ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF WOOD PROCESSING FACTORY IN SAPELE LGA OF DELTA STATE

OF

WOODLAND NIGERIA LIMITED

DRAFT REPORT

MARCH, 2020

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BY: MIFOR CONSULT NIGERIA LMITED

55 MARIAN ROAD, CALABAR.

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LIST OF ABBREVIATIONS

WNL	Woodland Nigeria limited
RSKD	Rough Sawn Kiln Dry
NPV	Net Present Value
NDDC	Niger Delta Development Commission
DSUBEB	Delta State Universal Basic Education Board
ESMP	Environmental and Social Management Plan (ESMP)
PIU	project implementation unit (PIU)
NESREA	The National Environmental Standards & Regulations Enforcement Agency (NESREA)
FMEnv	Federal ministry of environment
DSMEnv	Delta State Ministry of Environment
DELSEPA	Delta State Environmental Protection Agency
JIV	Joint Investigation team
ROW	Right Of Way `
ESIA	Environmental and Social Impact Assessment
CBN	Central Bank of Nigeria
EPA	Environmental Protection Agency
QHSE	Quality, Safety, Health & Environment
GHG	Greenhouse gases
VOC	Volatile organic compound
NIOSH	National Institute of Safety and Health
MCNL	Mifor Consult Nigeria Limited
EMF	Electric and Magnetic Field
WHO	World Health Organization
THB	Total Heterotrophic Bacteria
HUB	Hydrocarbon Utilizing Bacteria
THF	Total Heterotrophic Fungi,
HUF	Hydrocarbon Utilizing Fungi.
DBH	Diameter at Breast Height
EC	Electrical Conductivity

THC	Total Hydrocarbon
FGDs	Focus Group Discussions
IUCN	International Union for the Conservation of Natural Resources
VU	Vulnerable
LC	Least Concern
STI	Sexually Transmissible Infections
HIV	Human Immunodeficiency Virus
AIDS	Acquired Immune Deficiency Syndrome
OPV	Oral Polio Vaccine
NIDs	National Immunization days
FGM	Female Genital Mutilation
ALARP	As Low as Reasonably Practicable
GEMIS	Global Emission Model of Integrated Systems
STD	Sexually Transmitted Diseases

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EXECUTIVE SUMMARY

E.S 1.0 INTRODUCTION

E.S 1.1 The Project Proponent and Project Location

Woodland Nigeria Limited (RC 178093) was registered and Incorporated in 1991 with Corporate Affairs Commission (CAC), as a Manufacturing and Offshore Marine & Leasing Services Company. Woodland is a major player in the furniture industry; she focuses mainly on the production and supply of ergonomically designed furniture's for schools, offices and household. The company operates from its factory location at 1, Woodland Drive GRA Sapele in Delta State, Nigeria and Corporate Head Office at 30, Raymond Njoku Street, Ikoyi South-West Lagos, Nigeria.

Woodland has obtained the required counterpart funding of Two Million Three Hundred and Sixty Thousand Dollars (US$2.36million) from NEXIM bank to enable her procure, install and commission a state of the art "finger joint laminated rubber wood board" production plant in Sapele, Delta State Nigeria. The factory has the potential of converting harvested over aged round rubber wood logs into sawn wood or planks of various dimensions, the sawn planks are treated against infestation by insects or fungi using vacuum impregnation process.

The project has potentials for employment and will offer significant boost toward the revival of the moribund rubber tree replanting culture in the south-south and south-west region.

Total project investment is estimated at USD 3.3 Million to be funded by a combination of equity and debt. The project proposes to commence payback after 1 year with an Internal Rate of Return (IRR) of 35% and Net Present Value (NPV) of US$642,323 at 25% discount rate

E.S 1.2Purpose of this report

The purpose of this ESIA report is to identify the key environmental and social impacts which are likely to result from the activities of the proposed project and associated facilities. These impacts will be assessed and mitigation measures to be adopted for their minimization.

The ultimate goal of this ESIA report is to produce an Environmental and ESMP to address impacts that may occur during the various phases of the proposed project.

E.S 1.3Accessibility

The proposed site could be accessed through road. The proposed site is along the Benin – Warri Expressway Amukpe-Sapele. However, the site can also be accessed from Abraka-Eku-Amukpe Roundabout. Complimentarily, the Benin airport is about 58.4km away could readily serve air transportation to the site while the surrounding Warri and Onne ports would provide further transport routes alternatives.

E.S 1.4 Legal and Administrative Frameworks

Responsibilities for the ESIA and its implementation are shared between multiple stakeholders, institutional and legislative guidelines including concerned ministries and agencies, competent authorities, the HSE department, and the contractors. Some of which include the following:

- The Federal Government of Nigeria
- Federal Ministry of Environment
- Federal Ministry of Industry, Trade and Investment
- Federal Ministry of Agriculture and Rural Development
- National Policy on the Environment (1999)
- EIA Act Cap E12 LFN 2004
- The regulations, standards, codes and recommended practices of the National Environmental Standards and Regulatory Enforcement Agency (NESREA)
- National Environmental Protection (Management of Solid and Hazardous Wastes) Regulations, 1991.
- Land Use Act CAP 202, LFN 2004
- National Land Policy
- Water Resources ACT, CAP W2, LFN 2004
- All applicable International Agreements and Conventions to which Nigeria is a signatory;
- The regulations, standards, codes and recommended practices of the Federal Ministry of Environment;
- The regulations, standards, codes and recommended practices of Delta State Ministry of Environment and Sapele Governments Environmental Departments.
- EHS applicable to wood processing and construction sub sector

E.S 1.5 The ESIA Process

ESIA is an iterative process with the public, government, lease holders, the contractors and other project planning groups so that any identified unacceptable environmental effects of the project are mitigated through feed back into the design and planning. Constant consultation amongst members of the ESIA project team will ensure that all relevant information regarding design, construction, operation and maintenance are mutually appreciated.

E.S 2.0 Project Justification and Alternatives

E.S 2.1 Purpose of the project

The Basic Idea of the project tagged "Have a Project" is to harness the existing old unviable rubber plantations in and around the Niger Delta and creating an exportable commodity from it. This is in addition to uplifting the lot of the local small scale farmers by helping them clear the land of old rubber trees thereby providing new planting material. The project has potentials for employment and will offer significant boost toward the revival of the moribund rubber tree growing plantation culture in the Delta region. It will have tremendous impact in the rubber crump business, employment in rubber plantation, cultivation and rubber tapping as well as provide organized rubber tree cutting practices with enormous potentials for agriculture in the Niger Delta generally.

E.S 2.1 Envisaged Sustainability

The project is technologically sustainable as it will be based on the Best Available Technology (BAT) and will be operated fully by trained and qualified personnel in accordance with the standard operational procedure for its operation. The project is environmentally sustainable as all its activities (including construction, operation and decommissioning) shall keep associated impacts to acceptable levels in line with Woodland's HSE policy as well as all local, state, national and International regulations. The project is economically sustainable because the rubber trees which used to be burned at the end of their productive lifespan would now be harvested for rubber wood and the construction materials would be sourced locally within the vicinity of the wood processing plant, cutting down cost of transportation. There is adequate financial plan to fund it as well as ready market for the wood produced.

E.S 2.2 Project Option

Four options were considered before arriving at the present options that were adopted:

- ✧ Do nothing option
- ✧ Distribute already processed products
- ✧ Delayed Project Option
- ✧ Implement the project as proposed

E.S 2.2 Projective Alternatives

A step-by-step comparison of feasible project alternatives, in terms of the industry, feedstock, location, technology, location etc. is provided. Fourteen (14) alternatives were considered before arriving at the present options that were adopted:

- ✧ Industry Type
- ✧ Feedstock
- ✧ Location
- ✧ Technology
- ✧ Site
- ✧ Fire Protection
- ✧ Power
- ✧ Water Supply Systems
- ✧ Transport Route
- ✧ Mode of Feedstock Supply
- ✧ Imported Construction Material Port of Entry

With the option, to site the wood processing plant in Sapele, the expected benefits mentioned earlier will be realized.

E.S 3.0: Project Description

E.S 3.1Project Location

The proposed project is located at Sapele Local Government Area, Delta state. The site is bounded by the Ethiope River to the North, the Benin-Sapele road to the West, a secondary/freshwater swamp forest to the East and South.

E.S 3.2 Design objectives

The design objectives include:

- ✧ accommodating expansion due to future load growth and planned distribution additions
- ✧ maintaining a safe operating environment
- ✧ keeping any disturbance footprint to the minimum size required
- ✧ providing options for vegetation offsets and re-vegetation works
- ✧ adopting environmentally sensitive design features to reduce the clearing of canopy trees within the project area of influence
- ✧ adopting alternative clearing profiles for sensitive vegetated areas
- ✧ providing a service life of 50 years that can be extended by refurbishment programs so long as the need for the facilities continues

E.S 3.3 Project Scope

The establishment of the wood processing facility will involve:

- ✧ Pre-construction phase- This phase includes preparation of relevant planning documentation, technical and design documentation and analysis of the environment aspects. The planning documentation will be prepared in accordance with the requirements of the current Nigerian and international legislation for this type of facility. It will also include site preparation, which will involve clearing of the site and transport of construction materials to site, mobilization of personnel to site and construction of temporary camp facilities for accommodation of some or all personnel as well as storage of construction materials and equipment.
- ✧ Construction of facility and installation of associated infrastructures and machines- This phase shall involve construction of the proposed wood processing plants and associated

infrastructures and the installation of machines and equipment relevant to the proposed project.

- Commissioning and Operation of the facility- This involves the day to day activities pertaining to raw material acquisition, wood processing and transport of finished products offsite.
- Decommissioning- This shall occur after 50 years when the lifespan of the project has been exhausted. The activities in the phase shall be geared towards restoring the project site to as much as its preconstruction state.

E.S 3.4 Land Take

The proposed wood processing facility shall occupy a land take of about 2 hectares.

E.S 3.5Access Tracks/Road Network

The Benin-Sapele road shall be the main assess road to and from the site. On the other hand, the Eku-Oviri road and the Old Amukpe-Warri road shall serve as alternative roads.

E.S 3.6 Constructions

The target start date for the construction of the first stage of works is slated for second quarter of 2020. As part of the construction process, a detailed Project Execution Plan, including a Construction Management Plan and an Environmental Management Plans would be produced. These will guide the overall process, and will be informed by both this document, and any relevant conditions imposed on the Project.

The Project is to be undertaken in three stages.

- **Stage 1** – site works, construction of detention basin and hardstand areas.
- **Stage 2** – construction of rubber wood processing facility, offices, associated utilities and installation of related plants (saw mill, seasoning kilns including handling, Vacuum treatment plant, Binding/De binding).
- **Stage 3** –Construction of new automated storage warehouse.

E.S 3.7 Operations

The operation of the Facility can generally be divided into the following key areas:

Import – raw material (timber) delivered to the site: The rubber trees shall be initially cut in each designated rubber plantation. After cutting the aged rubber tree, the branches are removed and the main trunk is cut into short lengths of about 6feet. They are then dipped in boric acid at a central place and loaded in the truck and conveyed to the proposed WNL factory's log yard. The logistics manager must always be on hand to advise the plantation owners on appropriate techniques for final uproot of cut rubber trees.

Production – Rubber wood: A detailed description of the processes involved in the wood processing activities is presented in Figure 3.3.

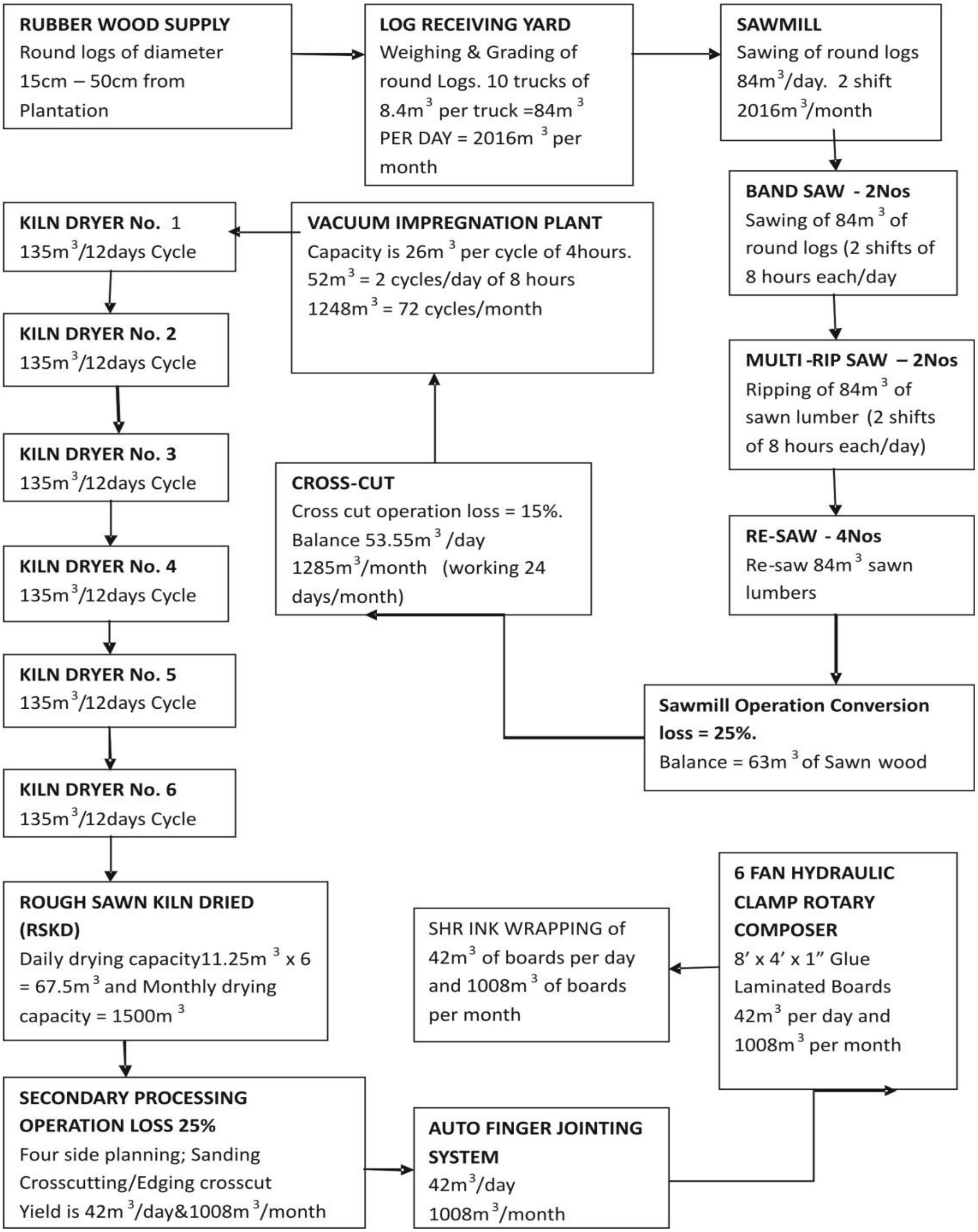


Figure 3.1: Process description of the proposed project

Storage – in the facility: The finished products shall be methodically packaged for distribution either as exported or locally sold wood stocks. Final grading and quality control procedures will be standardized by the logistics and production Staff. The finished products shall be stored in the automated storage warehouse. The automated storage warehouse building will encompass a completely automated storage and packing process.

Dispatch – Out loading of product for delivery to customers by truck and for potential up-takers: The distribution process entails supply and sale of rubber wood manufactured at the factory to customers. The bundling of composed boards is reinforced and then adequately protected and loaded into containers and transported to the appropriate customers. Depending on the dispatch mode agreement, the manufactured products may also be taken offsite by third party up takers.

E.S 3.8 Raw material requirement

The feedstock required for the proposed project shall be sourced from Rubber Estate Nigeria Limited. Rubber Estate Nigeria Limited is the largest rubber estate in Africa, having rubber plantations in Delta, Edo, Cross River and Ondo States.

Details of raw material availability and requirement in relation to the proposed project are presented in Table 3.1.

