree was issued in 1991. It provides national Guidelines and Standards for industrial effluents, gaseous emissions, noise, air quality and hazardous wastes management for Nigeria.

(iii) *National Environmental Protection (Pollution and Abatement in Industries in Facilities Producing Waste) Regulations, 1991*

This provides general guidelines for the containment of pollution in industries that generate harmful wastes. These include:

Regulations S.1.8, S.1.9, S.1.15 of 15 August 1991

- National Environmental Protection (Effluent Limitation) Regulations S.I.8 (FEPA, 1991).
- National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulations – S.I.9 (FEPA, 1991).
- National Environmental Protection (Management of Solid and Hazardous Wastes) Regulation S.I. 15

Waste Notification

Industries are obliged to notify the FMENV of all toxic hazardous and radioactive wastes which are stored on site or which are generated as part of operations (*Regulations 1991*, Article 2).

Waste Management

With regard to waste management, a legal basis exists in Nigeria for the establishment and implementation of a "*cradle-to-grave*" tracking system. Specifically, the *Solid and Hazardous Wastes Management Regulations 1991* provide for the establishment of a

documentation scheme to cover the generation, transport, treatment and disposal of hazardous wastes.

(iv) ***Environmental Impact Assessment Decree No. 86 of 10 December 1992***

This decree provides the guideline for activities or development projects for which EIA is mandatory in Nigeria. Such developments include oil and gas fields, conversion of mangrove swamps covering area of 50 hectares or more for industrial use, land/coastal reclamation projects involving an area of 50 hectares or more. Pursuant to this, the EIA Decree No 86 sets out the procedure for prior consideration of environmental issues in certain categories of public and private development projects.

(v) *Federal Ministry of Environment Sectoral Guidelines for EIA*

The FEPA Act, cap 131, LFN, 1990 allocates powers of environment legislation making and enforcement to the Federal Environmental Protection Agency (FEPA).

In-line with its functions, FEPA has published the EIA Sectoral Guidelines (revised in September 1995). The guidelines cover major development projects and are intended to inform and assist proponents in conducting EIA studies.

(vi) *Harmful Waste Decree No. 42 of 25 November 1988*
Harmful Wastes (Special Criminal Provisions etc.).

(vii) *Ordinance of 23 May 1937: Forest Ordinance - Northern Region and Decree No. 36 of 26 August 1991 Federal National Parks Decree*

For instance, *Decree No. 86/92* (*Management Procedure on Environmental Impact Assessment*) includes a number of provisions concerning protected areas and makes an ESIA mandatory where: Logging or conversion of forestland to other land uses is planned to take place within river basin catchment areas and irrigation areas for hydropower generation.

(viii) National Environmental Standards and Regulations Enforcement Agency (NESREA) Act 2007

NESREA is charged with the responsibility of enforcing all environmental laws, guidelines, policies, standards and regulations in Nigeria. It also has the responsibility to enforce compliance with provisions of international agreements, protocols, conventions and treaties on the environment.

1.6.2 Other Environmental Regulations Governing Environmental Protection

The environmental regulations related to the protection of environment include:

(i) *Criminal Code*

Section 247 of the Nigerian Criminal code makes it an offence punishable with up to 6 months imprisonment for "Any person who: Violates the atmosphere in any place so as to make it noxious to the health of persons in general dwelling or carrying on business in the neighbourhoods or passing along a public way or, does any act which is, and which he knows or has reason to believe to be, likely to spread the infection of any disease dangerous to life, whether human or animal".

(ii) *Forestry Act, 1958*

Provides for the preservation of forests and the setting up of forest reserves and makes it an offence, punishable with a fine of N100 or up to 6 months imprisonment to cut down trees over 2 feet in girth or to set fire to the forest except under special circumstances.

(iii) *Land Use Decree 1978*

States that "… it is also in the public interest that the rights of all Nigerians to use and enjoy land in Nigeria and the natural fruits thereof in sufficient quality to enable them to provide for the sustenance of themselves and their families should be assured, protected and preserved".

1.6.3 Statutory Limits/Standards

The Guidelines and standards for Environmental Pollutions Control in Nigeria (1991) of the Federal Ministry of Environment provides interim permissible effluent limits as protective measures against the indiscriminate discharge of particulate matter and untreated industrial effluent into lakes, rivers, estuaries, lagoons and coastal waters. The national limitations on effluent and gaseous emissions in Nigeria as applicable to the construction and operational phases of the proposed project are shown in Appendix 1. These statutory limits shall also form the basis for future environmental monitoring of the project.

1.6.4 Ekiti State Government Legislation

The Nigerian Constitution allows States to make legislations, laws and edicts on the Environment. The EIA Decree No. 86 of 1992 also recommends the setting up of State Environmental Protection Agencies (SMENV), to participate in regulating the consequences of project development on the environment in their area of jurisdiction. The state has a Ministry of Environment with the Ekiti State Environmental Protection Agency, (EKSEPA) as a regulatory organ in areas bordering on the protection of environment. SMENVs thus have the responsibility for environmental protection at the state level within their states. The functions of the SMENV s include:

- Routine liaison and ensuring effective harmonisation with the FMENV in order to achieve the objectives of the National Policy on the Environment;
- Co-operate with FMENV and other relevant National Directorates/Agencies in the promotion of environmental education;
- Be responsible for monitoring compliance with waste management standards;
- Monitor the implementation of the EIA and the Environmental Audit Report (EAR) guidelines and procedures on all developments policies and projects within the State.

1.6.5 Ekiti State Environmental Protection Agency Law, 2009

Among other responsibilities, the functions of Ekiti SEPA include:

- To ensure the protection of environment against all forms of pollution on air, water, land and vegetation;
- To prescribe standards for noise and gaseous pollution in order to create harmony between man and his environment;
- To promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of Ekiti people in general;
- To vet and approved Environmental Impact Assessment/analysis/Audit of new and existing projects and issues appropriate Environmental Impact Statement/Directive;
- To issue environmental clearance for siting of major land uses or other land polluting uses to prevent soil and water pollution.

1.6.6 International Standards, Treaties and Conventions

Global and Regional Treaties and Conventions are, in principle, binding in first instance on National Governments that accede to them. They are obliged to implement such arrangements through national legislation. At the international level, Nigeria is party to a number of Conventions that are relevant to the proposed development project. UNEP (1991) provides an overview of applicable, international Treaties and conventions. The more relevant ones are reviewed briefly below:

(i) *Vienna Convention for the Protection of the Ozone Layer, including the Montreal Protocol and the London Amendment*

The objectives of this Convention adopted in 1985 are to protect human health and the environment against adverse effects resulting or likely to result from human activities which modify or are likely to modify the Ozone Layer and to adopt agreed measures to control human activities found to have adverse effects on the Ozone Layer.

(ii) *Convention on the Conservation of Migratory Species of Wild Animals or Bonn Convention*

The Bonn Convention's adopted in 1979 aims at the conservation and management of migratory species (including waterfowl and other wetland species) and promotion of measures for their conservation, including habitat conservation.

(iii) *Convention on Biological Diversity*

The objectives of this Convention, which was opened for signature at the 1992 Rio Earth Summit and adopted in 1994, are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources by appropriate transfer of relevant technologies.

(iv) *Convention concerning the Protection of the World Cultural and Natural Heritage or World Heritage Convention*

This Convention adopted in 1972 defines cultural and natural heritage. The latter is defined as areas with outstanding universal value from the aesthetic and conservation points of view.

1.6.7 Health, Safety and Environment Policies and Guidelines of SMWT

The following will be SMWT's objectives, targets and minimum environmental practice. It will be the policy of SMWT to:

(i) establish and maintain the highest standards of occupational health, safety and environmental protection at work, so as to prevent personal injury or illness, property damage, fires security losses and environmental pollution and to ensure that its consumers and customers are provided with products that are safe in use by designing safety into all product and processes;

(ii) Require its staff and contractors working on their behalf to apply health, safety and environmental matters; provide them with relevant information and discuss with them related company policies and practices;

(iii) Develop and maintain contingency procedures, in co-operation with authorities and emergency services, in order to minimise harm from accidents;

(iv) Work with government and others in the development of improved regulations and industry standards, which relate to health, safety and environmental matters;

(v) Conduct or support research towards the improvement of health, safety and environmental aspects of their products, processes and operations;

(vi) Facilitate the transfer to others, freely or on a commercial basis, of know-how developed by the component companies in these fields.

Health, Safety and Environment (HSE) Commitment Statement will ensure that:

SMWT is committed to:

- Pursue the goal of no harm to people
- Protect the environment
- Use material and energy efficiently to provide products and services
- Develop energy resources, products and services consistent with these aims
- Consult with stakeholders and publicly report on performance
- Manage Health, Safety and Environment matters as any other key business activity
- Promote a culture in which all SMWT employees, contractors and partners share this commitment.

In this way SMWT intends to earn the confidence of the customers, shareholder and society at large, by being a good neighbour and contribute to sustainable development.

In the implementation of these policies, SMWT will be guided by the following objectives amongst others;

- Collective and personal responsibility

- Regular consultation and the involvement of stakeholders;
- Utilisation of best available equipment, materials, contractors, specialist services and operational methods;
- Maintenance of clean, healthy and safe working environment;
- Provision of appropriate protective clothing and equipment;
- Safeguarding the health and safety of employees and protecting people, property and environment in hazardous/emergency planning/situations within the vicinity of SMWT operations;
- Maintaining adequate provisions for the prevention of fire, fire-fighting, fire evacuation;
- Provide expert professional support on occupational health issues;
- Have certified safety, health and environmental protection specialist;
- establish and maintain close working relationship with all relevant Government Agencies;
- Report and investigate incidents/accidents with potential damage to workers and environment and take necessary actions; and
- Ensure that SMWT minimum standards and Nigerian legislation product safety standards are achieved.

1.6.8 Organisation and Responsibilities

The responsibility for implementing the SMWT HSE Policy will reside with Planning Division of the Highway Department.

1.6.9 World Bank Safeguard Policies

Operational Directive 4.01 'Environmental Assessment' (1991)

The World Bank is committed to a number of operational and safeguards policies which aim to prevent and mitigate undue harm to people and their environment in any development initiative involving the bank. These policies provide guidelines for bank and borrower staff in the identification, preparation, and implementation of programs and projects. There are ten World Bank Environmental/Safeguard Policies.

Relevant World Bank Safeguard Policies

The World Bank safegaurd policies that may be triggered by the proposed project are:

(i) World Bank Safeguard PolicyOP/BP 4.01: Environmental Assessment

The is the umbrella policy for the Bank's environmental 'safeguard policies' which among others include: Natural Habitats (OP 4.04), Forests (OP 4.36), Pest Management (OP 4.09), Physical Cultural Resources (OP 4.11), and Safety of Dams (OP 4.37)

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

EA looks at the interaction of the project with the natural environment (air, water, and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples, and physical cultural resources); and where applicable, transboundary and global environmental aspects. World Bank safeguard policy and Nigeria EIA law are very similar indeed. However, in the event discordance between World Bank policy and the existing laws in Nigeria, the more stringent shall apply

Summary of Provisions:

- States that all projects proposed for World Bank Group funding require EA review/analysis to ensure that they are environmentally and socially sound/sustainable.
- An EA evaluates a project’s potential environmental impacts; examines project alternatives; identifies ways of preventing, minimizing, mitigating or compensating for adverse environmental impacts and enhancing positive impacts.
- EA considers: the natural environment (air, water and land); human health and safety; social aspects (involuntary resettlement, cultural property); as well as, trans-boundary and global environmental aspects.
- Projects are categorized based on environmental significance and the type of EA required.

Category A - projects are those whose impacts are sensitive, diverse, unprecedented, felt beyond the immediate project environment and are potentially irreversible over the long term. Such projects require full EA. Category 'A' projects require a full EIA undertaken by independent EA experts.

Category B - projects involve site specific and immediate project environment interactions, do not significantly affect human populations, do not significantly alter natural systems and resources, do not consume much natural resources (e.g., ground water) and have adverse impacts that are not sensitive, diverse, unprecedented and are mostly reversible. Category B projects will require partial EA, and environmental and social action plans.

Category C - Projects are mostly benign and are likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project, although some may require environmental and social action plans.

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

- Project sponsors for Category A projects must prepare a Public Consultation and Disclosure Plan (PCDP) and an Environmental Action Plan (EAP). Project sponsor must consult project-affected groups and local NGOs at least twice: before TORs for EA are finalized and once a draft EA report is prepared.
- During project implementation, the project sponsor reports on compliance with (a) measures as agreed upon with IFC, including implementation of an EAP; (b) status of mitigative measures; and (c) the findings of monitoring programs.

The World Bank Pollution Prevention and Abatement Handbook describe pollution prevention and abatement measures and emission levels that are normally acceptable to the Bank. However, taking into account borrower country legislation and local conditions, the Bank works with alternative emission levels and approaches to pollution prevention and abatement for projects. The EA report must provide full and detailed justification for the levels and approaches chosen for the particular project or site.

(ii) Operational Policy/Bank Procedure 4.04 - ***Natural Habitat*** - seeks to ensure that World Bank-supported infrastructure and other development projects take into account

the conservation of biodiversity, as well as the numerous environmental services and products which natural habitats provide to human society

(iii) Operational Policy/Bank Procedure 4.36 - ***Forests.*** This policy aims to reduce deforestation, enhance the environmental contribution of forested areas, promote afforestation, reduce poverty, and encourage economic development.

(iv) **Operational Policy 4.09** - ***Pest Management*** **-** policy recognizes that pesticides can be persistent and harmful to the environment for a long time. If pesticides must be used, the policy requires that Pest Management Plan (PMP) be prepared by the borrower, either as a stand-alone document or as part of an Environmental Assessment.

(v) Operational Policy /Bank Procedure 4.11 - ***Physical Cultural Resources*** seeks to avoid, or mitigate, adverse impacts on cultural resources from development projects that the World Bank finances. This project will not affect physical cultural resources because it requires no land acquisition.

(vi) Operational Policy 4.12: Involuntary Resettlement is concerned with situations involving involuntary taking of land and involuntary restrictions of access to legally designated parks and protected areas. The policy aims to avoid involuntary resettlement to the extent feasible, or to minimize and mitigate its adverse social and economic impacts. It promotes participation of displaced people in resettlement planning and implementation, and its key economic objective is to assist displaced persons in their efforts to improve or at least restore their incomes and standards of living after displacement.

Summary of Provisions:

- Operational Policy 4.12 is forthcoming; projects must comply with OD 4.30, Involuntary Resettlement in the interim.
- Aims to avoid or minimise the involuntary resettlement of people required for projects.
- Applied wherever land, housing, or other resources are taken involuntarily from people.
- Sets out procedures for baseline studies impact analyses and mitigation plans for affected people.
- Project sponsors must implement a Resettlement Action Plan (RAP), as specified in the policy.

However, in the course of implementing the road project, a number of environmental and

social safeguards policies will be triggered. Temporally shops and structures along the ROW of the road corridor will be displaced. This will result to involuntary displacement and disturbance of access to means of livelihoods, and therefore, triggering the World Bank's Operational Policy 4.12 (Involuntary Resettlement).

- RAP must address both physical resettlement and economic effects of displacement.
- The physical cultural resource will not be affected because the project requires no land acquisition.

1.7 ENVIRONMENTAL IMPACT ASSESSMENT

Environmental impact is any alteration of the environmental conditions or creation of a new set of environmental conditions adverse or beneficial caused or induced by the action or set of actions under consideration. EIA is the documentation of an environmental analysis, which includes identification, interpretation, prediction and mitigation of impacts caused by a proposed action or project. The SMWT has commissioned this EIA study in order to anticipate the impacts of road development on the environment. The objective is to articulate the mitigation measures that will be incorporated into the project Environmental Management Plan and design. The EIA study which covers the baseline studies, consultation programmes, environmental quality assessment and impact prediction and quantification was conducted in consonance with the laid down procedures contained in the National Sectoral Guidelines for Environmental Impact Assessment (Decree 86 of 1992) for transportation development projects (roads and highways) issued by the Federal Ministry of Environment in 1995.

1.7.1 EIA Objectives

The main purpose of this EIA is to establish a baseline of existing conditions in the project area and to assess proactively the potential impact and associated impacts, including health, socio-economic and gender issues of the proposed construction and operation of the roads on the environment. It aims at ensuring sustainable development (i.e. the minimization of negative impacts) during project conception and implementation through the conduct of baseline pre-impact studies of the environment, systematic identification and evaluation of the potential impacts of proposed projects, plans, programme or legislative actions and mitigating negative impacts from the project as well

as monitoring the environment during and after the project. The main specific objectives of the EIA are to:

(i) establish the existing biological, physical and socio-economic conditions of the project area;

(ii) characterize the environment, thereby identifying the resultant hazards (including social) associated with the project;

(iii) identify, evaluate and predict the impacts of the project on the environment including socio-economic and health aspects with adequate interfacing and project interaction;

(iv) make recommendations to eliminate/mitigate/control the magnitude and significance of the impacts;

(v) ensure proper consultation with the host communities around the proposed project site;

(vi) development of an Environmental Management Plan (EMP) that will ensure environmental sustainability throughout the project life-span.

1.7.2 Scope of the EIA

The Scope of Work for the EIA requires field observations, field measurements and laboratory analyses. It also covers all the phases of the road development and improvement project including mobilization, construction, operation, maintenance and decommissioning in as much as the activities take place within the field area and the access routes and in as far as these activities are within the responsibility of SMWT. The study has focused on evaluating the potential environmental impacts due to road development activities thereby, providing guidelines for the project execution.

Detailed work scope for the EIA includes:

- Project definition and preparation of TOR for the study in accordance with SMENV guidelines.
- Preparation of Preliminary Impact Assessment
- Extensive literature search for theoretical support and direction.
- Screening, preliminary impact assessment and scoping
- Carrying out a detailed baseline survey involving field sampling and laboratory analysis of the collected samples

- Predicting the potential impacts of project activities using appropriate models, and recommending options for mitigation of impacts
- Development of a comprehensive Environmental Management Plan, including monitoring, decommissioning/abandonment and remediation plans
- Preparation of detailed reports to meet SMENV standards.

1.7.3 Terms of Reference

The Terms of Reference (TOR) used as a guide in executing and implementing the EIA study of the proposed New Ado-Iyin Ekiti road under Phase I, reconstruction and operation include the following tasks:

- Outline the general scope of the EIA study including the overall data requirements on the proposed project and affected environment
- Carry out the detailed Environmental baseline studies of the ambient environment;
- Define the procedures and protocols for identification and assessment of associated and potential impacts;
- Select appropriate mitigation measures for such impacts and develop an effective Environmental Management Plan for the project;
- Define framework for interaction and integration of views of a multidisciplinary project team with regulators, host communities and other stakeholders;
- Define relevant framework of legal and administrative requirements of the project.
- Prepare the EIA Report for the approval/permit to commence the projects from the State Ministry of Environment.

1.7.4 Methodology

The methodology adopted for conducting this EIA is as follows:

(i) *Literature Search*

Desktop research was carried out to establish an environmental information database for the EIA. Consulted materials include textbooks, articles, reports, maps and photographs, as specified in the references section to this report.

(ii) *Field Work and Laboratory Analysis*

A reconnaissance survey was first undertaken to familiarize the EIA Team with the proposed project area and to facilitate concept design of field work execution. Baseline data gathering and laboratory analysis were then carried out to verify and complement

information obtained from literature search. The fieldwork covered all the relevant aspects of the ecological and socio-economic environment.

(iii) *Validation*

The systematic incorporation of expert opinions, as well as mathematical modeling techniques were used to identify potential environmental impacts and to predict their magnitudes and significance (empirical worst case scenario). Experts in the relevant fields (as listed in the list of report preparers) were consulted for their opinions on issues relating to the potential ecological impacts of the proposed project.

(iv) *Consultation with Stakeholders*

Stakeholder consultation is a very important aspect of the EIA study. The result of the process forms the basis for consultation with key stakeholders who are identified in Chapter three of this report.

(v) *Project Logistics*

The logistic support for the project included the following:

- A preliminary project kick-off meeting was held between SMWT and Tpl. (Chief) Bisi Kumapayi, the Project Consultants' Team Leader. The meeting discussed the Terms of Reference prepared by the Clients in relation to the Work Plan submitted by the Contractor. The details of the Scope of Services for the Project were agreed upon;
- A Pre-mobilization meeting before the fieldwork commenced;
- Field Work and sample collection were carried out at the project site;
- Consultation and interaction with Stakeholders within the communities along the route in project area;
- Administration of EIA survey questionnaires and in-depth interview;
- Analysis of results;
- Preparation of draft EIA Report;
- Submission of EIA Report to the regulatory authority, SMENV.

1.8 Structure of the Report

The EIA report is presented in seven chapters. Chapter 1 is the Introduction. It gives relevant background information on the project, SMWT (the EIA proponent), the Statutory Regulations and project objectives. In addition, it highlights the environmental assessment process.

Chapter 2 discusses description for the project, project alternatives the proposed project and processes, project operation and maintenance and schedule. Chapter 3 describes the existing environmental status of the study area, consultations, institutional arrangement, budget for the implementation of EMP and Chapter 4 identifies and predicts the potential impacts. Chapter 5 proffers mitigative and ameliorative measures. The project involves road rehabilitation and construction through the widening (in places) and improving the pavement of the existing roadway by grading and paving with asphalt surfacing. In general, the project will involve some civil works, vegetation (bush) clearing, earth (soil) movement, topographic leveling, alignment and re-alignment of road segments, creation of road pavement, coal tarring, etc with potential environmental impacts. The works will be hosted and founded on surface and the near-surface earth where adverse potential impacts identified. Chapter 6 presents the Environmental Management Plan that will be adopted throughout the project cycle. It also includes the Monitoring Plan that will ensure the effectiveness of the mitigative measures and the remediation plans after de-commissioning/closure. Chapter 7 contains the Conclusions.

CHAPTER TWO

THE PROJECT DESCRIPTION

2.1 NEED FOR THE PROJECT

Nigeria's economy is highly dependent on good transportation networks to facilitate haulage of people, goods and services. Its inadequacy can therefore be a serious constraint to national development. Handling increased traffic volumes efficiently require the widening the existing road network through the rehabilitation and construction of degraded portions. The New Ado-Iyin road is one of the major and shorter road linking Ado Ekiti, the state capital, to Iyin Ekiti and carrying the bulk of the commuter and goods from the neighbouring Osun State. Development of this road would be a confidence reassurance measure to improve the movement of vehicles. The construction of this road is also considered necessary to accommodate the existing and projected traffic demand, improve the transportation infrastructure of the State and promote economic development in and around the project corridors.

2.2 PROJECT ALTERNATIVES

Study alternatives will be considered that best suit the purpose and need for the Project. Potential alternatives include:

(1) taking no action;

(2) using alternative new alignment;

(3) adoption of the abandoned ELSAN project alignment construction.

2.2.1 No-Project

A no-project or no-development scenario in which road development/improvement project is not executed. With the "no-project" option, existing levels of service and safety deficiencies in the project area will worsen as automobile and truck traffic volumes continue to increase and would make industrial and socio-economic development impossible or unaffordably expensive. This will negatively impact the nation's economy that is highly dependent on good road network especially the accident prone Akannasan section of the existing Ado-Iyin Ekiti Road. This scenario is therefore rejected as it would prevent meeting the state's growing transport needs.

In general all the interactions with the communities were positive. They wanted the project to commence in earnest. The results of the public meetings and the completed questionnaires supported the Project and considered it a necessity to promote economic development and reduce poverty in the region.

2.2.2 Alternative Alignments

Alternative alignment options would be prohibitively expensive and more disruptive, and could lead to loss of revenues from diverted traffic. This involves the adoption of an entirely new alignment that will bye pass Ado-Ekiti ending up at the Ikere-Ekiti periphery. This will be relatively more expensive in that it will be a totally new road which will also involve the construction of link roads to Iyin and Ado Ekiti. It would also entail very high costs for property acquisition and compensation claims, loss of employment, a decreased tax base, and reduced access. This alternative is not acceptable as it would be prohibitively expensive.

2.2.3 Construction of the abandoned ELSAN project alignment (Preferred Alternative)

The Preferred Alternative – Construction of the abandoned ELSAN project alignment is a solution to the transportation needs in the Ado – Iyin Corridor. It is identified based on a thorough analysis of its transportation performance and potential environmental impact in meeting the purpose and need of the proposed road project. Given this analysis, the Preferred Alternative is compared to the other alternative as follows:

- Environmental impacts of the Preferred Alternative within the Corridor are considered to be preventable, or able to be mitigated;
- Opportunities for enhancement of existing environmental conditions can be achieved through sound design practices; and
- The investments in the Preferred Alternative provides a balanced system of roadway, transit, and demand management strategies, which are expected to provide a reasonable long-term solution to the needs for personal, socio-economic activities, and freight mobility, safety, and improved traffic flow within the study area.

The main reasons for constructing the road are: (a) to increase access of the combined urban and rural populations to social services and business locations, resulting in overall improved quality of living; and (b) to boost regional commerce In addition, the Preferred Alternative accommodates potential future planning for expanded managed lanes in the Corridor. The Preferred Alternative will improve the Ado-Iyin Ekiti Corridor to an acceptable level. The construction of the road will also support the economic and social development of the project area. Thus, developmental opportunities, such as easy movement of motorists and commercial goods, creation of new jobs, and reduced vehicle-operating costs, etc. would be enhanced. Although certain construction activities would have negative impacts, the socio-economic benefits to both Ekiti State and the country far outweigh any potential concern. This alternative is acceptable.

2.3 PROJECT BENEFITS

There are tangible benefits some of which are listed below:

- reduce the transport operating cost by improving the riding quality of the road.
- reduce journey time by minimizing congestion in urban centers.
- minimize road accidents by increasing road widths, improving inter sections and road geometry.
- upgrade roads to function in all weathers, by improving drainage and raising road levels.
- provide route options to achieve better distribution of traffic.
- minimize annual road maintenance costs.
- minimize the environmental impact from road improvement works.

2.4 ENVISAGED SUSTAINABILITY

The road development project will be undertaken according to best industry practice, including standard and time-tested design, standard construction methods, standard operational procedures and fully trained and qualified personnel to man the project. For any form of development to be sustainable, it should also incorporate an enhancement and the preservation of the existing environment. The sustainability of the project is based on the above premise and on the following specific considerations:

- Time-tested standard civil designs as listed below. This will improve the life cycle costs, environmental performance and project economics;
- All other works would follow Standard Construction methods of SMWT so as to keep the disruption to the environment at acceptable levels;
- The use of best available technology and effective waste management will be carried out to enhance environmental protection;
- Operation, maintenance and upkeep of roads by periodic inspection in accordance with the operational procedures developed through SMWT's extensive experience.
- Project management by fully trained and qualified personnel who are conversant with the SMWT's HSE policy guidelines;

2.5 TYPE OF PROJECT

The project involves road construction and rehabilitation through the widening and improving the pavement of the present roadway by grading and paving with asphalt surfacing and the construction of the new portions built on new alignments where significant disturbance to village properties and people would otherwise occur. In general, the project will involve some civil works, vegetation (bush) clearing, earth (soil) movement, topographic leveling, alignment and re-alignment of road segments, creation of road pavement, coal tarring, etc with potential environmental impacts. The works will be hosted and founded on surface and the near-surface earth,

2.6 PROJECT LOCATION

The New Ado-Iyin Ekiti road is located within co-ordinates (expressed in the Universal Traverse Mercator (UTM) coordinates of Zone 31 using Minna datum) 843938.98mN, 744303.40mE and 947353.86mN, 738942.67mE. The topography along the highway route which stretches through a distance of about 7km is gently undulating. It starts from the junction of Government house at Fajuyi in front of Adunni Olayinka house in Ado Ekiti, passing through Bank road and Ekiti State Pavillion and terminates at Iyin Ekiti. It traverses Ado Ekiti Local Government Area, and Ifelodun/Irepodun Local Government Area of Ekiti State and transecting or outlying some urban and rural settlements such as Ofin village. The topography along the highway is gently undulating. The Satellite image in Figure 1.3 shows the location of the New Ado-Iyin Ekiti road.

Plate 2.1 The New Ado –Iyin road at the state pavilion, Ado Ekiti

The proposed road is expected to be completed within 24 months of mobilization, and will have a life span of 20 years. The dualisation and construction of the proposed road will involve the following:

1) Reconstruction/ Construction of the dual carriageway ;
2) Construction of covered storm drainage on both sides of the road;
3) Expansion of the road to two lanes on both sides for new alignment
4) Provision of concrete kerbs along the median of the carriageway.
5) Provision of pipe and box culverts of various sizes as well as service ducts at the edge of the carriage way;
6) Provision of Bridge at strategic locations
7) Provision of 1.5m wide pedestrian walkway on both sides of the carriageway;
8) Installation of adequate street lights at specific location;
9) Provision of Traffic System Management (TSM) Measures, Road marking, Road signs, Roundabout and Traffic Lights;
10) Provision of grade separated interchanges
11) Provision of an efficient, integrated, and safe transportation network; and
12) Support a vibrant local, state, and national economy.

2.7 EXISTING CONDITIONS OF THE PROJECT ROAD

The project covered a distance of 7 kilometres and involved 20.8 metres right of way (ROW) on either side of the road (CH. 0+000-CH. 2+130) and 24.8metres right of way (ROW) on either side of the road (CH2+130-CH. 3+400) as well as 24.0 metres right of way (ROW) on either side of the road (CH3+400-CH. 7+000). A site assessment of the project roads, covering the full length of approximately 7km from the Fajuyi ends in Ado-Ekiti to Iyin Ekiti. The objectives of this study were:

- To assess the present condition of the local network at each location so as to determine the present state of effects of the local environment.
- To ascertain the details of the road geometry (width, slopes, curvature, etc) pavement construction method and pavement conditions, drainage location and condition of structures;
- To ascertain the present site of the road development in its locality, the communities served by the section of the highway, the common goods moved, the alternative mode of transportation, problems militating transport and travel within these locations.

2.8 Explosives.

There are locations along the road alignment where there are obstructions from occurrence of boulders and rock outcrops. These locations are found at Ch.4+125 - Ch.4+300 and Ch.4+550 - Ch.4+650 respectively as well as Ch.5+375 - Ch.5+600 and Ch.5+775 - Ch.6+575.

Plate 2.2a and 2.2b showing sections of the road with rocky terarain

Generally, the rocks in Ekiti are mainly granitic in origin. They are rocks belonging to the Precambrian rock series and have been subjected to weathering for ages. The remains of such outcrops are the famous inselbergs (island mountains) after which the state is named. Granites are hard rock. Granite with a good quantity of quartz (SiO2) will rank high on mineral scale of hardness. Its hardness may however be affected by the percentage of orthoclase or plagioclase feldspar content.

The contractors will therefore be expected to consider the hardness, cleavage and faults in the outcrops and decide on the type of high or low explosives to be used in blasting the

rocks. The contractors are not new to this and one is sure that international safety values will be adopted.

2.9 Project Activities

The proposed project will involve complete reconstruction of the road with construction of new drainage structures. Because of the modification to the alignments, there will be potential impacts associated with the construction and operation phases.

Road Reconstruction Phases

The upgrading and reconstruction work will initially involve a comprehensive survey of the entire road. This activity will include land investigation, drilling, measurements, and pre-working examination of the location. However, in order to facilitate the conceptual design, this EIA was performed to identify any key concerns at this stage of the project. The road reconstruction works are divided into two main phases, namely:

(1) construction, and

(2) operation.

The potential environmental impacts in each phase may be different. Below are activities that may be associated with each one. The road construction activities will probably extend to the wet season as the case may be (i.e., April to November); hence, appropriate measures must be taken to prevent any potential runoffs of hazardous chemicals from the site.

a) Construction Phase

The actual reconstruction of the road will be in the construction phase. In addition, the projected road work will cover the following activities:

i. Road upgrading

As the conditions of the road vary, it will have to undergo different degrees of work, which will have various levels of impact on the environment. The EIA Team performed a number of surveys and analysis of road conditions to determine the necessary requirements for improving the environmental quality aspect of the Fajuyi/Adunni Olayinka junction. This upgrade would include provision of additional lanes, resurfacing, safety road markers, road re-

contouring etc. Other estimated work required to bring the road to an acceptable standard would include certain environmental interventions described below.

ii. Cleaning and clearing of ditches, culverts and drains

The EIA team also observed that the general condition of the shoulders of the road is very poor. Most of the shoulders have completely disappeared or covered with vegetation. The vegetation consists mostly of weeds and grasses,. It was observed that the ditches constructed along the sides of the road are silted up and overgrown with garbage. These, of course, will need to be cleared and reshaped during the rehabilitation process.

Plate 2.3: Drains covered with vegetation

iii. Installation of road safety features

Presently, the alignments of the existing section of the road that require reconstruction has no road signs, demarcations and lining, safety barriers, kilometre posts, culvert beacons, or traffic lights. The current traffic situation in section I (Fajuyi-Bank Road-NTA road junction), of the project area is already hectic. The proposed Project is expected to address most of these issues.

iv. Road safety measures

Presently, there are few traffic safety measures or speed controlling devices along the existing road within the proposed road. The proposed Project will install these at black spots and strategic areas of settlements along the road. Also roundabout will be constructed at Iyin Ekiti ends.

Plate 2.4a and 2.4b: The end of the road at Iyin Ekiti

b) Operation Phase

This is the post-construction phase when all the road construction works would have been completed and the road has been commissioned for use. This phase comprises of the following activities:

i. Construction Camp

The construction camp will be located near the Project area. It will take into consideration storm water and surface water drainage, location of interceptors, as well as wastewater and sewage requirements.

ii. Cut and Fill

All fill materials will be mainly obtained from the cut and transported by trucks to the designated fill areas. Quarries will be identified, based on proximity to the project, needed materials, and other required permits and approvals.

Vehicular Movement

All motorized vehicles within the proposed route will be restricted to a maximum speed considered safe for workers. Speed limit signs will be posted at appropriate locations.