Table 3.1: Raw material requirement for the proposed project

Rubber Estate Nigeria Limited felling proposal				Woodland Nigeria limited annual log intake estimate	
Year	Total Ha. Available	Total alive trees	Year	Total Annual kg/m^3 required	Total Ha
2021	168.7	31708	2021	14000	55.5
2022	256.9	45381	2022	14000	134
2023	81	38059	2023	14000	134
2024	142.1	38059	2024	14000	134
2025	20.1	9617	2025	14000	134
TOTAL	668.8	149927			591.5

E.S 3.9: Decommissioning and Closure Plan

The project has a life span of 50 years. Decommissioning activities will be implemented in compliance with applicable regulations. Decisions regarding specific post closure land uses will need to be addressed in future detailed closure plans and in discussion with various internal and external stakeholders including local government, the municipality, the local communities and other stakeholders as identified.

The activities that would be involved during the decommissioning include the following:

- Decommission and site-clean – up
- Disposal of waste generated

ES 4.0 Baseline condition of Bio-Physical Environment

The field below is a summary of the baseline result of the biophysical environment

Field 1: Summary of Baseline Result of the Biophysical Environment of the Project Area

PARAMETERS	SUMMARY
	Biophysical
Ambient Air quality	All parameters were within the regulatory limits except for NO_2 where the concentrations were above **WHO/FMEnv** regulatory limit across all sampling stations. The increase may be attributed to industrial activity around the study area or emissions from vehicles
Noise quality	The results as presented in Table 4.6 indicated an elevated noise level above the day time threshold stipulated for the various environments (school, hospital, residential and farmlands) across the sampled points for all the sampling stations. However, these results were within the general noise level of short exposure of 105dB (A) or that of prolonged exposure of 90dB (A) and compared favourably well with the obtained secondary data.
Geology	The area is predominantly underlayed by sedimentary rocks with the following stratigraphic units underlying most part of the region: the Benin Formation, the Ogwashi - Asaba Formation, the Bende-Ameki Formation, Imo Shale Formation, Nsukka Formation and Ajali Formations.
Pedology	The project area is made up of majorly alluvial soil
Soil quality	All physicochemical parameters measured in the soil samples were within WHO/FMEnv threshold values. *Bacillus, Pseudonomas, Staphylococcus, Proteus, Arthrobacter, Enterobacter* and *Micrococcus* were some of the THB *taxa assayed in the area while Aspergillus, Mucor Penicillium and Fusarium* accounted for the THF taxa. Possible organic waste substrates for these organisms could include nitrogenous, peptide rich and sugar rich food sources.

Ground water	Physicochemical parameters analyzed for the three ground water samples revealed concentrations within WHO/FMEnv limits. The result compared well with reviewed secondary data.
Hydrology/drainage	Ethiope River takes its source from a spring at Umuaja and flows over 100km to empty into Benin River. This river serves as the terminal point for storm runoff in the project area. Inhabitants of the area rely on the river for activities such as washing, fishing, sand mining and inter-village transportation. At the lower reaches of the river, it is subjected to tidal influence of the Atlantic Ocean.
Surface water	Surface water was collected in four points. All physico chemical parameters analyzed in the water samples were within threshold values, except for turbidity which was slightly above regulatory limit at the station two (SW2). The microbial study revealed the presence of faecal indicator species (*Escherichia* species) at SW2 and SW4, which is an indicative of faecal discharge into the water bodies.
Sediment	All physico chemical parameters analyzed in the sediment samples were within ISQG and FMEnv threshold values. The microbial composition of sediments is similar to those observed in the surface water samples, except for the absence of faecal indicators, inferring possibly, efficient consumption of the faecal waste load at the upper water column by surface water dwelling organisms
Hydrobiology	A total of five (5) macro benthic species were counted in the sediment samples. Two pollution (heavy metal) sensitive species (Nereis sp, Polydoraciliiata) of the Polycheate group were assayed in the water samples specifically in stations 2 and 3. A total of 27 individuals in seven (7) Zooplankton species were sampled in the water samples collected. Three pollutant sensitive species (*Keratellacochlearis*, *Keratella quadrata*, *Trichocerca cylindrical*) which revealed the euthrophic nature of the water body. A total of 197 individual counts in 14 phytoplankton species were recovered in the samples. The result also indicated a stable ecosystem as phytoplankton abundance out-weighted zooplankton.
Fisheries	Information was sourced from local fishermen and market women. A total of 16 species of fish representing 10 families were collected in the water bodies. The fish community was numerically dominated by Planktinovores/microcarnivores (50 %) followed by intermediate carnivores (37.5 %) and predators (12.5 %). None of the species encountered in the present study is in IUCN Red list of threatened species. The educational qualification of the fisher folks ranged from non-formal educational to secondary education.

	The age structure of the fishermen was mostly in the range of 25 to 60 years old. Most of the fishermen in this area are monogamous with only about 5% having two or more wives. Most of the Fishermen do not have any source of finance other than the money that accrues to them from the sale of their fish. At this time of the year a fisherman makes about N1, 000 to N3, 000 for the sale of fish per day depending on the total catch.
Vegetation	The study area consists of three micro-habitats pattern. Secondary forest sampled constituted about 40.66% to the South-Eastern flank of the proposed project site, fresh water swamp made 31.87 % to the North-Eastern flak while grassland made up the remainder 27.47% mainly on the seat of the proposed plant. This implies that the proposed project will impact mainly on the grassland habitat. A total of 55 species were inventoried in the study area, this include the 38, 29 and 25 species censured in opened grassland, freshwater swamp forest and secondary forest respectively. A 3.69 and 0.92 values were observed for Shannon and Equitability indices respectively in the entire study area. A total of 2,866 individuals were censured in the entire sampled transects. This include the 1795 individuals censure in transect 1 (grassland habitat), 717 in transect 2 (freshwater swamp forest) and 355 individuals in transect 3 (secondary forest). Greater proportion of the censured species (56.4 %) was within the herbaceous canopy (0-1m). Transect 1 equally had the highest proportion of species in herbaceous canopy. The tree canopy (>4 m) dominated in transect 2 and transect 3 to North-East-Southern flank of the proposed plant site. This means that the vegetation at transects 2 and 3 is relatively stable Woody species with average height was ≥12 m and an average DBH ≥18 m was used to estimate possible vegetal waste to be generated during preconstruction. A total of 12 species, amounting to 234 individuals satisfies the stated criteria in the entire study area. However, no tree satisfies the stated criteria in transect 1 (area marked for clearing) and hence vegetal waste from woodland clearing is negligible. Four species (*Chromolaena odorata*, *Mimosa pudica*, *Mimosa invisa* and *Schrankia leptocarpa*) are invasive and also alien in the study area. All the species were censured in transect 1. The presence of these alien/invasive species in the study area signifies a disturbed ecosystem with fertile loci for proliferation. One species (*Mitragynale dermannii*) in the study area is vulnerable according to IUCN

	Forty-seven (47) species representing about 72.31 % have indigenous uses. *Elaeis guineensis*, *Bambusa vulgaris*, *Albizia adantifolia*, *Mitragynale dermannii*, *Spondias mombin* and *Musa sapian tum*are the most used plant species in the study area as a result of the wide range of products they offer. This include; Medicine, fuel wood, raw material (wood for construction of bridge, houses and electric pole, etc.).
Fauna/ wildlife	**Herpetofauna** Six Amphibians and five reptilian species were censored in the study area. Fresh water recorded the highest number of species abundance. *Rana lithobates*, *Hyperodius concolor*, *Agama agama*, *Panaspistogoensis,* and *Mabuya sp,* are some of the sighted herpatofauna species of the study area. There was no species of conservation interest in the study area
	Avian study A total of 38 individuals of sixteen (16) avian species were censored. *Streptopeliase mitoquata*, *Turturbrehemeri and Pycnonotus barbatus* were the most frequently observed species. *Polybroides typhus* was the sole migratory specie while *Polyboroides typhus* and *Necrosyrtes monachus* were the raptor species censored.
	Mammals -A total of 11 Mammalian species were censured in the study area. -These include 6 sighted species and 5 species via indirect evidences. -The species sighted include *Tragelaphus scriptus*, *Chaerephon nigeriae*, *Chaerephon pumilus* and *Rattu rattus* -Except for *Rattu rattus* and *Chrotomys whiteheadi* that were sighted at transect 1 (grassland), the remainder species were censored either in the secondary forest or fresh water habitats. -All sighted species were of Least Concern (LC) status using the IUCN Red list 2019 version one criterion. -The major threat for all the species is hunting. No endemic mammalian species was recorded.
	Socio-economics
Political context	Nigeria is a Federal Republic made up of 36 States and a Federal Capital Territory of which Delta and Edo states are component parts. Delta State currently has 25 LGAs, including Sapele
Demography	Delta State has a population of 4,112,445, a land area 17,698km^2 land area. Men population is marginally above that of the female in contrast to that of Nigeria. Age group of 0-14 years constituted about a-third of the population of the state and literacy level is 69.9%
Conflict	Civil cases in the communities are arbitrated by the Chiefs-in-Council, Elders-

Resolution	in-Council, religious leaders, traditional priests, age grade, women groups or family heads. Potential sources of conflicts in the project area include Non-recognition of communities as critical stakeholders, land disputes, agitation for employment/contracts, non-compliance with court rulings and orders especially for cases in court between Amukpe community versus Woodland, divide and rule tactics and ineffective communication channels
Sources of Data	Socio economic information was gathered from three sources: Key Informant Interview (KII), Focus Group Discussion and household questionnaire. The household questionnaires were administered on a Household basis. The questionnaires were administered to about 75% of the 125 available homesteads within the project area. The people were assisted (mainly in pidgin and local dialects) in responding to the questionnaires. A total of 94 questionnaires were administered and 85 house hold questionnaires were retrieved representing a success rate of a 90%.
Gender of heads of household	About 80 % male household heads was recorded in the project area against the Nigerian average of 85.7%, and 76.6% for South-South states implying more female house heads in the project area than the Nigerian average
Marital Status of Head of Household	About 60 % of the respondents are married. This is less than the Nigerian average of 77.4% and that of South-South at 65.7%. A 63.63% monogamous marriage was recorded in the study against the Nigerian and South-South averages of 60.7 and 57.7% respectively.
Household Size	Household sizes in the project area are mainly made up of 3-5 persons and 6-10 persons accounting for about 90% of the respondent populations. The data closely mirrors that of Nigeria and South South.
Ethnic Composition	The dominant ethnic groups in the project area are the Opke, Urhobos and Isoko. Other ethnic groups surveyed include Itsekiri, Ijaw, Afemai, Yoruba and the Hausa/Fulani. These are reflective of the accommodative nature of the people
Religion	The respondents are adherents of Christianity, Animist/ African Traditional Religion (ATR) and Islam with the Christian Faith accounting for about 86 % , ATR with about 11.2% and 2.8 % for the Islamic Faith
Educational Facilities	A total of 1 primary school, 3 secondary schools and 1 tertiary institution are in the project area. About 60 % of these schools are publicly owned, with affordable tuition fees. In addition, there are privately own adult literacy schools and skill acquisition centres are available in the project area; which improves the literacy level among adults and enhances availability of middle level man power
Water	Privately and publicly owned boreholes were recorded in the study area with

facilities	the former accounting for most of them. Less than 10 % of the respondents' population depends entirely on communal borehole boreholes for their water needs.
Household facilities	Result on the survey revealed that power generator, gas stove/kerosene, television, radio cassette player and refrigerator were the most common facilities among households in the project area. Cars and Motor cycle are the common means of transportation while the combined percentage of persons that own houses and/or land is less than 25% of the sampled population.
Roofing materials	The use of iron sheets, and aluminum accounted for about 96 % of the roofing materials. The least used roofing material is asbestos, accounting for about 4 %. The relative high percentage of aluminum building could be indicative of the prevailing economic situation
Walling materials	Mud and concrete were the walling material in the study area. The use of bricks as walling materials is predominant. This indicates an urban status of the project area.
Flooring Material	Five flooring materials were observed to be in use. Smooth cement and ceramic tiles accounted for well about 87%. The data provided closely mirrors the Nigeria average for Flooring Materials.
Transport Facilities	The project area is traversed by three main roads and other feeder roads: The Benin- Warri express way, Oviri – Eko Road and Old Warri - Sapele Road. Smaller feeder roads linking the major roads within the project community, and unpaved roads connecting small villages and settlements Public buses, cars and motorcycles are the major means of transportation in the project area. Public motor vehicles ply roads that link the project area to major towns while motorcycle transport is used for shorter distances and unpaved roads
Communication Facilities	The people in all the communities have access to mobile communication through fixed wireless lines provided by communication service providers like MTN, GLO, AIRTEL and ETISALAT.
Health Facilities	The health facilities in the project comprise of four (4) primary health centres (PHC). The grossly inadequate health facilities provide both out-patient and in-patient services. Principle cases are referred to Sapele central Hospital, Sapele Hope Clinic and Eternity Clinic available outside the project community
Prevalence of Diseases in the study area	The commonest and most prevalent diseases affecting all age groups in the communities are Malaria Fever, Upper Respiratory Tract Infection, Typhoid Fever, Diarrhoea/vomiting and Rheumatism. Other common ailments in the study area include: Worm Infestation, Diabetes Mellitus, Lower Respiratory Tract Infection, and Arthritis.
Traditional Medical	The practice of traditional medicine was common in the area. Their practice commonly involved the use of herbs and body charms, body massaging and

Practice	scarification were also common. The services offered by these practices are shrouded in secrecy. Traditional birth attendants are also popular.
Sexual Activities and Knowledge of (STI)	Three quarter of the respondents is aware of the causal and preventive measures against STIs.
Land Use	Land ownership in the project site is either by community or family. The land uses is residential areas, predominantly agricultural fields, swamps and fallow lands.
Occupation	The respondents are mainly into trading/fishing, civil service, farming and/or self-employed.
Artisanal Skills	Experienced pylon assembler, Carpenter, Welder, Electrician, Truck driver, Taxi (car, tricycle, and motorcycle), Heavy machinery operator, (*shovel operator, caterpillar, etc.)* Mechanic, Mason, Painter and Chainsaw operator
Income	About 88% of the respondents in the area earn below ₦500, 000 per annum while 12% earned above ₦500, 000 per annum from all sources combined. It was observed that the basic challenges to income generating activities in the project area include high cost of transportation, high level of post-harvest loss, epileptic power supply, lack of access to credit facilities, lack of farming inputs and inadequate extension services, post-harvest losses and high cost of labour among others.
Households' Main Source of Energy	Electricity from the national grid is the main source of lighting in the project area. Other frequently used energy sources for lighting are generator and touch lights. On the other hand, kerosene followed by gas was the most used energy source for cooking.
Households' Main Source of Potable Water	About 66% of households in the project area use water from boreholes. Other frequently used water sources are wells, water vendors and tanker trucks. The least used water sources were rain water, bottles water, surface water and rivers.
Waste Disposal by Households	Open dumping is the prevalent refuse disposal method in the area followed by refuse incineration. However most households practice both methods. Also, about 60% and above of respondents households in use the Water Closet (WC) system while about 25% of respondent households in the project area used the pit latrine. About 15% of the households use the bush
Gender Issues	Among the respondents, 98 and 15 % of the male and female respondents respectively were circumcised which shows the need for increased FGM sensitization. In terms of land ownership, there is a higher ratio of male land owners than female in project area. This was claimed to be related to the culture of preferentially giving wealth to men over women on inheritance.

	Banks and lending agencies including local thrift societies in the project area often establish one set of criteria for male folks and another, including a male surety for the female folks. Socio-cultural and religious bias in favour of the male folks in household decision process is evident in the data obtained. Personal communications in the field suggested sensitization on FGM as main reason for lower circumcision rate among female gender whose ages were less than 50 years. About 15 % of the female respondents were circumcised which shows the need for increased FGM sensitization.
Vulnerable Groups	The most vulnerable group in the project area is non-indigenes, children and women
Cultural Heritage Resources	There are no cultural sites within the project impacted area.
Consultation	A scooping workshop was organized by woodland Nig. Ltd at Hampshire Hotel, Sapele on the 3rd of October, 2019 to inform relevant stakeholders about the project. Thereafter, key informant interview (KII) was organized with the chief and elders of host community (Amukpe) at the Amukpe town Hall. In a similar manner, FGD meetings were held with representatives from the youths, women, traders/business owners, famers/hunters and fisher men from Amukpe community.

E.S 5.0: Associated and Potential impacts.

ES 5.1 Anticipated Socio-economic Benefits

The potential socio-economic benefits that will arise due to the commencement of the project includes

- Creation of temporary jobs for locals residents and Nigerian nationals with skilled trades
- Supply chain opportunities for Nigerian companies that can provide goods and services needed by the factory
- Influx of outside workers may pose additional pressure on social infrastructure, like medical posts, emergency services, water supply, solid waste management

ES 5.2 Potential Negative Impacts and Mitigation

The environmental issues addressed by the study that may involve negative impacts includes:

- ✧ Impairment of ambient air quality
- ✧ GHG emissions
- ✧ Elevated noise level
- ✧ Change to soil structure and potential contamination of soil
- ✧ Potential surface and groundwater contamination and exploitation of water resources
- ✧ Fauna migration
- ✧ Flora impact
- ✧ Degradation of aquatic habitats
- ✧ Visual effects
- ✧ Public health issues involving waste management, and potential effects of dust on community health.

E.S 6.0: Mitigation measures

The following measure will be implemented to minimize or reduce impacts of the projects:

- ✧ **Air Pollutant Emission:** Cover properly loose materials and keep top layers moist; use binder material for erosion and dust control for long term exposed surfaces; Regular cleaning of equipment, drains and roads to avoid excessive build-up of dirt; Spray surfaces prior to excavation; use covered trucks for the transportation of materials that release dust emissions; and speed limits on-site of 25km/hr on unhardened roads and surfaces.

- ✧ **Green House Gas Emission:** use of good international practice, including maintaining and operating all vehicles and equipment engines in accordance with manufacturers recommendations, restriction of vegetation clearing to only the required area and the use of experienced drivers and fuel efficient equipment, vehicles and machineries during construction activities.

- ✧ **Noise and Vibration**: Routine monitoring of noise and vibrations will be carried out and mitigation measures will be implemented.

- ✧ **Geology and Soil:** Construction of building foundations to be undertaken in the dry season; backfill foundation pits by the excavated soils which will resemble the order of the original soil layers; vegetal clearance should be reduced to project footprint to prevent soil erosion; ensure that the land is physically; and use of existing track for transport of man and material to the extent possible.

- ✧ **Impact on Hydrogeology and water resource:** Construction of drainage around project area; avoiding storage of materials that are likely to leach into soil in the open; maintain and operate all oil using equipment and machines in accordance with the manufacture's manual; and construction of bund wall around fuel and oil storage areas.

- ✧ **Impact on Terrestrial flora and Fauna:** Clearing of vegetation will be restricted to construction sites only and a re-vegetation program will also be put in place.

- ✧ **Aquatic Ecology:** Conduct activities during the dry season to minimize disturbance of sensitive wetland areas; based on an appropriate project design, avoid erecting structures within wetlands. If unavoidable, select the most optimized site for each and avoid equipment and vehicle movements in floodplains and wetland areas. If unavoidable, reduce access to a minimum length in wetlands and floodplains and select the most optimized site for the access considering human uses and areas of higher ecological integrity.

- ✧ **Visual Amenities:** Construction waste will be appropriated managed at the site and disposed by licensed company.

- ✧ **Community Health, Safety and Security:** Implementation of traffic safety plan including design of access point, signalization, speed limits, training of drivers, use of traffic guards, procedures for transport of oversized loads (e.g., engines), maintain log of traffic related incidents, sensitization of road users and people living close to the construction site.

- ✧ **Labour and Working Conditions:** Develop transparent human resources policies and procedures for recruitment process, working conditions, terms of employment wages, worker-employer relations, non-discrimination policy, monitoring, roles and responsibilities; provide reasonable, and if applicable negotiated, working terms and conditions; a worker's grievance mechanism will be in place; train staff regularly and thoroughly in prevention and response of electrocution incidents, monitor and keep record; develop and implementing health and safety procedures, based on woodland's HSE guidelines, including provisions for training and certifications to be followed by all workers including subcontractors; and consulting with local health facilities to be prepared in case of incidents that need medical help.

- **Employment and Economy: A L**ocal content plan shall be prepared implemented to enhance the ability to locate local hires and Nigerian nationals.

- **Infrastructure:** Proper and independent facilities for water supply, sanitation, solid and liquid waste need to be installed at the construction site, so that pressure on community infrastructure is limited.

- **Traffic and safety:** Implement a traffic safety plan including design of access point, signalization, speed limits, training of drivers, use of traffic guards, procedures for transport of oversized loads (e.g., engines); maintain log of traffic related incidents, sensitization of road users and people living close to the construction site; and periodic maintenance of transport vehicles
- **Cultural Heritage:** If archaeological or historic remains are discovered, the construction works will immediately stop, the National Commission for Museums and Monuments (NCMM) and the LGA authorities and the State Ministry responsible for culture in Delta State should be informed.

E.S 7.0 Environmental and Social Management Plan (ESMP)

E.S 7.1 Objectives of the ESMP

The ESMP is prepared to achieve the following objectives.

- promote environmental and social management in the project implementation in all phases;

- ensure that all relevant stakeholders are aware of their respective responsibility - promoter, contractors, regulators and other relevant agencies;
- incorporate environmental and social management into project design and operating procedures and activities;
- serve as an action plan for environmental and social management for the project;
- provide a framework for implementing environmental and social commitments described in chapter seven;
- prepare and maintain records of project environmental performance for monitoring and evaluating performance.

E.S 7.2 Institutional Framework for Implementation

Responsibilities for the ESMP and its implementation are shared between multiple stakeholders, including concerned ministries, competent authorities, Woodland and the contractors. These include the following;

- The Federal Government of Nigeria (FGN)
- Federal Ministry of Environment
- Delta State Ministry of Environment
- Delta State Environmental Protection Agency (DSEPA)
- Delta State Bureau for Lands and Survey (DSBLS)
- Delta Waste Management Authority
- Delta State Bureau for Lands

E.S 7.4: Management Sub plans/Programs

The ESIA study did triggered development of specific management plans which include;

- Air Quality Management Plan
- Waste Management Plan;
- Biodiversity Management Program;
- Community Health and Safety Management Plan
- Traffic Management Plan
- Construction Management Plan

Each plan outlines developmental and implementable procedures as part of the overarching ESMS to be developed and implemented by woodland and the Contractor, as applicable.

The Contractors required to develop and implement the following Construction triggered Management Plan

- Access Roads Location and Management Plan;
- Soil and Erosion Management Plan;
- Update the Traffic Management Plan;
- Training and Skill Transfer Program;
- Worker's Health and Safety Management Plan;
- Environmental and Social Code of Conduct;
- Contractors' GRM for Communities and Workers;
- Method Statements, including, but not limited to: erosion control, work in heights, and others that may be required by the Contractor.

These specific management plans will be drafted by the Contractor, based on the requirements presented in this ESMP, and submitted to Woodland for approval in consultation with stakeholders prior to activity kick off.

E.S 8.0 Decommissioning/Closure

A decommissioning plan incorporating the reclamation plan shall be submitted to Federal Ministry of Environment before the cessation of wood processing factory operations. The Decommissioning Plan shall:

- Nominate the end use(s) of all lands affected by the project
- Nominate the end use(s) of all buildings, houses and other infrastructure components;
- Describe the steps to make the area safe;
- Describe the type and duration of post decommissioning monitoring

A Post Decommissioning Report shall be prepared as required by statutory regulations and submitted to regulators. The report will provide the following details.

- Overview of decommissioned facilities.
- Details of methods used for decommissioning.

- Nature of decommissioning (whole or partial).
- Records of consultation meetings.
- Details of recyclable/reusable facility components.
- Decontaminated facilities.
- Decommissioning schedule.
- State of the surrounding environment.
- Waste Management Plan.
- Plans for restoration/remediation where necessary.

E.S 9 Conclusion and Recommendations

The Environmental Impact Assessment study of the proposed Woodland factory was carried out with strict adherence to the guidelines and regulations of the Federal Ministry of Environment. The study has identified the environmental issues/impacts associated with the proposed project activities on the immediate environment. And, in order to minimize these impacts appropriate mitigation has been proffered.

On the socio-economic impacts, potentially, the project will provide social and economic opportunities capable of enhancing the economic growth of the Delta State in particular and the country in general.

Thus, in view of the fact that the stakeholder communities shall be carried along during the project construction and operation, and that there is no stern environmental, health, social or cultural issues that may warrant the cancellation of the proposed project, it is therefore strongly recommended that the project be embark upon as proposed.

CHAPTER1: INTRODUCTION AND BACKGROUND INFORMATION

1.1 Introduction

Woodland Nigeria Limited (RC 178093) was registered and Incorporated in 1991 with Corporate Affairs Commission (CAC), as a Manufacturing and Offshore Marine & Leasing Services Company.

Woodland is a major player in the furniture industry; she focuses mainly on the production and supply of ergonomically designed furniture’s for schools, offices and household. However, a review of the company business in the last five years shows a rapid decline in the supply of hard wood for furniture production.

The dearth of hard wood occasioned by the rapid decline in natural forest resources and the global campaign against deforestation poses a major challenge to most of the local furniture industry. The imported alternative wood based raw materials such as medium density fibre-board (MDF), high density fibre-board (HDF), Ply board, laminated board etc. are very expensive. In view of this development Woodland management team paid several technical visits to Malaysia, Singapore and India with a view of setting up a finger joint laminated rubber board factory Nigeria.

Woodland has obtained the required counterpart funding of Two Million Three Hundred and Sixty Thousand Dollars (US$2.36million) from the Nigerian Export-Import (NEXIM) bank to enable her procure, install and commission a state of the art “finger joint laminated rubber wood board” production plant in Sapele, Delta State Nigeria.

The factory has the potential of converting harvested over aged round rubber wood logs into sawn wood or planks of various dimensions, the sawn planks are treated against infestation by insects or fungi using vacuum impregnation process, the treated planks are moved into the kiln dryer for drying where the planks are dried to a moisture content of 10%, The product at this stage is known as Rough Sawn Kiln Dry rubber wood strips (RSKD). The products made by RSKD serve as input to the finger joint and laminating section where the final product comes in 4ft x 8ft board of various thicknesses.

Primary process

- Felling of over aged rubber tree using bull dozers and excavators to uproot and prepare the soil for replanting. Deploy chain saws to cut the felled logs into approved dimensions. Load the logs into trucks and transport via road to factory,
- Sawmilling – Round logs are sawn into lumbers or planks of various sizes and thicknesses

Secondary process

- Vacuum Impregnation process – Treatment of sawn lumbers or planks against infestation by insect or fungi
- Kiln dryer – Drying the treated sawn wood in a regulated temperature and moisture control enclosure, reduce the moisture content to between 12 – 10%
- Wood processing – Convert RSKD to 4ft x 8ft finger joint laminated board

The project has potentials for employment and will offer significant boost toward the revival of the moribund rubber tree replanting culture in the south-south and south-west region.
Total project investment is estimated at USD 3.3Million to be funded by a combination of equity and debt. The project proposes to commence payback after 1 year with an Internal Rate of Return (IRR) of 35% and Net Present Value (NPV) of US$642,323 at 25% discount rate.

1.2 The Proponent

Woodland Nigeria Limited (WNL) is currently engaged in furniture business for institutional and household purposes. It also includes training, apprenticeship, furniture and wood equipment procurement business. WNL is an indigenous company that has operated successfully for over 25 years in the Nigerian business landscape. The company operates from its factory location at 1, Woodland Drive GRA Sapele in Delta State, Nigeria and Corporate Head Office at 30, Raymond Njoku Street, Ikoyi South-West Lagos, Nigeria.

Apart from the wood business, the company's operations also covered offshore Marine Services. WNL's offshore group provides engineering marine services, equipment leasing, dredging, offshore construction, Rig transportation and maintenance.

The company was founded by **Prince Ete Omatseye** and his brother **Prince Tuoyo Omatseye** and the project's main philosophy is to produce finger joint laminated rubber wood boards and position the company among the best in the world.

Woodland Nigeria Ltd has been successful over the years and the company's reputation has grown steadily both in the Wood/Timber business and in the Nigerian Oil & Gas servicing sector respectively. The company's clientele includes:

- Niger Delta Development Commission(NDDC)
- Delta State Universal Basic Education Board(SUBEB)
- Delta State Ministry of Education
- Willbros Nigeria Limited (Defunct)
- Cavendish Petroleum
- Saipem (Agip) Petroleum amongst others

In line with its philosophy of continuous improvement in quality, the company has embarked on the modernization and expansion of its plant to accommodate its rubber wood processing operations.

1.2.1 Corporate Objectives and Core Values

1.2.1.1 Vision

The vision of the rejuvenated WNL is to become one of the largest manufacturers of rubber wood boards in Africa producing and selling best quality products to the world market. The company aims to become the rubber wood furniture producer of first 18 choices in Africa serving governments, agencies, corporations and high net worth individuals.

1.2.1.2 Mission & Objectives

The company's principal mission and objectives are as follows:

- ✧ To harness the existing old unviable rubber plantations and creating an exportable commodity from it.
- ✧ To uplift the lot of the local small-scale rubber farmers in Nigeria by helping them clear the land of old rubber trees and providing new planting material.
- ✧ To increase the variety of furniture boards that is available locally and contributes to meeting the global demands for eco-friendly rubber wood furniture
- ✧ To contribute significantly to the growth of the Nigerian economy via revenues to government and its agencies.
- ✧ To provide employment, training and development opportunities for the youths in and around the Niger Delta in particular and Nigeria at Large.

1.2.1.3 Core Values

WNL's operations and business are driven by a set of values that have formed the bedrock of its consistent growth and performance over the years. These values have provided a strong platform for the company's ability to innovate and expand its range of products and services.

WNL's core values include:

- ✧ **Excellence &Total Quality**

  WNL's focus on production of quality and excellent products at all times is total. The company has a built-in and rigorous process of wood treatment and quality control that guarantees the quality of goods and services produced by the company. The company's insistence on excellence and quality is a core value that is imbibed company wide.

- ✧ **Service**

  WNL is a service-oriented company. The company's commitment to provision of excellent services to its clients is significant and reflects greatly in all the company's activities.

- ✧ **Cost Leadership (Affordable Products)**

  One of the critical values that undergird WNL's operations is to produce quality and affordable products across its products range. Despite the harsh operating conditions, the company has ensured that its products are appropriately priced and within the reach of its average consumer.

- **People Oriented**

  Woodland Nigeria Ltd.'s major strength is the quality of its management team. The company has adopted a very robust approach towards the welfare and development of its workforce. This core value has ensured the maintenance of peace and industrial harmony among its constituent units.

1.3 Purpose of the ESIA

The purpose of this ESIA report is to identify the key environmental and social impacts which are likely to result from the activities of the proposed project and associated facilities. These impacts will be assessed and mitigation measures to be adopted for their minimization.

The ultimate goal of this ESIA report is to produce an Environmental and Social Management Plan (ESMP) to address impacts that may occur during the various phases of the proposed project. Compliance with the ESMP and the associated mitigation measures for the identified significant negative impacts will ensure implementation of this project in an environmentally sustainable manner across all stages of the Project life cycle.

1.4 Accessibility

The proposed site (see Chapter 3) could be accessed through road. The proposed site is along the Benin – Warri Expressway Amukpe-Sapele. However, the site can also be accessed from Abraka-Eku-Amukpe Roundabout. Complimentarily, the Benin airport is about 58.4km away could readily serve air transportation to the site while the surrounding Warri and Onne ports would provide further transport routes alternatives.

1.5 Legal and Institutional Framework

Responsibilities for the ESIA and its implementation are shared between multiple stakeholders, including concerned ministries, competent authorities, the HSE department, and the contractors. These include the following;

1.5.1 The Federal Government of Nigeria

The constitution of Nigeria (1999), as the national legal order, recognizes the importance of improving and protecting the environment and makes provision for it. Relevant sections are:

Section 20 makes it an objective of the Nigerian State to improve and protect the air, land, water, forest and wildlife of Nigeria.

Section 12 establishes, though impliedly, that international treaties (including environmental treaties) ratified by the National Assembly should be implemented as law in Nigeria.

Sections 33 and 34 which guarantee fundamental human rights to life and human dignity, respectively, have also been argued to be linked to the need for a healthy and safe environment to give these rights effect.

This section provides the Nigerian administrative framework and describes the relevant Nigerian legislation, industry standards and that the Project will follow. Specifically, Table 1 provides a summary of: Nigerian administrative and legislative organization; National environmental and social legislation deemed applicable to the Project; Other international conventions to which Nigeria is a signatory; International standards and guidelines to which the Project will also align.