Haulage and delivery vehicles will be restricted to designated roadways inside the Project area. The vehicles transporting dusty materials will be fitted with side and tailboards. All transported materials will be securely covered on trucks, while dusty materials will be dampened before transportation.

Waste Management

All waste materials will be managed in accordance with the Project environmental management plan. They will be disposed of in accordance with the relevant laws, guidelines and best practices. For example, a waste management hierarchy will be utilized to achieve the following:

i. Avoidance and minimization of generated wastes
ii. Selection of products that will cause zero or minimum environmental impacts
iii. Reuse of materials to avoid disposing
iv. Waste treatment and disposal in accordance with relevant environmental regulations and guidelines

Hazardous Waste

Hazardous waste will be appropriately classified, and special controls will be applied for storage, labeling, transport, and disposal.

Construction Waste

In general, waste materials may include any excavation spoils, sewage, wastewater or effluent containing sand, asphalt, cement, silt or any other suspended or dissolved material from the Project site. All construction waste will be sorted on site into inert and non-inert materials. Non-inert materials, such as wood, glass, plastic, or metals will be recycled or reused, and/or disposed in a landfill. Inert materials, such as soil, sand, or rubbles will be separated from non-inert materials and disposed in approved public dumps or spoil sites. All vehicles carrying wastes will have properly fitted side and tailboards, while the materials being transported will be securely covered in trucks.

CHAPTER THREE

DESCRIPTION OF THE EXISTING ENVIRONMENT

3.1 Introduction

This chapter presents the environmental (biophysical, health and social) setting of the study area along New Ado and Iyin Ekiti road. In this study, the environmental characteristics of the project area were established through extensive literature search, field sampling/measurements, laboratory analysis, stakeholder consultation and data interpretation. Gaps in environmental baseline information of the area were identified, and fieldwork activities designed to acquire additional data to fill these gaps was then planned and conducted.

Section 1: Fajuyi - Bank Road - NTA Junction Road (chainage 0+000 – 2+150

This section is an existing road which commences at Fajuyi underpass, lies approximately within latitude 7^0 37’ 45”N and longitude 5^0 12’ 53”E. It is approximately 2.15km in length with an average width of 20.80 between chainage 0+000 and 2+150. The road corridor is heavily built-up through out its entire length with an existing side drains and partly silted. The pavement condition of the road is generally good to fair with notable isolated failed portions and cracking.

Plate 3.1: Heavily built up areas of section 1 of the road

Plate 3.2: Beginning of section 1 at Fajuyi underpass

Section 2: NTA Road Junction- Ofin Village Road (chainage 2+150 – 3+750

The road at its end in Ofin village lies approximately on latitude 7^0 40' N and longitude 5^0 11'E. The road is an earth road from chainage 2+150 – 3+750. This section starts from NTA road junction (Ekiti State Pavilion) and passes through the major Federal establishments such as the Central Bank Building, INEC building, SSS building among others. The road corridor is lightly populated. The terrain along the route is characterized by low, flat and hilly terrain.

Plate 3.3: NTA Road Junction - Ofin Village

Plate 3.4: Section II between NTA road junction and Ofin Village

Section 3: Ofin Village Junction- Old Iyin Road (chainage 3+750 – 7+000

The road is an existing earth route and also traverses through an inaccessible hilly and rocky terrain at Ch.4+125 - Ch.4+300 and Ch.4+550 - Ch.4+650 respectively as well as Ch.5+375 - Ch.5+600 and Ch.5+775 - Ch.6+575. It passes through bushy and farmland and terminates near the cemetery at Iyin Ekiti ends.

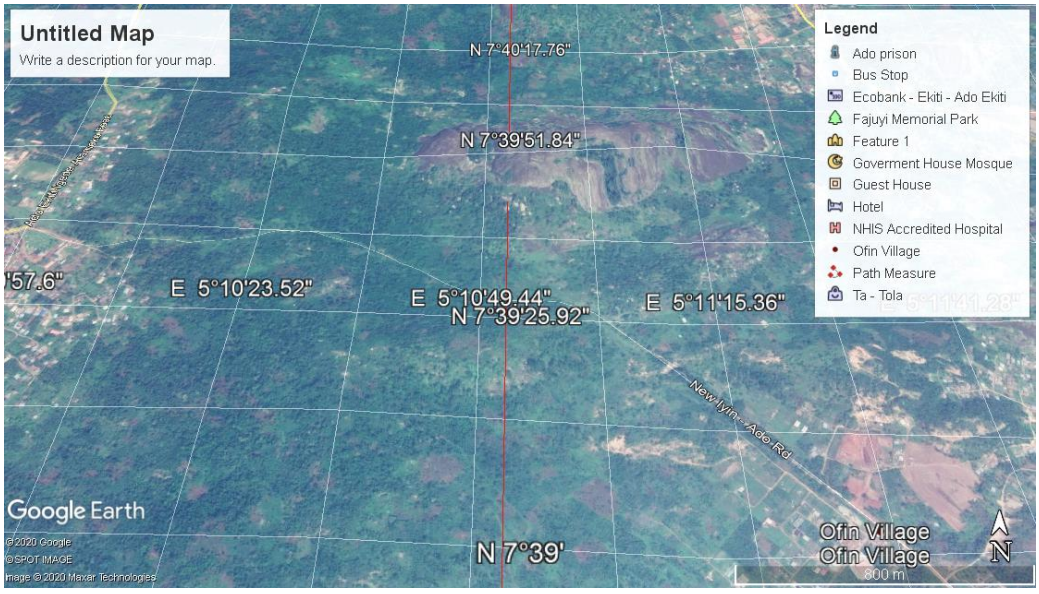

Plate 3.5: Ofin Village Junction- Old Iyin Road

3.2 General Approach

An EIA team of experienced interdisciplinary professionals utilized an interactive approach in conducting this comprehensive assessment. They applied a Charette-style approach in performing the required resource assessment, generation and analysis of baseline data, determination of potential impacts, and development of mitigation measures. Toward this end, the critical decision-making elements were exhaustively applied by the experts. The primary sources of baseline information included the following:

- Analysis of maps, plans, aerial photos
- Laboratory analysis of field samples
- Review of engineer survey reports and scientific literature,
- Review of Government Agency documents
- Published literature and Internet information
- Structured interactive community surveys

3.3 Baseline Data Acquisition Methods

Prior to commencing baseline studies, known issues and impacts identified from some of the EIA projects review were used in further developing the scope of this study. These identified issues were complemented by examining inventory of potential negative impacts of major energy and industry developments as contained in the Guidelines for Environment Assessment of Energy and Industry Projects, Vol. 111, World Bank Technical Paper no. 154 of the Environment Department.

3.3.1 Sampling Methods and Field Measurement

A two-season fieldwork was embarked upon for the biophysical as well as social and health studies. The field sampling and measurement was carried out between May 2019 and November, 2019 for wet season fieldwork and between December 2019 and February 2020 for the dry season. FMENV, EKMENV and EKSEPA Guidelines and Standards were strictly adhered to in the course of field sampling and measurement. A multi-disciplinary approach was adopted for the ecological characterization and data acquisition. The environmental components covered include topography, climate/Meteorology, air quality, and noise soil, vegetation, animal ecology, aquatic systems including ecology and fisheries, geology/geophysics/hydrogeology, socio-economics, health status assessment and waste management. The sampling points were

geo-referenced using Global Positioning System (GPS). The coordinates were used to generate sampling and location map for the study area (plate 3.5). Parameters with short-holding time were determined *in-situ* using calibrated instruments. Detailed field sampling methodologies are provided in Appendix I

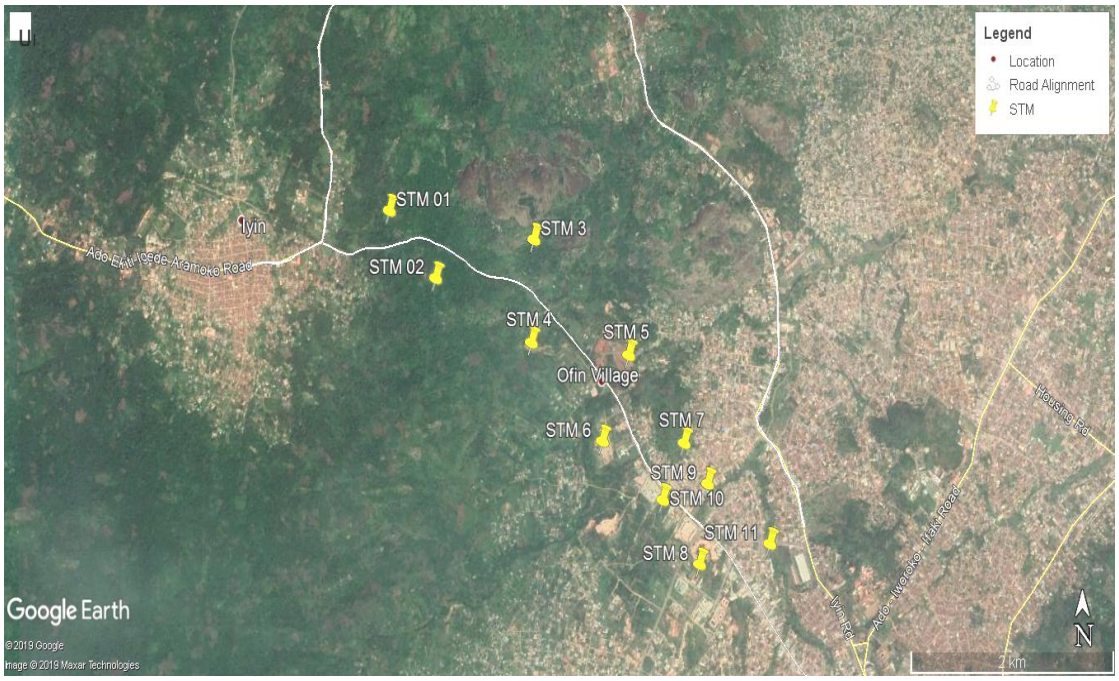

Plate 3.6: Sampling and Location Map of the Study Area

3.3.2 Quality Assurance/Control Procedure

Quality Assurance/quality Control (QA/QC) procedures covered all aspects of the study, including sample collection, handling, laboratory analyses, data coding and manipulation, statistical analyses, presentation and communication of results. Chain of custody procedures including sample handling, transportation, logging and cross-checking in the laboratory were also implemented. All analyses were carried out in FMENV accredited laboratories. The methods of analyses used in this study were those specified in EGASPIN 2002 and other internationally accepted analytical procedures, in order to ensure the reliability and integrity of the data obtained. Details of the sampling procedures and the laboratory analysis methods used are presented in Appendix 2.

3.4 The Physical Environment

Below is the description of the baseline status of environmental components of the proposed construction of New Ado-Iyin Ekiti Road.

3.4.1 Climate and Meteorology in Ado-Ekiti and Environs

The climate of the project area is typical of the humid tropics with considerable influence resulting from the nearness of Ekiti State to the Atlantic Ocean, existing seasonal winds, latitude and apparent movement of the sun across the tropics and relative stability of the Inter Tropical Convergence Zone (ITCZ) or Inter Tropical Front (ITF) over southern Nigeria. The two dominating air masses are the drier Tropical continental (TC) from the Sahara in the North and the humid Tropical Maritime from across the Atlantic Ocean in the south. They are separated by an Inter Tropical Discontinuity (ITD) zone. This zone oscillates seasonally depending on the apparent movement of the sun.

The third air mass is the Equatorial Easterlies, a rather cool one that comes from the east and goes lower in the upper atmosphere along the Inter Tropical Zone of Convergence. Occasionally, it drives southwards undercutting either the tropical maritime or topical continental air mass or gives rise to line squalls. The major climatic elements of Ekiti State and its environs include rainfall, temperature, thunderstorm, wind pattern (speed and direction) and relative humidity.

The state is largely influenced by the two wind systems, the southwesterly (SW) monsoon winds and the northeasterly winds. The former is due to the hot and humid tropical maritime air mass blowing in from the Atlantic Ocean while the latter is due to the tropical continental air mass that is a cold, dusty and dry air mass from the Sahara desert. The northeast (NE) winds are characterized by the dry season, which lasts from November to March, also the wet season begins in April and ends in November and is characterized by southwest wind.

(a) Temperature

Temperature is almost uniform throughout the year with little deviation from the mean annual of 27^0C. February and March are the hottest months with mean temperatures of 28^0C and 29^0C respectively while June with temperature of 25.0^0C is the coolest (Adebayo, 1993). The lowest minimum temperature of 20.0^0C is recorded during the peak of the harmattan in January. The lowest mean maximum temperature is recorded in August when the amount of solar radiation incident on the ground is lowest because of the presence of thick cloud cover. The daily range of temperature is small, never exceeding 9^0C in the wet season but rise to between 9^0C and 12^0C in the dry season.

(b) Rainfall

The mean annual total rainfall in the area is 1369mm with a low co-efficient of variation of about 10%. Rainfall is highly seasonal with marked wet and dry seasons and double maxima as a result of the "Little Dry Season" experienced in August. These distinct wet and dry seasons are seasons respectively associated with the alternating prevalence of moist maritime southwest monsoon winds from the Atlantic Ocean and the dry continental north easterly harmattan from the Sahara Desert. The rainy season lasts from April to October, with a break in August when rainfall is relatively low on account of the prevalence of stratiform clouds which are not thick enough to yield large amounts of rain. The dry season lasts from November to early March.

The average number of rainy days is 112 per annum. A rainy day is defined by the Nigerian Metrological Services as one in which a minimum of 254mm of rain falls. The number of rainy days also varies from month to month and within each month. Daily variability is highest during the dry months when irrigation farming is essential. Recent years have witnessed considered variability in the actual rainfall totals in Ibadan. Rainfall variability is the amount by which actual rainfall at any Plant differs on average from the mean value. Variations below the mean of 1303mm are more frequent than above, a factor that has contributed to the risks incurred by farmers and decline in agricultural output in recent times.

Rainfall at the start and end of the rainy season and during the dry season months are often marked by severe thunderstorms known as squall lines and are derived convective sources. These are experienced mainly in the afternoon and occasionally at night. Most of the rainfall events, however, occur in the form of high intensity showers of short duration. Light showers of less than 10mm/hr account for only 26% of rainfall intensities. About 75% of all rainfall events, therefore, are moderate to high intensities.

The actual totals of isolation received at the earth's surface are substantially reduced mainly by cloudiness and the persistent influence of the south-west winds; yearly sunshine values in western region, therefore, is about 50% of daily sunshine hours in this region is about 2000 hours with mean daily sunshine of about 5 hours. Seasonal variation in the lengths of day light in Ibadan region is not great. In January, when the sun is overhead at the Tropic of Capricorn, high sunshine hours in January are 11 hours 50 minutes. Conversely in July and August, sunshine totals are at their lowest in this region due to uniform and thick stratiform cloud cover.

Despite the fact that isolation is the most easily measured and the most commonly used indicator of extraterrestrial energy at the earth's surface, it has been found in recent years that it is more accurate to use the net global radiation for various purposes, most especially in predicting and planning the possibilities of cultivating various crops. This comprises not only direct sunshine but also the varying quantities of radiation, particularly ultra-violet, that are able to penetrate the clouds, especially when these are not exceptionally thick (Oguntoyinbo, 1982). The consequence is that while mean annual sunshine hours is about 2000 hours, the mean annual radiation is about 130k-cal/cm^2/year in Ibadan region.

(c) Relative Humidity

During the dry season months of December to February the values range from 60% to 87%. The lowest relative humidity was recorded in January 1994 (61%) and February 2003 (60%). In the wet season the relative humidity was in excess of 80%.

(d) Wind Pattern

Wind direction follows the Inter Tropical Discontinuity (ITD) zone which shows that it is mainly southwesterly (SW), westerly (W) and southerly (S) with northeasterly (NE) in some years in January. Wind speed was lowest in December ranging from 1.6ms^{-1} to 3.8ms^{-1} and highest in July/August ranging from 3.0ms^{-1} to 5.8ms^{-1}.

(e) Drainage

Along certain sections of the existing section of the proposed road especially Bank road, both sides exhibit open lined drains. The effluent from the drainage channel is discharged through box or pipe culverts to either side of the carriageway. However, most of the drainage channels, box and pipe culverts were heavily silted because of inadequate hydraulic system and lack of scheduled maintenance. In addition, the management of solid waste is generally very poor in the communities. There seems to be inadequate waste collection and disposal services; hence, several streets were often littered with refuse. In addition, most water drains were generally blocked with garbage, thus, resulting into flooding incidents after heavy rainfall.

3.4.2Soil

The New Ado-Iyin road is underlain by four major soil types. These soils which are derived from basement complex rocks comprise broad groups of poorly drained and well upland drained soils. The well drained soils covered over 70% of the study area and have good potential to support arable crops. The coordinates of the soil sample is given in Table 3.2 while the physical and chemical properties of the soils of the proposed construction of New Ado-Iyin Ekiti road are presented. The soil samples were collected on 19th December 2019.

Table 3.1: Instrument and Method Used

PARAMETERS	METHOD
pH, and EC	Bench Top Jenway pH Meter & Hanna/Combo Meter
Particle size distribution	Hydrometer method
Exchangeable cations (K^+, Na^+, Mg^{2+} and Ca^{2+})	Extraction with ammonium acetate /Flame photometry method / Titrimetry using EDTA
Metals (As, Cd, Fe, Zn, Mn, Cr, Pb, Cu, Co, V, Ni)	Acid digestion / Atomic Absorption Spectrometric (AAS) method
Total nitrogen	Macro Kjeldahl method/ Titrimetry
Total Phosphorus	Vanado- molybdate colorimetric method
Total Organic Matter	Walkley- black wet oxidation method
Cations Exchange Capacity	Empirical method
Oil & grease/THC	Extraction with N : Hexane & DCM mixture /Gravimetry/GC method (GC FID)
Porosity	Core Method
Permeability	Falling Head Method
Microbiology	Plate method (ASTM D 5465-93)

Table 3.2 : Soil Sampling Points

SAMPLE CODES	GPS COORDINATES
Soil Sampling 1 (SS 1)	N07^0.64’17.9’’ E005^{0}19’84.3’’
Soil Sampling 2 (SS 2)	N07^{0}64’36.3’’ E005^{0}19’63.2’’
Soil Sampling 3 (SS 3)	N07^{0}64’76.7’’ E005^{0}19’36.0’’
Soil Sampling 4 (SS 4)	N07^{0}65’19.4’’ E005^{0}19’00.9’’
Soil Sampling 5 (SS 5)	N07^{0}65’45.8’’ E005^{0}18’83.1’’
Soil Sampling 6 (SS 6)	N07^{0}65’66.8’’ E005^{0}18’47.3’’
Soil Sampling 7 (SS 7)	N07^0’65’90.8’’ E005^{0}17’86.1’’
Soil Sampling 8 (SS 8)	N07^{0}65’96.1’’ E005^{0}17’01.7’’
Soil Sampling 9 (SS 9)	N07^{0}65’95.7’’ E005^{0}17’80.5’’
Soil Sampling 10 (SS 10)	N07^0’66.00.1’’ E005^{0}16’69.3’’
Soil Sampling Control (SS 11)	N07^{0}66·91.0’’ E005^{0}16’66.8’’

Physical Properties

In general, the soils ranged in texture from sand to sandy loam in the topsoil (top 15cm of soil profile) with the sand fraction varying from 69.0% to 85.0% with mean values of 76.4 ± 6.3% and 67.5 ± 13.5% in the top 15cm and the subsoil horizons respectively and the silt fractions from 6.9% to 12.0% (means of 8.6 ± 5.1% and 11.1 ± 6.5% in top and sub soil layers respectively. The soils were moderately aerated, as porosity values (computed from measured bulk density values) ranged from 47.0 to 52.0%, with mean values of 50.0 ± 2.8% in the top soils.

Chemical Properties

The soils are characterised by acidic reaction (pH range of 4.5 to 5.7 in the surface 15cm to pH 4.6 to 5.3 at lower depths with mean values of 5.4 ± 0.36 and 5.0 ± 0.19 for the top and sub-soil horizons, respectively), low EC (58-190μS/cm) and low organic matter (1.08-4.43%), total nitrogen (0.05-0.38% with mean for top and sub-soils of 1.05±0.20 and 0.83±1.8%, respectively). Contents of available phosphorus were moderate to high in the soils with available P ranging from 10.6 to 31.3 ppm for all soils and mean values of 18.2±7.3ppm in top soils and 16.7±5.8ppm in the sub soils, while the concentrations of other anions were low to moderate and composed mainly of nitrates (0.06-0.32ppm); ammonium (0.12-19.5ppm) and sulphates (0.76-8.56ppm). The chloride concentrations were generally low (77.6-995ppm). Contents of exchangeable cations were either low or moderate. Range of values of exchangeable cations in the soils was for potassium, 0.06 to 0.26 cmol/Kg soil, calcium, 2.03 to 5.21 cmol/Kg soil; magnesium, 1.50 to 2.71 cmol/Kg soil, and sodium, 0.08 to 0.18cmol/Kg, low ECEC 3.88-4.85 cmol/Kg and moderate to high base saturation values (82-98%). Heavy metal and hydrocarbon contents of the soils were generally low and of little or no environmental consequences. Contents of iron (Fe) varied widely from 119.5 to 230.7 ppm (mean = 188.4 ± 67.5ppm and 201.6±45.7 in the top and subsoil layers, respectively). Values of Mn varied from 63.2 to 125.9μg/g with mean values of 89.3±35.28 μg/g in surface soils and 117.6±34.13 μg/g in the subsurface layers. The soils contain adequate concentrations of other microelements or heavy metals for the healthy growth of plants. There was no indication of accumulation of microelements as a result of past/present farming practices or industrial activities or the construction of the proposed road.

The total hydrocarbon concentrations of the soils of the study area were low with values varying widely from 6.5 to 18.2 mg/g THC (mean values of 12.2±6.6 mg/g and

8.1±5.7mg/g for the top and sub soils, respectively). These could be from biogenic sources (decaying plant and animal parts - suberins, waxes, chitin etc). There is therefore no addition of hydrocarbon from anthropogenic or pathogenic sources within the study area.

Table 3.3 : Chemical Properties of Soil in the Study Area

PARAMETERS	TOP SOIL (0 – 15) cm										
	SS 1	**SS 2**	**SS 3**	**SS 4**	**SS 5**	**SS 6**	**SS 7**	**SS 8**	**SS 9**	**SS 10**	**SS 11**
Sand (%)	67.93	64.95	69.55	74.46	63.88	66.90	67.46	72.17	65.82	67.85	68.68
Clay (%)	18.62	20.82	18.68	13.21	19.65	20.85	18.12	18.01	20.87	19.62	18.24
Silt (%)	13.45	14.23	11.77	12.33	16.47	12.25	14.42	9.82	13.31	12.53	13.08
pH	5.72	5.93	6.12	5.98	5.79	5.81	6.10	5.91	5.86	6.10	6.16
Porosity (%)	54.52	50.60	52.83	53.81	58.73	55.48	53.28	57.84	55.95	57.81	56.91
Permeability (cm/s)	1.29	1.96	1.62	1.87	1.74	2.55	1.70	2.13	1.95	2.36	1.85
Bulk Density (gcm^{-3})	1.35	1.45	1.23	1.52	1.32	1.28	1.46	1.32	1.25	1.38	1.41
Total N (%)	0.13	0.15	0.13	0.16	0.10	0.19	0.15	0.18	0.14	0.12	0.20
TOM (%)	1.95	2.07	2.25	2.58	1.92	2.75	2.19	1.89	2.43	2.17	2.45
Total Phosphorus (mg/kg)	5.84	8.27	6.57	7.83	5.83	6.74	5.27	8.05	6.30	5.19	7.48
EA (cmol/kg)	2.34	2.27	2.74	2.51	2.25	2.51	2.29	2.44	2.51	2.72	2.58
CEC (cmol/kg)	7.52	8.27	7.83	9.24	6.98	8.37	7.18	9.37	7.27	9.36	7.58
BS (%)	75.50	79.20	67.80	73.60	69.30	81.50	77.90	85.10	70.40	65.60	75.20
Na^{+} (cmol/kg)	0.76	0.82	0.86	0.73	0.80	0.58	0.87	0.84	0.60	0.66	0.80
K^{+} (cmol/kg)	1.47	1.68	1.70	1.42	1.65	1.26	1.59	1.74	1.34	1.40	1.57
Ca^{2+} (cmol/kg)	4.80	5.04	3.95	4.73	4.36	3.94	5.38	5.08	4.58	4.98	5.09
Mg^{2+} (cmol/kg)	3.40	3.85	4.13	3.26	4.24	2.98	3.28	2.96	3.26	4.03	3.82
Oil & Grease (mg/kg)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
THC (mg/kg)	0.01	0.02	BDL	0.01	BDL	BDL	BDL	0.03	BDL	BDL	0.01
HEAVY METAL CHARACTERISTICS											
As (mg/kg)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Cd (mg/kg)	0.02	BDL	BDL	0.01	0.02	BDL	0.01	0.01	BDL	BDL	0.01
Cr (mg/kg)	0.37	0.64	0.29	0.43	0.74	0.46	0.71	0.52	0.54	0.39	0.61
Cu (mg/kg)	1.01	0.84	0.87	0.70	1.08	0.82	0.77	1.05	1.17	1.30	1.13
Co (mg/kg)	0.01	BDL	BDL	0.03	BDL	0.02	BDL	0.01	BDL	BDL	0.02
Fe (mg/kg)	323.00	356.80	347.10	299.70	280.30	371.50	289.30	295.00	413.50	270.90	397.50

Ni (mg/kg)	0.93	1.19	0.88	0.80	0.67	1.12	0.98	1.23	0.87	1.03	1.07
Mn (mg/kg)	0.10	0.09	0.13	0.09	0.15	0.13	0.07	0.08	0.10	0.14	0.12
V (mg/kg)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Pb (mg/kg)	0.15	0.10	0.17	0.16	0.10	0.16	0.15	0.17	0.20	0.10	0.08
Zn (mg/kg)	35.57	29.69	32.90	31.54	26.44	37.14	30.88	34.98	30.07	25.85	31.29
MICROBIOLOGICAL CHARACTERISTICS											
THB (cfu/g) x 10^3	2.90	2.30	1.60	1.90	3.30	1.20	2.90	1.80	2.70	3.10	3.10
THF (spore/g) x 10^3	1.80	2.10	1.20	1.30	2.70	1.00	2.20	1.10	1.90	2.60	2.13
HUB (cfu/g) x 10^2	0.20	0.10	0.10	0.20	0.30	0.10	0.20	0.30	0.20	0.30	0.20
HUF (spore/g) x 10^2	0.04	0.08	0.06	0.07	0.10	0.07	0.06	0.10	0.05	0.06	0.09

NOTE: BDL = Below Instrument Detection Limit (<0.01), THB = Total Heterotrophic Bacteria, THF = Total Heterotrophic Fungi; HUB = Hydrocarbon Utilizing Bacteria; HUF = Hydrocarbon Utilizing Fungi, cfu/g = Colony Forming Unit per gram, mg/kg = milligram per kilogram, gcm^{-3} = gram per centimeter cube, cmol/kg = Cubic mol per kilogram, BS = Base Saturation, TOM = Total Organic Matter, EA = Exchangeable Acidity, CEC = Cation Exchange Capacity, cm/s = Centimeter per Second, Cd = Cadmium, Cr = Cromium, V = Vanadium, Pb = Lead, Zn = Zinc, Mn = Manganese, Cu = Copper, Ni = Nickel, Fe = Iron, Co = Cobalt

Soil Microbiology

Total heterotrophic bacteria abundance ranged from 3.20-8.26x105 and 2.85-7.25x105 CFU g-1 in the surface and subsurface samples respectively during the dry season. During the wet season, the counts were slightly higher ranging from 3.83-8.88 x105 and 1.83-8.25x105 CFU g-1 in the surface and subsurface samples, respectively. The pre-dominant heterotrophic bacterial isolates were *Bacillus* sp, *Pseudomonas* sp, *Serratia* sp, *Escherichia* sp, *Vibro* sp, *Flavobacterium* sp and *Alkalegenes* sp. The abundance of heterotrophic fungi varied from 2.50-5.15 x103 and 3.12-6.33x103 CFU g-1 in surface and subsurface samples in the dry-season. Lower counts were observed during the wet season. The major fungal isolates are *Penicillium sp, Aspergillus sp, Candida sp,* and *Mucor sp*. Hydrocarbon utilizing bacteria and fungi in the surface and subsurface were higher during the wet season sampling than during the dry season. Heterotrophic bacteria and fungi were generally more numerous in the surface than subsurface. This trend may be related with availability of more organic material and better growth conditions in the surface than the subsurface. The low percentage of hydrocarbon utilizes to heterotrophy (less than 5%) in both seasons indicates that the soils have no recent anthropogenic hydrocarbon pollution.

3.4.3 Geology

Geologically, the project area lies within the Precambrian Basement Complex Rock group, which underlies much of south west Nigeria. This Basement Rock shows variation in grain size and structure, the rocks vary from very coarse grained pegmatite to medium grained gneisses. The rocks are strongly foliated and they occur as outcrops. In general, the topography of the proposed road is noticeably undulating to flat due to the slight difference in lithologic units (soil type).

Geotechnical Classification

The historical stratigraphical succession consisted of the Cretaceous age Abeokuta Formation non-conformably deposited on the Precambrian Basement Complex. The Paleocene Ewekoro Formation was deposited conformably on the Abeokuta, followed by Eocene Ilaro Formation. The Pleistocene-age Benin Formation, which immediately underlies the region (also called Coastal Plain Sands) consist of loose, poor to moderately sorted sands, clays, gravel, sandy clays, and clayey or silty sands, with traces of lignite beds. The most recent

deposit overlying the Benin Formation is the Quaternary Alluvial Deposits of unconsolidated and unsorted sands, clays, and silts. These appear not to outcrop significantly in the region, but further south of the region.

3.5 Collection and Analysis of Field Samples

3.5.1 Air Quality

In general, it is important to establish the baseline ambient air quality of a project area as part of conducting a comprehensive EIA. This information is very useful in the determination of the potential effects associated with the proposed project. In the course of construction of the proposed road, there is the potential for significant impact on ambient air due to the emissions of harmful gases and suspended particulates associated with construction and operation activities. Additionally, adverse air quality impacts upon construction of the road network from increased traffic use should be expected, with its attendant future road network capacity limitations.

Ambient air samples were collected from identified sensitive receptor locations along the proposed route, with consideration for both upstream and downstream wind directions. Samples were taken using standard in-situ digital air quality monitoring equipment.

The laboratory analyses that were identified and measured in the samples included nitrogen oxides [NOx], carbon monoxide [CO], and total suspended particulates [TSP]. For the purpose of this EIA, the concentrations of the air pollutants were compared with applicable Ambient Air Quality Standards for Nigeria (FEPA, 1991).

3.5.1.1 Field Measurements

Field data gathering exercise was carried out in 18th December 2019 for Dry season while existing data for similar project in Ado Ekiti was used for Wet season.

Table 3.4: Sampling Locations for Meteorology, Air Quality and Noise in construction site of New Iyin road Ado Ekiti and Environs

S/No	Station on Map	Coordinates	Elevation(Meter)
1.	AQ1	73936,79 N	323m
		51036.26 E	
2.	AQ2	73925.93 N	323m
		5113.05 E	
3.	AQ3	73918.38 N	323m
		51110.91 E	
4.	AQ4	73916.38N	327
		51113.70 E	
5.	AQ5	73915.44N	328
		51125.20 E	
6.	AQ6	73830.22 N	328m
		51152.65 E	

Source: Field suvey, December 2019

3.5.1.2 Climate and Meteorology

During the study, the climate and meteorological parameters collected were: wind speed and direction, ambient air temperature, pressure and relative humidity using Weather Tracker Kestrel 4500. This Weather Tracker is a multi-function environmental monitoring instrument used to measure major environmental condition including Barometric Pressure, Altitude, Density, Temperature, Humidity, Wind Speed, Wind Chill, Dew Point, Wet Bulb, and Heat Index. It has a chart mode that allows users to recall and graph up to 250 measurements, along with the date and time of storage with a PC interface that allows data uploading for long-term storage, in-depth analysis and detailed charting.

3.5.2.2 Air Quality and Noise

Ammonia (NH_3), carbon monoxide (CO), hydrogen sulphide (H_2S), oxides of nitrogen (NO_X), sulphur dioxide (SO_2), and volatile organic compounds (VOCs) gaseous air pollutants were measured during the study in the ambient environment of the proposed project site using various methods of sampling as described below:

Ammonia (NH_3) Measurements: NH_3 measurements were taken using an *in situ* non-integrated single gas ammonia monitor (ToxiRAE Model PGM-1150). The monitor is a 9.3 cm x 4.9 cm x 2.2 cm measuring instrument weighing about 0.1 kg with an instantaneous direct readout displays through which current ammonia concentrations can be continuously monitored in ppm (parts per million). It has facility for Short Term Exposure Limit (STEL) from which the ammonia concentration for the last 15 minutes can be determined; the Time Weighted Average (TWA) from which the accumulated reading of the gas concentration since the monitor was turned on is divided by 8 hours; and the Peak Reading, which is the highest reading since the monitor was turned on. It has detection range of 0 – 20 ppm with 0.1 ppm resolution.

Carbon Monoxide (CO) Measurements: CO measurements were taken using an *in situ* non-integrated single gas carbon monoxide monitor (ToxiRAE Model PGM-1150). The monitor is a 9.3 cm x 4.9 cm x 2.2 cm measuring instrument weighing about 0.1 kg with an instantaneous direct readout displays through which current carbon monoxide concentrations can be continuously monitored in ppm (parts per million). It has facility for Short Term Exposure Limit (STEL) from which the carbon monoxide concentration for the last 15 minutes can be determined; the Time Weighted Average (TWA) from which the accumulated reading of the gas concentration since the monitor was turned on is divided by 8 hours; and the Peak Reading, which is the highest reading since the monitor was turned on. It has detection range of 0 – 500 ppm with 1 ppm resolution.

Oxides of Nitrogen (NO_X) Measurements: NO_X concentrations were measured as NO and NO_2 using two *in situ* single gas monitors (ToxiRAE Model PGM-1110). The monitors are each of 9.3 cm x 4.9 cm x 2.2 cm measuring instrument weighing about 0.1 kg with an instantaneous direct readout displays through which current NO_2 concentrations can be continuously monitored in ppm (parts per million) with a detection range of 0 – 20 ppm and 0.1 ppm resolution. They have facility for Short Term Exposure Limit (STEL) from which the NO and NO_2 concentrations for the last 15 minutes can be determined; the Time Weighted Average (TWA) from which the accumulated reading of the gas concentration since the monitor was turned on is divided by 8 hours; and the Peak Reading, which is the

highest reading since the monitor was turned on. For every field measurement, the "Auto-Zero at Start-up" calibration was carried out as required in the study.

Sulphur Dioxides (SO_2) Measurements: To measure the SO_2 concentrations during the field study, an *in situ* single gas SO_2 monitor (ToxiRAE Model PGM-1130) was used. The monitor is a 9.3 cm x 4.9 cm x 2.2 cm measuring instrument weighing about 0.1 kg with an instantaneous direct readout displays through which current SO_2 concentrations can be continuously monitored in ppm (parts per million) with a detection range of 0 – 20 ppm and 0.1 ppm resolution. It has facility for Short Term Exposure Limit (STEL) from which the SO_2 concentration for the last 15 minutes can be determined; the Time Weighted Average (TWA) from which the accumulated reading of the gas concentration since the monitor was turned on is divided by 8 hours; and the Peak Reading.

Hydrogen Sulphide (H_2S) and Volatile Organic Compounds (VOCs): These compounds were measured using an *insitu* MultiRAE gas monitor (Model PGM50-5P). The monitor is a 9.3 cm x 4.9 cm x 2.2 cm measuring instrument weighing about 0.1 kg with an instantaneous direct readout displays through which current VOCs concentrations can be continuously monitored in ppm (parts per million). It has facility for Short Term Exposure Limit (STEL) from which the H_2S and VOCs concentrations for the last 15 minutes can be determined; the Time Weighted Average (TWA) from which the accumulated reading of the gas concentration since the monitor was turned on is divided by 8 hours; and the Peak Reading, which is the highest since the monitor was turned on. It has detection range of 0 – 200 ppm with 0.1 ppm resolution.

3.6 Noise Measurements

Noise measurements were taken with a digital, battery-powered, sound pressure level meter (EXTEC Instruments, US Model 407735). It has both A and C weighting and 0.1 dB resolution with fast/slow responses. Its high- and low-metering ranges were 35 – 100 dB and 65 – 130 dB, respectively. The meter is also equipped with a build-in calibration check (94 dB), tripod mount, and analogue DC/AC conditioned outputs of 10mV/dB and utilized a 0.49 " (12.3 mm) condenser microphone. To measure the noise levels at any of the sampling locations, the sound level meter was placed at a distance of at least 3 m from any barrier or

other sound reflecting sources and at about 1.2 – 1.5 m above ground level. Measurements were taken by setting the sound level meter to the "A" weighting network.

Air Sampling for Particulates

Particulate matter (PM) was measured with GT-321 Particle Counter/Dust Monitor, an equipment from Met One Instruments. It is handheld, battery operated and completely portable unit measuring five number ranges of TSP: $PM_{0.3}$, $PM_{0.5}$, PM_1, PM_2, and PM_5. It has a sampling period of 2 minutes and a flow rate of 2.83 l/min. To measure, it is placed at 1 m above the ground level, switched on in the environment of interest and the measured concentration read directly on the screen after particle capturing.

The PM_{10} measurements were made by an HD-1100 HAZ-DUST particulate monitor during the study. This is a real time dust monitor designed for air monitoring investigations. It uses infrared technology to obtain accurate and instantaneous data on airborne particle concentrations, in accordance with the NIOSH method 0600. The instrument is of 9"x3"x1.5" dimension weighing about 0.75 kg with concentration range of 0.01-200mg/m^3 and can capture PM_{10} and TSP levels. It displays 4/20 alphanumeric on screen display LCD 3.5 digits mg/m^3 concentration reading which allows for a complete time vs. concentration profile. This is impossible to obtain with the common filter/gravimetric techniques. In addition to these features, it has facility to get coupled with data logger, and through this, maximum automation is achieved for data collection, statistical analysis, graphs and detailed report generation. It is with a recording time of 1 min to 12 hours, a sampling rate of 1 or 2 sec/sample with facility for TWA, STEL, MAX/MIN concentration, and start/stop time. All these methods are as recommended by the Federal Ministry of Environment (FEPA, 1991)

3.7 Description of the Atmospheric Condition of the Study Area

The climatic condition of the study area both from the historical perspective and the field observation are discussed in this section with the air quality status and the ambient noise conditions.

3.7.1 Climate and Meteorology

The study area is located in the same air basin as Ado Ekiti in the south-western part of Nigeria and it shares the same climatic conditions with it from historical data. However, its climate is influenced by its proximity to the Atlantic Ocean and characterized with both the dry and wet seasons associated with the movement of the Inter-Tropical Convergence Zone (ITCZ) north and south of the equator as other parts of Nigeria. Generally, annual rainfall in Ekiti State varies from 1,150 mm in the northern areas to 2,000 mm in the southern areas (where the proposed project area belongs).

3.7.2 Relative Humidity

The relative humidity in Ado Ekiti ranges between 57 and 89% using a 10-year historical data with the mean monthly level indicating the months of June through September as wettest (87% – 89%) and December through March as driest. The relative humidity range of 60.7% – 66.9% with an average of 65.2 obtained in the area during the study (Figure 2.1) agrees with the historical data.

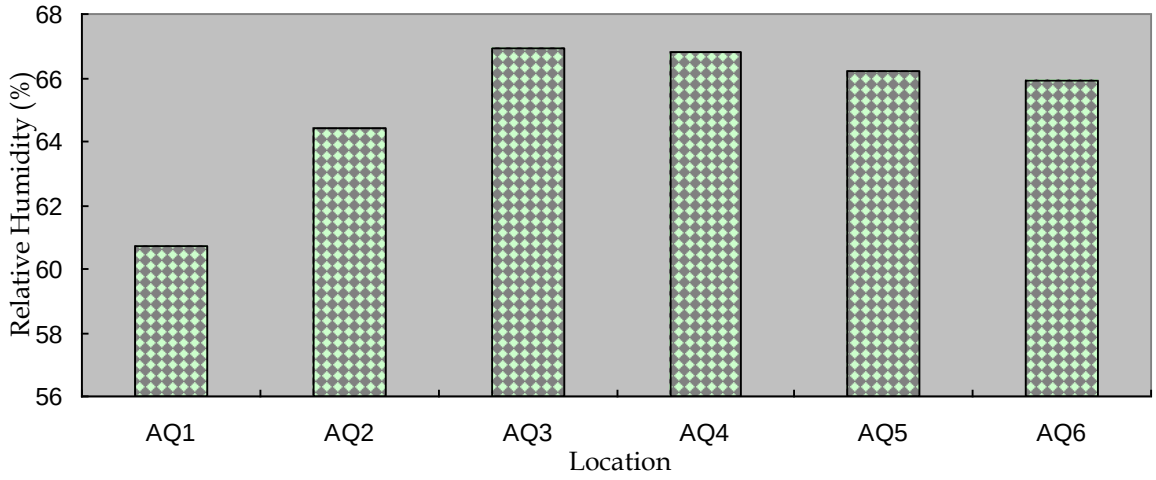

Figure 3.2: Measured Relative Humidity in the Area during the Study

3.7.3 Air Temperature

Being in the coastal zone, Ado Ekiti experiences relatively low temperatures throughout the Year with a mean monthly maximum temperature of 29 °C (Figure 3.3) with the highest temperature occurring around December and the lowest in between August and September. While the period of highest ambient temperature is in the dry season its period of lowest temperature happens to be in the wet season of the year. The lowest temperature during the wet season is attributed to the depletion of incoming solar radiation by greater cloud cover.

During the field study, the measured ambient air temperature was 31.4 – 32.0 °C with an average of 31.6 °C (Figure 3.4) which agrees with the historical temperature variation of the study area.

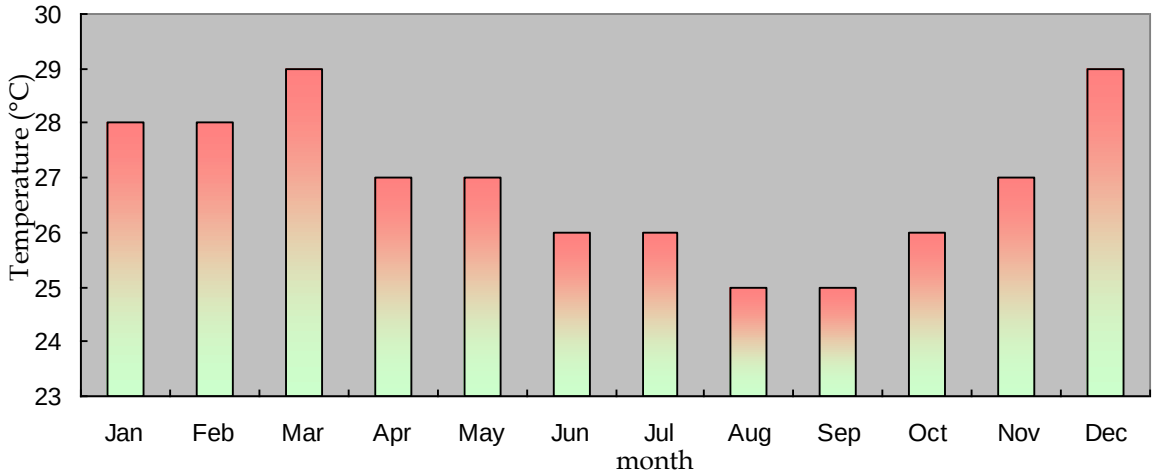

Figure 3.3: Mean monthly Air Temperature in the Study Area

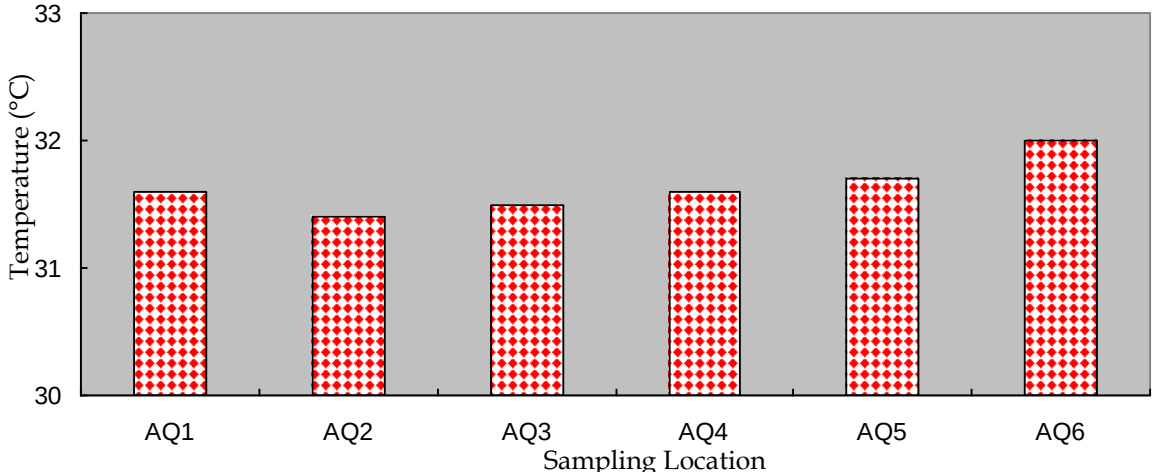

Figure 3.4: Measured Air Temperature in the Study Area during the Study

3.7.4 Wind Pattern

Surface wind speed in the area is characterized by small diurnal variation and influenced by both land and sea breezes resulting from the alternate warming of the land and sea. It reaches maximum level during the night due to radiation cooling leading to instability in the surface layer. The two major wind regimes are the North-East and the South-West Trade Winds

which are similar to the measured wind pattern during the field study. The wind speed during the wet season is usually a gentle breeze (1.6 – 3.3 m/sec) followed by light breeze (3.4 - 5.4 m/sec), and moderate breeze (5.5 - 7.9 m/sec). Winds above 10 m/sec occur but only during thunderstorms. During this study, the NE wind speed ranged between 0.4 and 2.1 m/s with an average of 1.6 m/s while the SW wind speed was 1.7 – 3.8 m/s with an average of 2.4 m/s (Table 3.2).These all fall within the historical wind data for the area.

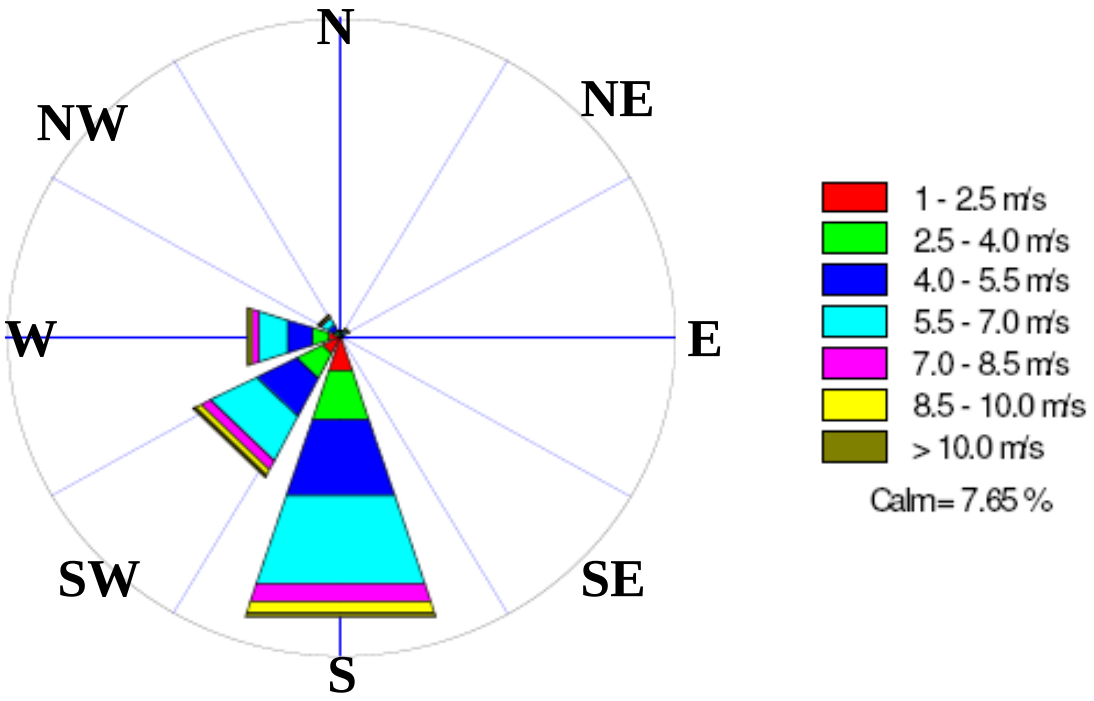

Figure 3.5 : Wind Direction in the Study Area

Table 3.5: Measured Wind Speeds and Directions at the project site during the Study

Sampling Location	Northeast Mean Wind Speed	Southwest Wind Speed
AQ1	2.0	2.8
AQ2	1.6	1.8
AQ3	0.4	3.8
AQ4	2.1	2.4
AQ5	1.8	2.1
AQ6	1.5	1.7

3.7.5 Pressure

Atmospheric pressure in the study area in the past has been reported to be 1002 - 1012 mb. During the study, the measured atmospheric pressure ranged between 1007.9 and 1008.7 mb

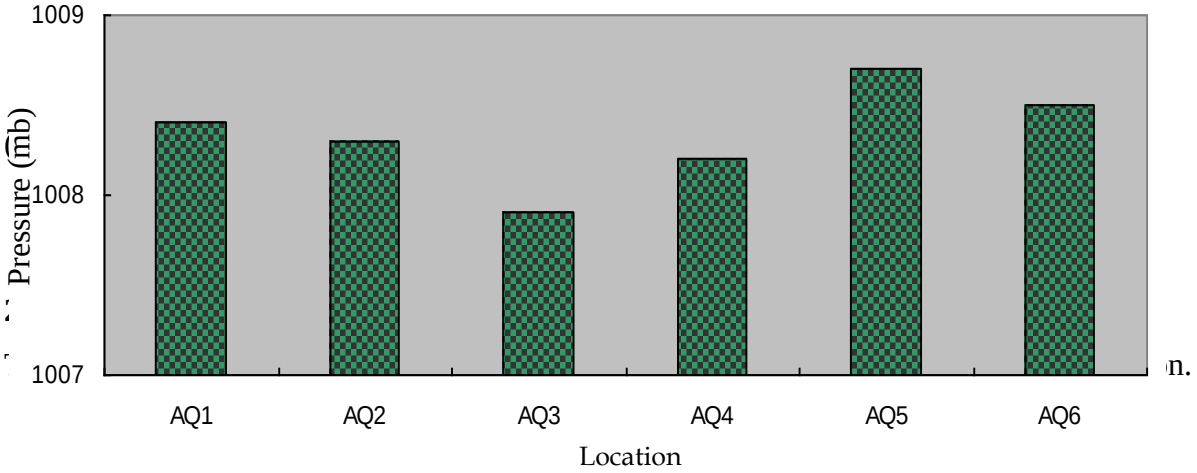

Figure 3.6: Measured Atmospheric Pressure in the Area during the Study

3.7.6 Air Quality

Table 3.7 summarises the average measured 1 – hour concentrations of ambient gaseous pollutants in the area as obtained during the field study. Though seven gaseous air quality parameters were monitored in the proposed project area, only VOCs were detected during the study. While the presence of SO_2, NO, NO_2, CO, NH_3, and H_2S were below the measuring instruments' detection limit, VOCs were detected in all the sampling locations at a range of

0.3 – 3.1 ppm. Similarly, PM_{10} was detected in all the sampling locations with a range of 39.3 – 46.7 μg/m^3 and an average of 43.4 μg/m^3.

.

Table 3.6: 1-Hour Measured Gaseous and Particulate Concentrations at the New Iyin Road Project Site.

Sampling Locations	Concentrations (ppm)							PM_{10} (μg/m^3)
	SO_2	NO	NO_2	CO	NH_3	H_2S	VOCs	
AQ1	<0.1	<0.1	<0.1	<1.0	<1.0	<0.1	3.1	46.7
AQ2	<0.1	<0.1	<0.1	<1.0	<1.0	<0.1	1.3	43.6
AQ3	<0.1	<0.1	<0.1	<1.0	<1.0	<0.1	0.7	42.8
AQ4	<0.1	<0.1	<0.1	<1.0	<1.0	<0.1	0.5	43.2
AQ5	<0.1	<0.1	<0.1	<1.0	<1.0	<0.1	0.9	39.3
AQ6	<0.1	<0.1	<0.1	<1.0	<1.0	<0.1	0.3	44.5

On extrapolation, the 24-hour concentration of the measured VOCs are of the range 0.2 – 1.6 ppm with an average of 0.6 ppm while PM_{10} equivalents were 20.2 – 24.0 μg/m^3 with an average of 22.2 μg/m^3 .

Table 3.7: 24-Hour Calculated Gaseous and Particulate Concentrations at New Iyin Road Project Site.

Sampling Locations	Concentrations (ppm)						PM_{10} (μg/m^3)
	SO_2	NO_2	CO	NH_3	H_2S	VOCs	
AQ1	ND	ND	ND	ND	ND	1.6	24.0
AQ2	ND	ND	ND	ND	ND	0.7	22.4
AQ3	ND	ND	ND	ND	ND	0.4	22.0
AQ4	ND	ND	ND	ND	ND	0.3	22.2
AQ5	ND	ND	ND	ND	ND	0.5	20.2
AQ6	ND	ND	ND	ND	ND	0.2	22.8
FMENV Limit*	0.01	0.04 – 0.06	10.0	-	-	-	250.0
World Bank Limit[a]	0.06	0.08	26.0	-	-	-	80.0

*Source: FEPA (1991); and World Bank (1998); ND = Not Detected

Since the SO_2, NO, NO_2, CO, NH_3, and H_2S were below the measuring instruments' detection limit during the study, they can be considered to be within the recommended limits of the Federal Ministry of Environment and the World Bank in the study area. The VOCs detected in all the six sampling locations in the study area during the study have 24-hour equivalent levels within the 1.9 ppm limit of the Federal Ministry of Environment. VOCs are combustion products of fuel in both internal and external combustion engines thus their presence in the study area may be attributed to some combustion activities in the study area as noticed during the study. Fuel vaporization from storage tanks which may be located around the study area may be additional source.

The extrapolated PM_{10} to 24-hour concentrations are within the Federal World Bank limit of 80 µg/m^3. During the study, the identified major sources of particulates are combustion activities.

3.7.7 Ambient Noise Status

The measured ambient noise levels in the proposed project area during the study were 18.1 – 30.8 dB(A) and 50.5 – 68.4 dB(A) for the minimum and maximum respectively. When compared with the shop floor 8-hour limit of the FMENV, this was not breached neither by the measured minimum nor the maximum noise levels in any of the sampling locations. Similarly, the measured minimum noise levels did not breach both the sleep disturbance limit (Berglund et al, 1999) of 45 dB(A) and the WHO's limit of 55 dB(A) for ambient environment in any of the sampling locations. However the measured maximum

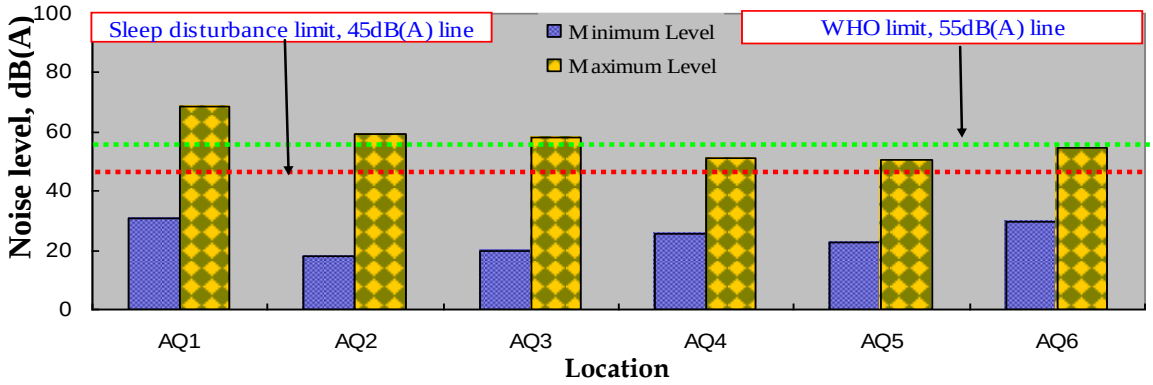

Figure 3.7: Measured Noise Level in the Area during the Study

noise levels breached the sleep disturbance limit in all the sampling locations while they breached the WHO limit three locations. The major identified noise sources including crickets, wind and human beings.

3.7.7.1 Noise

Every activity involving the use of machineries, either stationary or mobile, may generate noise with intensity of generation depending on several factors, chief among which is age of machinery (Sonibare et al, 2016). At the construction phase of the proposed project, the use of heavy equipment in site preparation may lead to generation of high noise levels with negative impact, reversible, but only to last the period of construction. This has high likelihood of occurrence with considerable consequence and moderate rating. The onsite construction activities may generate the same impacts as this is expected from the site preparation. The supply of construction equipment and materials at the construction phase is bound to have impact on the ambient noise levels. This will have direct and negative impact on the environment with high likelihood of occurrence, little consequence and moderate rating.

3.7.7.2 Air Quality

To minimize all the combustion associated emissions during the construction phase on site, all vehicles and equipment shall be turned off when not in use while vehicular and equipment idling shall be avoided. Also, vehicles and equipment (generators) shall be regularly maintained in order to reduce any possible emissions. Fugitive dust emissions that may affect ambient air quality during land clearing will be controlled with spraying of water using water trucks on site. Trucks transporting materials will be covered to prevent any loose material from blowing away while vehicular speeds shall be limited to further reduce any possible fugitive dust emissions. Since the proposed project is located around a feeder road to a major high-way, Traffic Officers will be engaged to allow for free flow of traffic during construction so as to control vehicular emissions at the proposed project site.. The detail mitigation measures are summarized in Tables 29 and 30 for both the construction and operation phases respectively. During the construction phase of the proposed road, mitigation measures to be taken for effective control of noise will be in form of equipment, hearing protection devices, and creation of awareness. Detail information on these is provided below:

Equipment

- The contractors shall be encouraged to locate noisy plant (generators, compressors, pumps, and concrete batching plant) away from work areas and screen them to prevent human impact.
- Plan at quarry shall be made to obtain probable noise levels of different equipment in selection while quieter alternative work methods shall be considered.
- Noise issues that may occur shall be identified by contractors proactively and resolved to the satisfaction of existing guidelines e.g. if contractors will be bringing a noisy machine on site, the precautions needed to reduce noise shall be discussed.
- Noisy machines shall be located away from main areas of activity. Otherwise, plant shall be screened from work areas by using noise screen/barriers.
- Combustion engines shall be fitted with silencers that work effectively.
- Hand-held concrete breakers shall be muffled.
- There will be regular maintenance of machines for them to be quieter.
- Machinery covers and panels shall always be closed and well fitted while bolt/fasteners shall be done up tightly to avoid rattles.
- Engines shall be switched off or reduced to idle when not in use.

3.7.7.3 Hearing Protection Devices (HPDs)

Contractors shall ensure that workers know when / why to use HPDs while warning signs shall be fitted on noisy machines; Comfortable HPDs shall be made available as these are likely to be worn by workers; Contractors shall ensure that workers know how to use / care for HPDs (e.g. headbands go over the head not around the neck, compress foam ear plugs well before insertion); Damaged, hard or worn muff seals shall be in constant replacement; It shall be ensured that mangers and foremen set good examples.

Awareness Promotion: The contractor handling the project shall ensure that awareness of noise levels and noise management is included in all trade, health and safety courses, toolbox talks, etc. This will also be extended to all community interactions that may be planned at the occupation phase of the project.

Mitigation measures that shall be incorporated into the project's HSE-MS document have been proposed for moderate associated impacts on air quality and noise as representation of **NEW IYIN ROAD** commitment to environmental protection. The highlights of measures proposed for the various project activities include:

Air Quality

*** During Construction**

- Equipment (and generators) not in use shall be switched off to avoid idling
- Equipment (and generators) shall be regularly maintained to reduce any possible emissions

*** During Operation**

The following additional mitigation measures shall be applied:

- Management shall maintain the combustion systems regularly to ensure compliance with regulatory limits.
- Management shall undertake periodic measurements of criteria air pollutants in and around the proposed project site.
- Dedicated line shall be negotiated with the Power Holding Company of Nigeria to secure some levels of stable power supply into the plant.

Noise

Noise shall be mitigated following a two-pronged approach from the perspective of machine/plant efficiency and the provision of requisite PPE to cope with the nuisance. The suggestion for securing dedicated line for relative stable power supply into the plant to limit the use of electric power generators will also minimize if not abate noise generation.

❖ **During construction phase**, mitigation measures to be taken for effective control of noise shall include:

Equipment

- Contractors shall locate noisy plant away or screen from work areas.
- Plant shall be made to obtain probable noise levels of different equipment in selection while quieter alternative work methods shall be considered.

- Noise problems that may occur shall be discussed by Management with the contractors e.g. if contractors will be bringing a noisy machine on site, the precautions needed to reduce noise shall be discussed.
- Combustion engines shall be fitted with effective silencers.
- Hand-held concrete breakers shall be muffled.
- There will be regular maintenance of machines to enhance quiet operation.
- Machinery covers and panels shall always be closed and well fitted
- Engines shall be switched off or reduced to idle when not in use.

Hearing Protection Devices (HPDs)

- Contractors shall ensure that workers know when / why to use HPDs while warning signs shall be fitted on noisy machines.
- Comfortable HPDs shall be made available for workers.
- Management shall ensure that workers know how to use / care for HPDs (e.g. headbands go over the head not around the neck, compress foam ear plugs well before insertion).
- Damaged, hard or worn ear muff seals shall be in constant replacement.
- It shall be ensured that Managers and Foremen set good examples.

❖ **During Operation Phase**

During operation Management shall ensure that:

- Workers know when/why for HPDs; warning signs shall be fitted on noisy machines.
- Comfortable HPDs are made available as these are likely to be worn by workers.
- Workers know how to use / care for HPDs (e.g. headbands go over the head not around the neck, compress foam ear plugs well before insertion).
- Damaged, hard or worn muff seals are in constant replacement.
- There will be regular maintenance of machines for them to be quieter.
- Machinery covers and panels are always closed and well fitted while bolt/fasteners shall be done up tightly to avoid rattles.

3.8 Vegetation

The main block of the Nigerian forest formation at low and medium altitude along this route is Lowland Rainforest. The human population densities and their activities along the road have greatly transformed the complex structure and species richness of this route. Plant cover in the study area consisted predominantly of farmlands, fallow lands at various stages of regeneration and degraded remnant lowland tropical moist forests (freshwater swamp and dry-land rainforests).

Plate 3.6a, b and c: capture the vegetation forms encountered along the proposed road

The bush re-growth vegetation includes fallow of less than five years of age. The rotational bush fallow systems of cultivation accounts for much of the structural and floristic variations as well as the micro pattern of the present cover along the route. Elaeis guineensis (oil palm) forms an upper stratum with isolated crowns in most of the encountered fallow lands while a great variety of species with relatively small crowns generally in lateral contact with each other such as Albizia zygia, Alstonia boonei, Anthocleista vogelli, Mangifera indica, Myrianthus arboreus, Azadiractha indica, Bambusa vulgaris, Alchornea spp, Blighia sapida, Newbouldia laevis, Ricinus communis, Tithonia diversifolia, Tremia orientalis, and Cnetis ferruginea form the middle stratum. Herbaceous species such as Panicum maximum, Aspilia africana, Urena lobata, Axonopus compresus, Sida acuta, Andropogon gayanus. Imperata cylindrica and Chromolaena odorata form the ground layer. Climbers, epiphytes, saprophytes and parasite are also found along this route. The epiphytic components include a large number of lower cryptograms and ferns and flowering epiphytes were conspicuous. The tree density is is generally low as a result of human influence.

Fallow land vegetation of the following distinct physiognomy was encountered at the study site:

- Fallow land vegetation with Tremia orientalis as the dominant woody species and Chromolaena odorata as the dominantnt shrubby/herbaceous species.

- Fallow land vegetation with Musanga cecrepoides as the dominantnt woody species and Chromolaena odorata as the dominant shrubby/herbaceous species
- Fallow land vegetation dominated by Cassia siamea (woody species and Chromolaena odorata (shrubby/herbaceous species)
- Fallow land vegetation with woody species such as Cassia siamea, Cola gigantea,Mangifera indica,Elaeis guineensis and shrubs such Jatropha species,Ricinus communis,Chromolaena odorata and Solanum torvum guineensis,Newbouldia laevis Trema orientalis and Spondias mombim,
- Fallow land vegetation with woody species such as Alstonia boonei,Alchornea cordifolia,Gliricidia sepium, Anthoclestia vogelli,shrubs such as Chromolaena odorata and grasses as ground layer such as Andropogon spp, Panicum maximum
- Fallow land vegetation of fresh water swamp dominated by Alchornea cordifolia and Elaeis guineensis.
- Fallow land vegetation of grasses and Chromolaena odorata with evidence of annual burning.
- Fallow land vegetation dominated by Tithonia diversifolia

Plate 3.7: Fallow / Bush Regrowth Vegetation Stand

3.9 Agriculture

The major cultivated crops in the areas include cassava (*Mannihot esculenta),* Yams (*Dioscorea sp),* Pumpkin (*Telfainia occidentalis*), banana and plantain (Musa sp). Tree species, which offer non-timber forest products (barks, fruits, roots etc) that play roles in traditional medicine and nutrition, abound in the areas and include *Raphia hookeri* (wine palm), *Alstonia booneii* (Stool wood), *Harungana madagascariensis* (Blood tree), and *Musanga cercropioides* (Umbrella trees). Checklist of crops encountered along the rehabilitation road are presented in Table 3.8

The study area has a diversity of plants that are of economic importance, including their uses as fuel, timber, dyes, vegetable, edible fruits and seed trees, medicinal and religious plants and sponge. A checklist of the common economic plants within the study area is presented in Table 3.9

Table 3.8: Checklist of Crops Plants in Farms Encountered along the Proposed Road

S/N	Scientific Name	Family/Sub family	Common Name	Uses/Economic Importance
1	*Zea mays*	Poaceae	Maize/Corn	Grains
2	*Manihot esculenta*	Euphoriace	Cassava	Root tuber
3	*Arachis hypogea*	Fabaceae (papilionaceae)	Groundnut	Peanuts
4	*Dioscorea rotundata*	Dioscoreaceae	White yam	Stem tuber
5	*Dioscorea alata*	Discoreaceae	Water yam	Stem tuber
6	*Vigna unguiculata*	Fabaceae	Cowpea	Grain legume
7	*Dioscorea trifoliate*	Dioscoreaceae	Yellow yam	Stem tuber
8	*Capsicum Annum*	Solanaceae	Pepper	Spice
9	*Lycopersicon esculentum*	Solanaceae	Tomato	Fruit vegetable
10	*Corchorus olitorus*	Malvaceae	Yoruba: Ewedu	Leafy vegetable edible fruits
11	*Hibiscus Esculentus*	Malvaceae	Okra	Edible fruit
12	*Oryza sativa*	Poaceae	Rice	Grains
13	*Citrulus lanatus*	Cucurbitaceae	Melon	Seeds for soup
14	*Saccharum officinarum*	Poaceae	Sugar cane	Edible stem/sugar

Source: Field work January, 2020

Table 3.9: Checklist of Common Economic Plant Species along the route

Economic Plant Species	Common Name	Use(s)
Mangifera indica	Mango	Edible fruit
Alchornea spp	Christinas bush	Medicinal
Raphia hookeri	Rafia	Wine
Elaeis guineensis	Oil palm	Palm oil / wine brown
Alstonia boonei	Alstonia	Medicinal / timber
Manihot esculenta	Cassava	Food product
Oryza sativa	Rice	Food prodcts
Musa spp	Banana	Food product
Xanthosoma mafaffa	Cocoyam	Food products
Abelmoschus esculentus	Okro	Food products
Zea mays	Maize	Food product
Rauvolfia vomitoria	Medicinal	
Chromolaena odorata	Awolowo/Akintola	Medicinal
Ananas spp	Pineapple	Food product
Piliostigma thonningii	Thonning's piliostigm	Dye yielding, Religions purposes
Daniellia oliveri	African copaiba balsam	Timber, fuel wood
Vitex doniana	Black plum Yoruba: orinla	Fuel wood, Edible fruits
Anacardium occidentalis	Cashew	Edible fruit, Medicinal
Mangifera indica	Mango	Edible fruit, Medicinal
Tectonia grandis	Teak	Used as poles for high/low tension electric lines
Citrus aurantium	Orange	Edible fruit

Source: Field work January, 2020

3.10 Terrestrial Fauna and Wildlife

A check list wildlife species were encountered, based on ground surveys and participatory rural appraisal interviews is shown in Table 3.11. Of the species of vertebrate wildlife identified, the avifauna and mammals were the dominant groups. The mammals, reportedly sighted or reported to occur in the area were mainly browsers or grazers including medium-sized mammals such as duikers and antelopes. Others include some primates (*Cercopithecus Erthropgaster*) and rodents (small mammals) like *Thryonomys swinderianus* (cutting grass), *Xerus erythropus* (ground squirrel) and *Cricetomys gambianus* (Gambia pouched rat). At Ofin village, the farmer interviewed confirmed the presence of the primates (*Papio anubis*, *Erythrocebus patas*, and *Goilla gorilla*) as well as those of the Reed buck (*Redunca redunca*) and the Civet cat (*Cirettictis civetta*) was also confirmed by famers in the forest reserve area.