Table 1.1Institutional and legislative guidelines

INSTITUTION/LEGISLATION	DESCRIPTION
National Policy on the Environment (1999)	The National Policy on the Environment describes the conceptual framework and strategies for achieving the overall goal of sustainable development in Nigeria. Specifically, the goals of the Policy include to: Secure a quality of environment adequate for good health and human well-being; Conserve and use the environment and natural resources sustainably for the benefit of present and future generations; Restore, maintain and enhance ecosystems and ecological processes essential for the functioning of the biosphere to

	preserve biological diversity and the principle of optimum sustainable yield in the use of living natural resources and ecosystems; Raise public awareness and promote understanding of the essential linkages between the environment, resources and development, and encourage individual and community participation in environmental improvement efforts; and Co-operate with other countries, international organizations and agencies to achieve optimal use of trans-boundary natural resources and effective prevention or abatement of trans-boundary environmental degradation.
EIA Act Cap E12 LFN 2004	An Environmental Impact Assessment (EIA) is an assessment of the potential impacts whether positive or negative, of a proposed project on the natural environment: The E.I.A Act, as it is informally called, deals with the considerations of environmental impact in respect of public and private projects. Sections relevant to environmental emergency prevention under the EIA include:- Section 2 (1) requires an assessment of public or private projects likely to have a significant (negative) impact on the environment. Section 2 (4) requires an application in writing to the Agency before embarking on projects for their environmental assessment to determine approval. Section 13 establishes cases where an EIA is required and Section 60 creates a legal liability for contravention of any provision. The project is considered to be a major development, which is expected to have some impacts on the environment.

	Hence, full compliance with the EIA Act is required. The EIA guidelines (procedural and sectorial) issued by the FMEnv drives from this Act and the project proponents shall conduct its activities in conformance with these guidelines.
National Environmental Standards and Regulations Enforcement Agency (NESREA) Act 2007	The National Environmental Standards & Regulations Enforcement Agency (NESREA) Act repealed the FEPA Act and established NESREA, with the responsibility for the protection and development of the environment, biodiversity conservation and sustainable development of Nigeria's natural resources in general and environmental technology, including coordination and liaison with relevant stakeholders within and outside Nigeria on matters of enforcement of environmental standards, regulations, rules, laws, policies and guidelines.
National Environmental Protection (Management of Solid and Hazardous Wastes) Regulations, 1991	The management of hazardous and solid waste regulation, 15 of 1991 (No. 102, Vol. 78, August, 1991), defines the requirements for groundwater protection, surface impoundment, land treatment, waste piles, landfills, incinerators etc. It also describes the hazardous substances tracking program with a comprehensive list of acutely hazardous chemical products and dangerous waste constituents. It also states the requirements and procedure for inspection, enforcement and penalty.
National Environmental (Sanitation and Wastes Control) Regulations, 2009	The Regulations provide the legal framework for the adoption of sustainable and environment friendly practices in sanitation and control of solid wastes, hazardous wastes and effluent discharges to minimize pollution. Part 3 of the Regulations states that all owners or occupiers of premises shall provide waste receptacles for storage before collection

	by licensed waste managers. In addition, the Regulations make it mandatory for facilities that generate waste, to reduce, re-use, recycle and ensure safe disposal to minimize pollution. The Regulations also spell out roles and responsibilities of State and Local Government Authorities.
National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulations, 1991	The pollution abatement regulation, 9 of 1991 (No. 42, Vol. 78, August, 1991), imposes restrictions on the release of toxic substances and stipulates requirements for pollution monitoring units, machinery for combating pollution and contingency plan by industries; submission of lists and details of chemicals used by industries to FMEnv; requirement of permit by industries for the storage and transportation of harmful toxic waste; the generator's liability; strategies for waste reduction; permissible limits of discharge into public drains; protection of workers and safety requirements; for environmental audit (or Environmental and Social Impact Assessment for new industries) and penalty for contravention.
National Environmental (Noise Standards and Control) Regulations, 2009	The purpose of these Regulations is to ensure maintenance of a healthy environment for all people in Nigeria, the tranquillity of their surroundings and their psychological wellbeing by regulating noise levels. The Regulations prescribe the maximum permissible noise levels on a facility or activity to which a person may be exposed and provide for the control of noise and for mitigating measures for the reduction of noise.

National Environmental (Surface & Groundwater Quality Control) Regulations 2011	The purpose of these Regulations is to restore, enhance and preserve the physical, chemical and biological integrity of the nation's surface waters and to maintain existing water uses. The Regulations also seek to protect groundwater sources by regulating the discharge of hazardous wastes, fossil fuels energy and any other substances having the potential to contaminate groundwater. The Regulations also include amongst others, the application and general provisions of water quality standards for various uses such as agriculture, industrial, aquatic life and recreation.
Land Use Act CAP L5 LFN 2004	The land use Act of 2004 as amended (Decree No 6 of 1978) places the ownership management and control of land in each state of the Federation in the Governor of the State. The Act divests traditional owners of land and vests such land in the state governor for the benefit and use of all Nigerians. It provides the processes through which land may be acquired by the federal government. The project requires land take, which was acquired in accordance with requirements of this Act. The policy under the act relevant to this project is the National Land Policy
National Land Policy	The legal basis for land acquisition and resettlement in Nigeria is the Land Use Act of 1978 as amended by Act Cap 227 of 2004. According to the act, all land in Nigeria is vested in the Governor of each State, to be held in trust for the use and common benefit of all people. The administration of urban land is directly under the control and management of the Governor; whereas non – urban land is under the control and management of the Local Government Area. The project acquired land was in conformance to the

	national land policy as well as the land use Act described in Section 1.7.6.
Water Resources ACT, CAP W2, LFN 2004	The Water Resources Act is targeted at developing and improving the quantity and quality of water resources. The following sections are pertinent: Section 5 and 6 provides authority to make pollution prevention plans and regulations for the protection of fisheries, flora and fauna. Section 18 makes offenders liable, under this Act, to be punished with a fine not exceeding N2000 or an imprisonment term of six months. This project shall generate effluent that will be treated before release to water bodies to prevent pollution of aquatic organisms.
National Environmental (Soil Erosion and Flood Control) Regulations, 2011	The overall objective of these Regulations is to control erosion and flooding by checking all earth-disturbing activities, practices or developments for non-agricultural, commercial, industrial and residential purposes.
Employee Compensation Act, 2010	The Act provides compensation to employees who suffer from occupational diseases or sustain injuries arising from accidents at workplace or in the course of employment. Payment of compensation (to the worker or to his dependents in case of death) by the employer is rooted in the accepted principle that the employer has a duty of care to protect the health, welfare and safety of workers at work.
Nigerian Urban and Regional Planning Act CAP 138 LFN 2004	The Act is aimed at overseeing a realistic, purposeful planning of the country to avoid overcrowding and poor environmental conditions. The Act establishes that an application for land development would be rejected if such

	development would harm the environment or constitute a nuisance to the community.
EIA Procedural Guidelines, 1995	Provides Procedural context and guidance for the conduct of EIA in Nigeria
Natural Resources Conservation Act CAP 268 LFN 1990	The Natural Resources Conservation Act CAP 268 LFN 1990 is the most direct existing piece of legislation on natural resources conservation. The Act establishes the Natural Resources Conservation Council, which is empowered to address soil, water, forestry, fisheries and wildlife conservation by formulating and implementing policies, programs and projects on conservation of the country's natural resources.
Endangered Species Act Cap E9, LFN 2016	Section 1 (prohibition of hunting of or trading in wild animals) of the Endangered Species Act of 2016 (as amended) prohibits the hunting, capture and trade of endangered species The Act also stipulates pertinent permits, certificates and the processes for trading of the identified endangered species as well as prescribes penalties for contraventions.
Labour Act	The Labour Act (Decree No 198 of 1990) is the primary law protecting the Employment rights of individual workers. The Act covers protection of wages; contracts; Employment terms and conditions; recruitment; and classifies workers and special worker types. Union membership is governed by the Trade Union Amendment Act (1995). The 1999 constitution as amended includes stipulation of equal pay for equal work without discrimination on account of gender, race or any other ground whatsoever.

The Factories Act CAP F1, LFN 2004	The Factories Act promotes the safety of workers and professionals exposed to occupational hazards. Under this Act, it is an offence to use unregistered premises for factory purposes. In particular: Section 13 allows an inspector take emergency measures or request that emergency measures be taken by a person qualified to do so in cases of pollution or any nuisance. This project would entail land clearing and logging and hence this legal instrument is triggered.
National Policy on Agriculture 2010	The purpose of agricultural policy is the development of favourable and sustainable guidelines for the promotion of efficient agricultural practices that will guarantee food security, provide employment for the citizens, raw material for all agro – based industries as well as to earn foreign exchange. The National Agricultural Policy seeks to raise the profile of the agricultural sector so that it effectively contributes to the national development aspirations of turning the country from a predominantly consuming to a producing and exporting nation targeting all value chain stages.
Federal Ministry of Agriculture and Rural Development	The Federal Ministry of Agriculture and Rural Development is a ministry of the Nigerian government that regulates agricultural research, agriculture and natural resources, forestry and veterinary research throughout Nigeria. It is responsible for the development of inclusive and sustained growth framework in the Agricultural Sector and has over the years created various strategic initiatives to enhance knowledge sharing between Stakeholders at the Federal, State and Local Government levels
Federal Ministry of Industry,	The Federal Ministry of Trade and Investment was created

Trade and Investment	to help diversify the resource base of the economy by promoting trade and investment with special emphasis on increased production and export of non-oil and gas products. The mandate of the FMITI is to formulate policies that will help create wealth and employment, reduce poverty and ensure enhanced service delivery in a manner that will stimulate the growth of the domestic economy through industrialization, trade and investment.

1.5.2 Delta State Environmental Laws

Table 1.2 provides a summary of: Delta State and the affected LGA environmental and social legislation deemed applicable to the Project;

Table 1.2 Environmental and social legislations of Delta State

LEGISLATION	DESCRIPTION
The Delta State Town and Country Planning Laws Cap 165 of 1975	This law grants the Government and its operating agencies the authority to require lands and undertake layouts and boundary adjustments of plots, if necessary, authority to grant leases and sell plots as necessary as well as preservation of trees, landmarks for amenities, authority to approve building designs and external appearance of structures; prohibition of unsuitable buildings.
Delta State Environmental Protection Agency Edict No 5 of 1997	The DSEPA is an agency under the Delta State Ministry of Environment. Although the EIA decree No 86 of 1992 is the substantive law that regulates the siting of industrial projects that impinge on environmental elements in Nigeria, with part of the project in Delta State, this edict has a role to play in the overall EIA process as a matter of law. The edict setting up the Delta State Environmental Protection Agency (DSEPA). Captioned as Edict No 5 of 1997 outlines the primary responsibilities of the agency, which is to protect and develop the general environment of Delta State.

Delta State Ecology Law, 2006	The law empowers the Delta State Ministry of Environment with the responsibility of protecting the environment in order to achieve sustainable environmental development in the State. It empowers the Ministry with the statutory responsibility of handling environmental pollution cases. It liaises with oil companies on pollution matters. It enables, the Ministry to participate in the management of oil spills in the State .It empowers the Ministry to be an integral part of the Joint Investigation team (JIV) that investigates the causes of oil spills; carrying out assessment of damage to the environment, property, health and assessment of the ecological damage to the marine and terrestrial habitat as well as vegetation and ecosystem. The law also empowers the Ministry to handle flood and erosion cases.
Delta State Forestry Law Cap 59, 1976	This law is all about the sustainable use of Delta State forests and its bio-diversity which is a renewable source of wealth in the area especially for tourism, food supply, fuel and timber as well as the protection of the environment.

1.5.3 Other Relevant National Policies

1.5.3.1 Environmental Policy

The policy was first developed in 1989 following the promulgation of the Federal Environmental Protection Agency (FEPA) decree no 58 of 1988 and revised in 1999. WNL as a corporate entity is committed to implementing sound environmental practices through the introduction of state-of-the art technology which meets stringent international environmental standards. To attain its environmental policy objectives, WNL is committed to the following:

- To ensure compliance with national legislation and guidelines on environmental health and safety;
- To assess the impact of any proposed activities, products and services on the environment, health of personnel and local population;
- To implement a range of preventive measures aimed to preclude any emergency and mitigate impacts on the environment;
- To prioritize actions and measures, projected and under implementation, aimed at preventing an adverse impact on the environment, personnel and local population;
- To strive for continuous improvement in the quality of environment in the area where the refinery will operate;

- ✧ To ensure a pro-active involvement of staff in environmental and occupational safety activities.
- ✧ To inform on a regular basis all regulatory parties of the environmental and safety performance;
- ✧ To ensure all the personnel perform in compliance with the existing safety standards and labour and environmental protection rules.
- ✧ Training will be a key activity in achieving this objective;

WNL is aimed at improving the competitiveness of its range of products in the market place. The establishment of the new factory will enhance its ability to produce quality rubber wood boards for exports and local consumption. Given the company's long experience in furniture and hardwood business its rubber board products will surely be competitive and balance out the challenge of seasonality or cyclicality in its overall business. The company is also pursuing a two-pronged strategy of increasing its market share by pursuing a backward integration strategy while moving into new markets with new products development.

Other strategies that will assist WNL in further exploiting the market include

- ✧ Maintenance and strengthening of its Brand Equity
- ✧ Improvement of its logistics and management of export products
- ✧ Cost management via improved process efficiency and economies of scale
- ✧ Varied product offerings and continuous innovation

1.5.3.2 Health & Safety Policy

This is reflected in the 1999 constitution of the Federal Republic of Nigeria, Section 17.3c "the state shall divert its policy towards ensuring that the health, safety and welfare of all persons in employment is safeguarded and not endangered or abused". The Occupational Safety and Health policy strengthens the National Labour Policy and extant labour legislations, provisions) Cap 126, the workmen's Compensation Act Cap 470, Trade Union Act Cap 437, Trade Dispute Act Cap 432, wages Board and Industrial Councils Act Cap 466 and the Labour Act Cap 198, and other relevant Laws of the Federation of Nigeria.

WLN is committed with the Health and Safety of:

- ✧ Any persons performing any job in our plant.

- Any persons we have contact with such as visitors, suppliers, customers…

Therefore:

- We provide safe and healthy working areas
- We implement occupational safe and health regulations.
- We offer any persons performing an Employment activity in our company the necessary resources and
- Training to implement occupational safe and health regulations.

1.5.3.3 Sustainable Development Policy

With particular emphasis on the environmental pillar of sustainable development, Article 20 (sub-section 2), of the 1999 Constitution states that, "the State shall protect and improve the environment and safeguard the water, air and land, forest and wild life of Nigeria".

In view of this, the overarching goals of WNL policy are as follows:

- To establish a durable and locally appropriate framework and model for sustained and cooperative socio-economic development of affected local communities
- To enhance community participation in the determination and implementation of the social development priorities in and around the project impacted area, for the duration of the project
- To promote corporate and social citizenship so as to ensure and sustain a social license to operate and
- To provide a framework and guidance to put into practice the company's community development responsibilities.

1.6 The ESIA Process

ESIA is an iterative process of interacting with the public, government, stakeholders, the contractors and other project planning groups so that any identified unacceptable environmental effects of the project are mitigated through feed back into the design and planning. Constant consultation amongst members of the ESIA project team will ensure that all relevant information regarding design, construction, operation and maintenance are mutually appreciated. Baseline data for the assessment were acquired through field surveys, questionnaires/interviews, supplemented with published data (literature). These enabled the existing state of the environment to be established. Upon production of the Draft-final-report and subjected to a public hearing, all the inputs of all the stakeholders shall be addressed in the final report. Fig 1.1 shows the ESIA process as contained in the *EIA Procedural Guidelines* by the FMEnv.