The observed mammalian taxonomic diversity was however low for this environment indicating a disturbed ecosystem, due to farming activities and annual bush burning.

Amphibians and reptiles include frogs, toads, lizards, and snakes (cobra and vipers). Toads are represented by the genus *Bufo* while the frogs were mainly *Rana* spp. The reptiles are represented by snakes (Cobra, viper, and African python); lizards (*Hemidactylus brooki*, Brook's gecko; *Chameleo senegalensis*, African chameleon; and *Agama agama*, the rainbow lizard). Four (4) reptilian species which were not sighted during the rainy period were sighted during the dry season. These are the rainbow lizard, the monitor lizard (*Varanus niloticus*), the black cobra (*Naja nigricollis*) and the West African Green tree mamba (*Dendroaspis viridis*).

A number of species sighted in the rainy season but not during the dry season include the mouse-brown sun bird (*Anthreptes gabonicus*) (which is known to be dependent on nectars of flowers) and Black and White-tailed hornbill (*Tockus fasciatus*). The Senegal Indigo Finch (*Vindua calybeata*) and the Yellow Fronted Canary (*Serinus mozambicus*) sighted during the rainy season were also absent during the dry season. Black hawks were sighted along the water banks.

In general, low densities and sparse distribution of wildlife were observed in the project area, apparently due to the exposure of the study area has anthropogenic impacts such as clearance for agriculture, annual bush burning and hunting (including the setting of traps). Literature review and information gap analysis also revealed a dearth of information on the wildlife of the project area, resulting in an unclear picture of wildlife diversity, abundance and distribution. Most of the wildlife data would, therefore, be classified as not evaluated' or "data deficient" based on IUCN (1994) guidelines. This implies that data is insufficient to assign conservation status to these wildlife data. Under these circumstances, the IUCN (1994) recommends that such organisms should be given the same degree of protection as threatened taxa, at least until their status can be evaluated. Other than the small mammals whose conservation status may be considered as satisfactory (survival not threatened), most vertebrate wildlife would be considered as rare (and therefore vulnerable). Some of the mammalian (*Athercunus africanus* and *Tragelephus spekei*), avifauna (Family Arceidae) and reptilian (Pyton (*Morelia spilotata*) and Crocodyius) species identified are threatened or endangered and international trade is either prohibited or requiring licenses (NEST, 1991).

Table 3.10 : List of Wildlife Species sighted or reported around the project area

Common Name	Biological Name	Detection method (DS/IH)	Decrees 11/1985	National Resources Conservation Council, 1992
MAMMALIAN				
White throatedGuenon	*Cercopithecus Erthropgaster*	IH		**Vulnerable**
Common Rats	*Rattus rattus*	10		
House Mouse	*Mus musculus*	5		
Gambia pouched rat	*Cricetomys gambianus*	10		
African Palm Squirrel	*Epixerus ebii*	8	Schedule 1	Endangered
Ground Squirrel	*Xenus erythropus*	IH		
Grass Cutters	*Thryonomys swinderianus*	IH		
African Civet	*Civettictis civetta*	IH		**Threatened**
Small Deer		IH		
Antelope	*Neotragus batesi*			
Bushbuck	*Tragelaphus scriplus*	IH		
Maxwell's Duiker	*Cephalopus maxwelli*	IH		**Vulnerable**
Porcupine	*Atherunus africanus*	IH	Schedule 1	
Nigerian musk shrew	*Crocidura nigenriae*	IH		
REPTILIA				
African Pyton	*Morelia spilotata*	IH		
Black Cobra	*Naja melanoleuca*	IH	**Schedule 1**	
Viper	*Echis caminatus*	IH		
Black Tree Snake	*Thrasops occidentalis*	IH		
Snake	*Dendroaspis viridis*	IH		
Snake	*Atheris chloraechis*	IH		
Common Lizards	*Agamma agamma*	15		
Monitor Lizard	*Veranus niloticus*	20		
AMPHIBIAN				
Frogs	*Dicoglossus sp*	5		
Long-Legged Frog	*Ptychodena sp*	4		
Toads	*Bufo regularis*	5		
Crabs		2		
African chameleon	*Chameleo senegalensis,*	2		
AVIES				
Black Kites	*Milvus nigrans*	8		
Chicken Hawk	*Accipter erythropus*	5		
Cattle Egret	*Ardeola ibis*	25		
White Egret	*Egretta alba*	IH	Schedule 2	
Common Vultures	*Necrosyrtes monarchus*	15		
Sparrows	Sparrows	IH		
Eagle	Eagle	IH		
Pin-Tailed Whydah	*Vidua macroura*	IH		
Pied Crow	*Corvus albus*	IH		
Wood Pecker	*Dendropicos pyrrhogaster*	IH		
Bronze Manikin	*Lonchura cucullatus*	IH		
Weaver Bird	*Plesiositagra cucullatus*	20		
White-Crested hornbill	*Tropicranus albocristatus* Cassin	IH		
Guinea fowl	*Guttera pulcherani*	15		
Nectar Bird	*Anthreptes collaris* Vieil.	IH		

Source: Field work January, 2020

Note: Schedule 1 Animals in relation to which international trade is absolutely prohibited
Schedule 2 Animals in relation to which international trade may only be conducted under license
DS Direct sighting
IH Interview with Hunters, communities or literature search

3.11 Wastes Management

The waste stream encountered in the project area comprises both bio-degradable and non-bio-degradable products. The biodegradable wastes include domestic wastes, vegetable matter, food remnants and other assorted organic materials. Waste is also generated by craftsmen engaged in various trades. The non-bio-degradable wastes include plastics, glasses, scraps from past sand mining, scraps of vehicle involved in accidents on New Ado-Iyin Ekiti expressway. Wastes are disposed of generally by free litter. Dry refuse is burnt and the residue used as much on plants around homesteads.

3.12 S*ocio-Economic Environment*

3.12.1 Land Use

The land use pattern in the project environment is predominantly urban in section I (Fajuyi Bus stop Chainage 0+000 to NTA Road Junction (2+150). Section I is highly dominated by heavy concentration of residential, educational, commercial (such as shops and market and petrol stations, banks and public/institutional, at both sides of the road.

Plate 3.8: A section of Bank road with built up areas on both sides of the road.

Also, section II have high concentration of residential, commercial and public/institutional (from chainage 2+150, NTA Road Junction/ Ekiti State Pavilion to chainage 3+750.

Plate 3.9: New Central bank building along the project area

Section III of the project area is dominated by rural settlements. Being a new area, pockets of residential development are found scattered and along the proposed alignment. There are also small subsistence farmlands along this section of the project. Individuals who mainly grow food crops and vegetables for personal use own these farms.

3.12.2 Socio Economic attributes of the study area

Socioeconomic data was collected in three locations along the study area. The affected communities are Ado Ekiti, Iyin Ekiti and Ofin village. The distribution indicates that most of the PAPs are in Ado Ekiti and Iyin Ekiti. There were many Project Affected People (PAP) in Ado Ekiti because of its size and population (Ado Ekiti is the Capital of Ekiti State and a magnet to people from all parts of the state, including roadside artisans and traders). However , Ado Ekiti has the largest number of PAPs due to having lots of structures too

close to the highway (the encroachments include permanent physical structures and makeshift shops.

Gender of PAPs

Most of the PAPs are females, 44% are males while the remaining 56% are females. Most of the PAPs are roadside traders. These are areas where women are mainly engaged to earn a living, hence their preponderance among the PAPs.

Age Distribution

The disaggregation of the PAPs by age shows that they are between age range of 17 and 90 years. When grouped (in ten-year intervals), the majority of the PAPs are between ages 21 and 50 (83%). A third of the PAPs are between 21 – 30 years, and about a quarter each are between ages 31 – 40 (25%) and 41 – 50 (27%) respectively. Thus, the data suggests that most of those to be affected by the project are people in their primes who are making a livelihood from the roadsides.

Marital status

The data also show in figure 3.8 that three-quarters (75%) of the PAPs interviewed are married, 12% are unmarried, 10% are widowed and 3% are divorced. This indicates that most of the PAPs are either currently married or were in a marital union; these people are likely to have families that depend on them for livelihood and hence any displacement will not only have a direct effect on the PAPs but also on their likely dependants.

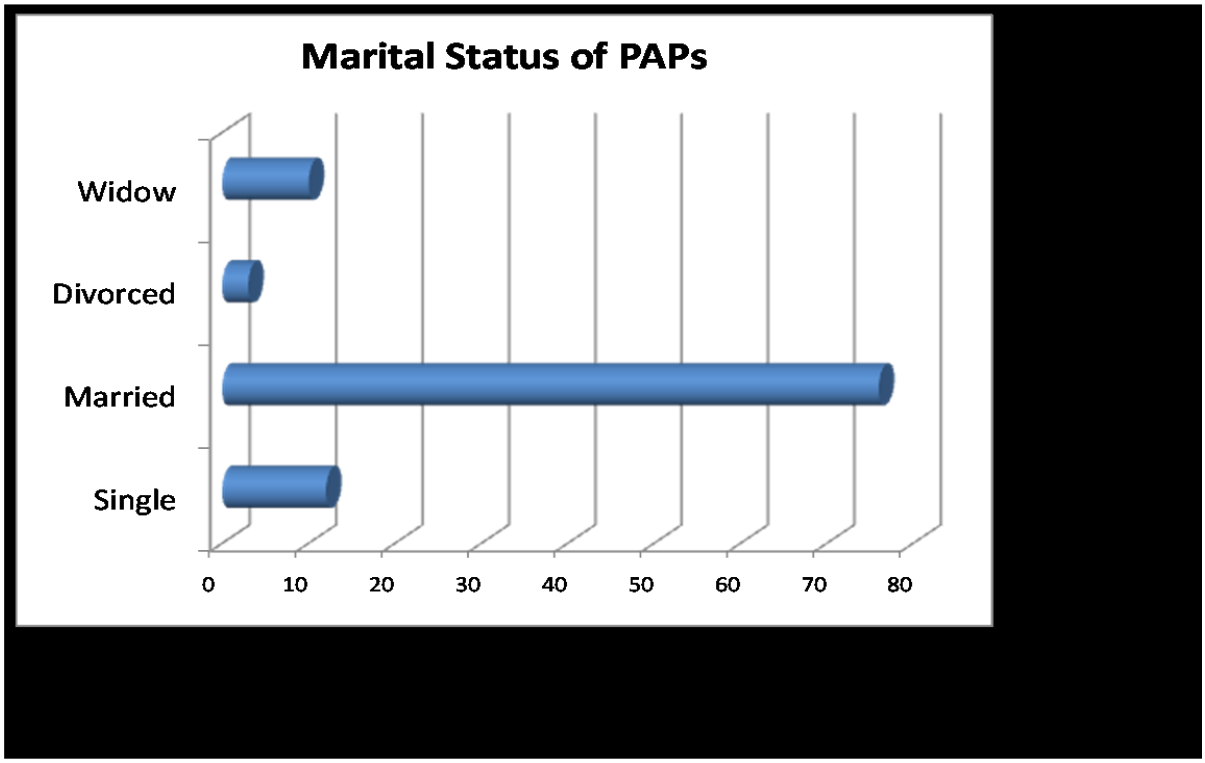

Figure 3.8: Marital status

Education

Examining the education level of the PAPs, from figure 3.9 shows that about 40% either did not go to school at all or attended only primary school. 38% attended secondary school while 15% had tertiary education. The literacy level is generally high, with 85% having at least primary education.

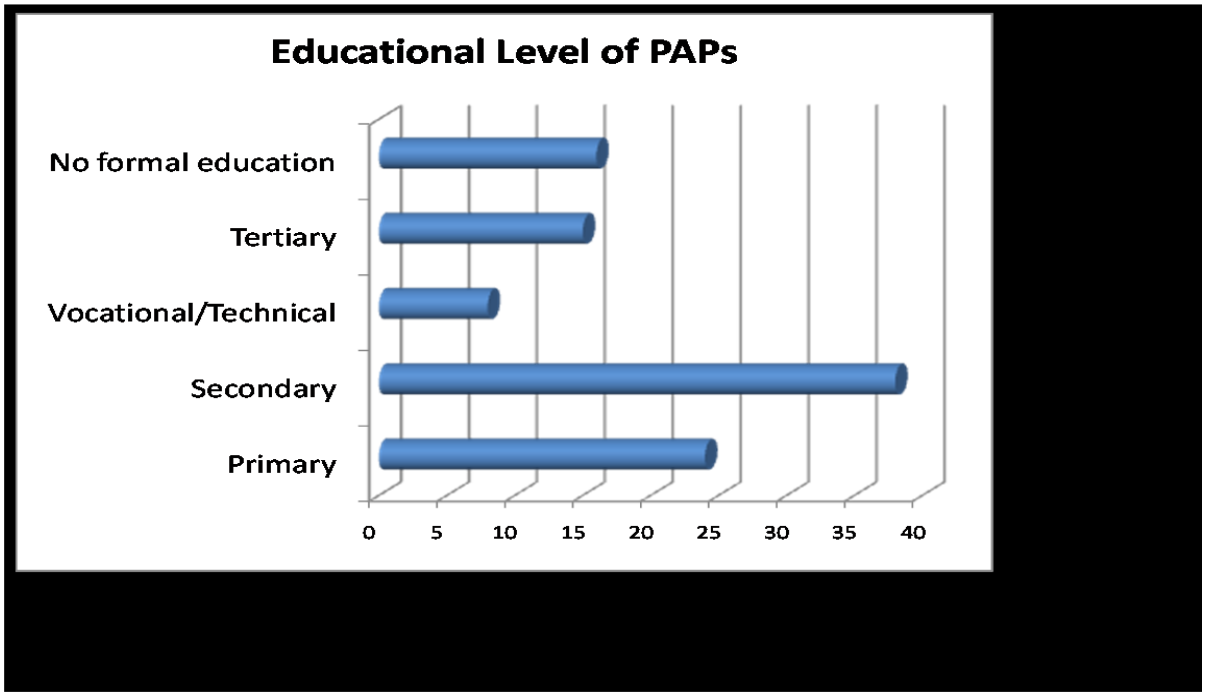

Figure 3.9: Education

Occupation

The occupational distribution of the PAPs shows in figure 3.9 that they are predominantly roadside traders (77%). A further 14% claim to be business contractors. The others are mainly artisans. This is not surprising giving the educational qualifications and the locations where they earn their livelihood (by the roadside). This suggests that they are mostly struggling to make a livelihood from the mostly petty trading they engage in by the sides of the New Ado – Iyin Ekiti highway. The skills reported by the respondents further underscores the educational and occupational data described earlier. About 9 in 10 of the interviewed PAPs were unskilled workers (92%) while the remaining 8% comprises mainly of technicians and transporters.

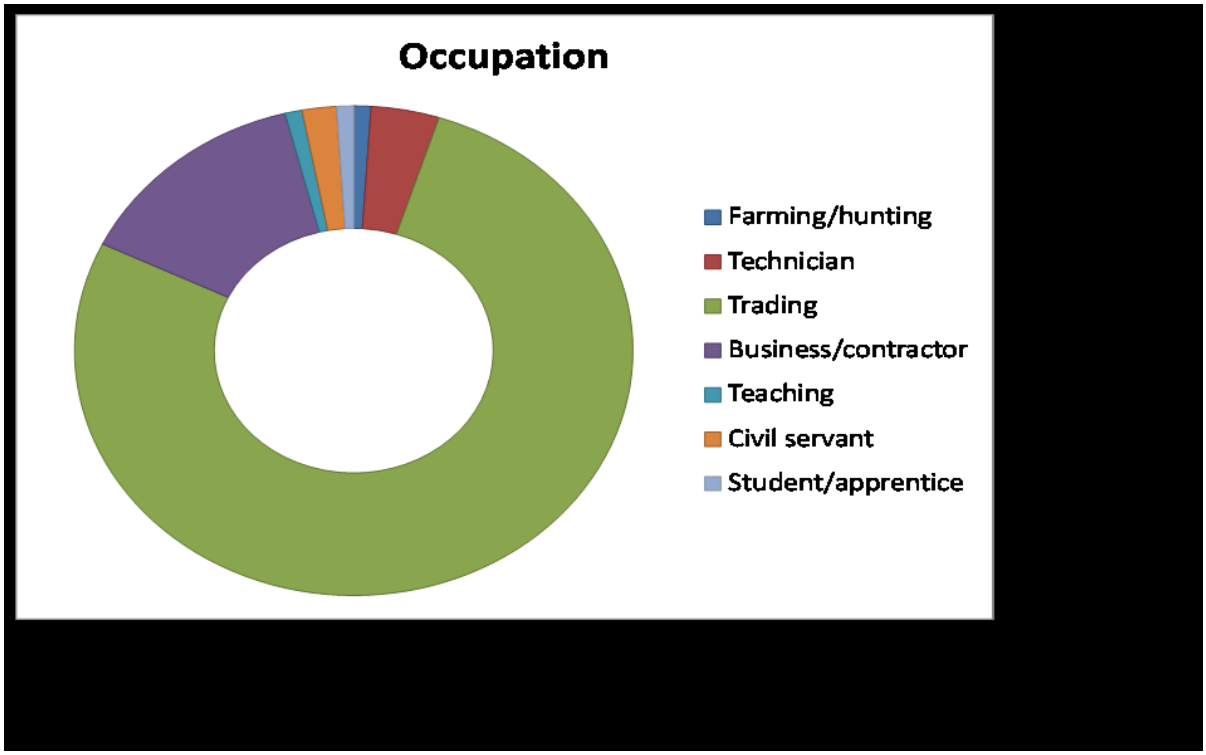

Figure 3.10: Primary Occupation

Annual Income

The income distribution of the affected persons show that majority of them (83%) earn incomes in excess of ₦80,000 per annum. Only a few earn less than ₦70,000 per annum among the affected persons.

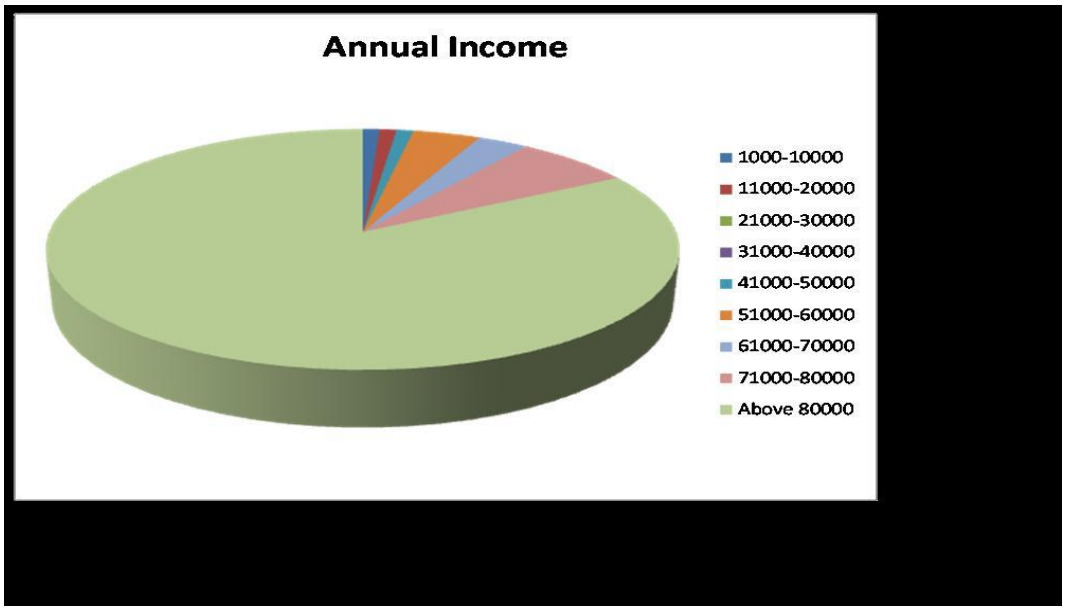

Figure 3.11: Annual Income

Length of Stay in the Community

The findings show that majority (32%) of the affected persons have stayed in the communities for less than six years while about a fifth (21%) have been living in the communities either since birth or for at least twenty years. About 47% of the affected persons have lived in the communities where they were interviewed for between 6 years and 20 years.

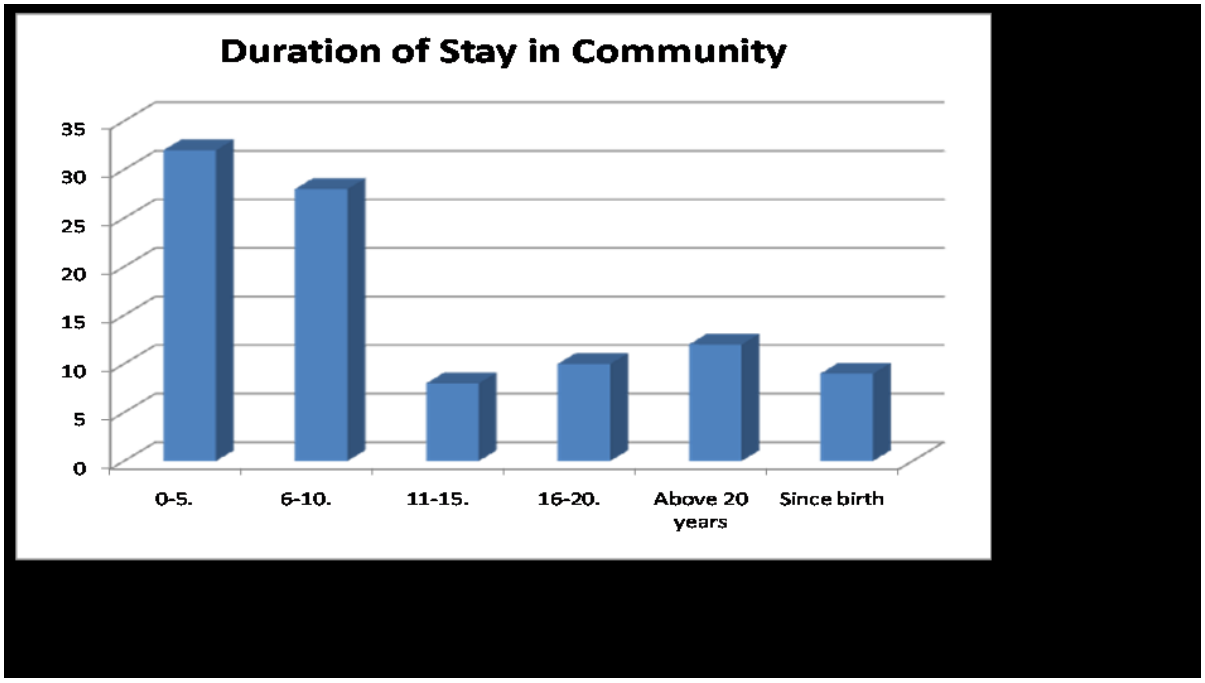

Figure 3.12: Length of stay in the Community

Attitude towards the road project

The findings also show that almost all the affected persons are favourably disposed to the project. About 8% are opposed to the project while the remaining 92% have no opposition to the project; 87% outrightly supports the project.

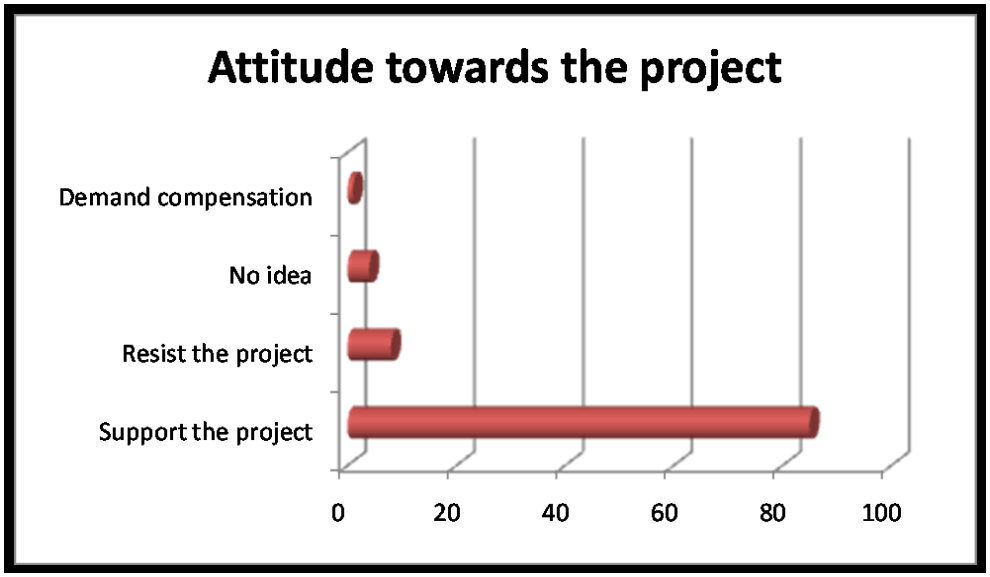

Figure 3.13: Attitude towards the Road

Expected benefits from the project

On the benefits that the affected persons expect should accrue from the project, most expects that the project will impact positively on the communities in terms of employment and economic opportunities and infrastructural developments.

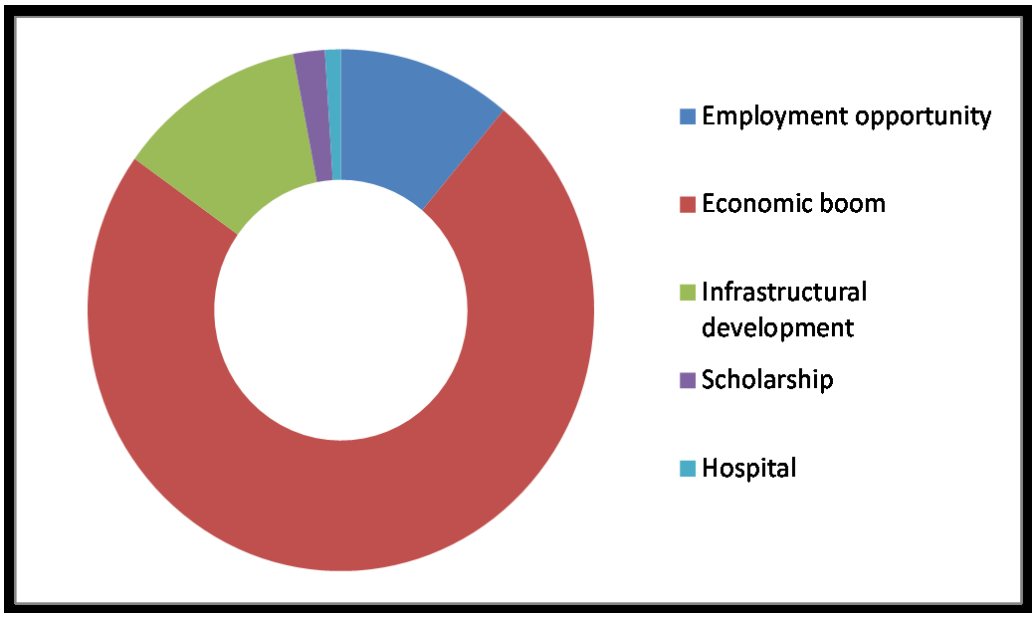

Figure 3.14: Expected benefits from the project

3.13 Community Health Status

Common health facilities in the project area include Chemist Stores, hospitals, and clinics, (private and/or government owned). Chemist or patent store is the most common and the most used health facility in the rural communities. Self medication is practiced in at least 7 out of 10 households. In the urban sites, hospitals and clinics were reported as the popularly used health facilities. Other alternative local health resources are Traditional Birth Attendants (TBA) and Herbalists. The common ailments reported are malaria, typhoid fever, coughs, and water borne diseases e.g. diarrhea, cholera and guinea worm.

3.13.1 Knowledge, Attitude and Practice Regarding Sexually Transmitted Infections

About 56% of the respondents have heard of sexually transmitted infections (STIs) but only 11% reported that they can describe symptoms of STIs in women and while none reported being able to describe symptoms of STIs in men. Also, about 41% of the respondents have heard of HIV/AIDS though only about 3% knows of a person who is infected or have died of HIV/AIDS. The symptoms of STIs described for women include burning pains on urination, genital ulcers/sores, itching, abdominal pains and genital discharge.

3.14 Consultation with Key Stakeholders

Early and effective community engagement engenders the success of risks and impacts identification and management. It is therefore our wish to effect the International Finance Corporation (IFC) process of "free Prior and informed consultation with Affected Communities" at the various stages of activities. During the study, meetings and consultations were held with community leaders and different groups.

- Consultation process and outcome are important and seen as early and mandatory exercise as the best strategy to overcome the problems that may arise during project execution and as a means to achieve the overall scope of the activities of the project. This is in line with the definition of World Bank which defined Consultation as "the soliciting of people's views on a proposed action and engaging them in a dialogue". It is pertinent as a process of informing the community of the need for citing a project in their domain, the scope and the need for the community to own and safeguard the project as beneficiaries and stakeholders. It also affords an opportunity for input and feedback information,

aimed at strengthening the development project and avoiding negative impacts or mitigating them, where they cannot be avoided.

Based on these, the public consultation which started with the reconnaissance level-survey was done at two levels, viz community level and project affected person's level.

3.14.1 Community Consultations

Field activities that took place offered the opportunity to interact with host communities along New Ado-Iyin Ekiti road. The consultation took place across the corridor in order to sample the opinion of the people on the project and their expectations from the proponent. During the subsequent field work that commenced on December 17, 2019, consultative meetings through Landlord's Associations, In-depth Interviews and questionnaire survey were conducted at various times by the Socio-Economic Team and leaders with different social groups and youth leaders of each community. At the meetings, the socio-economic benefits and environmental implications of the proposed project, and the need for and objectives of an environmental impact assessment were explained.

Plate 3.10: Ofin Village Youth Forum Meeting

Plate 3.11: Awedele area of Ado Ekiti Consultation Meeting

Plate 3.12: Iyin Ekiti Consultation Meeting

The socio-economic aspect of the studies involved field interviews and consultation with the host communities, the leaders, and other community representatives. The community leaders interviewed included the chiefs of the different towns and villages. Issues of concern raised by the communities during the meetings and interviews are as summarized below.

3.14.2 Issues and Concerns

Opinions gathered through interaction with stakeholders along the proposed rehabilitation road indicate that the people are well disposed to the project. However, issues and concerns were expressed by them. Some of the issues raised and the way they were addressed at the meetings are highlighted in Table 3.11.

Table 3.11: Summary of the outcome of the Consultation

S/N	Issues Raised	Recommended Action
1	That government should inform PAPs on time when the road project operation will take place to enable them remove their belongings	That a workable time line be given to PAPs for early evacuation of belongings
2	That the project authority should ensure that compensation benefits reach the actual PAPs	That the resettlement committee should ensure transparency in dispensing compensation benefits
3	That practical alternative in the form of by-pass be constructed where feasible to enable the people's movement during project operation phase	That contractor should show professional standards and social responsibility during road rehabilitation by providing temporary access way so that communities and commuters are not hindered from going about their normal businesses That contractor should put in place appropriate safeguard measures and signal words to prevent public intrusion into construction work areas
4	That government should engage their youths in employment even as casual labourers in the proposed road construction	Consultant/SMWT is happy to have everyone's support as the project is for the common good of everyone especially those that transverse the corridor.

In general, interactions with the communities were positive and there was widespread appreciation of the consultation process undertaken. In terms of proposed road construction project, the communities were of the view that it would afford considerable potential for

providing significant socio-economic benefits and community assistance projects. However, their priority was to ensure that compensations are paid.

3.15 INSTITUTIONAL ARRANGEMENT

One of the basic elements of any Environmental Impact Assessment (EIA) implementation and management is the appropriate institutional framework that will ensure the timely establishment and functioning of the team or agency mandated to implement the plan.

The major institutions that are involved in the EIA are the Federal Ministry of Environment, Federal Ministry of Works, the World Bank, Federal Ministry of Transportation, State Ministry of Environment, State Waste Management Authority, Environmental NGOs, State Ministry of Works and Transport, Federal Road Safety and Local Government Area in each project designated area. Their functions could also be complimentary or over lapping.

The roles and responsibilities of the institutions regarding Environmental and Social Impact Assessment Implementation are below;

Ministry of Transport (Federal and State)

The Ministry formulates policies and other agencies. It also sees to the implementation of policy decisions and coordinates various transport law and policies. Statutorily, the Ministry is mandated to: provide road infrastructures, enforce traffic regulations, carry out public education and enlightenment. Specifically, the Ministry shall ensure that affected people are compensated in areas that will not impede traffic and also with the NURTW.

Federal Ministry of Environment

Federal Ministry of Environment is the supreme reference authority in environmental matters in Nigeria although state and local government authorities and institutions including their environmental departments are still expected to play their traditional role of monitoring and enforcing standards as well as fixing penalties charges, taxes and incentives to achieve certain environmental goals. The agency was also empowered to initiate specific programmes of environmental protection and may establish monitoring stations or networks to locate sources of and dangers associated with pollution. Furthermore, it had powers to conduct public investigations or enquiries into aspects of pollution (Federal Government of Nigeria, 1988). The Ministry shall work directly with SMWT.

State Ministry of Environment

The Ministry is responsible for the overall environmental policy of the State. Pursuant to the fulfillment of its responsibilities, the government enacted the Environmental Sanitation law 2009. The law provides for Environmental sanitation in the state and establishment of environmental sanitation Corps. It imposes responsibility on all facets of environmental media, and prohibition of certain acts and conducts. The Ministry shall work directly with EKSEPA and SMWT.

Federal Road Safety Commission (FRSC)

Federal Road Safety Commission has the power to regulate, control and manage traffic and other related matters. Parts of the functions of the commission include:

- Conducting high visible day and night traffic patrols to enforce traffic rule and regulations and clear the highways of obstruction;
- Reducing the incidence and severity of road traffic accidents
- Safeguarding highways from encroachment from the activities (market, trading e.t.c.)
- Safeguarding motor vehicles and motor cyclists

The Ministry shall mandate FRSC to enforce traffic regulations on the road during construction and operation phases of the project. FRSC shall report directly to SMWT.

Local Government Areas and Environmental NGO

These are part of stakeholders for the implementation of EIA. The EIA work shall be carried out in close cooperation with Local Government Area (LGA) and Environmental NGO. Relevant NGOs and affected LGAs shall be consulted and the outcome of consultation shall be forwarded to SMENV SWMT.

State Waste Management Authority

The affected State Waste Management Authority shall coordinate the waste management of the project activities especially, construction phase. The Authority shall report to SWMT through Ministry of Environment.

CHAPTER FOUR

ASSOCIATED AND POTENTIAL ENVIRONMENTAL IMPACTS

4.1 IMPACT PREDICTION METHODOLOGY

To be of most benefit, it is essential that an environmental assessment is carried out to identify significant impacts early in the project cycle so that recommendations can be built into the design. The first stage in the identification of impacts is to establish the scope of the investigations needed for each of the environmental components. This was carried out using a combination of desk study, consultation with stakeholders and field survey to characterize the ambient environment. Then, the potential impacts were assessed and mitigation measures identified. The significance of the environmental impacts of the project was also established. The objectives of this chapter are to:

- Identify potential environmental and social impacts of the proposed project activities, both negative and positive;
- Empirically predict the likelihood and magnitude of such impacts and evaluate the significance of changes likely to result from them; and
- Proffer appropriate impact mitigation and/or control measures.

Methods for the assessment of environmental impacts range from simple checklists and qualitative impact matrices to much more complex computer-based approaches using, for example, simulation modeling and optimization, geographical information systems (GIS), or expert systems techniques. The methods of assessment also ought to include some of the more important aspects, such as legal, procedural and institutional components, that may differ widely from country to country and from project to project. The following five major approaches are considered for this study:

(i) Leopold matrix (Leopold et al., 1971)

(ii) Peterson Matrix (Peterson et al., 1974)

(iii) Overlays (McHarg, 1968); and

(iv) Battelie Environmental Evaluation System (Dee et al., 1972).

(v) Rau'Ad Hoc method' (Rau 1990)

All of these methods employ the following steps:

- Identification of impacts

- Prediction of impacts
- Evaluation and interpretation of impacts
- Communication
- Inspection procedure

For this project, the associated and potential impacts of the project activities were predicted using a combination of the Peterson Interaction Model (Peterson 1974) which relates project activities with environment components and the Rau'Ad Hoc method (Rau 1990). This methodology is expected to indicate whether the impact is beneficial or adverse, whether it has temporal or spatial dimension, cumulative, spontaneous, and primary or secondary. (Table 4.2).

The Leopold Matrix, (Leopold, et al. 1971), another assessment method, was used to identify cause-effect relationships between specific project actions in the environment and potential environmental impacts. The checklist presented in Table 4.1 shows a comprehensive list of environmental effects and impact indicators that helped to review possible consequences of contemplated actions. The method provides a semi-quantitative insight into the potential impacts, specified as an expert opinion value for Impact Magnitude and one for Impact Significance. Magnitude represents the extent and duration of interaction between the activity and the environment. Significance which represents the severity of impact and the importance of the environmental component is related to the rate by which legislative environmental standards are exceeded. A significant impact is considered to be an impact that should be taken into account during the decision-making process.

(i) *The Leopold Matrix*

The Leopold Matrix is a comprehensive checklist designed for the identification, evaluation, assessment and analysis of environmental impacts on the Development project following the interaction matrix analysis approach by Leopold. The Leopold Matrix developed for the road construction/rehabilitation project is provided as Table 4.3. The checklist interaction matrix for environmental impact assessment was obtained by placing identified existing environmental components in the columns and the proposed project activities in the rows of the matrix. The number on the left hand side of the diagonal, in a cell, represents the magnitude of identified impact, while

that on the right hand side, and represents the importance or significance of the impact. A plus (+) sign indicates a positive or beneficial impact while the minus (-) sign is used to express negative or adverse impact. The process is summarized as follow:

The Leopold Matrix Table

Columns represent identified existing environmental components

Rows, proposed project activities

Cells – x/y

where x = magnitude of identified impact, and y = importance or significance of impact.

(+) sign = positive or beneficial impact

(-) sign = negative or adverse impact.

An attribute description package is complied and by means of "value functions", measured environmental parameters such as pollutant concentrations are translated into environmental quality rating of high quality, moderate and poor quality with numerical ratings of (0 -1.9), (2.0 - 5.9) and (6.0 - 10.0), respectively:

The magnitude (severity of impacts) is scaled as follows:

1 - 2 - negligible

3 - 4 - mild

5 - 6 - moderate

7 - 10 - severe

The degree of importance or probability of identified impacts:

1 - 2 - negligible

3 - 4 - low

5 - 6 - medium

7 - 10 - high.

The criteria applied to the screening of various activities are:

(i) Magnitude - probable level of severity.

(ii) Prevalence - likely extent of the impact.

(iii) Duration and frequency - likely duration - long-term, short-term or intermittent.

(iv) Risks - probability of serious impacts.

(v) Importance - value attached to the undisturbed project environment.

Example of impact indicator value derivation:

If baseline noise level is 40dBA and project activity is predicted to result in incremental impact of 10dBA then resultant noise level = 50dBA

Since resultant environmental noise level of 50dBA<55dBA, the environmental quality is rated as high with indicator value of 0-1.9.

If the incremental impact raises the environmental noise level to between 55dBA and 60 dBA then impact indicator value will be 2-6.

If the incremental impact raises the environmental noise level to > 60dBA then impact indicator value will be 7-10.

Total Impact Score = sum of {(x) *x* (y)} for each environmental component and for each project activity. Thus the far right column in Table = total impact on environmental component. While the lowest row = total impact caused by each project activity.

Procedure

A panel of experts from Envikare Associates in association with Rejov Resources Ltd and MOA Planners LtD in association with Rejov Resources Ltd (see list of Consultants) independently ranked the impacts of each project activity on selected environmental indicator, on a 1 - 10 scale.

Independent scores were then statistically analyzed and the results of the scores judged as follows:

if variance, s2 < 5% of the mean, subjectivity was minimal and the score was good; if s2 > 5% but < 10% of the mean, the score was fair, then scorers were given the opportunity to review their scores. This process was repeated and the parameters with high levels of scores (5 and above) were then considered for detailed impact assessment and mitigation.

TABLE 4.1: IMPACT INDICATORS FOR VARIOUS ENVIRONMENTAL COMPONENTS

Environmental Components	Impact Indicators
Climate	Humidity, temperature, rainfall, wind speed and direction
Air Quality	Particulates, NOx, SOx, CO2, CO, Oil and grease
Water Quality	Solids (DS, SS), turbidity, toxicity, eutrophication, contamination, microbiology, E. coli
Hydrology	Drainage, discharge, hydrologic balance, sedimentation, erosion.
Hydrogeology	Ground water level, quality & availability
Soil/Landuse	Erosion, fertility, subsidence, farming, hunting, recreation
Ecology	Diversity, distribution & abundance of Aquatic & Terrestrial Flora & Fauna.
Fisheries	Productivity, diversity & abundance.
Archaeology	Cultural relics, shrines & taboos.
Noise & Vibration	Day-time disturbance, hearing loss, communication impairment, annoyance
Socio-economic	Population, income, settlement pattern, health, safety and security.
Wildlife & Forestry	Abundance, diversity of species, numbers of unique, rare or endangered species.

(ii) *Peterson Matrix*

Peterson Matrix is a modification of Leopold Matrix which relies directly on the multiplication properties of matrices. Also, the individual impacts are subjectively evaluated on an ordinal scale by a team of assessors, and separate matrix layers are produced for physical and human impacts. The matrices are also multiplied to find the effect of the casual elements on human environment while the resulting product is weighed according to the significance of the human impact. The 'weighted' impacts are finally aggregated to produce a single overall impact score.

(iii) *The Rau'Ad Hoc method*

The Rau method provides guidance for total impact assessment while suggesting the broad nature of these possible impacts. Using this, it is possible to quickly judge the order of magnitude of effects or impacts as follows: No effect, Positive effect, Negative effect, Beneficial, Adverse, Problematic, Short-term, Long-term, Reversible and Irreversible. The total potential impact of the proposed project is assessed in Table 4.2 according to the *Rau'Ad Hoc method*.

(iv) Prime Potential Impacts

The results of total impact evaluation as presented in Table 4.2 indicate that both the construction and the operation phases of the development projects will contribute to the adverse impacts on the project environment unless proper mitigation measures are put in place. The nature of the impacts is however different in each of the phases and projects. The impacts resulting from operations would generally be long term, as indicated by the higher figures for impact magnitude. The prime contributors to the total impact are the air emissions and socioeconomic impact.

Table 4.2: THE ENVIRONMENTAL IMPACTS OF ROAD CONSTRUCTION AND OPERATIONS (FROM RAU'S (1990) METHOD)

Impacts	No Effect	Positive Effects	Negative Effects	Beneficial Effects	Adverse effects	Problematic	Short-Term	Long-Term	Reversible	Irreversible
Highway Construction/Rehabilitation										
Loss of agricultural land for road & excavation of filling materials			*		*	*		*		*
Air quality impairment from particulate (dust) & construction vehicle emission			*		*		*		*	
Increased noise level from clearing equipment & construction machinery			*				*		*	
Soil deterioration due to motor vehicle lead emission, erosion from desurfacing			*		*		*		*	
Impaired water quality from siltation, erosional discharge & construction camp domestic effluent			*		*		*		*	
Reduced Floral & faunal diversity from bush clearing and land-use			*		*		*		*	
Habitat change/reduced population of wildlife from noise			*		*				*	
Waste management of the materials used for construction and domestics			*		*		*		*	
Creation of burrow pit and earth movement may lead to traffic congestion			*		*		*		*	
Displacement of people and property			*		*	*		*	*	
Increased transport infrastructure, employment opportunity & revenue Diffusion of diseases like HIV and others		*		*				*		
Highway Operation										
Transportattion of hazardous materials results in explosions, fires, or spills			*		*	*	*		*	
Impaired air quality from motor vehicle emissions of & particulate (dust) emission			*		*			*	*	
Impaired hearing from noise from vehicle traffic			*		*			*	*	
Soil deterioration due to motor vehicle lead emission			*		*			*	*	
Increased health risk from vehicle emissions inhalation & traffic hazards			*		*			*		
Economic development employment opportunity & improved rural economy		*		*				*		
Land and community severance by road			*		*	*		*		*

76

TABLE 4.3: IMPACT EVALUATION MATRIX FOR THE NEW ADO-IYIN EKITI ROAD DEVELOPMENT PROJECT

Environmental Components	PHASE DEVELOPMENT ACTIVITIES												
	Site Preparation		Excavation		Construction				Operation & Maintenance				
	Bush clearing & destumping	Access road construction	Road Traffic	Emissions	Waste Disposal	Levelling/Compaction	Spoil Disposal	Oil spill/leakage	Emissions	Accidents	Hazardous Wastes	Weighting Factor	Total weighted Factor
1. CLIMATE												1	
Wind direction & speed	-1/0									-2/-1			-1
Temperature				-3/-2					-4/-2	-4/-2			-6
2. AIR QUALITY												2	
TSP	-1/-2	-3/-2	-1/-2			-3/-2			-3/-2				-10
NOx, SOx, CO	-3/-1	-3/0		-3/-4		-3/0			-4/-4	-4/-3			-12
HC	-2/-2	-3/-2				-3/-2			-3/-2				-8
3. WATER QUALITY												2	
Solids	-1/-2	-2/-2			-2/-1	-2/-1	-2/-2	-2/-1			-3/-2		-11
Turbidity	-1/-2	-2/-2				-2/-1	-2/-2	-2/-1			-2/-2		-10
Toxicity								-3/-1			-3/-2		-3
BOD/COD								-3/-1			-3/-2		-3
4. HYDROLOGY												2	
Drainage	-3/-2	-4/-2				-4/-2	-2/-2						-8
Hydrologic balance	-2/-2	-2/0				-2/0							-2
5. HYDROGEOLOGY												2	
Groundwater quality					-2/-1			-2/-2			-3/-2		-5
Groundwater level	-2/-2	-3/-2						-2/-2			-3/-2		-8
6. SOIL & LANDUSE												3	
Soil erosion	-4/-2	-4/-3				-4/-3							-8
Farming	-4/-2				-2/-2								-4
7. ECOLOGY												2	
Flora & Fauna diversity	-4/-2	-4/-3		-3/-3	-3/-2				-4/-3	-4/-3			-16
Flora & Fauna abundance	-4/-2	-4/-2		-3/-3	-3/-2				-4/-3	-3/-2			-14
8. FISHERIES												1	
Productivity	-2/-2												-2
Fish kill					-2/-1								-1
9. NOISE												2	
Impared hearing	-3/0	-3/-2				-3/-2				-4/-3			-7
Communication interference	-3/-3	-3/-2				-3/-2				-4/-3			-10
10.WILDLIFE/FORESTRY												1	
Diversity & abundance	-3/-1	-3/-1				-3/-1							-3
Habitat	-3/-2	-3/-1				-3/-1							-4
11.SOCIO-ECONOMIC												2	
Population	3/10	4/10											20
Income	4/10	4/10											20
Health &			-3/-8		-3/-2				-4/-3				-13
Aesthetics	4/10												10
Total Impact	-1	-8	-13	-12	-11	-19	-6	-8	-19	-20	-12		-129

Notes: 0=No impact; 1-2=minimum; 3-4=Small; 5-6=Moderate; 7-8=Significant; 9-10 =Severe; x/y = Impact Magnitude/Indicator Value

4.2 IMPACT APPRAISAL

4.2.1 Environmental Issues

Direct impacts of road development result from construction, maintenance and operation of the facility. The most significant project-related impacts are those related to site preparation activities, construction and commissioning and operation and maintenance. Some of the major project actions that will have potential impacts on the environment are discussed in the next section. The project activities which may impact the environment include:

Site Preparation Activities

These consist essentially of bush clearing and de-stumping of approximately 120ha of mainly agricultural land for the new carriageway of the proposed dualized New Ado-Iyin Ekiti road, levelling, grading and compacting.

Construction/Civil Work and Commissioning

The project construction activities will involve civil engineering construction works, vegetation (bush) clearing, earth (soil) movement, topographic levelling, alignment and re-alignment of road segments, creation of road pavement, coal tarring and bridge and culvert works. The pavement will be mostly of lateritic materials (200mm) stabilized with cement as sub-base course and crushed stones (200mm) as base course and the surfacing of hot-rolled asphaltic concrete (40mm) and 20mm surface dressing.

Operation and Maintenance Activities

Periodic inspection of roads to maintain good drainage, bridges and culverts in functional conditions, road rehabilitation by mending potholes, rutting, reworking or strengthening of base and sub-bases of deteriorated pavement to improve their structural integrity and asphalt surfacing as necessary, clearing of road shoulders of bush and maintaining adequate road furniture.

4.2.2 Environmental Consequences of the Project

The potential impacts resulting from project actions are summarized in Table 4.4. The potential impacts are discussed as follow:

Site Clearing and Construction/Civil Work

The impact of these activities on the environment will depend of the types of clearing and construction equipment used.

(i) *Air quality*

The primary air emissions during project construction will be from pug mills and airborne dust from construction truck movements and bush clearing and construction equipment. Air monitoring for similar highway projects have indicated that at 100 m leeward to the source, concentrations of pug mill emissions were up to 1.2 to 1.7 mg/m3 and dust (as TSP) from truck traffic 20 mg/m3; contaminated areas could reach 150 m leeward. TSP of 60-206 (Ug.m-3) measured in the area during the study for both wet and dry season was lower in concentration than the acceptable limit of 250ug.m-3 in any given day stipulated by FMENV. The clearing and construction activities will also be of short duration thus making the impact of low significance.

Table 4.4: Summary of Project Actions and Potential Impacts

	Project Activity	Potential Impact
1	Land Clearing	□ Air quality impairment from clearing equipment gaseous ($S0_2$ $C0_2$) & particulate (dust) emission □ Noise from bush clearing equipment □ Soil deterioration due to desurfacing & compaction □ Loss of land, property and population displacement; □ Loss of vegetation, wildlife & wildlife habitat □ Degradation of surface water quality by discharge from runoff & erosion □ Loss of biodiversity vegetation & wildlife □ Interference with farming activities;
2	Construction	□ Air quality impairment from construction-related equipment gaseous ($S0_2$ $C0_2$) & fugitive (dust) emission □ Contamination of surface & groundwater from construction camp chemical effluents, solid waste and domestic sewage discharge & discarded lubricants, fuel and oils □ Noise from construction equipment □ Soil deterioration due to desurfacing & compaction □ Diffusion of disease like HIV/AIDS □ Creation of burrow pit and earth movement equipment □ Traffic congestion
3	Operation& maintenance	□ Air quality impairment from emission of gases (CO, $S0_2$, $N0_2$) □ Noise from vehicle traffic □ Risk to health and safety from dust and gaseous emissions inhalation & traffic □ Provision of improved transport infrastructure to neighbourhood □ Improved employment opportunities & rural economy

(ii) *Noise*

The main noise sources during construction are construction machinery, which are known to generate noise at levels from 76 dB(A) to 98 dB(A) measured 5 m from running machines. At about 100 m, the noise levels are expected to reduce to levels within the daytime national noise standards of 85 dB(A). The noise will have an impact mostly on construction workers and residents living within 100 meters from the construction sites. Impacts during construction will arise from equipment noise, blasting and vibration and, during operation, those closest to the highway will hear vehicle movement. The existing ambient noise level (LA90) along the study corridor is within acceptable limits (47.9-70.5 dBA). The noise sources during site preparation and construction activities are the internal combustion diesel engines powering bush clearing and civil works.

(iii) *Ecology*

Site clearing will destroy the plant community and wildlife habitat, leading to the death of plants and relatively immobile animals as well as the migration of the animals that are capable of escaping. This will lead to the reduction of biodiversity in the area and possible soil erosion by rain water due to soil exposure. The majority of lands crossed by the New Ado-Iyin Ekiti road are forests.

Although there are no known rare or endangered plants or animal species within the corridor for the proposed alignment, there are known occurrences within the broader study area. Therefore, there exists some potential for impacts by the proposed alignment. Fauna species along the New Ado-Iyin Ekiti route are sparse due to habitat fragmentation and agricultural usage.

Construction noise may disrupt nearby wildlife during their nesting period.

(v) *Water Quality*

During the bush clearing and construction stage, silt from disturbed soil and in-river construction activities may result in increased suspended solids (SS) in rivers immediately downstream from the expressway, and duck/fish ponds and water wells near the roads. Such impacts will be temporary and limited to small areas downstream, but can affect a large portion of an adjacent fish pond. Construction camps will generate domestic effluent of 60 L per person per day on average, and total wastewater in the largest camp may be up to

60,000 L per day. If discharged directly into natural water bodies, the domestic effluent from construction camps would raise COD concentrations by about 1.2 mg/L in large rivers and up to 34.7 mg/L in smaller streams.

During the operational stage, small quantities of sediment and dripping oil and grease from the road surface may be washed out and discharged to nearby surface water bodies as runoff during the rainy season. As this would also be the season when the rivers have their highest flow rates, the impact to water quality will be small. The surface stations will generate effluent containing COD and SS. The effluent will eventually be discharged to the Streams and Rivers, year-round.

(vii) *Wildlife and Forestry*

The proposed project is expected to have direct impact on wildlife and forestry in the following ways:

- Site preparation and construction will result in the reduction of wildlife habitats for arboreal and in faunal species.
- Noise from the use of clearing and construction equipment and machinery will cause the migration of much of the remaining wildlife from project areas.
- Bush clearing will lead to the loss of important vegetation and economic tree species (oil palm, kola, and cocoa trees) which constitute over 65% of the area.

(viii) *Socio-Economics & Health*

The proposed New Ado-Iyin Ekiti alignment will directly impact several homes and it is in close proximity to residential development at several locations. Indirect negative impacts may include increased noise and pollution levels, and reduced access to properties. The New Ado-Iyin Ekiti construction will separate some farmland from farmers and some villages from one another on both sides of the alignment. It will limit the access of certain farmers to their fields and certain rural residents to schools, markets, services, and relatives and friends. Increased motor vehicle traffic from project development would constitute nuisance and higher safety risk to local road users (cyclists and pedestrians). A number of crossings will be constructed under the expressway. The majority of the crossings are designed to be at existing roads and meet the need for agricultural and social activities. The crossings will eliminate the impact of land and community severance, except that pedestrians who otherwise could walk to their destinations through the field will have to walk no more than

300 m on average to one of the crossings. Social & health problems (new communicable diseases, sexually transmitted infections (STIs), HIV/AIDS) from influx of job seekers & post-construction demobilisation of large contingent of workers.

Migration of workers and alteration of existing population characteristics are envisaged as the employment opportunities bring an influx of new people to the project area.

The Project will improve infrastructure in the region and make the area more attractive to outside investments. Economic benefits will also include higher efficiency in transport of local raw materials (minerals, agricultural produce such as fruits, etc.) and finished goods to local and outside markets. More tangible and immediate benefits will be increased employment opportunities directly related to project construction and operation. Of the labor-days required for the expressway construction, 60 percent is expected to come from the local labor force. Of the labor requirements for roads construction, 80-90 percent will come directly from seasonal labor of the rural villages. Indirect employment related to services, vendors, etc. will generate additional income-earning opportunities, especially for women and children during the construction period.

Recreation

The proposed alignment is expected to have very little impact on recreation in the area.

Utilities

The proposed alignment crosses several lower voltage power transmission lines, telephone and cable lines, and municipal water and sewer lines. There are currently no gas pipelines in the study area. Temporary disruption of power, telecommunication services, and municipal services may occur as they will be crossed by the proposed Highway during construction. Utilities are typically encountered at roadway crossing locations.

Heritage Resources and Archaeology

There are no heritage properties, National Historic Sites, or known archaeological/fossil sites within the corridor for the proposed alignment.

4.3 Project Operation

The approach incorporates a list of project activities with a checklist of environmental components associated with the activities. Identified environmental impacts for different project activities are discussed in the sections below.

4.3.1 Construction Phase

4.3.1.1 Impacts on Biophysical Environment

1) Climate and Meteorology

During road construction activities, dust and suspended particulates generated could create hazes, which will significantly reduce visibility in the immediate project vicinity. In addition, gaseous emissions from the various machineries to be used for the project would impact on air quality, visibility, odour, and elevate temperature in the project area. There could also be the potential release of NO_2 and $S0_2$ gases, causing acid rainfall with adverse effects on rooftops, soils and vegetation in the project area. However, the proposed project is not expected to have any major impact on climate and meteorology. Rather, the significance of impact of construction activities on the climate and meteorology would be relatively minimal, given the duration would be short-term.

2) Air Quality

During the construction phase large amounts of soil will be excavated and transported. The various vehicles and machinery that will be used will include tippers, pay loaders, graders, jackhammers, etc. The heavy machinery will generate dust, which can be dispersed by the wind affecting a zone of up to 100 metres of the immediate area. Essentially, construction activities, which include earthworks, increased traffic, use of cement, asphalt, and other building materials, will produce excessive airborne dust and toxic asphalt fumes, causing a major impact on air quality. In addition, dust from stripping, grubbing and trenching for roadside drainage will generate coarse and fine particulates that will further degrade ambient air quality in the general vicinity of the project area.

In general, air pollution caused by diesel fumes and dust from excavators, bulldozers, graders, as well as site clearing will affect humans and vegetation. The hazardous pollutants will also disturb bird and animal habitats in the study area. Overall, the intensity of potential impacts associated with construction activities will probably be moderate because it will cover the entire project area. The duration of the impacts will

also be short-lived because rain and wind will effectively scrub the air of pollutants. In addition, the spatial extent of the impacts will be local, while the significance will be moderate, given that the air will be very mobile and airborne pollutants are likely to be transported to downwind areas.

3) Noise

The use of heavy equipment during site clearance and construction works will inevitably generate noise, which may create a nuisance for nearby residents and workers. Noise, vibrations, and intrusive activities related to construction works will also tend to ward off the fauna in close proximity to the site after vegetation clearance. However, the duration of this impact will be short term. It should be noted that baseline noise levels along the Corridor fall well below the FMEnv-recommended 90dB (A) maximum value for 8-hr occupational exposure. In addition, average noise levels at the site are within the WHO guidelines of 55 dB(A) for serious annoyance, as well as the NEPA daytime guideline of 55 dB(A) for residential areas.

4) Surface and Groundwater

A significant amount of water will be needed for the project; hence, water will be available from Ofin River and Stream within the project area . Hence there will be no water shortage for the construction camps. The project is likely to employ hundreds of people for the duration of the construction. Moreover, most of those employed will probably be from the local population. However, the abstraction of water in large quantities from nearby wells for consumption may lead to water shortage to the local community, and potential for groundwater contamination.

Major sources of potential water impacts during construction activities include: (i) increased soil erosion that may cause surface water pollution with high sedimentation; (ii) wastewater pollution from improperly disposed human waste effluents at anticipated large construction sites, in particular bridge construction; and

(iii) pollution caused by surface runoff and service area wastewater. Specifically, wastewater and hazardous materials (e.g., fuel, oil, acids, caustics, etc.) may drain into streams and drainage areas, causing pollution to surface water or groundwater.

This is particularly applicable to bridge construction sites, construction campsites, and staging areas where workers, construction equipment, and building materials are stored. In addition, rainwater could potentially wash out atmospheric pollutants, pick up roadway deposits, and run off into nearby water bodies.

However, the increase of pollutant concentrations of the affected water will be insignificant and will have little impact on the water quality. Overall, very little impact is expected on surface and groundwater in the study area, based on construction activities. Thus, the duration, intensity, and spatial extent of potential impacts are insignificant.

5) Soil Erosion, Flora and Fauna

When natural conditions are modified by the construction of a road, it marks the start of a race between the appearance of erosion and the growth of vegetation. There will be a natural occurrence of soil erosion at the project site due to vegetation removal, soil disturbance, and exposure of bare soil surface. Thus, project-related activities would aggravate the effects of natural soil erosion. Such activities will include embankment construction, road sections with heavy cuts and fills, borrow and spoil sites, as well as bridge and culvert construction area, particularly on rainy days. In addition, the clearing and removal of trees and vegetation will result in reduction in the habitat for the flora and fauna. However, the duration of the potential adverse impacts will be either short term or long term, depending on specific project-related activities. The overall significance on soil erosion, flora and fauna will be moderate in the project area.

6) Vegetation and Wildlife Habitat

During the construction stage of the road upgrading and reconstruction, there will be disruptions in habitats, natural ecosystems, landscapes and vegetation within the corridor. Thus, the clearing and removal of trees and vegetation during the construction will result in reduction in the habitat for the flora and fauna. However, the significance of associated impacts of the proposed road on vegetation in the project area will be moderate. This assessment is predicated on the fact that almost half of the area is already open with limited vegetation growth in the Corridor.

In the case of wildlife, very few species currently inhabit part of the immediate project area, because section I and part of sections II and III of the project is extensively developed and populated. There is also constant human presence and ongoing activities most of the day in these developed areas. Nevertheless, the removal of trees and other vegetation that provide habitat for the wildlife species could force them to seek shelter elsewhere. The spatial extent will be local as any vegetation clearance will be limited to the route alignment at the designated project area. The duration of the potential impacts will be short term, given that the project timeline is targeted for about 24 months. The intensity of the impacts will probably be negligible because the project activities will be limited to the corridor, Overall, the significance of associated potential impacts on vegetation and wildlife at the project site is considered to be of medium impact.

4.3.1.2 Impacts on Socio-economic Environment

The anticipated economic impacts from this project are increases in non farm incomes due to improved information service and traveling convenience, improved access to social and production services, employment opportunities and enhanced safety and reduced traffic congestions. The proposed road is expected to have considerable positive effects on the socio-economic setting of the project area. Nevertheless, some negative impacts are also associated with the project. These are briefly described in the following subsections:

1) Land Acquisition and Resettlement

The design of the proposed route was developed with a view to minimizing the need for land acquisition and involuntary resettlement of people. However, it will encroach on many buildings and commercial outlets that are along the proposed alignment, most especially, on both sides of section I (Fajuyi bus-stop – NTA road Junction), part of section II, where buildings are directly found along the proposed alignment. Hence, the construction of this road requires the acquisition of large expanse of land. Specifically, several hectares of land will be required and hundreds of people are likely to be impacted in the process directly or indirectly. For example, hundreds of roadside hawkers are likely to be affected during construction work. The road construction will affect many structures, including shops, businesses, residential houses, filling stations, churches, mosques, markets, and landed properties. The duration of the impact of the project

activity on resettlement will be long term and the intensity or magnitude will be moderate. In general, the significance of the associated impact of the proposed project on resettlement will be moderate.

2) Employment Opportunities

The potential impact of the proposed project activity on employment is largely positive. For instance, during construction the project will generate significant employment opportunities in the area. During the duration of the construction, thousands of skilled and unskilled workers will be needed, and preference will be given to those below the poverty line. Overall, it is projected that about 1,000 – 1,500 local people will be directly and indirectly employed for various construction and related works. In fact, several consultants and experts will also be involved at different stages of the project.

Possible adverse impacts of the project will include disruption of road traffic (increased and prolonged traffic jams) in sections I and II project, potential of accidental disruption or damage to above or below grade electrical and communications facilities. Additionally, the health of construction workers, local population, and road users may also be affected.

3) Transportation

The current traffic situation in section I (Fajuyi-Bank Road-NTA road junction), of the project area is already hectic; however, the construction activities will worsen the problem. The main impacts on transportation will include an increase in the volume of vehicles in the area. Hence, the traffic build-up is expected to increase as well. The additional traffic demand will subject motorists to a high level of physical stress. However, the overall significance of the impact is considered low to moderate, if best management practices are deployed during road upgrades and reconstruction.

4) Health and Safety

Road projects often have serious negative consequences for the health of local populations. Due to the direct contact, roads provide ideal corridors for the transmission of disease between humans and from plants and animals to humans. This project will

require construction camps and itinerant workers. The entire construction process will take about two years, with the result that the camps will become semi-permanent. The people, as well as the changes they bring, can have significant impacts on the local communities and social structures. For example, construction camps for workers, and the storage of plants and materials may adversely affect the lives of local residents. The influx of construction workers may attract drug trafficking and prostitution in the project area. Disease transmission is facilitated by the migration of workers which accompanies road projects. This will result in the proliferation of sexually transmitted diseases, such as HIV/AIDS.

Nonetheless, based on the current level of development and sophistication in the project area, these health impacts may already be present. Hence, the general significance of the impact on health and safety, with respect to occurrence, magnitude, spatial extent, and duration, will be comparatively inconsequential.

5) Public Utilities

During soil excavation and scrubbing activities at the site, the operation of public utilities could be affected. For example, electricity cables, underground water pipelines, cable and telecommunication lines, etc. could be damaged accidentally. This could result in the interruption of electricity and water supply, as well as telephone service in the project area. However, in order to avert such occurrence consultations were held with appropriate utility agencies. These included the Benin Electricity Distribution Company (BEDC), Ekiti State Water Corporation, and Nigeria Telecommunications Service Provider with fibre optical cable along sections 1 and 2. Subsequently, adequate measures to address such eventuality were incorporated into the project design.