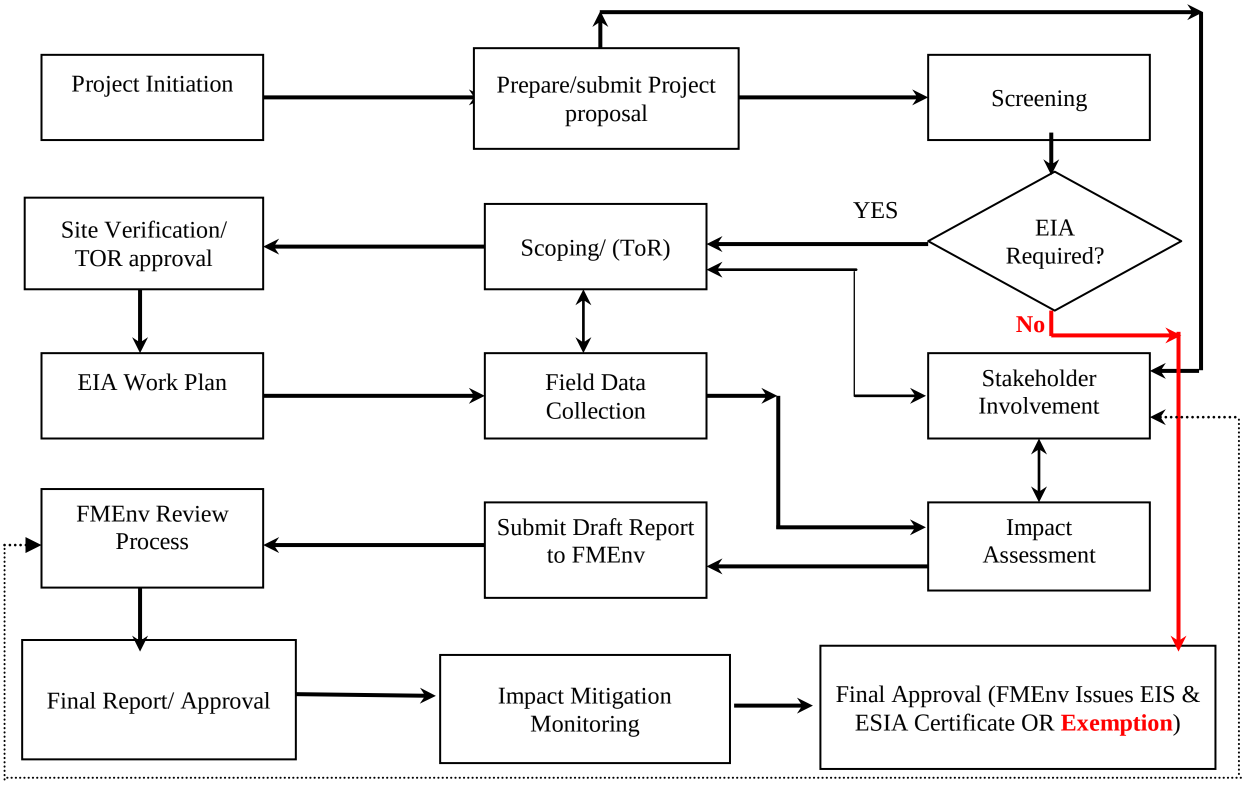


Figure 1.1 ESIA Process in Nigeria

This will again be vetted by the Federal Ministry of Environment who may issue the permit. As part of the implementation program the measures evolved to mitigate the predicted impacts would be fully adopted. Also monitoring of the predicted impacts would be undertaken to test the level of confidence of the predictions and for statutory compliance with the FMEnv guidelines on pollution of the receiving environment. As part of the woodland processing plant environmental Management program, audits will be undertaken to verify the effectiveness of the environmental management controls Employed throughout all the stages of the project implementation.

1.7 Structure of the ESIA Report

This ESIA Report is based on field data generated for one season at site and data collected from secondary sources. This ESIA report is prepared in accordance with the FMEnv guidelines and has been divided into eight chapters (in addition to Executive Summary) as briefed hereunder:

Front Page - Title page, acknowledgements, authors and contributors, table of contents (including lists of figures, tables, and maps)

Executive Summary - It contains a non-technical summary (executive summary) of the content of the chapters in the report

Chapter 1 – Introduction and Background Information

The chapter provides description of project background, site and surroundings, objectives, scope and organization of the study, Policy, Legal and Administrative framework applicable to such projects.

Chapter 2 - Project Justification and Alternatives

The chapter looks at the project justification, alternatives, the need/value and the envisaged sustainability of the project.

Chapter 3 – Project Description

This chapter includes a description of the site, area of influence, project components and activities.

Chapter 4 - Baseline Environmental Studies

This chapter presents the data gathering methodology, including field studies undertaken with respect to ambient air, meteorology, water, soil, noise levels, ecology to define the various existing environmental status in the area. This chapter also presents socio-economic profile of the study area based on primary and secondary information on socio-economic aspects of the study area.

Chapter 5–Associated& Potential Impacts

In this chapter, the potential impacts of the proposed wood processing project and allied activities, which could cause significant environmental concerns, are identified and discussed. This discussion will form the basis for environmental management activities.

Chapter 6 – Mitigation Measures

In this chapter, mitigation measures were proposed for all the identified and ranked impacts across all phases of the project life cycle. The chapter also quantifies the residual impact after mitigation measures would have been applied

Chapter 7 - Environnemental and Social Management Plan (ESMP)

This chapter provides recommendation for environmental management plan aimed at minimizing the negative environmental impacts of the project. Environmental monitoring requirements for effective implementation of mitigating measures during all phases of the proposed mine plant along monitoring plans, frequency and the respective action party. Also, specific management plans were documented.

Chapter 8 – Chapter 8: Decommissioning/abandonment

This chapter provides recommendation for a decommissioning plan incorporating the reclamation plan which shall be submitted to Federal Ministry of Environment before the cessation of Woodland operations.

Chapter 9 - Conclusion & Recommendations

The key findings in the study were reported in the conclusion and summary of key recommendations were stated.

References - All references made in the report and documents drawn upon during the course of the assessment

Appendices - These will include technical annexes with details of specific technical surveys.

CHAPTER2: PROJECT JUSTIFICATION AND ALTERNATIVES

2.1 Introduction

This chapter discusses the justification for the project and as well as description of all alternatives considered to ensure that the least environmentally and socially damaging alternative was selected.

2.2 Project Justification

2.2.1 Purpose of the project

The Basic Idea of the project tagged "Have a Project" is to harness the existing old unviable rubber plantations in and around the Niger Delta and creating an economic commodity from it. This is in addition to uplifting the lot of the local small-scale farmers by helping them clear the land of old rubber trees thereby providing new planting material. The project has potentials for employment and will offer significant boost toward the revival of the moribund rubber tree growing plantation culture in the Delta region. It will have tremendous impact in the rubber crump business, employment in rubber plantation, cultivation and rubber tapping as well as provide organized rubber tree cutting practices with enormous potentials for agriculture in the Niger Delta generally. This ESIA document/ report is purposed to highlight the prospects and profitability of the proposed project and WNL's operational strategy.

2.2.2 Need of the Project

The demand for imported kiln dried wood for high quality furniture and housing needs are growing rapidly in Nigeria. This trend is expected to continue rising over the next decade. It is expected that creating a local sourcing of inputs and materials will further create incremental yearly employment opportunities to over 500 people and generate average value addition in the neighborhood of USD11.2million during the projected period. It is expected that the project would gradually stem the crave for imported products thereby conserving scarce foreign exchange

2.2.3 Benefits of the project

WNL currently provides direct employment to about 100 employees and another 200 indirectly. Operations of the project would add additional 80 direct jobs and another 350 indirect jobs. Aside employment, the proposed project further increases the company's export earnings capacity by over 200%. Also, rubber wood can serve as a substitute for certain tropical hardwoods that now risk depletion. Because rubber trees grow relatively rapidly and are comparatively inexpensive to cultivate, they represent an economical sustainable resource and can be a viable alternative to increasingly rare tropical timbers. The development of this factory will also help by way of technology and transfer of expertise in the area of Rubber wood processing. The success of the factory will also guarantee increased job creation along the various chains of the business. Rubber wood is in high demand in developed countries given its eco-friendly nature and other beautiful features. The bulk of the products after local consumption are targeted for exports and this will significantly improve the companies' foreign exchange earning capacity of the company and also boost the larger Nigerian economy.

2.3 Envisaged Sustainability

The total capital outlay of the project including working capital requirement is estimated at USD3.3million. The funds will be channeled towards purchase of plant & machinery, installation, provision of additional infrastructure and working capital support. The obtainment of USD2.36Million from Nexim Bank to complement shareholders equity contribution of USD750,000 guarantees project takes off.

The loan is a 5-year term loan with Twelve (12) months moratorium on principal and Six (6) months moratorium on interest at an interest rate not exceeding 8% per annum. Interest on the facility will be serviced from the sixth (6th) month during the moratorium period while principal repayment will commence from the 13thmonth accordingly.

2.3.1 Environmental Sustainability

Rubber wood comes from mature rubber trees. This means that they have had about 30 years of productive life, providing rubber from their sap. During that lifespan, they help reduce global warming by absorbing carbon dioxide and releasing oxygen. Rubber trees used to be burned at the end of their productive lifespan, but are now being harvested for Rubber wood. Since mature rubber trees grow to about 30 meters in height and 1 meter in diameter, they provide plenty of environmentally beneficial timber. The current project will adhere strictly to the extant environmental laws, as well as implementations of the ESMP developed for the project.

2.3.2 Social Sustainability

The project has secured the buy-in of the people due to their quest for wood products. Also, the benefit to create job opportunities for unemployed indigenes and Nigerians would ensure social sustainability.

In addition, Wood land is committed to effective and continuous stakeholders' engagements and consultations and effective implementation of applicable national and social laws. Wood land has also committed to training and re training of the HSE team members on environmental and social management risks.

2.3.3 Technological sustainability

Technology &Technical Expertise: Technology is a key determinant of success in the rubber wood board manufacturing plan. WNL has a solid understanding with its key suppliers for the deployment of support engineers and technicians to assist in its production processes. The company shall source its manpower and equipment requirement shown in chapter three of this report.

2.3.4 Economic Sustainability

The economic sustainability of the current project is dependent on availability of funds, equipment and technical know-how of staff, evidence of up-takers and feedstock volume over life cycle period, all of which have been stated in the introductory part of this document, as well as in chapters two, three and four of this report.

2.4 Project Option

Four options were considered before arriving at the present options that were adopted:

- Do nothing option
- Distribute already processed products
- Delayed Project Option
- Implement the project as proposed

2.4.1. 'Do Not Do' Option

The 'does not-do" alternative means what the situation will be like if the project were not developed. This means that, the volume of rubber wood product in Nigeria and the volume imported would remain the same. The 'Do Nothing' alternative does not seem plausible given the legitimacy of the proposed project rationale and the benefits to be derived. Regardless of its few negative social and environmental impacts, the proposed project is expected to provide about numerous job opportunities during its operation phase and additional job and economic opportunities. In addition, this alternative was chosen because there will be transfer of technology associated with installation, operation of the equipment and maintenance and savings on foreign exchange. The investment potential as proposed by the Project Proponents will not be utilized with "Do Nothing" option.

2.4.2. Distribute already processed products

The first implication of this option is that, most of the employment opportunities which will be opened for the processing of the wood product will be lost to the country when the finished product is imported. In addition, there will be loss of foreign exchange to the country. For these reasons, this option is rejected.

2.4.3 Delayed Project Option

This option implies postponing or delaying initialization of the planned project to a later date. This option is usually considered when prevailing conditions will adversely affect project implementation, for instance during a conflict, or when host communities have reservation for the project, or if the economics of the project are objectionable and unappealing.

As it is, there is no conflict or any other unpleasant situation at the proposed site. It is worthy of note that both the socio-economic and the political situation are favourably disposed to the execution of the project.

Furthermore, a delayed project option will lead to a delay in the take-off of the proposed project which depends on the wood resources. Alternatively, the proposed technology may become obsolete and the anticipated cost of the plant may increase

In view of the economic trend globally amongst other factors, the delayed option is not attractive, thus it is not been considered for the envisaged project.

2.4.4 Implement the project as proposed

This option entails the development of the WNL plant. In order to demonstrate that this preferred option can achieved these benefits while continuing to have minimal community or environmental impacts, a detailed impact assessment has been undertaken and is contained in this ESIA report. Where there is potential for impact to occur, mitigation measures have been recommended to manage impacts to acceptable levels.

2.5 Project Alternatives

This section discusses the various alternatives taken into consideration during project planning and design, as well as reasons for the selection of the preferred alternative. A step-by-step comparison of feasible project alternatives, in terms of the project (i.e., design, technology, operation, etc.) and site selection is provided. The assessment of the project alternatives and site selection includes environmental and social factors as well as the no-go (i.e. the situation if the project were not developed) alternative is considered. Table 2.1 outlines the various alternatives and rationale for selecting one or more.

For ease of perusal, Fig 2.2 outlines all alternatives and the selected options in a graphical representation

Table 2.1 Project Alternatives

S/N	Alternatives	Various Options Considered	Selected Alternatives	Justification
1	Industry Type	A. Wood Processing B. Oil and Gas C. Food Processing	Option A (Wood Processing)	Wood Processing was chosen rather than others because some of the company shareholders have huge experience in wood processing from defunct Africa Timber and Plywood (AT&P). The need to convert the huge and extensive availability of the old rubber plantations in the area into wealth and job creation informed its choice over the other two options considered. Also, it is not capital intensive and does not involve extensive regulatory requirements as oil and gas. The need to bridge supply-demand gaps in wood and wood products in Nigeria also influenced its selection.
2	Feedstock	A. Old existing Rubber Plantation B. Cultivatable Timber Species C. Wild Timber Logging	Options A (Old Existing Rubber Plantation)	Old existing rubber plantations that abounds in the region is currently laying fallow requiring felling for charcoal purposes. It therefore presents a cheaper, readily available option, conversion of fallowing trees into wealth and re-establishment of unproductive rubber occupied land for replanting. This option does not entail logging and deforestation as would have been the case for wild timber logging. It does not involve land acquisition, cultivation and all attendant challenges associated with cultivable timber species.
3	Location	A. Urhonigbe in Edo State B. Calabar in Cross-River State C. Sapele in Delta State	Option C (Sapele in Delta State)	Sapele, is renowned for Timber and wood product processing hence, there exist available pool of personnel and usable machinery (absent in Calabar) parts for the proposed industry. More so, the basic infrastructures of water bodies, road connectivity (absent in Urhonigbe) network and raw material feedstock required for this industry is available in Sapele. Additionally, the extreme location of Calabar would have entailed greater transportation cost of finished products while the incessant security challenges in Urhonigbe makes it further unenviable to site this industry there.
4	Technology	A. Brush Application B. Dipping Application C. Open Tank Immersion	Option D (Pressure Application)	The effectiveness of a wood preservative depends largely on penetration and retention. Pressure Application offers deep uniform penetration than Brush, Dipping

		Application D. Pressure Application		and Open Tank Immersion methods. It offers better control over retention than Dipping and Open Tank Immersion methods. Employment of pressure technology guarantees reliable, regulated and faster pre-conditioning in the treatment chamber than all other methods. This option is thus selected.
5	Site	A. Site A (Acquired Community Land) B. Site B (Personal/Inherited Land)	Site B (Personal/Inherited Land)	It is obvious that if Site A is considered, numerous property titles would be destroyed and will incur extra cost on the project execution. Also, the amount of available land to situate this sort of project is limited, hence was rejected. There is a vast of personal/inherited lands in non-sensitive modified habitat suitable for the establishment of wood processing plant. More so, the location is not inhabited by people thus, there will be no displacement. For these reasons, Site B was selected.
6	Fire Protection	A. Water B. Combination of water hydrants, fixed and semi-fixed foam systems, safety shower, toxic gas, smoke, fire detectors.	Option B (Combination of water hydrants, fixed and semi-fixed foam systems, safety shower, toxic gas, smoke, fire detectors)	With the assumption that there will be no outside help to the plant and thus the fire-fighting facilities on the site will need to be self-supporting. Option A is rejected not only because water alone will not be sufficient in fighting and preventing fire outbreaks that may occur in the plant, but option B integrates water option with other elements, Hence Option B is selected.
7	Power	A. Coal Fuelled Powered Plant B. Gas Powered Plant C. Diesel Fired Generators and Backup Generators	Option C (Diesel Fired Generators and Backup Generators)	Using modules with Coal as a fossil fuel is never a good option since it is a contributor to greenhouse effect; hence, option A was rejected. Power plants with gas as fuel source are usually used in operating several systems, especially those that require large amount of power. The proposed plant would not require up to 600kw of power for its operation which is significantly small compared to the quantity of power produced by most gas-powered plants. This also will reduce the ambient air quality of the project area. Therefore, option B was rejected. Unlike the Coal and Gas-Powered Plants, most Diesel-Powered generators produce lesser amount of power. Also, the diesel fired and backup generators will ensure continuous and uninterrupted power supply to the plant and associated facilities. For these reasons, the diesel-fired generator and sufficient backup generators were

				chosen as the power source for the proposed wood processing plant.
8	Water Supply Systems	A. Surface Water Supply B. Ground Water Supply	Option B (Ground Water Supply)	Water from the Ethiope River can be pumped via pipes to the plant. Laying and construction of pipeline to harvest the water from this source would be expensive and the rate of abstraction would pose unsustainability risk, thus option A was rejected. A ground water borehole source with water treatment system (or trucked-in water) shall be constructed to supply make-up water to the utilities, fire system and potable water for human consumption. This potable system shall include water tanks and the appropriate treatment system. Hence, this option was adopted and accepted.
9	Transport Route	A. Benin-Warri Dual Carriageway B. Sapele-Amukpe Internal Road C. Eku-Oviri Road	Options A (Benin-Warri Dual Carriageway), B (Sapele-Amukpe Internal Road) and C (Eku-Oviri Road)	A, B and C were all selected so as to correct and mitigate prospective delay caused by traffic burden as the selected option would promote distribution diversity in delivery routes and aid prompt attendance to company's operations.
10	Mode of Feedstock Supply	A. Road B. Water C. Road/Water	Option C (Road/Water)	An integrated method is always more preferable to single approach; hence the singular utilization of road or water was rejected in preference to utilizing both. Option C is thus Selected.
11	Imported Construction Material Port of Entry	A. Apapa Port B. Warri Port C. Onne Port	Option C (Onne Port)	Although Warri port would have offered reduced logistic concerns, its near non-functional state made the relatively farther but functional Onne port more feasible to be Selected. Apapa port offers same functional advantages as Onne port but would be unwise to select one that is comparatively farther and offers more logistic challenge. Hence Apapa port was rejected and Onne port was selected.