6) Landscape Visual Aesthetics

The upgrading and opening up of the road will lead to the restoration of the visual aesthetics, assuming good drainage, re-vegetation of the scarped shoulder land, permanent setbacks and removal of street vendor shops are sustainably conducted. This project-related activity represents a positive impact in study area. Thus, the Corridor has potentials for enhancing the visual quality of the environment in the area after

completion. In general, the proposed road will provide a captivating vista along the axis for both the communities and road users.

4.4. Operation Phase

4.4.1 Impacts on Biophysical Environment

1) Climate and Meteorology

The operation and maintenance of the project may slightly affect the climate in the region because of gaseous emissions from vehicles and heavy machinery. Additionally, the potential release of NO_2 and $S0_2$ gases could result in acid rainfall with adverse effects on rooftops, soils and vegetation in the project area. However, the intensity of the impact will be minimal; the spatial extent will be local; and the duration will be moderate.

2) Air Quality

The increased number of vehicles using the newly upgraded and constructed road will result in higher emission of pollutants in the form of NO_2, SO_2, CO and other hydrocarbons. Hence, the main impacts of site restoration activities on air quality will be in terms of gaseous emissions and suspended particulate. However, the new alignments on the upgraded and constructed road will allow for faster moving and free flowing traffic; less idling, and thereby, limited hazardous emissions. Thus, higher engine speeds lead to more efficient combustion and less emission of CO and NOx. Specifically, higher speeds will result in more dispersion and so generate lower ambient levels of noxious gasses. The duration of the impacts will be long term because they will continue, or last for the entire operational period of the project. However, the magnitude of the potential impacts will be temporally and transiently minor because they will cover the entire project area. However, this is only to the extent the newly upgraded road network can hold capacity.

3) Noise

During operating phase, noise will be generated by passing vehicles. In open areas, traffic noise will be linearly dispersed, but will only have a minor impact. The duration will be long-term because it will last for the entire operational period of the project. However, the magnitude will be moderate because it will cover the entire project area.

4) Surface and Groundwater

During the operation phase at the project site, erosion of scarified soil, resulting from human trampling, excavation, grading works and construction of drainage channels may increase runoff. This will lead to sedimentation and increased turbidity in any proximal surface water, as well as reduced ground water infiltration. In addition, the flow of hazardous materials spills into water sources will result in pollution.

It should be noted that drainage represents an important part of road maintenance. Therefore, drainage should be adequately maintained to prevent the blockage of drains and culverts. Such blockage can cause significant local flooding and damage to the road itself. Accordingly, it is necessary to be committed to a regular monitoring and maintenance schedule at the site.

5) Soil Erosion, Flora and Fauna

During operation activities, associated potential impacts on soil erosion, flora and fauna will be very limited. However, soil structure and vegetation may be affected by the deposition of wet and dry particulates, as well as dissolved gases from emissions. In particular, during project operation, areas that are downwind will be more susceptible to these impacts. In addition, soil erosion near culverts and drainage channels could increase the velocity of water runoff. Nevertheless, the duration will be short term; the spatial extent will be local; and the significance will be relatively negligible.

6) Vegetation and Wildlife Habitat

The newly constructed expressway will encourage real estate development in area communities due to land speculation. Hence, this will trigger the clearing and removal of trees and vegetation, as well sand filling, resulting in reduced wildlife habitat for the flora and fauna. However, the magnitude of the impact will be minimal in section I and part of section II because the area is already heavily populated and mostly developed but will be moderate in the newly open up area of the project. The duration of the potential adverse impacts will be short term or long term, depending on specific project-related activities. Overall, the spatial extent of the potential impact on vegetation and wildlife habitat is local, while the intensity and significance is moderate.

The construction of the road requires the acquisition of large expanse of land. The resultant land use impacts are the loss of valuable vegetation containing economic trees such as palm tree and other forest resources and loss of farmland, which is the source of food crops such as cassava, vegetables, maize etc. The destruction of the vegetation will also affect the micro-climatic condition of the area.

4.4.2 Impacts on Socio-economic Environment

In general, the proposed road upgrade and construction is expected to have overall positive impact on the socio-economic setting of the project area. However, there are a few negative impacts as well. These are described in the following subsections:

1) Land Acquisition and Resettlement

Based on conducted surveys, the proposed upgrading and construction of the new road will transform the area to a growth sector. For example, the influx of people into the communities will result in the construction of new houses, and opportunity for new businesses. There will be increase in the population of people which will ultimately lead to the development of new settlements. Where land acquisition is inevitable, the affected communities can be given options to resettle close to families or friends within the project vicinity. However, such resettlement may be difficult to mutually implement, and such actions could lead to other indirect socio-economic issues along the corridor and locations selected for resettlements. This will minimize undesirable social costs of re-integration into new areas or communities. In general, these are all positive impacts on the acquisition of land for the proposed project and the concomitant resettlement of people in the area.

2) Employment Opportunities

In general, during operation activities, the projected income of residents, business owners, and workers will increase. In particular, a number of industries and small businesses are likely to spring up in the vicinity. This will create employment prospects and increased revenue for property owners as well. The project will use many local and indigenous inhabitants of the communities as maintenance workers. The above represent potential impacts as related to the proposed project. Other inherent adverse impacts may be

related to grossly inordinate hiring of local community members; significantly low remunerations for easily disposable work force; increased inflationary conditions, and overall attendant crime and vagrancy along the corridor.

3) Transportation

The EIA Project team observed that some of the rural roads adjacent to the proposed route are unpaved. Hence, the upgrading and construction of this route will lead to improvements of these side roads. These will include construction of asphalt roads and side drains. Specifically, the project will facilitate transportation services and the development of facilities within the area and the entire region as well as part of the neighbouring Osun State. Both private motorists and commercial vehicles will also spend considerably less time traveling within the axis. In addition, the new alignments will allow for faster moving and relatively unimpeded traffic flow.

4) Health and Safety

The project has a high probability of improving the standard of living of the people in the communities along the road. The road improvement is also capable of inducing other developments, such as the establishment of new hospitals and clinics. This will enhance the overall quality of health care in the study area. The adverse impacts would be mostly due to vehicular accidents from recklessly speeding motorists.

5) Landscape Visual Aesthetics

The upgrading and opening up new road will lead to the restoration of facilities along the road. The Corridor has potentials for enhancing the visual quality of the environment. In general, the proposed road will provide a captivating vista along the axis for both communities and travelers. However, based on experience, visual aesthetics could be impacted by the common place littering, illegal dumping, scarification of the land corridor (i.e., devegetation and deforestation patches), poor or non-existing urban planning and zoning laws; and escalation of ramshackle sign boards, illegal commercial structures etc.

4.5 Closure Phase

4.5.1 Impacts on Biophysical Environment

1) Climate and Meteorology

During site closure activities, generated dust and suspended particulates could create hazes, which will significantly reduce visibility in the immediate project vicinity. Moreover, this may or may not adversely affect the weather conditions in the area with respect to local population.

2) Air Quality

The various vehicles and machinery that will be used during site closure will include tippers, pay loaders, graders, jackhammers, etc. The heavy machinery will generate dust and noxious gases, which can cause a transient impact on air quality. However, the site decommissioning activities will not have any significant negative impact on air quality because the intensity, spatial extent, and duration of the impacts would be negligible.

3) Noise

The use of heavy equipment during site closure will generate noise, which may create a nuisance for nearby residents and workers. However, the duration of this impact will be short term.

4) Soil Erosion, Flora and Fauna

There will be soil erosion in the project area due to vegetation removal, soil disturbance, and exposure of bare soil surface. However, the intensity and duration of the impact will be limited because the site will be re-vegetated and restored.

5) Vegetation and Wildlife Habitat

Positive impacts are anticipated from the site decommissioning activities because of the restoration of vegetation to pre-construction state. This may also facilitate the return of wildlife species to their native habitats.

4.5.2 Impacts on Socio-economic Environment

1) Land Acquisition and Resettlement

During the site-decommissioning phase, the influx of people into the communities will result in opportunity for new businesses and the development of new settlements. In general, the acquisition of land and resettlement represent positive impacts on the proposed road.

2) Employment Opportunities

The potential impact of proposed site decommissioning on employment is largely positive; however, very limited increase in new employment is anticipated. For instance, during construction, the project will generate employment opportunities for many skilled and unskilled workers, and preference will be given to those below the poverty line. Overall, it is projected that about 1000 – 1500 local people will be employed for various construction and related works.

3) Transportation

The main impacts of site decommissioning on transportation in the project area will include an increase in the volume of vehicles. Thus, the additional traffic demand may subject motorists to high-level physical stress. This will be a short-term adverse impact.

4) Health and Safety

The site decommissioning activity will require construction camps and itinerant workers. However, the people, as well as the changes they bring, can have significant impacts on the local communities and social structures. For example, the influx of construction workers may attract drug trafficking and prostitution in the project area. This will result in the proliferation of sexually transmitted diseases, such as HIV/AIDS. However, based on the current level of development and sophistication in the project area, these health impacts may already be present.

4.6 SIGNIFICANT POSITIVE IMPACTS

The significant positive impacts associated with the project include:

 Improved transportation infrastructure and the associated financial benefits to the stakeholders;

 Development of downstream industries dependent on electric energy

 Provision of employment opportunities including the opening up of an otherwise rural area.

4.7 SIGNIFICANT NEGATIVE IMPACTS

There are no expected significant negative impacts that cannot be mitigated.

4.8 PROJECT SPECIFIC ADVERSE/BENEFICIAL EFFECTS

Major adverse effects include:

- Impaired air quality from S02, C02 & particulate (dust) emission
- Impaired hearing due to noise from construction activities and traffic operation
- Increased health risk from dust and gas emission inhalation and vehicle traffic

The beneficial effects are the following:

- provision of improved transportation infrastructure to neighbourhood
- Increased employment opportunity, and revenue for inhabitants of the area from direct employment and indirectly by the downstream industries that depend on the establishment of the improved transportation infrastructure.

4.9 PROJECT SPECIFIC RISK AND HAZARD ASSESSMENT

The hazards associated with various events in the project are summarized under the following scenarios:

4.9.1 Risk Scenarios

In nearly all aspects of the project, there is a potential risk of an accidental event leading to an unwanted impact. Some specific operations carry a greater risk of accidents. The risk scenarios identified that can create environmental hazard include:

- Transportation of hazardous materials resulting in explosions, fires, or spills
- Motor vehicle accidents during transportation
- Abandonment of roads.
- Rock blasting during construction.

CHAPTER FIVE

MITIGATION OF POTENTIAL AND ASSOCIATED ENVIRONMENTAL IMPACTS

5.1 BEST AVAILABLE CONTROL TECHNOLOGY

In order to ensure that the impacts emanating from the project activities are mitigated, time-tested standard designs, employing new technology with bias for environmental safety and economics will be adopted in all the phases of the project - construction, operation and maintenance. The measures that will mitigate the impacts identified with the respective project activities are reviewed as follow:

In general, the road design shall be guided by the Federal Ministry of Works Federal Highways standards (Highway Manual Part I – Design), unless when this is not justifiable due to site constraints or economic considerations. The design speed required is 100Km/hr, where re-alignment is considered, after examining various alternatives, long stretches joined by large curves of minimum radius 300m will be aimed at. Permanent features like bridges and culverts shall be provided in accordance with the Federal Highways standards. Horizontal and vertical alignments of the route will conform with the design standards required of federal highways by the Federal Ministry of Works without much impediment and re-alignment.

Mitigation measures are designed to enhance potential positive impacts and minimize or prevent identified negative impacts associated with project activities. Proposed mitigation measures considered adequate to address the potential negative impacts that were discussed and presented in Table 5.1. In particular, these measures are intended to prevent, alleviate, or reduce potential environmental impacts related to the proposed alternative link route upgrading and construction.

5.2 Proposed Measures to Address Community Concerns

Appropriate mitigation measures will be taken to address project-related issues that will affect local communities within the study area. Some of the major issues are identified below.

A. Construction Campsite

The selection of construction campsite will be done in consultation with local authorities and the community in compliance with agreements with local governments, local stakeholders and affected communities as part of the public participation process.

B. Resettlement/Relocation and Compensation

People and properties will be affected by the proposed road reconstruction project. Hence, compensation would be required primarily for land acquisition, and for the demolition of structures, including houses, churches, mosques, businesses, crops, trees, etc. However, it is noted that resettlement/compensation is only necessary if the land is not under Government Acquisition.

C. **Health and Safety**

There will be sensitization to both construction workers and the local community on sexually transmitted diseases (STD) and HIV/AIDS, through education by using videos, pamphlets, etc. In addition, all site workers (temporary and permanent) must have a Health Certificate to limit potential occupational health hazards.

TABLE 5.1: SUMMARY OF IMPACTS AND MITIGATION MEASURES

Climate and Meteorology		
Phase	**Impact**	**Mitigation Measure**

Noise		
Construction	Exhaust fumes and dust from excavators, bulldozers, graders, as well as site clearing could cause acid rainfall and elevated temperatures in the study area for a very limited time	Mitigation is not required for this impact
Phase	**Impact**	**Mitigation Measure**
Operation	Operation and maintenance activities could generate toxic gases and acid rainfall in project area for a limited time	Mitigation is not required for this impact
Air Quality		
Phase	**Impact**	**Mitigation Measure**
Construction	Air pollution caused by exhaust fumes and dust from heavy machinery, such as excavators, bull dozers, graders, etc. This will affect humans and vegetation, as well as disturb animal and bird habitats in project area	Regular maintenance of construction equipment to limit air pollution. Workers will be fitted nose masks
		Wetting of project site, particularly, during dry season (December – March) to reduce dust generation
		Construction materials storage and concrete mixing plants will be sited more than 100 metres away
Operation	Dust from stripping, grubbing, and trenching from roadside drainage will generate coarse and fine particles that will degrade ambient air quality	Law enforcement to ensure only road-worthy vehicles on the road. Workers will be fitted with nose masks
		Trees will be planted along the roadside to reduce air pollution

Construction	Noise and vibration caused by use of construction equipment and drilling heavy machinery	Most activities will be during daytime hours with reduced vibration. Give communities advanced warning and obtain EKSEPA approval before any blasting near residential areas
Operation	Noise from increased traffic	Control noise levels during onsite operations
Decommissioning	Use of heavy equipment for site decommissioning	Institute similar measures as in construction phase
Vegetation and Wildlife Habitat		
Phase	**Impact**	**Mitigation Measure**
Construction	Reduction in flora and fauna habitats in project area due to noise, air pollution, and road expansion	Confine vegetation clearance and other activities to project area.
	Removal of trees and other vegetation that provide habitat for the wildlife species could force them to seek shelter elsewhere	Provide green areas and wildlife sanctuaries along the Corridor to minimize potential impacts on vegetation and wildlife
Operation	Loss of valuable vegetation and farmlands because of road expansion. Micro-climatic conditions in project area will be affected	Confine vegetation clearance and other construction activities to project area
Landscape Visual Aesthetics		
Phase	**Impact**	**Mitigation Measure**
Construction	Opening up and upgrading of the road will lead to the reclamation and restoration of many of the swamps along the project road.	No mitigation is necessary for this positive impact

Surface and Groundwater		
Phase	**Impact**	**Mitigation Measure**

Construction	No Shortage of water in the local community during road construction works because of the streams in the area	Prior to using water, obtain the approval of state and local authorities and the consent of local community
	Wastewater and hazardous materials (e.g., fuel, oil, acids, caustics, etc.) may drain into streams, rivers, canals and drainage areas, causing pollution to surface water or groundwater	Proper containerization of wastes, and certified disposal of hazardous wastes to avoid water contamination. Proper labeling of stored chemicals, and must ensure that community wells are covered.
	Blockage of storm drains in construction zones that could exacerbate flooding problems	Drainage will be adequately maintained to prevent the blockage of drains and culverts
Operation	Erosion of bare areas, resulting from excavation and construction of drainage channels may increase water runoff	Grass will be planted on sides of drainage channels
		Re-use of excavated soils for other road construction work, such as building shoulders
Quarries and Borrow Pits		
Phase	**Impact**	**Mitigation Measure**
Construction	Excessive noise from blasting and heavy machinery may disturb nearby communities	Quarrying activities will not be executed close to local communities
	Un-rehabilitated borrow pits could pose potential hazard to ecological units and residents	Quarrying will not be carried out near surface water bodies
Operation	Quarries and borrow pit location may negatively impact on important ecological units in the study area	Quarrying will not be done near identified ecological units in the study area but where unavoidable, adequate warning should be giving to the local community.

Land Acquisition and Resettlement

Phase	Impact	Mitigation Measure
Construction	Road expansion will encroach on many buildings and commercial outlets that are along the road alignment, most especially on both sides of section I and part of section II the proposed road. The livelihood of local residents may also become jeopardized	• Compensation and /or resettlement of local communities in new areas will be in consultation with host or existing community • Local people with the necessary skills will get priority employment on road project
Operation	A number of industries and small businesses are likely to spring up in the vicinity. This will create employment prospects and increased revenue for property owners	Trees will be planted along the expressway to minimize noise and posted speed limits will be enforced in the project area
Decommissioning	Several skilled and unskilled workers will be needed, with preference given to local residents	

Employment Opportunities

Phase	Impact	Mitigation Measure
Construction	Potential impact on local employment is largely positive. Thousands of skilled and unskilled workers will be needed, and preference will be given to those below the poverty line	No mitigation is necessary for this positive impact
Operation	The road widening will affect hundreds of roadside hawkers, shops, businesses, homes, churches, mosques, markets, etc. Improved road will lead to increase traffic volume, noise levels and automobile accidents	Compensation and/or resettlement of communities in new areas will be done in consultation with host or existing community No mitigation is necessary for this positive impact
Decommissioning	Several skilled and unskilled workers will be needed, with preference given to local residents	No mitigation is necessary for this positive impact

Transportation

Phase	Impact	Mitigation Measure
Construction	Main impacts on transportation include an increase in volume of vehicles in the area	Road construction work will be primarily executed during low traffic periods
Operation	Traffic build-up in the area is expected to increase	Provide alternative routes for commuters to reduce traffic jam in the area

Health and Safety

Phase	Impact	Mitigation Measure
Construction	Influx of construction workers may attract drug trafficking and prostitution in the project area	All workers must have Health Certificates to reduce occupational health hazards. Provide health education materials on illegal drugs to community
Operation	Increased automobile accidents because of increased traffic flow Proliferation of sexually transmitted diseases (STD), such as HIV/AIDS Traffic build-up in project area Road improvement may induce other developments, such as new hospitals and clinics. This will enhance the overall quality of health care in the study area	Provide adequate warning road signs in black spot areas and at pedestrian crossing Provide information to local community on STD and HIV/AIDS using video, oral and printed materials, etc. Road construction work will be primarily executed during low traffic periods No mitigation is necessary for this positive impact
Decommissioning	Site decommissioning activity will require construction camps and itinerant workers. These may result in drug trafficking and prostitution in the area	Provide health education materials on illegal drugs to local community

D. Road Navigation

Decisions on all road detours, access roads, and equipment parking will be in consultation with the local community. Such decisions will consider the existing land use in the settled areas. Adequate warning road signs will be placed in black spot and pedestrian crossing areas.

E. Quarries and Borrow Pits

Quarrying activities will not be conducted near the communities, but road construction waste may be reused for rehabilitation of the borrow pits.

F. Water Usage

The use of surface or ground water for construction works will be with the approval of state and local authorities, and the consent of the local community.

G. Drainage Culverts

Drainage systems will be discharged into constructed sedimentation basins. The local communities could use collected water from said basins for non-potable purposes only.

H. Waste Disposal

The disposal of wastes will be at locations within the area as designated by the Local or State governments.

I. Benefit of Project to Local Communities

The Contractor will ensure that the local people with the necessary skills are employed on the road project.

J. State Government/Local Government /Community Role in the Project

The representatives of the State and Local Governments, as well as affected communities will participate in the execution of the project through an environmental steering committee during the implementation phase. The State and Local governments will also become part of the monitoring team during the implementation of the mitigation measures by the Contractor. A report on the Contractor's performance will be prepared by the committee and submitted to the state and local governments, as well as affected communities. This will ensure that the concerns of communities are being adequately addressed.

5.3 REMEDIATION AFTER DECOMMISSIONING/CLOSURE

Decommissioning activities include the removal of road surfaces and associated structures and buildings at the completion of the proposed road project. Hence, it is important to design an appropriate plan for the restoration of the study area to its original state after the proposed project is completed. That is, any areas of temporarily used land will be cleared, cleaned (if necessary) and re-instated to its original condition. The process of decommissioning should be directed by regulatory agencies, such as the SMEnv and EKSEPA. Furthermore, at the completion of decommissioning activities a clean bill of health (CBH) should be issued by the appropriate regulatory agencies.

5.3.1 Decommissioning/Closure at Project Site

The sequence of decommissioning structures and buildings at the project site is:

1. **Re – Use:** Sale and/or transport of structures and equipment to another project or organization.
2. **Re-Cycle:** Structures will be broken down and transported to an approval waste disposal site or re-use in the rehabilitation of borrow pits. The materials should be tested for possible contamination at a EKSEPA certified laboratory.
3. **Disposal** – Materials that are unsuitable for recycling should be disposed to a licensed waste management facility.

5.3.2 Re – Vegetation Process

Positive environmental impacts are anticipated from the site decommissioning activities because of the restoration of vegetation to pre-construction state. This may also facilitate the return of wildlife species to their native habitats. The process of re-vegetation at the project site will involve the following.

- Replaced topsoil should be at a depth of between 75mm and 150mm (depending on the soil and slope conditions)
- Re-Vegetated areas should be protected from excessive trampling to prevent possible soil erosion or compaction.
- Seeded/Planted areas should be properly and regularly watered.

- Develop a 1 – 2 year maintenance programme to monitor seed germination, plant growth, weed removal and need for replanting. The contractor should take necessary precautions to prevent any occurrence of large scale soil erosion.
- Trucks and other heavy construction equipment should be prohibited in the re-vegetated areas.

CHAPTER SIX

ENVIRONMENTAL MANAGEMENT PLAN

6.1 INTRODUCTION

Environmental management is a planned, integrated programme aimed at ensuring that unforeseen and unidentified impacts of a proposed project are contained and brought to an acceptable minimum. In conducting its business activities, Ekiti State Ministry of Works and Transport, (SMWT) places a strong emphasis on maintaining safe and healthy working conditions for its personnel and minimising the effect of its activities on the natural environment. These objectives are achieved through the implementation of the policy and guidance that integrate environmental management approaches into its developmental and operational schemes and which typically addresses a number of environmental issues including the following:

- Identification of environmental sensitivities;
- Identification of potential significant impacts;
- Adoption of design measures or operational procedures that reduce impacts to acceptable levels;
- Establishing emergency and contingency plans;
- Monitoring the effectiveness of environmental protection; and
- Auditing the success of the overall strategy.

The EIA of road development (construction and rehabilitation) has addressed the impacts of the project. The results show that the impacts of the project are not severe and are thus acceptable. As part of the continuing process of management of Health, Safety and Environment issues relating to the project, the latter issues of monitoring and audit can now be addressed.

In order to ensure that the environmental consideration and mitigation recommendations of the EIA are implemented and to guarantee the achievement of SMWT's Corporate Policy on environment and that the provisions of the Health and Safety plan are accommodated in subsequent stages of the projects, an Environmental Management Plan (EMP) has been developed. The EMP consists of plans, procedures and programmes, covering areas such as: the handling of hazardous materials and wastes, emission and discharge monitoring, site

inspection and auditing and emergency response. It is formulated to ensure that the environmental mitigation requirements outlined in the EIA are central to the management of the implementation and operation of the proposed projects.

6.2 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

Environmental Management Plan (EMP) is usually prepared as part of an EIA reporting. It is a tool used to make sure that unnecessary or reasonably avoidable negative impacts associated with the construction, operation, and decommissioning of a project are prevented. It also makes certain that the positive impacts (benefits) of the project are enhanced. The mitigation measures recommended by EIA team in this report have been incorporated in the preparation of the EMP. This ensures that the management actions relating to the EIA also underscores all the physical and social economic elements (with respect to the environment) that should be monitored by the project proponent throughout the life cycle of the proposed project. In addition, the roles and responsibilities of key stakeholders with respect to the short- and long term environmental mitigation and monitoring are discussed as well.

In particular, this EMP provides an essential instrument to ensure that the mitigation of negative impacts and enhancement of positive impacts is implemented effectively during the life cycle of the proposed road project. It should, however be noted that the EMP should not be viewed as a prescriptive and inflexible document. Rather, based on given site conditions, the scope and technical approach can be modified. Essentially, the EMP is intended to promote the practice of pragmatic, cost – effective and efficient environmental management throughout all phrases of the project and post-project requirements. The objectives of the EMP for the proposed alternative link route are to:

1. Make sure that recommended mitigation measures described in EIA report are adopted during the implementation of the project.
2. Use best management practices in the environmental management of the proposed project to achieve continuous improvement in environmental performance are implemented.
3. Address changes in project execution not considered in the EIA.
4. Ensure strict compliance with regulatory standards and criteria for waste discharge and disposal; and

5. Promptly respond to unexpected developments in order to prevent or minimize potentials environmental impacts.

6.3 Roles and Responsibilities of Major Stakeholders

The roles and responsibilities of key stakeholders who will be involved in the implementation of the EMP for the proposed project are described in this section.

1. **Project Proponent**

   The Project Proponent (PP) is responsible for the development and implementation of the EMP as supported by the EIA consultant. For the proposed route project, the PP is the Ekiti State Ministry of Works and Transport. Although the construction, operation and decommission phases of the project have been given to private contractors, the liability associated with non-compliance still rests with the PP.

2. **Environmental Control Officer**

   The Environmental Control Officer (ECO) makes sure that EMP requirements are communicated, understood and implemented. The PP and not the contractor should appoint the ECO for specific project phrases. He should have appropriate training and experience in the implementation of environmental management requirements. The ECO provides feedback to the PP on all environmental matters. Contractors are answerable to the ECO for non-compliance with the requirements stated in the EMP.

   The ECO will ensure that monitoring programmes are developed and implemented during the construction, operations and decommissioning phrases of the project. In the event of a serious threat or actual impact on the environmental during construction work, the ECO is empowered to order work stoppage. However, such action is permitted only during emergencies when consultation with the PP or Resident Engineer (RE) is not immediately possible.

   In some cases, the ECO may recommend to the RE that the contractor's representative or any employee (s) be suspended or removed from the site. For example, if the contractor or a member of his staff fails to comply with specific EMP requirements. In addition, no extension of time will be considered and all incurred costs will be borne by the Contractor. The ECO should be a EKSEPA accredited consultant to ensure effective communication between the Agency and the contractor.

3. **Environmental Officer**

The Contractor will appoint one Environmental Officer (EO) or several, if necessary. The EO reports directly to the ECO and his primary role is to coordinate the implementation of the EMP during the construction phase. He will liaise with the construction team on the implementation of EMP requirements.

4. **Environmental Site Agent**

The Contractor will appoint an Environmental Site Agent (ESA) who will be responsible for the implementation of the EMP (i.e. the environmental specifications) during the construction phase and will report directly to the ECO.

5. **On –Site Communication Procedures**

The EO will maintain a record of environmental incidents (Spills, impacts, Legal transgression etc.) as well as corrective and preventive actions for submission to the PP. In addition, the EO is responsible for maintaining a public complaints register, for recording all complaints and corrective actions, which is submitted to the PP. Each of these records should be available, upon request, to local and state government authorities for inspection. The contractor's meeting minutes should include any official queries, recommendations, corrective actions, and dates of compliance. These minutes form part of the official environment records on the project site.

Method statements

A method statement is used to control operation at the site and to ensure that all concerned are aware of related safety precautions. In particular, Method Statements contain information concerning the order of construction activities and specific methodologies. The Contractor will provide Method Statements describing in detail how the management actions contained in the EMP will be implemented. These should be submitted to the ECO and RE for review and approval. Thus, the RE will be able to design appropriate mitigation measures to prevent or minimize environmental impacts. All Method Statements will form part of EMP documentation for the project, and are subject to all stated terms and conditions in the EMP.

ESA Records

This is an ESA obligation to safe guard Site Instruction Entries and Diaries along with any observation or remarks. These documents should include minutes of meetings, and are part of the Project's official environmental management record.

6. **Record Keeping**

All records relating to the implementation of the EMP should be safe guarded. The records include Video footage and site photographs prior to during and immediately after construction. Other kinds of record keeping may include completed monthly checklists for the projects. These records should be kept for at least two years and be made available to the authorities upon request.

7. **Institutional Matters**

The ESA is responsible for the day-to-day implementation of the EMP, while the ECO is responsible for the monitoring of its implementation. In addition, the ECO will authorize the independent external audit of EMP implementation on a quarterly basis during road construction. The external auditor will prepare a brief report after each audit. These reports will be discussed at the site meetings and will be part of the project record.

8. **Obligations of the Contractor**

The actions to be taken to minimize negative impacts and enhance positive impacts (i.e. benefits) should be clearly stipulated. The Method Statements, prepared by the Contractor, may be required for specific actions and will form part of the EMP.

9. **Use of Local Workers**

During the proposed projects construction phase, the Contractor should employ both skilled and unskilled workers from local communities. Toward this end, the Contractor should present the ECO with a comprehensive recruitment Plan for local workers.

10. **Environmental Awareness Training**

The Contractors teams should be briefed on specific responsibilities described in the EMP. Such briefings should be given before and during project activities. They should also be educated on routine Health and Safety practices designed for on-site workers.

11. **Operational Guidelines for Site Workers.**

The Contractor is responsible for the behaviour and conduct of workers. In addition, the Contractor should make sure of the following at the project site.

* Provide appropriate fire extinguishers, and train personnel on use of such equipment.
* Ensure that workers wear hard hats and appropriate protective clothing.
* Don't allow trespassing on properties, and animal or bird hunting.
* Ensure compliance with safety regulations on electricity supply.
* Provide adequate First Aid facility and training program.
* Provide Health and Safety information on HIV/AIDS and malaria.
* Provide adequate security for the workers.

12. **Contingency Plans**

The Contractor will prepare contingency plans for ECO approval and subsequent referred to the PP, if necessary. The contingency plans should cover incidents, such as disruption of water or electricity supply, or other incidents as required by the ECO.

13. **Environmental Completion Statements**

An Environmental Completion Statement is a report prepared by the ECO for relevant authorities such as SMEnv and EKSEPA. The report discusses the completion of the project and compliance with the EMP specifications. The completion statement is issued after a final external audit of EMP implementation.

14. **Penalties for EMP Non Compliance**

Below are proposed penalties for violations of the requirements in the EMP. The proposed fines may be modified by the ECO after consultation with the Resident Engineer; the penalties should be paid to EKSEPA after being deducted from the Contractor's invoiced payments.

Minimum fine for minor offences, such as littering, trespassing etc. (to be determined by SMENV)

Minimum fine for violators such as small oil spills in a sensitive area (to be determined by SMENV)

Minimum fine for serious violations, including accidentals removal or damage of indigenous vegetation, hunting wildlife etc. (to be determined by SMENV)

These fines will be deducted by the PP from the Contractor's invoiced payments, and will be recorded in the minutes of the monthly site meetings.

6.4 Environmental Management Practices

In general, all road works are to be done in such a way as to cause little disturbance to nearby residents, property, and the public (where applicable). The Contractor will be held responsible for any claims, which may arise from such inconvenience. He will also be responsible for the adequate maintenance and clearance of channels etc. and for providing pedestrian and vehicular access at the site. The general environmental practices for executing the construction activities of the proposed project are described below.

6.4.1 On – Site Traffic Control

- The Contractor will make provision for safe vehicle movement at all times, with the exception of short period for blasting. Some road detours may be required at the site for the navigation of vehicles. Property owners will have to be compensated if they are affected by the detours.
- The Contractor will demarcate work areas and post appropriate warning signs to ensure the safety of workers and pedestrians.
- During post-construction, the Contractor will remove the barricades and rehabilitate the road accordingly.

6.4.2 Noise Pollution Control

- In the case of noise level at the site, the Contractor will comply with the FMEnv recommended 90 decibels for 8-hours worker exposure per day.
- The contractor will provide an approved integrating sound level meter to the ECO.
- The Contractor will always maintain the equipment in a good working condition.
- All work at the site will be during the day typically from 6.am to 6.pm, depending on local conditions. Any night work will be with the prior approval of the authorities, as well as residents in the communities.
- Prior to commencing project work, the ECO may require that operational methods of equipment should be submitted for specification and approval to ensure their suitability for the project.
- The Contractor will use hydraulic concrete crusher whenever applicable.

- The only equipment that will be allowed on the site for rock drilling will be quiet drilling rigs with a sound power level not exceeding 110DB (A)
- The following will be considered noise sensitive receivers: domestic premises hotel, hostel, temporary housing accommodation, hospital, medical clinic, educational institution, place of worship, library, court of law, entertainment centres, office buildings etc.
- The Contractor will, when necessary, apply as soon as possible for a construction noise permit in accordance with the FMEnv Regulations and display the permit as required and give a copy to the ECO.

6.4. 3 Dust /Air Pollution Control

- The Contractor will ensure that project related activities that generate dust at the site are avoided.
- The Contractor will install effective dust-suppression equipment, at his own cost, and to the satisfaction of the ECO.
- The Contractor will take appropriate measures to make certain that the concentration of air-borne dust will not exceed 0.5 milligrams per cubic meter, at standard temperature (25^0C) and pressure (1.0 bar) averaged over 1 hour, and 0.26 milligrams per cubic metre, at standard temperature (25^0C) and pressure (1.0 bar) averaged over 24 hours. This concentration will be maintained at the site boundary and at any nearby sensitive receiver point.
- Any material with the potential to create dust will be treated with water or sprayed with wetting agent.
- A three-sided roofed enclosure with a flexible curtain across the entry will be provided where dusty materials are being discharged to vehicles from a conveying system at a fixed transfer point. An exhaust system will also be provided for this enclosure and vented to a fabric filler system.
- All materials with the potential to create dust will not be loaded to a level higher than the side and tail boards of vehicles. The vehicles will be covered with a clean tarpaulin, which will be properly secured to reduce spills.