CHAPTER 3: PROJECT DESCRIPTION

3.1 Introduction

Rubber wood plantations are considerable and widespread in the mid-west and south east regions of Nigeria. Most of the plantations within Nigeria were established in the beginning of the 20th century as a response to the booming rubber market. Rubber trees are grown in plantations for the purpose of harnessing rubber latex. The trees produce this latex up until they are roughly 20 years old, between the ages of 20-25 the trees start to decline in their latex production and by the age of 30 most trees stop producing quality latex. In Nigeria these trees are cut down, used as firewood or to make charcoal, thereby emitting large amounts of carbon dioxide into the atmosphere. The basic idea of the proposed project is to harness the existing old unviable rubber plantations in and around the Niger Delta and creating an exportable commodity from it. Rubber wood products are environmentally friendly since it recycles the trees after post-latex production. The trees are felled, treated and recycled into wooden products. With the new factory, WNL will be able to process rubber wood into a yellowish wood popularly called "MALAYSIAN OAK" for local consumption and export. The dimension of the laminated final product of 8ft by 4ft x 18mm thickness would yield 18 boards per m^3. The proposed factory will have an installed capacity of 12, 000m^3, consequently, the total number of boards expected to be produced is 216, 000.

3.2 Project Location

The proposed project is located at Sapele Local Government Area, Delta state. The site is surrounded by the Ethiope River to the North, the Benin-Sapele road to the West, a secondary/freshwater swamp forest to the East and vegetation to the South. Figure 3.1 is a map of the project site showing sphere of influence and surrounding features.

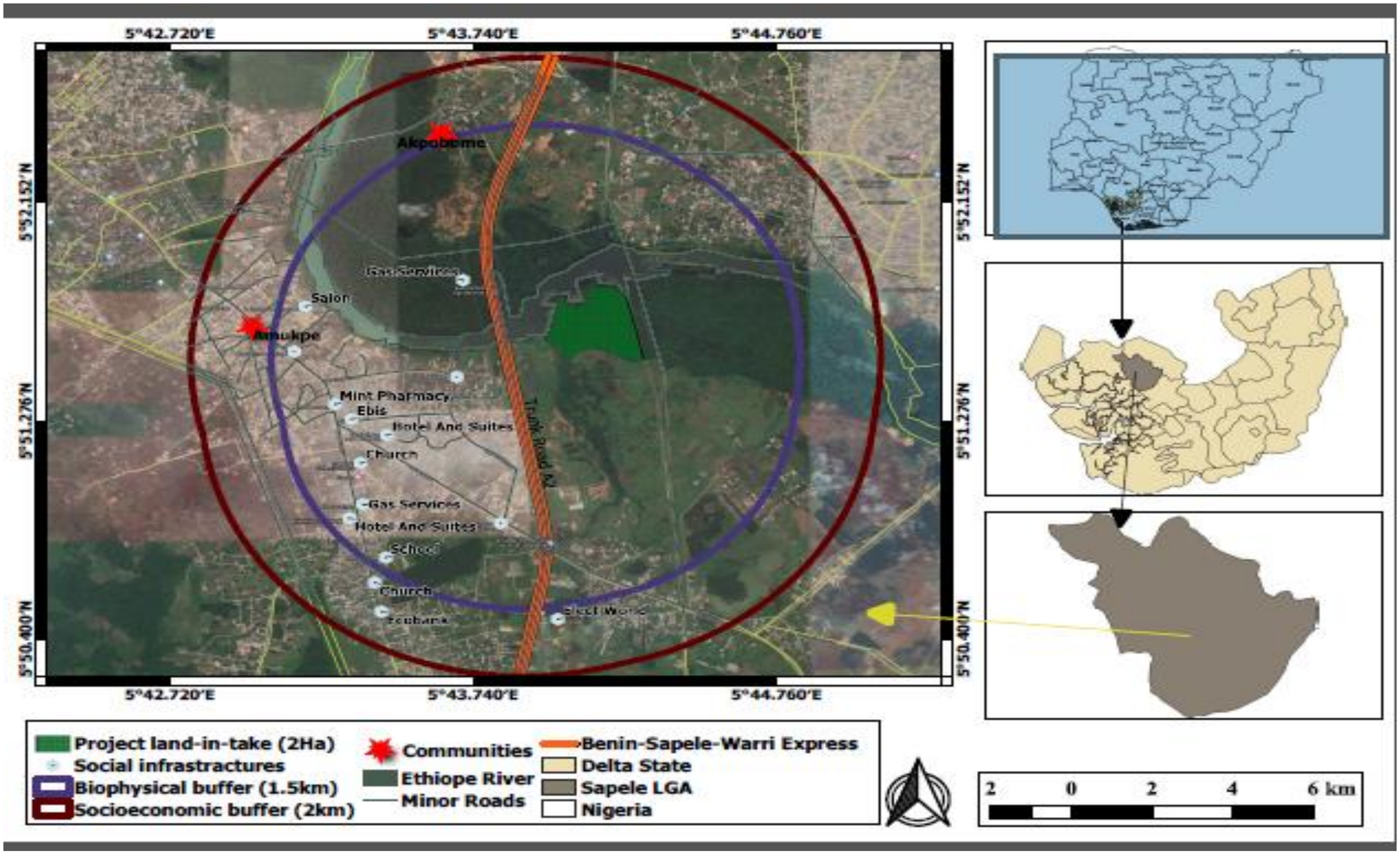


Fig 3.1:Project site and sphere of influence in relation to surrounding features

3.3 Design objectives

The design objectives include:

- accommodating expansion due to future load growth and planned distribution additions
- maintaining a safe operating environment
- keeping any disturbance footprint to the minimum size required
- providing options for vegetation offsets and re-vegetation works
- adopting environmentally sensitive design features to reduce the clearing of canopy trees within the project area of influence
- adopting alternative clearing profiles for sensitive vegetated areas
- providing a service life of 50 years that can be extended by refurbishment programs so long as the need for the facilities continues

3.4 Project Scope

The establishment of the wood processing facility will involve:

- Pre-construction phase- This phase includes preparation of relevant planning documentation, technical and design documentation and analysis of the environment aspects. The planning documentation will be prepared in accordance with the requirements of the current Nigerian and international legislation for this type of facility. It will also include site preparation, which will involve clearing of the site and transport of construction materials to site, mobilization of personnel to site and construction of temporary camp facilities for accommodation of some or all personnel as well as storage of construction materials and equipment.
- Construction of facility and installation of associated infrastructures and machines- This phase shall involve construction of the proposed wood processing plants and associated infrastructures and the installation of machines and equipment relevant to the proposed project.

- Commissioning and Operation of the facility- This involves the day to day activities pertaining to raw material acquisition, wood processing and transport of finished products offsite.
- Decommissioning- This shall occur after 50 years when the lifespan of the project has been exhausted. The activities in the phase shall be geared towards restoring the project site to as much as its preconstruction state.

3.5 General Facilities Layout

The layout of the proposed facility is shown in Figure 3.2.

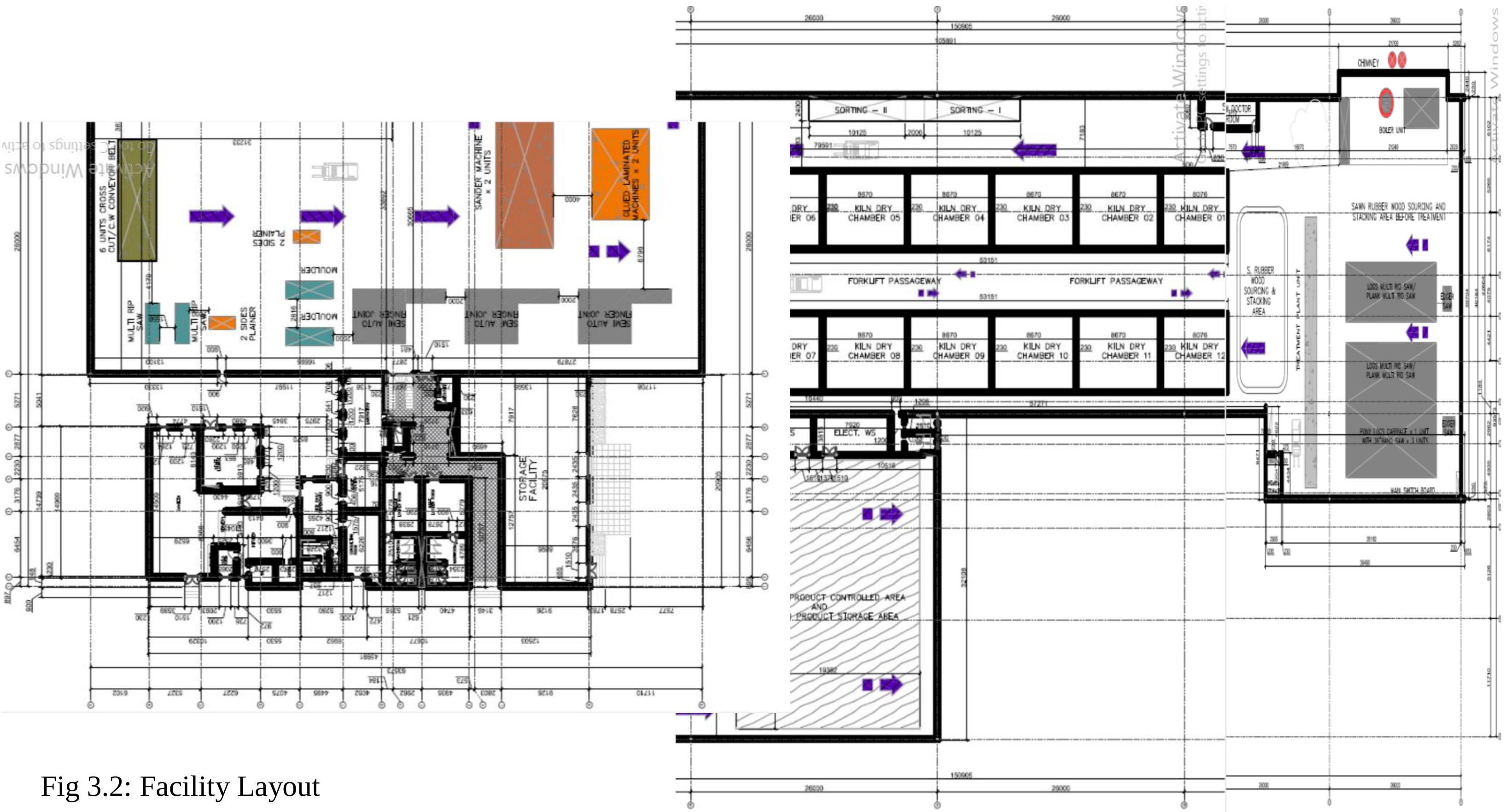


Fig 3.2: Facility Layout

3.6 Land Take

The proposed wood processing facility shall occupy a land take of about 2 hectares. A breakdown of the different components of the facility and their respective land take is presented in Table 3.1.

Table 3.1 Land take of Proposed Project

Component	Land take (m^2)
Main facility	800
Internal road network	100
Power Station	50
Automated storage warehouse	150
Green area	300
Truck parking lot	200
Administration block/First aid block	400

3.7 Safety Criteria

The design of the facility has been carried out taking into consideration corporate safety rules to assure safety, prevent accidents and reduce risks level to as low as practicable. Further safety and operability studies would be carried out during machine installation and general operation of the facility in order to verify safety systems and integrity of installations to possible changes in environmental conditions.

3.8 Access Tracks/Road Network

Access to the project site is required for site preparation, construction of the facility, as well during the operational and maintenance phases. It is also important in transporting raw materials and finished product to and from the facility. The Benin-Sapele road shall be the main assess road to and from the site. On the other hand, the Eku-Oviri road and the Old Amukpe-Warri road shall serve as alternative roads, objectively to reduce the traffic load on the aforementioned proposed main road.

Plate 3.1 a and b pictorial representations of two of the various arterial roads to the site that were termed Minor Roads in Fig 3.1

Plate 3.1: Benin-Sapele road Plate 3.2: Old Amukpe-Warri road

3.9 Traffic Survey for sites' access roads

Traffic Data Collection and projections thereof of traffic volumes are basic requirements for project development planning. Traffic data is essential in drawing up a rational transport policy for movement of passengers and goods. The traffic flow (frequency) of the three access roads (Benin-Sapele, Eku-Oviri and old Amukpe-Warri roads) to the woodland project site was studied in order to predict traffic flow volumes that can be expected on the road network during the project development and operational phases.

An hourly count pattern was adopted to evaluate the timely suitability of the routes for material movements. Data was generated from 5^{th} to 22^{nd}hour of the day or the period of three days. Fig. 4-showed the average result of the study.

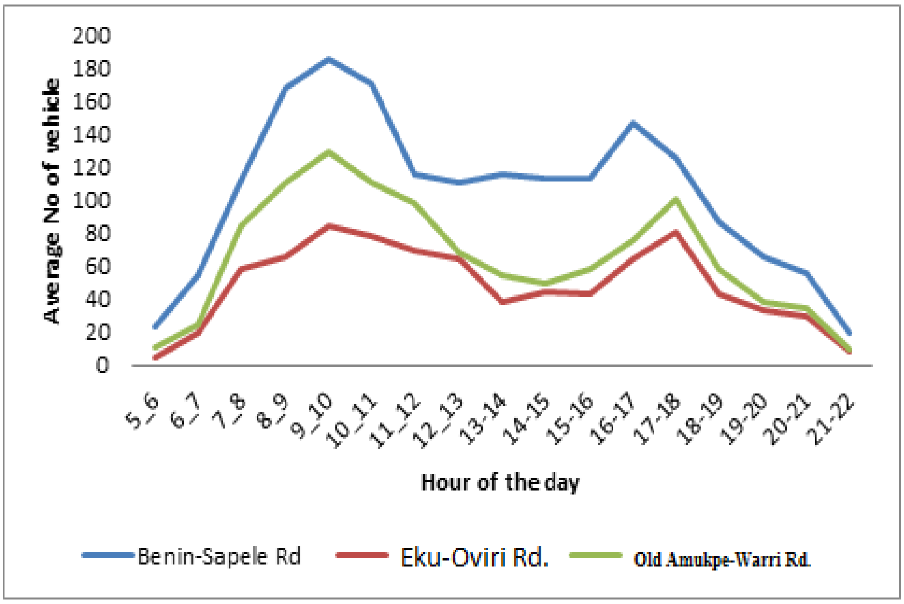


Figure 3.3: Traffic volume of Access Roads

As can be seen in Figure 3.3, traffic in was at the peak in the morning followed by a lean flow until another peak in the middle of the afternoon, after which there was a sharp drop in traffic flow. The peak in the morning is often more gradual by reaching the peak over a long duration and gradually dropping to its fairly constant point. The afternoon peak on the other hand is characterised by a shaper peak. The peak is reached and dispersed over a short period than the morning peak. Generally, the build-up was highest along Benin-Sapele road followed by Old Amukpe-Warri Road.

Experience from previous studies has showed that although traffic volumes may grow over time, the relative variations of traffic at the various hours of the day of a week quite consistent year after year. The pattern from Monday to Friday is often relatively consistent, a part from Monday morning and Friday afternoon traffic flow. The pattern during the weekend may vary considerably. The pattern also varies from Saturdays to Sundays. The pattern during the weekends is also likely to show more seasonal variation than during the working days.The result revealed that traffic build-up is least at the night hours.

A Traffic Management Plan outlined in Chapter 7 shall be updated by the construction Contractor, as a part of the CEMP. TMP will cover the preconstruction, construction, operational and maintenance phases of the project and in addition, must also include (but not be limited to including):

- The management of the delivery of equipment;
- Access to and from structure sites;
- Work methodologies for restringing across roadways;
- Arrangements for temporary road closures;
- Parking; and
- Any security access arrangements.

3.10 Pre-construction phase

This generally involve site survey and preparation. Collecting of data on ground elevation, cross-fall drainage on the study site, location of gullies, depressions, existing vegetation heights, roads as well as geotechnical and other information that could affect the final layout of the proposed wood processing facility will be carried out.

3.11 Construction phase

The target start date for the construction of the first stage of works is slated for second quarter of 2020. The work will be executed by a number of specialist and experienced contractors, managed as a project by a dedicated Construction management team led by a site-based Construction Manager.

As part of the construction process, a detailed Project Execution Plan, including a Construction Management Plan, and an Environmental Management Plan would be produced. These will guide the overall process, and will be informed by both this document, and any relevant conditions imposed on the Project.

3.11.1 Program of Works

The Project is to be undertaken in three stages.

- **Stage 1** – Site works, construction of detention basin and hardstand areas. Within this stage the construction of the detention basin and drainage swale will be undertaken first in order to ensure that the appropriate erosion and sediment control measures can be implemented for later stages. Stage 1 is to commence upon approval and is estimated to take approximately 1 month.

- **Stage 2** – Construction of rubber wood processing facility, offices, associated utilities and installation of related plants (saw mill, seasoning kilns including handling, Vacuum treatment plant, Binding/De binding). Stage 2 is to commence upon approval or slightly thereafter and is estimated to take up to 2 months, dependent on equipment availability.
- **Stage 3 –**Construction of new automated storage warehouse. This shall be located south-west of the site. Stage 3 is to commence concurrently with stage 2 during the 3rd month.

3.11.2. Security, Fencing and Lighting

During the construction phase of the project, site security measures shall be provided. This shall provide for secure site access, with all visitors to the site having to undertake an induction. As the site will continue to be operational during the construction phase these worker safeguards are important to be maintained. Security at the lay-down area is expected to consist of a combination of certified private security managers and local guards whom will be recruited from the host community. Perimeter security, entry control points will likely be used

The separation between the Wood-chemistry operations and the rest of the site will be by through fencing to clearly delineate the different operations and ensure that access can be achieved over the Project site without any intrusion in to areas of construction or storage.

Lighting shall be provided on site to allow the full 24-hour operation of the site in line with the proposed consent. This is designed to project downwards to minimise impacts on the amenity of the area and to increase overall site safety. Construction lighting will be accomplished by relying on mobile light towers, mainly required to illuminate the site each night for security.

3.11.3. Construction Workforce

Where possible, construction workers will be employed from the local community. Some off-site construction of plant and infrastructure will be required. A detail about the category and number of workforces for this phase is provided in Table 3.3.

3.11.4. Construction Hours

It is proposed that construction activities would occur during:

- Monday to Friday 7am to – 7 pm;
- Saturday 7am – 3pm; and
- No works on Sundays and Public Holidays.

3.11.5. Construction Lay-Down Area and Utilities

Laydown areas

A temporary laydown area shall be provided on site for the storage of construction materials. The lay down area shall be situated south of the project area, in order to keep an appreciable distance from the Ethiope River which is a potential sensitive receptor for runoffs. The laydown area will aid in keeping materials dry and to provide a surface suitable for vehicle traffic. The area will also accommodate some machines and equipment prior to installation.

Construction/Operation Water Source

Water for construction purposes will be sourced from onsite boreholes. This would reduce environmental impact on the Ethiope river body, as well as time and resources that will be spent on obtaining water from the river. Onsite borehole will be drilled at three points which will subsequently be upgraded and used for the operation phase.

Construction/Operation power Source

The major power source for the both construction and operation activities shall be from the National Grid, and stepped down by 11KVA transformer at the project site. Two dedicated 30 KVA diesel electric generators with a holding capacity of --- will be used as an alternative power supply to provide power for construction equipment, office lighting and service other loads associated with WNL facility operation. It is expected that temporary construction power will be provided by the EPC contractor using diesel generators for the construction period.

Construction Waste Management

Temporary portable sanitation units will be employed for construction labour. The Project will be responsible for pump-out and disposal of all sanitary waste.

The management and disposal of all construction generated waste streams will be conducted in accordance with all applicable Nigerian waste management regulations including project waste management and disposal standards. To ensure compliance with this commitment, the Project will contractually require its EPC contractor to develop and implement a waste management plan (WMP) consistent with its waste management standards and practices. The EPC contractor's WMP and any subsequent revisions will require approval from the Project. To further ensure compliance, the Project will conduct periodic assessments of the EPC contractor's waste management activities. The EPC Contractor will be required to promptly resolve any findings from these assessments to the Project's satisfaction.

3.11.6 Machines and equipment

WNL has contracted WDF PTE. LTD, located at 8 Upper Cross Street, Singapore (058327) for equipment purchase, installation and commission. The following machines would be installed;

1. 36" Band saw: A band saw is a power saw with a long, sharp blade consisting of a continuous band of toothed metal stretched between two or more wheels to cut material. They are used principally in woodworking, metalworking, and lumbering, but may cut a variety of materials.
2. Radial arm saw machine/ Crosscut saw: These are heavy, bulky machines that typically are not very portable. While it is mainly a crosscut saw, this tool can be used to rip, cut bevels or miters, dadoes and rabbets, form moldings, and in some cases, even serve as a guide for a router
3. Miter saw machine: This is a saw used to make accurate crosscuts and miters in a work piece by pulling a large backsaw or a mounted circular saw blade down onto a board in a quick motion.

4. Planer: This is a machine that uses a planer to plan the plane, groove or forming surface of a work piece. The planer is used to create a relative linear reciprocating motion between the tool and the work piece to achieve the purpose of planning the surface of the work piece.
5. Thicknesser: This is a woodworking machine which is used to trim boards to a consistent thickness throughout their length and flat on both surfaces.
6. Heat/ Chemical treatment equipment: This equipment helps to avoid problems of process control, and to provide high quality treated wood with accurately assessed properties to the market. It improves mainly the resistance of wood to decay and provides dimensional stability.

Other equipment includes:

7. Finishing and polishing equipment:
8. Dimensioning machines
9. Panel saw machine
10. Double ended tennoner machine
11. Mortising machine
12. Moulder machines up to eight headed moulders
13. Spindle moulder
14. Gluing press
15. Gluing roller
16. Hydraulic lathe machines
17. Hydraulic presses – 8 ‘X 4 ‘
18. Router machine
19. Sanding machines
20. Drilling machines
21. Wood joining machines
22. Fork lift.

Some of the machines and equipment are pictured below;

a.

b.

c.

d.

d.

e.

f.

g.

Plate 3.3 (a-g) Band saw, Cross-cut saw, Mitre saw, Wood planer, Thicknesser, Thermo wood heat treatment equipment, Prototype of proposed factory, Samples of finished products.

3.11.7 Green Area

A green area shall be maintained east of the project site where the secondary forest is. The total land take proposed for the green area is about 300 m^2. Measures shall be put in place to maintain local, keystone and ecological sensitive species in the green area.

3.12 Operational phase

3.12.1 Process Description

A detailed description of the processes involved in the wood processing activities is presented in Figure 3.3. All log processing activities will be completed 48hrs on arrival at the factory.

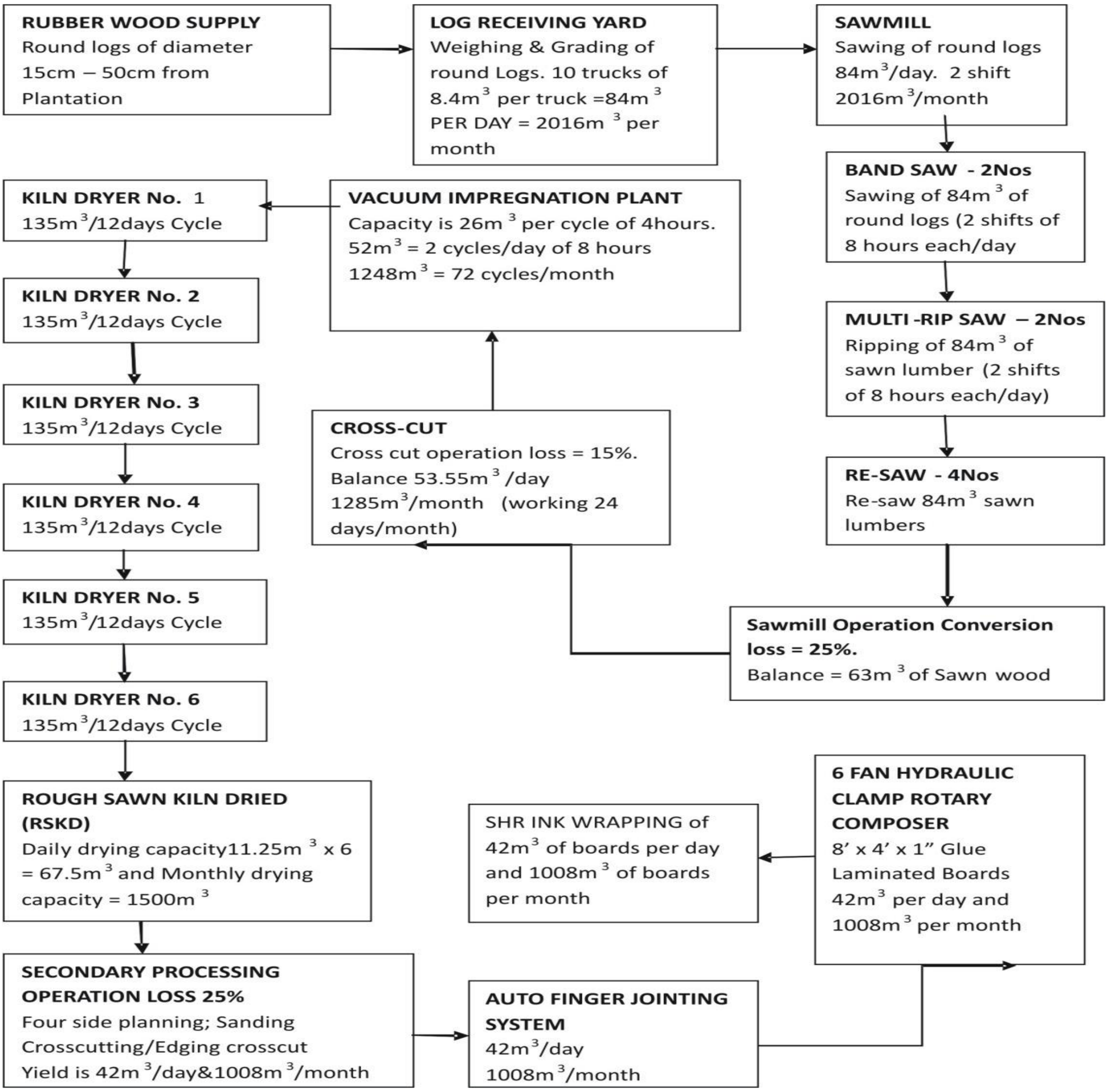


Figure 3.4 Process description of the proposed project

The operation of the Facility can generally be divided into the following key areas:

- Import – raw material (timber) delivered to the site;
- Production – Rubber wood
- Storage – in the facility; and

✧ Dispatch – Out loading of product for delivery to customers by truck and for potential up-takers.

3.12.1.1 Rubber wood Lumbering

The rubber trees shall be initially cut in each designated rubber plantation. After cutting the aged rubber tree, the branches are removed and the main trunk is cut into short lengths of about 6feet. They are then dipped in boric acid at a central place and loaded in the truck and conveyed to the proposed WNL factory's log yard. The logistics manager must always be on hand to advise the plantation owners on appropriate techniques for final uproot of cut rubber trees.

3.12.1.2 Transportation of logs/finished products

Delivery of timber to the WNL facility would generally be undertaken by a set of trucking fleet, or by nominated contractor. Much of the timber brought to site is produced in the surrounding area, and comes in a raw (unprocessed) form, directly from the plantation. No old growth or native forest shall be in the production of either MDF or Particle Board.

The completed Project would require approximately 50 truck movements per day to meet expected demand. A total of 25 dedicated logging trucks shall be utilized for movement of raw materials and finished rubber wood onsite and offsite. Log trucks would to enter the site at Gate 2 and proceed to the automated storage area in the south eastern corner of the site. The logs would be unloaded and then processed on site.

3.12.1.3 Grading

At the proposed log yard, the logs shall be graded and defects pointed out. This is done to assure that no bad strips go past the sawmill stage unnoticed.

3.12.1.4 Sawmilling

Here, the logs are debarked and cut into shorter lengths using the multi-rip saw and cross-cut saw respectively. The strips will then be tied into bundles of like sizes, and sent for treatment.

3.12.1.5 Treatment

Here, the rubber wood strips strapped in bundles in trolleys are wheeled into the impregnation vacuum chamber. The chamber door shall be secured. The first procedure shall involve evacuating all the air in the chamber. During this process, all latex, chemicals and liquids in the timber is forced out by pressure and the suction soaks this sludge to the sludge pipe out of the chamber into the sludge tank. The vacuum created is now filled by injecting environmentally friendly boric acid into the wood. Boric acid serves as an effective fungicide, insecticide, and flame retardant. Boron compounds are also odourless and relatively less toxic compared with other preservatives (e.g., lindane), which can pose a serious health hazard to workers performing the treatment and the processing of treated timber. This impregnation process is controlled and monitored. The duration of treatment is usually 2 – 4 hours depending on the thickness of the strips. Treated wood is conveyed to the bundling / de-bundling area where they are graded, heaped, bundled and placed on pallets.

3.12.1.6 Seasoning

The bundled wood from the impregnation chamber is conveyed to the kiln drying by fork lift in pallets. Inside the kilns, steam produced by the boiler is piped and fan circulated heat creates a forced hot air-drying system. The woods shall be sample-tested to check the moisture content intermittently. Within 10-15 days of drying the rubber wood bundled strips usually attains a moisture content of under 10%. The wood shall subsequently be moved to the bundling / de-bundling area once again and kept in a dry area, away from any water or moisture.

3.12.1.7 Composition

This operation enables strips of treated and seasoned wood to be jointed and or glued and held permanently together. The finger jointing (joinery process and the heat lamination, i.e. gluing, process have been selected by our consultants as complements or alternative ways for wood composition. Board of various lengths (6 to 10ft) width (4 – 8ft) and thickness (1in - 12inches) and special wood blocks shall be composed.

3.12.1.8 Finishing

Here, the composed rubber – wood is then lifted to the sanding area where they are sanded both with rough and smooth sanders. The sanded wood shall be passed through 4 – sided moulders to produce finished specification cut products.

3.12.1.9 Packaging and Storage

The finished products shall be methodically packaged for distribution either as exported or locally sold wood stocks. Final grading and quality control procedures will be standardized by the logistics and production Staff. The finished products shall be stored in the automated storage warehouse. The automated storage warehouse building will encompass a completely automated storage and packing process. It will consist of approximately 10,000 material bays, ranging in length, width and thickness. The store will be made up of 6 aisles with automated handling trolleys (stacker cranes) and significant amounts of suitable shelving and or racking which will store and retrieve the contents of the trolleys. The packs will be prepared at all times of the day and the process will be able to operate unmanned during the night once the orders are entered into the Warehouse management system. The prepared packs will then be presented ready for loading to the transport fleet and delivery to customers.

3.12.1.10 Distribution and sales of finished products

The distribution process entails supply and sale of rubber wood manufactured at the factory to customers. The bundling of composed boards is reinforced and then adequately protected and loaded into containers and transported to the appropriate customers. Depending on the dispatch mode agreement, the manufactured products may also be taken offsite by third party up takers.

3.12.2 Fire Management

The WNL facility shall be designed to minimise safety risks and hazards associated with operations, and is fitted with extensive fixed and portable fire-fighting capability. A detailed Fire Management Plan will be prepared prior to construction.