- Any stockpile of dusty material will be (i) covered entirely by impervious sheeting; (ii) placed in an area sheltered on the top and three sides; or (iii) sprayed with water or dust suppression chemicals.
- Topsoil is considered the top 150mm of the soil profile, irrespective of fertility appearance. It will be stripped when dry to avoid compaction.
- Soil stock piles will not be higher than 2.5m or stored for more than a year. They will not be contaminated with oil, diesel, garbage or any material that may affect vegetation growth.
- The Contractor will frequently clean and water the site to minimize fugitive dust omissions.
- The Contractor will restrict the speed of all motorized vehicles and confine haulage and delivery vehicles to designated roadways at the site.
- A facility for washing vehicle wheels will be installed at the site, and used by all vehicles prior to leaving the area. No earth, mud, debris, dust from working vehicles will be deposited on public roads. The contractor will submit details of the wheel clearing facility to the ECO prior to starting work at the site.
- All conveyors carrying materials that can potentially create dust will be totally enclosed and fitted with belt cleaners.

6.4.4 Water Usage

- Water for construction purposes may be abstracted from available water bodies with the prior approval of the ECO and EKSEPA.
- The Contractor will not discharge directly or indirectly (by runoff) any effluent or contaminated water or cooling or hot water into any public sewer, storm water drain, channel, stream course, or lagoon without the prior consent of the relevant authorities.
- If any office, site canteen or toilet facilities is erected, foul water effluent will be discharged into a sewer or sewage treatment facility.

6.4.5 Waste Management

- The Contractor will make sure that any sewage, waste water or effluent containing sand, cement, silt or any other suspended or dissolved material is not allowed to flow from the site onto any adjoining land. Any waste materials or refuse will not be

deposited anywhere on the site or on any adjoining land. rather, such materials should be removed from the site.

- The Contractor will be liable for any damages caused to adjoining land through failure to comply with EMP requirements.
- The Contractor will be responsible for adequately maintaining any existing site drainage system at all times, including removal of solids in sand traps, manholes and streambeds.
- Any proposed stream course and mullah temporary diversions will be submitted to the ECO for approval prior to such diversion work being commenced. Diversions will be designed to allow water discharge without overflowing, erosion or washout. The area through which the temporary diversion runs is to be reinstated to its original condition or as stipulated by the ECO after completion of permanent drainage system.
- The Contractor will provide the ECO the arrangements for ensuring that material from any earthworks does not wash into the drainage system. However, if such arrangements prove to be ineffective, the contractor will take additional measures, as directed by the ECO, to remove all silt that might have accumulated in the drainage system both on and off site.
- The Contractor will segregate all inert construction waste materials suitable for reclamation or land formation. These are to be disposed at specified dumping facilities.
- All non-inert construction waste materials considered unsuitable for reclamation or land formation will be disposed at a public landfill.

6.4.6 Erosion Control

- All existing erosion gullies along the alignment will be reconstructed by using suitable protection at the outlets. This may include stone pitching and by filling the gully with coarse compacted fill materials to curb the erosion.
- The presence of new erosion gullies is an indication that additional protection measures may be required. In order to curb the erosion, the contractor will promptly introduce adequate protection measures, as well as fill the erosion gully as described above. The ECO will monitor the formation of erosion gullies, and note the particular drainage of erosion. In addition, a photograph of the erosion will be kept on site.

- Topsoil from Road Construction work will be used to rehabilitate the construction of campsites, cut and fill areas.

6.4.7 Fauna, Flora and Farm Lands

- Natural vegetation at the site will not be disturbed. Any large tree, wetland, or swamp in the area will be preserved, except if it is directly affected by the road alignments.
- No indigenous plant, wildlife animals (i.e. reptiles, amphibians, birds etc) will be harmed. The ECO will be notified of any incident involving any of these species on the site.
- Care will be taken to ensure that cultivated farmlands and crops are not damaged by construction activities. In the event that the proposed alternative route alignment should affect any cultivated farmland, fence, or grazing field, the property owner should be notified, and duly compensated.
- In addition, care will be taken during construction activities that livestock is not injured or killed. This will include limiting the maximum speed for vehicles on site, and instructing drivers to give the right of way to pedestrians and livestock.

6.4.8 Accidental Risks

- To ensure safe construction in the temporary accesses during construction, Lighting devices and safety signal device will be installed.
- Traffic rules and regulations will be actively enforced in these temporary accesses.

6.5 Resettlement/Compensation Programme

Although the proposed route alignment mostly follows the existing road, there will be a number of changes that will require the relocation and resettlement of people. Compensation would be required primarily for land acquisition and structures, including houses, Churches, mosques, businesses, crops, and trees etc. which are located within the new alignment. Based on the EIA team observations and a review of the proposed road design, hundreds of people and several building and structures may be affected. These persons will have to be compensated, relocated and resettled in accordance with existing government policy. Where land acquisition is inevitable, the affected communities can be given option to resettle (if possible) close to their relatives, friends, neighbours in order to minimize the social costs of re-integration into new areas of communities.

The objectives of the Resettlement/Compensation Programme are to:

- Design a viable and equitable resettlement/compensation plan with community involvement.
- Ensure that persons whose land has been acquired for project purpose are adequately and appropriately compensated.
- Ascertain that displaced persons are socially and economically resettled in project vicinity or other suitable location.
- Reduce or prevent any potential negative environmental impacts relating to project activities.

Land Acquisition and Compensations Laws

In Nigeria, the possession of land for road projects is regulated by the Land Acquisition Act, 1978 and the Nigerian Urban Planning Act 1992. In addition, the Involuntary Resettlement Act (OP/BP 4.12) is triggered in the present situation because the proposed road will cause involuntary acquisition of land and other assets. Specifically, it will involve (a) relocation or loss of shelter (b) loss of assets or access to assets, and (c) loss of income or means of livelihood, whether or not affected persons physically move to another location. Therefore, a Resettlement Policy Framework (RPF) may need to be prepared by the government. The RPF sets the guidelines for the Resettlement and Compensation Plans (RAP) that would have to be prepared with due consideration to fairness for the impacted persons.

6.5.1 Compensation

The payment of cash as compensation complies with Part III (10) of the World Bank OP4.12, which states. “the payment of cash compensation is appropriate where livelihoods are land based, but the land taken for the project is a small fraction of the affected asset and the residual is economically viable, where active market for land, housing and labour exist”. A Resettlement/Compensation Committee should be formed to advise the government on the compensation of affected people and communities. The Committee should include officials or representatives of the following institutions and organizations:

- Project ECO
- Contractor’s ESA
- EKSEPA

- Ekiti State Ministry of Works and Transport
- Ekiti State Ministry of Environment.
- Ministry of Lands, Housing and Urban Development
- Local NGOs
- Local Residents Association
- Local Property Owners

The task of this Committee will be to oversee the relocation and compensation process, as outlined within a clearly defined Resettlement/Compensation Legal Framework. The Committee will encourage community participation; ensure transparency in the process as well as accountability, about the resettlement programme and people's entitlements. The main role of the committee will be to apply existing laws to ensure minimum hardships to affected persons during the relocation.

Eligibility

The owner of the property under the above Laws is the only person legally entitled to compensation. In most cases, the owner is the household head who takes care of the other members, including the extended family.

Valuation and Negotiation

Compensation for land and buildings/Structures will be assessed with regard to the market value of the affected property. Where particulars on transactions of similar properties are readily available and easily accessible, the simple comparative approach should be adopted with adjustment based on the condition of the properties (the subject property and the comparable ones). During the consultation process, the extent of damage to properties will be made known. When the amount of compensation to be paid is disclosed, the affected people may appeal if not satisfied. The affected people will be briefed on the compensation/resettlement process. In addition, each person will be given the opportunity to comment on the draft compensation/resettlement plan. Eventually, the final version of the plan will be presented to the affected persons for adoption.

6.6 Environmental Monitoring Programme

The overall objective of Environmental Monitoring is to make sure that mitigation measures are implemented and that they are effective. Monitoring also enables response to any new issues of concern at the site. The activities and indicators that have been recommended for monitoring are presented in the environmental monitoring programme. Essentially environmental monitoring will be used to ascertain that all construction activities comply with environmental provisions and standard specifications, so that all mitigation measures are implemented. The contractor will appoint an experienced professional who would be responsible for the implemented of social/environmental requirements. This person will maintain regular contact with the Ministry of Works &Transport and EKSEPA officials. The Contractor and the government officials are responsible for ensuring that the proposed mitigation measures are properly implemented during the construction and operation phases. The monitoring programme will be reviewed and modified according to EMP requirements as the road construction progresses. The monitoring programme will specifically address (1) Air Quality and Noise impact and (2) Soil Quality within the project area. The details are briefly described below.

The results of environmental monitoring will be evaluated and reported to the Ministry of Works and Transport, as well as to EKSEPA. Furthermore, based on updated information, additional mitigation measures may be considered for the project site.

1. **Air Quality and Noise Level**

   The levels of TSP, CO, NOx, and Sox will be monitored in ambient air by the State Ministry of Environment. The measured valued will be compared with FMEnv ambient air quality standards (Table 6.1) In addition, air sampling will be conducted around the base of the camp as well. Details of the air and noise monitoring at the site are presented in Table 6. 2

2. **Soil Quality**

   The parameters to be monitored in soil samples includes pH, particle size, total organic carbon (TOC) total nitrogen, heavy metals, and total hydrocarbons. The soil samples will be collected within the project area, as well as downwind of the site. Details of the soil quality monitoring at the site are presented in table 6.2.

TABLE 6.1: NIGERIA AMBIENT AIR QUALITY STANDARDS

Sampling Location	SO_2	CO	NO_2	TSP (PG/m^3)	**NOISE dB (A)**
	(ppm)				
FMEnv (Daily Average Concentrations)	0.01	10	0.04	250	90 (8 hrs)

TABLE 6.2: ENVIRONMENTAL MONITORING PROGRAMME

Environmental Component	**Indicator**	**Monitoring Frequency**	**Sampling Location**	**Responsible Authority**
Air Quality	TSP, Co, Nox, Sox Co_2 THC/VOC	• Monthly during construction phase • Quarterly during first 2 years of operation activities. • Bi-annually	Fajuyi/ Adunni Olayinka busstop, Awedele junction and NTA road junction Fajuyi/ Adunni Olayinka busstop, Awedele junction and NTA road junction	* Ministry of Works and Transport * EKSEPA Status report submitted to the SMENV and MLHUD
Noise	Noise Level at receptor points			
Soil Quality	PH conductivity. Heavy metals TOC, Total Hydro-carbons	• Quarterly during construction phase work. Bi-annually during operation phase work		• Ministry of Works and Transport • EKSEPA Status report to SMENV and MLHUD

CC carbon monoxide Sox = Sulfur dioxides

NOx = Nitrogen oxides TSS = Total suspended solids

pH = an expression of the intensity of the basic or acid condition

TSP = Total Suspended particulate matter.

For easy understanding and implementation, this section also include a summary of the impacts and corresponding mitigation measures, including responsibility and cost; institutional arrangement; monitoring; and capacity building for the implementation of the EMP.

Table 6.3: Summary of Environmental and Social Impacts and Mitigation Measures

S/N	Impacts	Mitigation	Responsibility	Monitoring	Supervision
	Soil Erosion	Place drain outlets so as to avoid cascade effect; proper termination of drains; planting vegetation	Contractor	SMWT/Third party entity/consultant	SMWT/SMENV
2	Water Pollution	Bridges drainage systems, embankment drainage canals	Contractor	SMWT/Third party entity/consultant	SMWT/SMENV
3	Air Pollution	Periodic water sprinklings, Vegetation screens	Contractor	SMWT/Third party entity/consultant	SMWT/SMENV
4	Flora and Fauna	Avoid animal road trespassing, forbid workers from poaching	Contractor	SMWT/Third party entity/consultant	SMWT/SMENV
5	Noise Pollution	In built-up areas, work will be limited to day time, workers will be obliged to used PPE (ear mufflers)	Contractor	SMWT/Third party entity/consultant	SMWT/SMENV
6	Damage to Cultural Heritage	None. But chance finding procedures would be followed as needed	Contractor	SMWT/Third party entity/consultant	SMWT/SMENV
7	Mines/Quarries//Borrow pits	Use of government approved sites and proper decommissioning at the end of project	Contractor	SMWT/Third party entity/consultant	SMWT/SMENV
8	Diffusion of Diseases	HIV/AIDS/STI awareness campaigns/orientation for workers and host communities	Contractor	SMWT/Third party entity/consultant	SMWT/SMENV
9	Traffic and Workers accidents	Diversion, Sign-posts, Speed limits, Police patrolling, use of PPE	Contractor	SMWT/Third party entity/consultant	SMWT/SMENV
10	Construction Camps	Careful location, construction and management of camps; restore site to satisfactory standard at the end of project	Contractor	SMWT/Third party entity/consultant	SMWT/SMENV
11	Waste management	Segregation, storage, evacuation and disposal at government approved sites; provide adequately located and maintained latrines	Contractor	SMWT/Third party entity/consultant	SMWT/SMENV

The consideration presented in table 6.3 indicates that the proposed construction of New Ado-Iyin Ekiti Road will have a number of significant adverse environmental and social impacts during construction and operation periods. These impacts are however, site specific, and the required mitigatory measures can be designed more readily - typical of category B projects. With appropriate mitigation, particularly during the construction phase of the project, none of the impacts referred to in this report will be significant. It should be pointed out that the road will bring numerous social and economic benefits to the communities within the area as a fast, safe and all weather roads will allow efficient and rapid movements of goods between the different regions of the country and beyond. The positive results would be sustained if the road works and subsequent maintenance are carried out in line with this EMP.

The EMP has been comprehensively developed by following international standards for (environmental) management planning. It covers all the phases of the projects from project design to project decommissioning. The various responsibilities and tasks involved in implementing the EMP for the development project vary with the project stage and are summarized in Table 6.4 and appendix 3. The key issues are briefly discussed below.

Table 6.4: SUMMARY OF ENVIRONMENTAL MANAGEMENT RESPONSIBILITIES FOR VARIOUS STAGES OF PROJECT

S/N	Project Phase	Action
1	Project design	Review design compliance with ESMP and regulations
2	Project planning and scheduling	Setting up of an environmental focal point and institutional arrangement
3	Contingency planning	Training, plan development and implementation
4	Project mobilization	Supervision of the process
5	Construction phase supervision	Supervision including inspection, monitoring, and auditing activities
6	Construction, demobilization	Supervision of the process
7	Operations and maintenance phase supervision	Supervision including inspection, monitoring and auditing of activities
8	Project Decommissioning	Post project monitoring and auditing

(i) *Waste Management Guidelines*

During the construction and subsequent operation an maintenance phases, it is inevitable that discharges of materials to the environment will occur. If these are not controlled, they may act as a source of environmental disturbance or nuisance. The level of discharge expected has been quantified in Chapter seven. All the wastes that cannot be re-used will be safely

managed and disposed off in a manner that meets regulatory requirements. Below are the waste management guidelines and waste disposal systems that will be considered in this project.

(ii) *Waste Inventory*

The primary wastes include exhaust emission gas – sulfur dioxide, carbon monoxide, construction materials, fuel storage containers, scrap metal and domestic and sewage wastes. These wastes shall first be segregated, minimized and/or disposed of in accordance with waste management standards as outlined in this Section of the report.

(iii) *Inspections, Audits and Monitoring*

During the course of construction and operation of facility, and eventual decommissioning of the project, agents of regulatory authorities SMENV and SMWT shall conduct regular inspections to determine the level of compliance with the guidelines of the EMP and applicable regulations and statutes. Specifically, the SMENV waste discharge requirements (FEPA, 1994), and statutory waste management guidelines must be complied with. Site inspections by SMWT and regulatory authorities shall be regular not necessarily according to any structured pattern. The inspection of facilities, in accordance with the industry practice, will be at least once in six months.

(iv) *Monitoring Objectives*

In order to measure and quantify the impacts of the project development on the receiving environment, the following monitoring objectives are established:

(i) Monitor alterations in existing physical, chemical, biological and social characteristics of the environment.

(ii) Determine whether any detected changes in environmental components are caused by the project or natural occurrences.

(iii) Determine the impacts of non compliance with EIA and EMP requirements by the contractor, in particular to monitor emissions and discharges and ensure compliance with local, national and international standards.

(iv) Determine the effectiveness of the ameliorating measures

(v) highlight areas of concern unforeseen in the EIA and EMP and provide a basis

for recommending further amelioration measures.

(v) ***Impact Indicators***

In identifying impact indicators, priority is given to environmentally sensitive areas, and in this regard, it is noteworthy that the entire project area falls under this category. Based on the results of baseline studies and consideration of SMENV limits, the following impact indicators (Table 6.2) are identified with the corresponding environmental components.

Table 6.5: Monitoring Impact Indicators

Environmental Components	**Impact Indicators**
Atmospheric	Particulates, Volume discharged, SO_x, NO_x, CO, heavy and trace metals, and HC.
Soil	Texture, pH, Total Organic Carbon, Nutrients, Heavy metals
Water Quality:	DO, COD, BOD, pH, Nutrients, Turbidity, TDS, TSS, Heavy metals, Hardness
Aquatic ecology	Diversity, Abundance, Benthic Fauna
Socio-Economic	Health status

(vi) ***Monitoring Programme***

A monitoring programme is being designed which will meet the data needs of SMWT for self enforcement of corporate policy and compliance with national and international regulatory standards. The programme is based on the status of the existing environment and the assessed incremental impact of the additional facilities on areas designated as environmentally sensitive. The proposed monitoring programme is shown in Table 6.3.

Table 6.6: Environmental Monitoring Programme for the Road Development Project

Impact Parameter	Time of Impact/Project Phase	Impact Indicator	FME Limits	Sampling Location	Sampling Frequency	Sampling Method	Monitoring Duration	Monitoring Personnel
Ambient Air Quality & particulate and gaseous emission	Site preparation, Construction & Operation of facility	TSP NO2 SO2 CO HC	600µg/m3 100 µg/m3 300 µg/m3 20 ppm	Receiving air - upwind & downwind of site	Daily, during site preparation, construction & for 1 month after; Once every three months during operation of facility	Air Sampler	Short-term Long-term	SMWT (Highway Div) Contractor (ENV)
Noise	Site Preparation, Construction & Operation of facility	Noise Level	80 dBA (8-hr)	Work Site and 200 m away	Daily (During site preparation, construction; Monthly during production	Decibel Noise Meter	Short-term Long-term	SMWT Contractor (ENV)
Water Quality (Surface & Undergro und)	Site Preparation, Construction	pH Temperature Oil & Grease Salinity COD BOD Turbidity TDS TSS Heavy Metals	as specified in FMENV Guidelines	(i) Receiving water - 500m upstream & downstream of discharge point; (ii) Monitoring wells onsite & down gradient;	Daily during Land preparation & construction & for 1 month after	Water Sampler, Turbidi-meter and pH-meter	Short-term	SMWT Contractor (ENV)
Soil	Site Preparation, Operation of facility & Decommissionin g	Particle Size, Total Org C, Oil & Grease Heavy Metals, Nutrients,	50m each side of Highway corridor.	For at least 1 year after project commissioning	Visual Inspection and Soil Sampler	Compliance, Data Bank	Long-term	SMWT Contractor (ENV)

Note:
short-term = Duration of clearing/Construction

Long-term = Duration of Operational activities

Presented in Table 6.3b is the monitoring programme of the Project Affected Peoples; the table highlights the different phases, various activities, and the responsibilities.

Table 6.7: Monitoring Programme of the Project Affected People

Time of Impact/Project Phase	**Activities**	**Responsibility**
PLANNING Scoping and Screening	□ Initial site visit an consultation □ Identification of Resettlement and Social Issues □ Application of safeguard policies □ Categorization □ Action plan □ Screening Report □ WB No-Objection	Consultant: Supervision by SMWT /MLHUD
DESIGN AND CONSTRUCTION	□ Compensation □ Construction □ WB No-Objection	Consultant: Supervision by SMWT /MLHUD
EXECUTION Implementation and monitoring	□ Implementation of EMP □ Monitoring and reporting on environmental and social mitigation measures □ Monitoring and reporting of Resettlement and livelihood issues	Contractors Supervision by SMWT /MLHUD and the community
OPERATIONS (POST-IMPLEMENTATION) Operation and maintenance	□ Maintenance □ Monitoring and reporting of Resettlement and social livelihood issues	Contractors Supervision by SMWT /MLHUD and the community

i) *Scope of Monitoring:*

The monitoring programme will be developed to verify the emissions and discharges based on existing national and international regulations on environmental pollution and on the findings in each monitoring campaign. The Environmental Guidelines and Standards for the Industry in Nigeria (FMENV, 1991) defines a required monitoring programme and the World Bank policies. The initial emissions and discharge monitoring programme is outlined in Table 6.2. The environment in the project area can be verified by focusing on measuring specific indicators of environmental and socia parameters that is representative for the overall environmental quality and at the same time relatively easy to measure.

(viii) *Parameters to be monitored*

The indicators of environmental quality of the surface water which will be monitored include:

Dissolved oxygen

 Total N

 pH

 Biological or chemical oxygen demand (BOD or COD)

 Turbidity

 Oil and grease

 Heavy metals

Discharges

- fluid discharges project operation;
- recipient water monitoring ; and

Emissions

During construction, operations and maintenance of the proposed project, all emissions of air, water and noise shall comply with regulatory limits. In addition to the above programmes, monitoring will be undertaken for the following atmospheric emissions:

- Particulates
- Volume discharged
- SOx
- NOx
- CO
- Heavy metals, and
- HC

(ix) *Monitoring Methodology*

The procedures for assessing the impacts of projects on the environment. include:

 identifying the source and characteristics of all wastes generated;

 quantifying emissions and discharges to the environment; and

 quantifying and qualifying land-take and its direct effect on terrestrial ecology.

This environmental and social assessment will continue to evolve along with the project, and is in fact the iterative process of impact mitigation. Monitoring and audit will continue throughout the life of these projects. Monitoring may involve measuring specific indicators of environmental quality parameters and comparing with baseline levels. The frequency of this depends on the results of the monitoring and inspections. If the results of the monitoring measurements give rise to concern about the environmental quality and social issue. For example, more detailed surveys will be performed which may include the sampling and analysis of organisms living within the habitats and PAPs livelihood of the project area.

6.7 WASTE MANAGEMENT STRATEGIES

The strategies of waste management which will be adopted are summarised as follows:

- To reduce the volumes of wastes generated.
- To recycle and re-use waste where feasible.
- To treat hazardous waste and make them inert before disposal.
- To ensure safe and responsible collection, storage and disposal of all wastes.
- To provide auditable records of all waste streams.
- To monitor waste disposal activities in order to prevent future liabilities.
- To reduce the negative impact of the project operations on the environment.

6.8 WASTE MANAGEMENT PROGRAMME

Construction activities will result in the generation of a variety of wastes which can be divided into distinct categories based on their constituents, as follows:

- surplus excavated material (public fill) that require disposal;
- construction and demolition(C&D) waste;
- chemical waste; and
- municipal waste.

The guideline for waste management would be used to further develop and articulate a tailored waste management plan that takes account of waste identification methods, waste storage, waste tracking, monitoring and audit of waste disposal sites.

Table 6.8: Environmental Monitoring Programme for the Road Development Project

Discharge Type	**Impact Indicator**	**FMENV Limits**	Sampling **Frequency**	**Monitoring Personnel**
Sewage and Domestic waste	Chloride Quantity		Weekly Daily	SMWT/ Contractor
Solid Wastes	Quantity	Segregated & treated according to current SMWT Guidelines	Segregated & Quantity recorded weekly	SMWT/ Contractor
Diesel oil Lube oil	Volume		Monthly	SMWT/ Contractor

Excavated material is defined as inert virgin material removed from the ground and sub-surface. Excavated material may be generated during the repositioning of slip roads / local access roads, drainage and utility undertakings and slope works. The proposed widening will involve extending and modifying the existing embankments to facilitate the construction of new carriageways at-grade with the existing Highway. This will include the clearance of high quality topsoil used for planting as well as cutting and filling of existing fill from the embankment construction to accommodate both widened embankments as well as retaining walls in areas of limited space. It has been identified that even with the reuse of excavated materials; there will be a net deficit of construction fill. A number of sources of fill have been investigated for the project.

Whilst there are a variety of sources of fill, the suitability of any such fill may need to be determined for particular uses. In particular, stringent acceptability criteria are likely to be applied to any materials used in reinforced slopes and associated structures where stability is a consideration. The environmental management measures would focus on reducing the production of dust, atmospheric emission, risks to life and accidents and energy efficiency and should include:

- Developing procedures to minimise the generation of particulates around the site;
- Implementing noise abatement programmes (depending upon the sensitivity of neighbouring facilities);
- Maintenance and efficiency of any on-site abatement equipment and treatment plant.

Excavated Materials

Some excavated material will be generated during the repositioning of slip roads / local access roads, drainage and utility undertakings and slope works. However, there is likely to

be a net deficit of fill. It is anticipated that cut material arising through the works will be reused on site thereby minimising the volume necessary for disposal. Where material is to be reused on site or where material is brought in to the site from the identified source, fill (and topsoil) may need to be stockpiled. Stockpiles have the potential to cause nuisance through fugitive emissions to air or increased suspended sediments of local water courses where materials are allowed to be eroded. Areas for stockpiling have not been determined at this stage, however given that any stockpiling results in "double-handling" of material (which is time consuming) , it can be reasonably assumed that this would be minimised as far as possible by the contractor. If the appropriate measures are taken for the management of stockpiles, impacts are not considered to be significant.

Table 6.9: Environmental Management Plan for the Road Development Project

Aspect	Environmental & Social hazard	Impact	Degree of Impact	Mitigation Measures
Site clearing and preparation	Physical disturbance	Land-take, disturbance and loss of flora & fauna; Loss of property; Human displacement Increased erosion potential	Acceptable	adequate supervisionn during site clearing, preparation Compensation & Resettlement
Construction	Dust & emission from earth moving equipment Increased traffic & noise Wastes discharge	Public health and nuisance; loss of wildlife Road safety Water quality and ecology	Acceptable	Create safety zone Water hauling road/site Locate equipment 300m away from sensitive receptor
Highway Operation & Maintenance	Air emission Noise Risk to life from traffic Accidents	Human health	Acceptable	Motor speed related emission control Provision of ear defenders
	Wastes discharge	Water quality and ecology	Acceptable	Compliance with SMENV regulations Provide waste Incinerator
	Employment opportunities	Improved quality of life	Acceptable	Provide training to unskilled local labour
Decommissioning	Wastes	Human health	Acceptable	Standard waste disposal guidelines
		Human health, hydrology Erosion potential	Acceptable	Land rehabilitation: re-vegetation

6.9 WASTE MANAGEMENT

The Waste Management Plan (WMP) shall be developed and implemented according to a best-practice philosophy of waste management. There are various waste management options, which can be categorised in terms of preference from an environmental viewpoint. The options considered to be more preferable have the least impacts and are more sustainable in a long-term context. Hence, the hierarchy is as follows:

- avoidance and minimisation, i.e. avoiding or not generating waste through changing or
- improving practices and design;
- reuse of materials, thus avoiding disposal (generally with only limited reprocessing);
- recovery and recycling, thus avoiding disposal (although reprocessing may be required); and
- treatment and disposal, according to relevant laws, guidelines and good practice.

There is anticipated shortfall in fill requirements as such:

- fill should be re-used on site;
- Inert material deemed unsuitable for reuse on site, reclamation or land formation; and non inert construction waste material should be disposed of at a landfill;

The suitability (or otherwise) of material for reuse on site shall be detailed in the WMP. If, for any reason, the recommendations cannot be implemented, full justification should be given in the WMP for approval by EPD.

As identified above, there is anticipated shortfall in fill requirements and excavated materials are expected to be reused on-site. Excavated material should be segregated, such that topsoil is stored separately from fill and treated accordingly to avoid degradation.

Any stockpiles should be sited away from existing watercourses and suitably covered to prevent wind erosion and impacts air quality and water.

6.10 MONITORING SCHEDULE

The monitoring actions required and frequency will vary depending on the parameter to be determined and discharge type as summarized in Tables 6.2, 6.3.and 6.4

6.11 ENVIRONMENTAL AUDIT

The effectiveness of the EIA process relies on the availability and quality of information and

data. In order to ensure that the EIA process remains valid and robust, the monitoring data must be reliable. Audit schemes aim at verifying the effectiveness of environmental control and highlights areas of weakness in environmental management. The audits are focused on areas of project perceived to be environmentally sensitive and having the highest environmental risk. The environmental audit process provides an assessment of the project, environmental management strategies and the effectiveness of the system in fulfilling the Company's environmental policy. Regular audit would be carried out for every major facility during construction and operations and maintenance, including on-site processing and storage facilities, waste disposal facility, maintenance facilities and emergency response facilities.

6.12 Contingency Planning

Despite all care and diligence exercised in project execution, accidents do occur. Accidents could occur from equipment failure or third party sabotage, all to the detriment of the environment. Consequently, Contingency Plans are usually made to handle such situations. Although serious incident is unlikely, SMWT has in place a Contingency Plan which will be activated; regularly updated with periodic exercises conducted.

6.13 Project Organization and Responsibilities

SMENV has to establish a policy and schedule for responsibilities and training on matters relating to the environment. There is a line responsibility for which all level of staff is accountable. Line management will take full responsibility for environmental issues.

A focal point, the Management Safety, Health and Environmental (SHE) Committee, which will consist of State Director of Highways, Deputy Director of Planning (Highways), SMWT HSE Manager, HSE representatives of the different zones will be set up to coordinate HSE performance and will be responsible for compliance with safety and environmental standards and regulations. The Committee has been charged with the following specific tasks:

- The developing and maintaining of the Environmental Management Plan (EMP) and associated plans for materials management, waste management, accident preparedness and response, inspection and monitoring, staff training;
- The implementation of the Environmental Management Plan related tasks;
- Conducting or organising periodic audits;

- Initiating or organising corrective actions when necessary;
- Preparing and managing documentation related to environmental performance;
- Regular and incidental reporting to the SMWT management;
- Liaising and reporting to the appropriate environmental regulatory authorities.

The director, SMENV is responsible for maintenance of the safety and pollution control equipment. The Quality Control Manager will operate independently from the Plant Manager. The Quality Control Unit will be staffed with at least two licensed chemists and one safety engineer. SMENV's management thus, affirms total commitment to safety and plans to ensure that all environmental considerations are integrated into related activities. Induction and training courses for staff are part and an effective parcel of environmental management system, which is of paramount importance to SMENV/PP.

6.14 FOLLOW-UP ACTION PLAN:

The SMENV is expected to conduct surprise inspection from time to time to confirm the compliance with its standards.

- Signs of poor housekeeping should be noted in the inspection of facility such road failures in form of pitting, rutting and slipping;
- Procurement of the monitoring equipment to analyze traffic count, weighing bridge, emission, ambient air quality, noise and water quality;
- Provision of adequate personal protective equipment, particularly effective protection against inhalation of particulate matter and ear protectors;
- The age of process equipment and the presence of emission abatement technology;
- The means of transport to and from the site and the associated impacts;
- The boundary of the site should be walked to determine the adjacent properties/facilities and their sensitivity;
- Views of stakeholders on the operation at the road facility;
- The disposal routes of any collected waste;
- Contact should be made with the local regulatory agencies to determine compliance record and whether complaints have been made by the public;
- Annual compilation of all the monitoring results and highlight of the activities related to facility social, safety and the environment of the quality control unit;

6.15 INTER-AGENCY AND PUBLIC/NGO

The EIA work shall be carried out in close cooperation with ERA. The Consultant shall assist in coordinating the Environmental Assessment with other governmental agencies, notably the Environmental Protection Authority (EPA), Wildlife Conservation Organization (WCO) and ERA's Environmental Monitoring and Safety Branch (EMSB), and in communicating with and obtaining the views of local affected groups and persons and NGOs, particularly in cases of new road alignments. Relevant institutions or individuals should be consulted and the outcome of consultation should be forwarded. The New Driving Force Programme will be implemented through a set of projects for the promotion of purchasing fuel e

fficient vehicles and of driver training and communication of fuel efficient driving behaviour.

CHAPTER SEVEN

CONCLUSIONS AND RECOMMENDATIONS

This EIA was conducted in accordance with applicable Nigerian Legislative requirements. Additionally, pertinent international standards and guidelines, including those issued by the World Bank were also used in the assessment. In particular, a structured approach was used to (a) identify project activities and associated environmental attributes; (b) assess potential impacts; and (c) minimize or prevent adverse effects through mitigation measures. Furthermore, stakeholders/public consultation was a key aspect of this assessment.

The findings of the EIA suggested that the proposed road project is expected to have a number of adverse impacts on the environment. However, most of these are anticipated to occur during the construction phrases, and will be mitigated in the road design – construction activities. Moreover, the proposed route will follow existing alignments in some sections of the road; hence, the potentials negative impacts will be spatially reduced along road construction segments.

7.1 Conclusions

There are a number of beneficial impacts associated with the proposed road project. Some of the most significant beneficial macro impacts on the environment are:

- The economic benefits generated by the project that include:
  - (1) reduced vehicle operating costs;
  - (2) reduced travel time and number of accidents;
  - (3) improved access to local markets;
  - (4) reduced cost of commodities;
  - (5) improved productivity in the project area.
- Employment opportunities will be available to local skilled and unskilled workers, in particular, during the construction phase. The increased financial flow will have overall benefits for the local economy.

Additionally, there are some adverse impacts that are related to the proposed road upgrading and reconstruction. The most significant adverse macro impacts on the environment include:

- Resettlement and compensation of people whose properties encroach on the proposed road alignments.
- Health and safety issues related to HIV/AIDS and Malaria.
- Removal of vegetation along the Corridor will result in soil erosion and loss of wildlife habitat.
- Potential for increased crime and illegal activities within Ekiti State and adjoining states due to a comparatively faster transport corridor.
- Increased urbanization of historically rural areas and potential impacts on relatively environmentally pristine corridor segments as future out posts for commercial migrant settlements and transitory shanty slums or rest stops.

As noted above, certain upgrading and reconstruction activities will have adverse impact on the environment; however, the overall socio-economic benefits to both Ekiti State and the country far outweigh any potential or anticipated concerns.

7.2 Recommendations

The EIA has proposed an Environmental management Plan and a Monitoring Programme to address the management of the identified environmental issues associated with the proposed project. The Plan primarily consists of these actions.

(a) Implementation of the Mitigation Measures in the EMP.

(b) Monitoring the implementation of EMP requirements.

(c) Resettlement/Complementation Plan.

In general, the mitigation of the potentially negative impacts on the biophysical environment will be part of the road design. However, the negative social impacts will require some intervention as outlined below:

- Improvement and expansion of social facilities and services
- Collaboration with local stakeholders to counter social upheavals
- Sex education campaigns to combat HIV/AIDS threats.
- Provision of alternative social services, facilities and job opportunities for people affected by the project.

The proposed alternative link route will cause involuntary acquisition of land and other assets along the proposed road alignment. Specifically, it will involve (a) relocation or loss of

shelter, (b) loss of assets or access to assets, and (c) loss of income or means of livelihood, whether or not affected persons physically move to another location. Consequently, a Resettlement Policy Framework (RPF) may need to be prepared by the government. The objective of the RPF is to develop appropriate guidelines for the development of a Resettlement and Compensation Plan (RAP) in consultation will the affected persons.

Overall, the socio-economic benefits associated with the proposed road upgrading and reconstruction significantly out weight the negative environmental and social impacts. Nevertheless, it is important that the application of EMP requirements should be pragmatic and cost-effective. In addition, the establishment of adequate institutional capacity is paramount to ensure compliance with the proposed EMP. This includes the recruitment and training of a competent ECO. This person will be responsible for implementation of the EMP, as well as the daily operations at the project site. In order to ensure an effective communication mechanism between EKSEPA and the Contractor regarding EMP requirements, the ECO should be a EKSEPA accredited consultant.

REFERENCES

Adeniyi, I.F. (1987): The Chemical Composition of Niger Delta Waters. In Final Report on The Environmental Pollution Monitoring of the Niger Delta Basin of Nigeria. Vol. 5.

Alloway, B. J. 1990. Heavy metals in soils. Blakie & John Wiley & Sons Inc. Glasgow & London. pp 29-39

Alpha (1981). Standard Methods for the Examination of Water and Waste Water, American Public Health Assoc., N.Y.

Amokaye, G.Oludayo.(2004) "Environmental Law and Practice in Nigeria: University of Lagos Press. Akoka, Lagos.

Apha, A, (1980): Standard methods for the examination of water and waste water. New York

Abbreviated Resettlement Action Plan (ARAP) Report of Proposed Rehabilitation of Akure-Ilesha Road by FMW,2011

Black, C.A. (ed) 1994). Methods of Soil Analysis. American Soc. of Agron, Madison, WI (USA), Parts 1 & 2.

Blocker, P. C., 1973. 'Major aspects air pollution monitoring in urban and industrial Area' *Concawe*. The Hague.

Bray, R.H., and Kurtz, L.T. (1945). Determination of Total Organic and available form of Phosphorus in soils. Soil Sci.:59:45-49.

BS 5228: 1975. British Standards Specifications on Construction Noise

Buchanan, R.E. and Gibbons, N.E. (1974). Bergey's Manual of Determinative bacteriology. 8th ed. The Williams and Wilkins Company Baltimore USA.

Burke, K., 1969. Neogene and Quartenary Tectonics of Nigeria. In Geology of Nigeria. (edited by Kogbe, C.A.). Elizabethan Publishing Co. Lagos. Nigeria. pp 363.

Canter, L.W. (1996) "Environmental Impact Assessment" (2nd Ed) McGraw Hill, New York
Federal Environmental Protection Agency (1995). "Guidelines and Standard for Environmental Control in Nigeria" Lagos.
GEMS/W.92.1

Concawe, 1994. *Environmental Quality Standards,* Concawe Review Vol. 3 No.2, p.18-19

FEPA (1991) Federal Environmental Protection Agency, Guidelines and Standards for Environmental Pollution Control in Nigeria. 238 pp

FEPA. 1991 Guideline and standards for Industrial effluents, Gaseous Emissions and Hazardous Management in Nigeria. Federal Environmental Protection Agency, Lagos

Geological Survey Division, (1974). Geological Map of Nigeria. Publication, Federal Ministry of Mines and Power, Nigeria.

Golterman, H.L. Chymo, R.S., and Ohristead, M.A.N. (1978): Methods for Physical and Chemical Analysis of Freshwater. IBP Handbook No. 8. Blackwell Scientific Publications. Oxford.

Hayward, D and Oguntoyibo, J 1987. Climatology of West Africa. Barens and Nobles, New Jersey, USA 271p.

International Finance Corporation (IFC) Operational Policies 4.01.

International Finance Corporation (IFC) General Health and Safety Guidelines.

International Finance Corporation (IFC) -Environmental, Health and Safety Guidelines for Waste Management Facilities

Jones, H. A. & R. D. Hockey, 1964. The geology of part of South-western Nigeria. Geological Survey of Nigeria Bull. No. 31, 1-87, 8 pb.

Kogbe, C. A. 1976. Geology of Nigeria. Elizabethan Publishers, Ibadan.

Leopold, L.B. Clarke, F.E; Hanshaw; B.B. and Balsley, J.R (1971). A procedure for evaluating environmental impact. Geological Survey Circular 645, Government Printing Office, Washington, D.C. 13 pp

Lohan, B., J.W. Evans,H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L. Tu (1997) "Environmental Impact Assessment in Asia . Vol. 1 – Overview" Asian Development Bank. Rau, J.G. Sr. and D.C. Wooten. 1980. "Environmental Impact Analysis Handbook." McGraw Hill, New York.

Loius, C. Umeh and Smart N.Uchegbu (1997) "Principles & Procedures of Environmental Impact Assessment".Computers Edge Publishers. Lagos.

NITP/TOPREC. "Environmental Impact Assessment and Physical Planning In Nigeria(Policy, Legal and Application Issues) (2009). MCPDP course Papers

Nwafor, J.C. (2006) "Environmental Impact Assessment for Sustainable Development: EDPCA. Enugu.

Ojo, (1972). The Climates of West Africa, Heinemann Books Limited, Ibadan.

Reyment, R. A. 1965. Aspects of the Geology of Nigeria, 133 pp., Ibadan Univ. Press.

U.S. Dept. of Agriculture. 1994. Soil taxonomy. A basic system of soil classification for making and interpreting soil surveys.

Usepa (1979): Methods for Chemical Analysis of Water and Wastes. Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268. EPA - 600/4-79-020 (March, 1979).

Viets, F.C. and W.L Lindsay (1973). Testing Soils for Zn, Cu, Mn, and Fe. In: Soil Testing and Plant Analysis. (Eds. L.M. Walsh and J.D. Bexton). Soil Sci Soc. Am. Inc. Madison Wl.

Walkley J.T. and Black C.A. (1934). An examination of the method for determining Soil Organic Matter and a proposal modification of the Chromic acid and titration method. Soil Sci. 37; 29-38.

Westphal, A. (1976): Protozoa. Blackie. Glasgow and London. WHO (2000) "Air Quality Guidelines for Europe. World Health Organisation Regional Office for Europe, Copenhagen." WHO Regional Publications, Europeans Series No. 91.

Work Bank Technical Paper No. 376. Roads and the Environment- A Handbook .Koji Tsunokawa and Christopher Hoban (Eds). The World Bank, Washington D.C.

WHO, 1976. Selected Methods of Measuring Air Pollutants, WHO offset Publication No. 24, E, Geneva.

W.H.O (1984). World Health Organization Guidelines on Drinking Water Quality. Vol. I, II, III. Geneva.

APPENDICES

APPENDIX 1

ENVIRONMENTAL STANDARDS

Inorganic constituents for drinking water quality

Characteristic	**Health-based guideline**
Antimony (mg/l)	0.005
Arsenic mg/l	0.01
Barium mg/l	0.7
Boron mg/l	0.3
Cadmium mg/l	0.003
Chromium mg/l	0.05
Copper mg/l	2
Cyanide mg/l	0.07
Fluoride mg/l	1.5
Lead mg/l	0.01
Manganese mg/l	0.5
Mercury mg/l	0.001
Molybdenum mg/l	0.07
Nickel mg/l	0.02
Nitrate mg/l	50
Nitrite mg/l	3
Selenium mg/l	0.01
Uranium □g/l	140
Consumer acceptability level	
Aluminium mg/l	0.2
Chloride mg/l	250
Hardness as CaCO3 mg/l	500
Hydrogen sulphide mg/l	0.05
Iron mg/l	0.3
Manganese mg/l	0.1
PH	6.5-9.5
Sodium mg/l	200
Sulphate mg/l	250
Total dissolved solids mg/l	1200
Zinc mg/l	4

(Source: WHO, 1993)

Emission Standards, Environmental (Motor Vehicle noise) Regulations 1987 (Environmental Quality Act 1974).

Item	Category of Vehicle	Maximum Sound Level Permitted (dBA)
3	Used for the carriage of goods. Permitted maximum weight does not exceed 3.5 tons. Engine is less than 200 hp DIN	81
6	Used for the carriage of goods. Permitted maximum weight exceeds 3.5 tons. Engine is less than 200 hp DIN	86
7	Used for the carriage of goods. Permitted maximum weight foes not exceed 3.5 tons. Engine is 200 hp DIN or more.	88

Source: Environmental Quality Act 1974 and Regulations

Nigeria Ambient Air Quality Standard (FEPA, 1991)

Pollutants	Time of Average	Limit
Particuclates	Daily Average of hourly values (1 hour)	250ug/m3
Sulphur Oxides	Daily Average of hourly values (1 hour)	
Sulphur Dioxide	Daily Average of hourly values (1 hour)	600ug/m3
Non-Methane	Daily Average of hourly values (3	0.01ppm
Hydrocarbon	hourly averages)	160ug/m3
Carbon Monoxide	Daily Average of hourly values (8	10ppm
Nitrogen Oxides	hourly average)	(20ppm)
(Nitrogen Dioxide)	Daily Average of hourly values (range)	0.04-0.06ppm
Photochemical Oxidants	Hourly Values	0.06

Noise Exposure Limits for Nigeria (FEPA, 1991)

Duration/Day-Hours	**Permissible Exposure Limit dB(A)**
8	90
6	92
4	95
3	97
2	100
1½	102
1	105
½	110
¼	115
Impulsive or Impact Noise	< 140 dB, Peak

Effluent Limitation/Guidelines in Nigeria for all Categories of Industries (FEPA, 1991)

Parameters	**Units in Milligram per litre (mg/l)** Unless Otherwise Stated	
	Limit for Discharge into Surface Water	**Limit for Land Application**
Temperature	Less than 40oC within 15 minutes of out fall	Less than 40oC
Colour (Lovibond Units)	7	-
pH	6 – 9	6 – 9
BOD5 at 20oC	50	500
Total Suspended Solids	30	-
Total Dissolve Solids	2,000	2,000
Chloride (as CI)	600	600
Sulphate (as SO42-)	500	1,000
Sulphide (as S2-)	0.2	-
Cyanide (as CN-)	0.1	-
Detergents (linear alkylated suphonate as methylene blue active substance)	15	15
Oil and Grease	10	30
Nitrate (as NO3)	20	-
Phosphate (as PO43-)	5	10
Arsenic (as As)	0.1	-
Barium (as Ba)	5	5
Manganese (as Mn)	5	-
Phenolic Compounds (as phenol)	0.2	-
Chlorine (free)	1.0	-
Cadmium, Cd	Less than 1	-
Chromium (trivalent and hexavalent)	Less than 1	-
Copper	Less than 1	-
Lead	Less than 1	-
Tin (as Sn)	10	10
Iron (as Fe)	20	-
Mercury	0.05	-
Nickel	Less than 1	-
Selenium	Less than 1	-
Silver	0.1	-
Zinc	Less than 1	-
Total Metals	3	-
Calcium (as Ca2+)	200	-
Magnesium (as Mg2+)	200	-
Boron (as B)	5	5
Alkyl Mercury Compounds	Not detectable	Not detectable
Polychlorinated Biphenyls (PCBs)	0.003	0.003
Pesticides (Total)	Less than 0.01	Less than 0.01
Alpha Emitter, uc/ml	10-7	-
Beta Emitters, uc/ml	10-6	-
Coliforms (daily average)	400MP/100ml	500MP/100ml
Suspended Fibre	-	-

International Finance Corporation (IFC) /World Bank Policies and Guidelines

Ambient Air
Concentrations of contaminants, measured outside the project boundary, should not exceed the following limits:

Particulate Matter (<10µm)	
Annual Arithmetic Mean	100 µg/m3
Maximum 24 hour Average	500 µg/m3
Nitrogen Oxides, as NO_2	
Annual Arithmetic Mean	100 µg/m3
Maximum 24 hour Average	200 µg/m3
Sulfur Dioxide	
Annual Arithmetic Mean	100 µg/m3
Maximum 24 hour Average	500 µg/m3

Workplace Air Quality
Threshold limit values (TLVs):

Arsenic	0.5 mg/m3
Carbon Monoxide	29 mg/m3
Copper	1 mg/m3
Free Silica	5.0 mg/m3
Hydrogen Cyanide	11 mg/m3
Hydrogen Sulfide	14 mg/m3
Lead, Dusts & Fumes, as Pb	0.15 mg/m3
Nitrogen Dioxide	6 mg/m3
Particulate (Inert or Nuisance Dusts)	10 mg/m3
Sulfur Dioxide	5 mg/m3

Workplace Noise
Ambient Noise levels should not exceed 85dBA

Liquid Effluents

pH	6 to 9
BOD_5	50 mg/l
Oil and Grease	20 mg/l
Total Suspended Solids	50 mg/l
Temperature – at the edge of	Max $5^{o}C$
above ambient temperature	

A designated mixing zone receiving waters – max $3^{o}C$ if receiving waters>$28^{o}C$

Residual Heavy Metals

Arsenic	1.0 mg/l
Cadmium	0.1 mg/l
Chromium, Hexavalent	0.05 mg/l
Chromium, Total	1.0 mg/l
Copper	0.3 mg/l
Iron, Total	2.0 mg/l

Lead	0.6 mg/l
Mercury	0.002 mg/l
Nickel	0.5 mg/l
Zinc	1.0 mg/l

Source: The World Bank policies and guidelines, supplemented with information from OECD sources and the proposed revisions to the World Bank guidelines.

Cyanide

In no case should the concentration in the receiving water outside of a designated mixing zone exceed 0.022mg/l

Free Cyanide	0.1 mg/l
Total Cyanide	1.0 mg/l
Week Acid Dissociable	0.5 mg/l

Measures to prevent access by wildlife and livestock are required for all open waters (examples tailings impoundments and pregnant leach ponds) where WAD cyanide is in excess of 50 mg/l.

Ambient Noise

Maximum Allowable L_{eq} (hourly), in dB(A)		
Receptor	Day time 07:00 – 22:00	Night time 22:00 – 07:00
Residential; Institutional; Educational	55	45
Industrial; Commercial	70	70

APPENDIX 1I

FIELD SAMPLE HANDLING CHARACTERISTICS

Parameters	Volume required, ml	Container	Maximum Holding Time	Preservation
pH	25	P, G	6 hrs	In situ determination
Conductivity	100	P, G	24 hrs	In situ determination
Colour	50	P G	24hrs	In situ determination
Odour	200	G	24hrs	In situ determination
Turbidity	100	P, G	7 days	In situ determination
TDS	50	P, G	6 months	Filter on site
TSS	50	-	6months	Filter on site
Salinity (Cl)	50	P, G	7days	Not required
COD	50	P, G	7 days	2ml H_2SO_4 per litre
BOD	1000	P, G	6days	Refrigeration at 40C
DO	300	G	No holding	In situ determination
Ammonia	400	P, G	24hrs	Cool at 40C H_2SO_4 to pH<2
Oil & Grease	1000	G	24hrs	Cool at 40C H_2SO_4 to pH<2
NO_3	100	P, G	24hrs	Cool at 40C H_2SO_4 to pH<2
Chromium	100	P, G	-	HNO_3 to pH<2
Cadmium	100	P, G	6 months	HNO_3 to pH<2
Copper	100	P, G	6 months	HNO_3 to pH<2
Iron	100	P, G	6 months	HNO_3 to pH<2
Mercury	100	P, G	38days, glass	Filter, HNO_3 to pH<2
Lead	100	P, G	6 months	HNO_3 to pH<2
Nickel	100	P, G	6 months	HNO_3 to pH<2
Zinc	100	P, G	6 months	HNO_3 to pH<2
Vanadium	100	P, G	6 months	HNO_3 to pH<2
Calcium	100	P, G	7days	None required
Magnesium	100	P, G	6 months	HNO_3 to pH<2

P = Plastic sample container G = Glass sample container

ANALYTICAL METHODS

I SOIL

Soil pH
Prior to laboratory analysis, soil samples were air-dried, gently crushed with pestle in agate mortar and passed through 2-mm sieve. The less than 2-mm fractions were retained for the following analysis. This was determined in 1:2 soil-water ratio after allowing for 30-minute equilibration.

Particle Size Distribution
Particle size analysis was carried out using the hydrometer method with Sodium hexametaphosphate as dispersing agent as described by Day (1953).

Organic Matter
This was determined by the acidified dichromate digestion and ferrous ammonium sulphate titration method of Walkley and Black (1934).

Available Phosphorus
Avail-P was extracted by the Bray-No 1 procedure (0.03N NH4F + 0.025 N HCl). The P-concentration was then determined colorimetrically by the molybdo-phosphoric and -blue technique.

Exchangeable Cations (Na+, K+, Mg2+, Ca2+**)**
These were extracted with 1N neutral (pH 7.0) ammonium acetate solution. The K and Na were determined using Collins Flame Analyzer while Ca and Mg concentrations were determined by Atomic Absorption Spectrophotometer.

Exchangeable Acidity
This comprises Al3+ and H+ which were extracted by 1N KCl solution and titrated against 0.05 N standard solution of NaOH.

Cation Exchange Capacity (CEC)
This was computed as the sum of the exchangeable bases (Na+, K+, Mg2+, Ca2+) and exchangeable acidity (Al3++H+).

Base Saturation
This was computed as the sum of cations expressed as a percent of the effective cation exchange capacity.

Exchangeable Fe+++
For this analysis, 2.5g of the finely ground soil sample was shaken in a conical flask with 25ml of 1N ammonium acetate for 1 hour and then filtered into plastic containers. Iron (Fe+++) was determined using an Atomic Absorption Spectrophotometer. The concentrations of this cation was calculated with reference to the dilution on factor and expressed in milligram equivalent per 100g of soil (meg/100/gsoil).

Total-Nitrogen
This was determined by the semi-micro kjeldahl digestion method. The ammonia was absorbed into the boric acid mixed indicator solution and then titrated with standard 0.01N sulphuric acid solution.

Chloride
A 1:2½ soil-water suspension was shaken for one hour on orbit shaken. The suspension was filtered using suction pump. The chloride content was determined by titration with 0.1N AgNO3 solution and potassium chromate as internal standard.

Sulphate Sulphur:
Potassium phosphate monobasic (KH2PO4) was used for the extraction and SO4-S of the extract was gravimetrically determined by barium chloride method as in Black(1965).

Oil & Grease
The oil content (grease) of the soils was determined by shaking 10g of a representative soil sample with 10ml of toluene and the oil extracted measured at 420mm using a spectronic 20 spectrophotometer. Absorbance was read directly. With reference to standard curve and multiplication by the appropriate dilution, factor, the hydrocarbon concentration was calculated.

Heavy Metals
The dried sub-samples were used in this analysis. The samples were finely ground to facilitate accurate measurements. Four grams (4gm) of this sample was weighed and put into a 250ml beaker to which was added 100ml of distilled water and 1ml of analytical grade concentrated HNO3 (specific gravity 1.42). A foaming reaction on addition of the acid indicated the presence of carbonates, in which case the acid was slowly added. Then 10ml of analytical grade concentrated HCI (specific gravity 1.19) was added. The beaker was covered with ribbed watch glasses and heated on hot plate at 95^{0c}, care was taken not to allow the solution to boil our bump by addition of anti bumping substances to prevent splattering and hence affecting the accuracy of the measurements. Heating was continued until 10-15ml of the solution was left in the beaker. This was then brought down, allowed to cool before being filtered into a 100ml volumetric flask and made up to volume with distilled water. The digested filtrate was used for the determination of the various trace metals by the Atomic Absorption/Flame Emission Spectrophotometer (SHIMADZU MODEL AA-670).

Soil Microbiology:
The soil samples were first subjected to conditioning by storing first in a refrigerator and then at room temperature for two days in order to restore normal microbial activities and avoid fluctuations in the numbers due to sporulation.

The conditioned samples were then ground in stomacher homogenizer in the collection bag to break up lumps. One gramme of the soil sample was weighed and added to 99ml sterile enrichment mineral solution in 250ml comical flasks. The samples were shaken for 6hr at room temperature in a Gallenkamp incubator shaker at 80-100 rev/min.

Dilution/media for cultivation**:**
Serial dilutions in sterile water put to 10-6 were prepared. The highest dilution was used for the enumeration of hydrocarbon decomposing bacteria and for the determination of total bacterial counts on mineral salt plus 1% hydrocarbon containing media with the addition of an antifungal agent and on plate count agar, respectively.

Inoculation/incubation
One ml aliquot from the highest dilution was pipetted into sterile pets dishes placed on a rotating plate holder and the media was poured over. The plates were rotated until the media was partially set, covered and incubated at 35^{oC} for 48h for total bacterial count and for hydrocarbon decompresers at 30^{oc} for 14 days. Counts were expressed as cfu/ml/g substrate after counting on a colony counter.

II WATER

The parameters measured in the laboratory include: pH, conductivity, total suspended solids, total dissolved solids, chloride, total alkalinity, hardness, sulphate, phosphate, nitrate, turbidity, chemical oxygen demand, oil and grease, surfactant, iron and heavy metals. Details and principles of the methods are as shown below:

Electrical Conductivity
The electrical conductivity of the samples were measured using Lovibond conductivity meter (Type CM-21).

Total Suspended Solids
This parameter was measured by the gravimetric method (APHA, 1995). Water samples, 200ml were filtered through pr-weighed 0.5 u membrane filters. The filters were then dried to constant eight in an oven at $103 – 105^{oC}$.

Chloride
The Chloride content was determined by Mohr's method potassium chromate indicator solution was added to the water sample and titrated with silver nitrate (which reacts with chlorides/bromides in water to form precipitates of the corresponding salts) to the formation of brick-red silver chromate precipitate as he end point. (APHA, 1975) limit of detection is 1.0mg/l.

Total Alkalinity
Total Alkalinity was determined by titrating 100ml of the water samples with 0.02N H_2SO_4 solution using methyl orange as the indicator (APHA, 1975) limit of detection is 1.0mg/l as $CaCO_3$.

Sulphate
Sulphate was determined by the turbidimeter method (APHA, 1975) colloidal Barium sulphate was formed by the reaction of sulphate with barium ion in a barium chloride-hydrochloric acid solution in the presence of glycerol ad ethyl alcohol. The colour intensity was measured using spectrophotometer (Spectronic 20) at 420mm wavelength. Limit of detection is 1.0mg/l. Sulphide was measured by a titrimetric (iodine) method (APHA, 1975).

Phosphate
Phosphate was determined by the Stannous Chlorine method (APHA), 1975, (Galley *et al*. 1975). Phosphate in water reacts with ammonium molybdate in acidic medium to form molybdo-

phosphoric acid, which is reduced to molybdenum blue complex by stannous chloride. The intensity of colour was measured using Spectronic 20 (Spectrophotometer) at 690mm. The limit of detection is 0.05mg/l.

Nitrate
The nitrates content of the samples was determined by the Brucine-Sulphate method (APHA, 1975). To 2ml of the water sample, was added 2ml of H_3SO_4 and 0.2ml of Brucine sulphate heated in a water bath. The intensity of the resultant yellow coloration was measured using a spectrophotometer (Spectronic 20) at 410nm. Limit of detection is 0.5mg/l.

Chemical Oxygen Demand
The chemical oxygen demand (COD) was determined using the Permanganate method as modified by Welcher (1975). It is a titrimetric method and the COD is recorded as the permanganate value in mg/l.

Oil and Grease
Oil and grease was measured after pre-extracting 100ml sample with 10.0ml carbon tetrachloride, using a Horiba Oil Content Analyzer (OCMA-200, range 0 – 100 ppm).

Heavy Metals
Heavy metals were determining by direct aspiration using a varian Atomic Absorption Spectrophotometer (AAS) model AA-10 with manual sample changer equipped with a C.T.A graphic table atomizer.

III AIR QUALITY

Suspended Particulate Matter
Pre-weighed filter paper are placed in a high volume air sampler, air is then sucked into the unit containing the filter paper within the sampler for 4 hours. The filter paper is then re-weighed, with the old weight subtracted from the new and the difference is the weight of the particulate in air. This is then subjected to some conversion and represented in parts per million (ppm).

Hydrocarbon Gases (VOC)
The equipment is switched on and using the various buttons for measurement of the various gases, the values are read out automatically. Readings are only taken when the values have stabilised, that is, when the values are no longer rising or falling. Usually the equipment is allowed enough time to suck in air and analyse to obtain representative sample readings. Time interval between measurements of the various hydrocarbon gases is about 5 minutes. Each analyte was estimated more than once for good representation.

Ammonia (NH3), Carbon Monoxide (CO), Sulphur Oxides (SOx), Nitrogen Oxides (NOx), and Hydrogen Sulphide (H_2S)
Lamotte Air Pollution Test Equipment with Lamotte® Model BD Air Sampling Pump was used with appropriate absorbing solutions and reagents recommended for each parameter.

APPENDIX 4

Institutional Responsibility for the Potential Impact and Mitigation Measures (Construction Phase)

Issue	Potential Impacts	Mitigation/Enhancement Measures	Monitoring Indicators	Institutional Responsibility
LAND TAKE	Impacts to ecology from land take – loss of natural habitats and biodiversity including mature roadside trees, loss of ecosystem service (eg. air quality)	□ Avoid sensitive areas (eg. Wetlands forests) through route selection □ Where unavoidable, develop mitigation suitable for type of habitat and species affected (mangroves, forests, river banks, etc) □ Ensure thorough surveys are carried out prior to construction to ensure mitigation fully informed □ Maintain ecologist on site during construction □ Avoid cutting of mature urban trees □ Replace urban trees where cutting is unavoidable	□ Change in number of species in habitat adjacent to road construction □ Change in area of critical habitat □ Number of trees planted /growing alongside road	□ SMWT □ State Ministry of Environment □ Environmental NGOs

NOISE AND VIBRATION	Impact in Noise from construction	□ Maximise daytime working, minimize night time working □ Use temporary noise barriers to mitigate noise from worksites □ Control hours of working □ Set maximum daytime and night time noise limits- any variation should be agreed with Local Government Authority □ Refine construction methods to select least noisy methods	□ Number of community complaints □ Db(A) sound pressure levels measured against acceptable noise level standards	SMWT contractors
	Impact in Noise from construction	□ Construction methods refinement for the method least likely to cause vibration □ Protect residents from level of vibration which causes nuisance □ Protect buildings from level of vibration which causes damage	□ Number of community complaints □ Integrity of structures □ Occurrence of damage caused by vibrations	SMWT construction contractors

Issue	Potential Impacts	Mitigation/Enhancement Measures	Monitoring Indicators	Institutional Responsibility
AIR QUALITY	Impacts to air quality from dust	□ Enclosure and damping down of stockpiles □ Water spraying especially of unpaved roads □ Sheeting of vehicles carrying waste and dusty materials □ Wheel cleaning facilities □ Limit vehicle speeds on unpaved surfaces □ Implement procedure for monitoring wind speed and direction □ Undertake visual inspections □ Design and implement strategy for demolition of structures that will minimize dust creation and exposure to receptors	□ Number of community complaints about dust □ Levels of airborne particulate matter □ Undertake visual inspections	SMWT construction contractors
	Impacts to air quality from construction related emissions	□ Use processes that do not generate hazardous fumed and / or hazardous dust □ Ensure that airborne hazards do not escape from the site to affect members of the public and surrounding environment □ Do not burn materials on site □ Ensure machinery is well on site □ Ensure machinery is switched off when not in use	□ Levels in air of: □ Carbon monoxide (CO) 8 hours □ Nitrogen dioxide (NO2) 1 hour □ Photochemical oxidants measured as ozone (03) 1 hour □ Sulphur dioxide (SO2) 1 hour □ Lead (Pb) 1 year □ Particles as PM10 1 day □ Particles as TSP 1 day □ CO_2 / Green House Gasses	SMWT construction contractors

SOIL AND WATER	Impacts to soil and water from increased soil erosion: Construction activities such as grading, excavations, and borrowing/ quarrying Inadequate design of culverts and drainage controls	□ Design: □ Use surface drainage controls & mulch on vulnerable surfaces and slopes □ Line receiving surfaces with stones or concrete □ Locate & design borrow/ quarry sites for erosion control during road construction & future maintenance operations □ Construction: □ Limit earth movement &soil exposure to the dry season □ Balance cut & fill for minimum deposition of earth □ Provide sedimentation basins □ Resurface & re-vegetate exposed surfaces □ Install drainage ditches to divert water away from road	Integrity of road structures Degree of erosion Quality of surface water(turbidity)	SMWT construction contractors
CONTAMINATED LAND AND WATSE	Impacts to water from accidental spillages	Ensure procedures are in place to deal with accidental spillages □ Install drainages systems w/ appropriate treatment	□ Presence of contaminates in surface water (including oil & gas, suspended solids)	□ SMWT construction contractors □ State Waste Management Authority to monitor
CONTAMINATED LAND AND WASTE	Impacts to public and staff health and safety from contaminated land and waste	□ Safe disposal strategy for solid waste: collect all solid waste from all site areas and dispose of either in local landfill or well-screened waste pits □ Develop and implement	□ Local complaints of excessive waste & odours □ BOD, COD, SS, and oil levels in soil (measured once a month during construction /	□ SMWT construction contractors □ State Waste Management Authority to

		remediation for contaminated land	rehabilitation phase)	monitor
TRAFFIC AND TRANSPORT	Disruption to roadside residents, passing pedestrians and passing traffic	Minimise construction duration; Plan and implement temporary road and pedestrian traffic management measures; Minimize construction generated traffic Transport construction workers to site on dedicated transport	Number of complaints received from roadside residents and road users	SMWT construction contractors Federal Road Safety

SOCIO-ECONOMICS	Impacts to archaeology and cultural heritage: Loss of or damage to structures of historic, religious, cultural or archaeological significance	Identify areas where buildings of historical or cultural significance predominates Avoid buildings of cultural, historical or religious significance through careful route selection Apply chance find procedures in construction clauses	Numbers of chance finds occurrences Records of measures implemented to ensure protection of structures of cultural significance	SMWT construction contractors NGO)
	Impacts to public health from stagnant pools of water created in construction borrow pits and quarries, and on road sides, that breed disease carriers	Develop and implement plan to deal with drainage impacts including: Drive roads after moderate rains to identify areas that collect or gully water Ensure proper drainage of construction areas and road sides Coordinate construction phases with dry season Ensure current system can handle improved drainage (prevent runoff erosion/ reservoir overflow)	Changes in occurrence of illness or disease(particularly malaria) in roadside communities Reported incidence of flooding/ reduced drainage capacity during construction	SMWT construction contractors (Ministry of Health to monitor)
	Involuntary resettlement due to loss of roadside space for vendors, traders, mechanics and other informal activity	Develop Resettlement Action Plan (RAP) according to guidelines set by World Bank Safeguard Policy: Identification and notification of all Project Affected Peoples(PAPs) Assessment and valuation of all property loss Identification of suitable alternative land for resettlement(considering accessibility, electricity, water, etc) Payment of compensation where appropriate	Number of project affected people adequately compensated and resettled Number of complaints received through grievance mechanism Records of consultation meetings before and after relocation Evaluation of livelihoods of PAPs post resettlement to alternative	Local Government Authority Community Development NGOs Community based Organizations (CBOs) Land Regularization

		• Assistance to PAPs with relocation and livelihoods rehabilitation post relocation • Establishment of a grievance mechanism	location	Directorate □ Land Valuation Bureau □ Ministry of Women's Affairs and Poverty Alleviation
	Impacts to employment and social networks from influx of construction workers, including social disruption and tension over employment opportunities	• Ensure that contractors work with CBOs to ensure that local people are used as far as possible for non-skilled jobs • Ensure that contractor has and implements a code of conduct for all construction workers (see Camp code of conduct below)	• Number of local people employed by contractors • Reported incidence of conflict between local residents & project workers • Reports from involved CBOs	• SMWT •construction contractors • Community Development NGOs
HEALTH AND SAFETY	Impacts to health and safety of construction workers	Plan/ Implement occupational health measures/ training programmes (certifiable/ verifiable) for workers & subcontractors Use proper protective equipment/ preventative practices Security controls at worksites (incl. traffic controls) Effective monitoring/ incident reporting @ site Ensuring minimum working conditions including regular breaks	Number of accidents/ incidents recorded Contractors have satisfactory Health and safety plan in place	• SMWT construction contractors
	Impacts to health and safety of pedestrians	Management of project waste removal/ treatment, incl.	Number of accidents/ incidents reported	

		measures to prevent water/ air contamination Effective traffic control and exclusion of public from construction sites where possible	Complaints from public	• SMWT construction contractors • State Waste Management Authority to monitor