Existing and new process controls will include a monitored fire system with deluge. There is also a manual deluge system proposed for most significant equipment groups.

3.12.3 Storm water Management

The majority of the site shall be sealed. However, a storm water management system shall be put in place to manage storm water within the facility. This system shall collect storm water from all areas of the facility and shall treat the water onsite through a series of treatment ponds. The clean water shall then be discharged from the site. This shall be done to prevent pollution of existing natural water sources (Ethiope River and Fresh water swamp) within the project's area of influence. It is expected that the facility will generate an estimated 20, 000 m^3 per annum. To this effect, two waste water treatment ponds of 10, 000m^3 will be constructed for storm water treatment. An integrated (biological, physical and chemical) storm water treatment system will be used.

3.12.4 Security

All visitors to the facility must check in with operations staff, undergo the appropriate level of induction and must wear appropriate Personal Protective Equipment (PPE) relevant to their visit, prior to entering the Site.

A chain wire mesh fence with a barbed wire top shall be constructed around the entire boundary. Truck access to the facility would continue to be managed via two automatic traffic gates (A and B) that would be opened by terminal staff or access cards (issued to inducted contractors). Emergency egress points shall be located at the manually-opened gate (C).

3.12.5 First Aid Station

A first aid station will be provided with all necessary medical kit. In addition to the recruitment of trained medical personnel, all engineers and supervisors will be trained in first-aid treatment to take care of any emergency. The factory clinic will effectively manage the medical emergencies on site, pending referrals to retainership hospitals, for more serious cases.

3.12.6 Hours of Operation

The hours of operation of the facility shall be 24 hours a day, 313 days a year, operating a three shifts per day of 6am – 2pm, 2pm - 10pm and 10pm - 6am including weekends.

3.12.7 Raw material requirement

The feedstock required for the proposed project shall be sourced from Rubber Estate Nigeria Limited. Rubber Estate Nigeria Limited is the largest rubber estate in Africa, having rubber plantations Delta, Edo, Cross River and Ondo States. Details of raw material availability and requirement in relation to the proposed project is presented in Table 3.2

Table 3.2: Raw material requirement for the proposed project

Rubber Estate Nigeria Limited felling proposal			Woodland Nigeria limited annual log intake estimate		
Year	Total Ha. Available	Total alive trees	Year	Total Annual kg/m^3 required	Total Ha
2021	168.7	31708	2021	14000	55.5
2022	256.9	45381	2022	14000	134
2023	81	38059	2023	14000	134
2024	142.1	38059	2024	14000	134
2025	20.1	9617	2025	14000	134
TOTAL	668.8	149927			591.5

3.13 Types, Quantity and sources of materials and work force

Details of the Types, Quantity and sources of materials and work force required throughout the stipulated project phases are presented in Table 3.3.

Table 3.3: Types, Quantity and sources of project requirements across phases

Requirements	Type	Source	Estimated Quantity/Number **Construction phase**		Estimated Quantity/Number **Operation phase**	
Energy	Electricity	Public utility and diesel generators	110V		Nil	
	Fuel	Local Vending Stations	As the need arises		As the need arises	
Manpower	Skilled	Contractor	Men	Women	Men	Women
			10	2	50	10
	Labourers	Locals in the project area	20	5		
Raw Materials	Coarse aggregates	From the nearby existing commercial quarries	2,350m^3		Nil	
	Hard core	Same as coarse aggregates	6,000m^3		Nil	
	Fine aggregates	From commercial sources	600m^3		Nil	
	Sand	From commercial sources	Nil		Nil	

	Water	From onsite boreholes	1,00,000 litres	1,000,0000 litres
	Cement	Local cement depot	7,133m^3	Nil
	Reinforcement bar	reinforcements are readily available in local iron and steel stores	17,342m^3	Nil
	Boulders	Contractors	Nil	Nil
Equipment/ Machines	Dump trucks	Contractor	1	Nil
	Graders	Contractor	1	Nil
	Motor Grader	Contractor	1	Nil
	Bull Dozers	Contractor	1	Nil
	Excavators	Contractor	1	Nil
	Water Truck	Contractor	1	Nil
	Tractor /Trailer	Contractor	1	Nil
	Crane	Contractor	1	Nil
	Diesel light trucks duty trucks	Contractor	3	Nil
	Concrete Batching Plant	Contractor	1	Nil
	Diesel Heavy Dump Truck	Contractor	3	Nil
	Workers Buses	Contractor	2	4
	Light Vehicle	Contractor	1	5

*Estimated quantity of materials and equipment are as supplied by WNL

3.14Emission Estimation

The amount of dust (from pre-construction and construction activities), noise (emission from bull dozer, diesel tanker, excavator, wheel loader, ambulance, dump truck, grader and generator) and noxious gases (from diesel tanker, excavator, wheel loader, dump truck, generator and grader), expected to be produced from each activity and equipment were quantified as shown in the succeeding sections.

3.14.1 GHG Emissions

3.14.1.1 Estimated GHG Emission Rate during the Construction Phase of the Project

Overview: Total emissions of GHGs from project equipment and vehicles were determined using the SCEG tool version 5.1 of the US Environmental Protection Agency. Mobile sources, like owned or leased cars and heavy-duty vehicles generate emissions by burning fuel. Mileage or fuel use was estimated based on vehicle fuel economy from www.fueleconomy.gov, since other data sources are not readily available as at present.

Fuel usage and mileage is reported the same for hybrid vehicles as for conventional vehicles such as Pickups and Vans are classified as "Light Trucks", Trucks (Diesel heavy dump truck, water truck,) weighing more than 8,500 lb are classified as "Heavy- Duty Trucks", while Non-highway vehicles (graders, crane, excavators, concrete batching plants) used in construction are classified as "Construction Equipment while Tractor /Trailer are termed Diesel Agricultural Equipment. Tables 3.4 present the details of equipment and vehicles required for the construction of the proposed WNL facility.

Table 3.4 Details of Estimated quantity and types of Equipment/vehicle required for the Project

Dump trucks	Quantity	Category
Graders	1	Diesel construction equipment
Motor Grader	1	
Bull Dozers	1	Diesel Heavy Dump Truck
Excavators	1	Diesel construction equipment
Water Truck	1	Diesel Heavy Dump Truck
Tractor /Trailer	1	Diesel Agricultural equipment
Crane	1	Diesel construction equipment
Diesel light trucks duty trucks	3	Diesel light trucks duty trucks
Concrete Batching Plant	1	Diesel construction equipment
Diesel Heavy Dump Truck	3	Diesel Heavy Dump Truck
Workers Buses	2	Passenger Car

The construction phase is expected to last for a period of three months, after which operation shall commence. The total estimated GHG emissions expected to result from construction activities is presented in Table 3.5

Table 3.5 Details of estimated GHG to be emitted during the construction phase

Equipment Category	Number	Average fuel economy (mileage/g)	Fuel usage (gal)	Mileage	CH_4 (g)	N_20 (g)	CO_2(metric tonnes)
Diesel Construction Equip.	5	17.1	7,695	279	4,386.2	2,000.7	190.9
Diesel Light-Duty Trucks	3	7.2	1,944	837	0.8	1.3	
Diesel Medium- and Heavy-Duty Vehicles	5	7.2	3,240	837	4.3	4.0	
Diesel Passenger Cars	2	23.3	4,194	781	0.4	0.8	
Diesel Agricultural Equipment	1	17.1	1,539	56	2,216.2	400.1	
Total	16		18,612	2,790	6,607.9	2,406.9	190.9

In all, a total of 190.9 metric tonnes of $CO_2$is estimated to be emitted during the construction phase of the proposed project. This also includes 6,607.9 g (0.0066079 metric tons) of Methane and 2,406.9 g (0.0024069 metric tons) of Nitrous oxide. When this was extrapolated taking into consideration the global warming potential of nitrous oxide (32) and methane (281), results indicated that an estimated total of 191.5763 CO_2 equivalent emissions (metric tons) of CO_{2is} shall be emitted as a result of WNL activities during the construction phase.

3.14.1.2 Emission Estimation during Operation phase

The two potential GHG sources for the operational phase of the project are diesel generators (stationary source) for powering the facility and trucks (mobile source) for movement of raw materials and finished goods. The total estimated GHG emissions expected to result from truck movement during the operation phase is presented in Table 3.6 (estimations do not involve third party trucks).

Table 3.6 Details of estimated GHG to be emitted from truck movements during the operation phase

Equipment Category	Number	Average fuel economy (mileage/g)	Fuel usage (gal)	Mileage (50 years, 25 trucks, 30 km per day)	CH_4 (g)	N_20 (g)	CO_2(g)

Diesel heavy Trucks.	25	7.2	168,827	2265937.043	11,556.3	10876.5	**1,723,723.7**

As could be seen in Table 3.6, a total of 1735.9 metric tonnes of $CO_2$is estimated to be emitted from truck movement during the operation phase. This also includes 11,566.3 g (0.0011566 metric tons) of Methane and 10876.5g (0.0010876 metric tons) of Nitrous oxide. When this was extrapolated taking into consideration the global warming potential of nitrous oxide (32) and methane (281), results indicated that an estimated total of 1727.3 CO_2 equivalent emissions (metric tons) of $CO_{2\ is}$ shall be emitted as a result of truck movement during the 50 years operation phase.

3.14.1.3 Estimated Emission from Diesel Generators during the operation Phase

The following factors were taken into considerations while estimating the total GHG emissions from stationary sources during operation phase;

- ✧ The operation phase will last for a period of 50 years (15650 working days)
- ✧ The capacity of the diesel electric generators is 30 KVA
- ✧ The facility shall utilize alternative power (diesel generators) for at most 6 hours per day

According to USA's Environment Protection Agency, https://www3.epa.gov/ttn/chief/ap42/ch03/final/c03s04.pdf, average heating value of diesel (uncontrolled levels) was assumed to be 19,300 Btu/lb with a density of 7.1 lb/gallon or 0.00322051 metric tons of CO_2 per gallon. It is also assumed that a 30 KVA generator on half load uses about 3.6 litres (0.95 gallon) of diesel in an hour (https://www.ablesales.com.au/source/Diesel Generator Fuel Consumption Chart in Litres.pdf).

*6 hours (estimated running hours/day for generators) × 15650 working days = 93900 (total working hours for diesel generators during operation phase)

*0.95 gallon (average fuel consumption rate per hour) × 93900 (total working hours for diesel generators during operation phase) = 89205 gallon (for 50 years operation phase)

*If I gallon of diesel emits 0.00322051 metric tons of CO_2(https://www3.epa.gov/ttn/chief/ap42/ch03/final/c03s04.pdf) then 89205 gallon will emit 287.286 metric tons of CO_2

The estimated emissions from diesel generators throughout the operation phase is about **287.286** metric tons of CO_2

Table 3.7 outlines gross total of carbon footprint (expressed in terms of MT CO2 equivalence) resulting from the proposed project.

Table 3.7 Total MTCO2 Equivalence

GHG supply Component		
Project Phases	MTCO2 Equivalence	
Construction	191.5763	
Operation phase	Mobile sources	1727.3
	Stationary sources	287.286
Net $MTCO^2$ Equivalence	**2206.1623**	

3.15 Waste stream and management

Potential waste on the site shall be deal with in a number of ways. Wastes generated by staff and typical operations (such as food scraps, paper and the like) shall be process internally before transferred to the municipal waste facility. Most materials would be recycled on site where possible (such as excess timber product) and agreements are in place with both the Delta State waste management board as well as independent contractors for dealing with waste stream which are not able to be recycle on site, such as boric acid and used oils. All waste management measures shall comply with the existing environmental sanitation law, edicts and by-laws. Details of the potential waste stream types and the proposed annual levels of waste generation as a result of the project is presented in Table 3.8.

Table 3.8: Estimated annual wastes generation for the project

Construction Waste	OnSite Disposal (Estimated) (m^3)	OffSite Disposal (Estimated)(m^3)	Disposal Method	Provider
Wood, soil and plant debris.	1500	1500	Reused onsite - Disposed by municipal waste facility	Onsite - Delta state Waste Management Board (DSWMB)
Domestic waste	500	500	Disposed by municipal waste facility	DSWMB
Liquid waste (spent oils)	-	-	Spent oils from shall be drained out before delivery to DSWMB Approved contractors	DSWMB Approved contractors
Operational Waste	**OnSite Disposal (Proposed) (m^3)**	**OffSite Disposal (Proposed) (m^3)**	**Disposal Method**	**Provider**
Waste VirginWood	26,176	N/A	Fuel for heatplant	Onsite
Oils		20	Recycling, material data safety sheet	-
Downgrade Product (sludge)	6,600	N/A	Fuel for heat plant	Onsite
Process Waste Water	1,500	N/A	Recycled on site	Onsite
Process wood dust	2,000	N/A	Would be sold	Onsite
Bark from log processing	21,748	N/A		Sale or Onsite
Spade able Resin	N/A	10	Transported to accredited Waste facility with leachate pits	-
Raw Effluent (Squeeze Out)	50,000	N/A	Recycled on site through effluent treatment plant	Onsite
Large offcuts (exchipper and CTS Saw)	8,500	N/A	Would be sold out	Onsite
Waste Water	N/A	N/A	Water Treatment Plant	Onsite
Domestic/office waste	N/A	N/A	Municipal waste	DSWMB
Solid wastes (tires, lead acid batteries, scrap metals)	N/A	N/A	Tires will be stored as scrap for export and recycling by accredited dealers. Lead acid batteries are collected by accredited local dealers	Accredited dealers

Medical waste	N/A	N/A	Medical wastes will be segregated based on hazardous nature	DSWMB
Decommissioning Waste	0nSite Disposal (Proposed) (m^3)	0ffSite Disposal (Proposed) (m^3)	Disposal Method	Provider
Solid waste (Non – degradable) Demolished concrete, glasses, plastics, soil	-	-	Top soil will used for backfilling foundation and pits Tins, glasses, plastics will be sold to licensed local recycling companies	Scrap buyers/ reuse location
Liquid waste (spent oils)	-	-	Spent oils from shall be drained out before delivery to DSWMB Approved contractors	DSWMB Approved contractors

N/A Not available

3.16 Project Schedule

The different stages of the project implementation are contained in the work schedule attached hereunder Table 3.8

Table 3.9: Project schedule for the WNL Rubber wood Processing Facility

S/N	Description	Duration (months)	2nd Qtr. 2019	3rd Qtr. 2019	1stQtr 2020	2ndQtr 2020	3rdQtr 2020	1st Qtr. 2021	2ndQtr 2021	3rdQtr 2021	1s Qtr. 2071	2ndQtr 2071
1	Feasibility studies	3										
2	EIA studies	9										
3	EPC Contract award Process	1		okay								
4	Check survey of EPC Contractors	1		Okay								
5	Detailed design of facility	1		Okay								
6	Mobilization of construction materials to site	15 days			Okay							
7	Construction of facility and Associated utilities	3			Okay	Okay						
8	Material/ Equipment shipment	3			Okay	Okay						
9	Equipment testing and Installation	1				Okay						
10	Facility operation	600										
11	Dismantling of equipment/facility	1										
12	Demobilization of facility	0.5										
13	Decommissioning and abandonment	2										

3.17 Decommissioning

The project has a life span of 50 years. Decommissioning activities will be implemented in compliance with applicable regulations. Decisions regarding specific post closure land uses will need to be addressed in future detailed closure plans and in discussion with various internal and external stakeholders including local government, the municipality, the local communities and other stakeholders as identified.

A conservative approach has been adopted for decommissioning and closure. This is based on the assumption that the most stringent measures likely to be imposed on the development would be that the Project site would have to be returned to the pre-construction land capability. The activities that would be involved during the decommissioning include the following:

3.17.1 Decommission and site-clean – up

The following shall be undertaken for infrastructure where written permission has not been obtained from the Ministry to leave the buildings for the socioeconomic development of the state and where a suitable third party has not been identified for the transference of liability of the structure. This includes structures in related infrastructure such as workshops, roads, offices stores, accommodation and other buildings;

- Equipment with potential resale or scrap value will be removed.
- Remaining equipment will be drained of all lubricants, hydraulic oils, fuels and other process reagents and disposed of as hazardous waste.
- Building will be demolished. Specific demolition requirements include:
  - All power and water services shall be disconnected and certified as safe prior to commencement of any demolition works;
  - All fittings, fixtures and equipment within buildings will be dismantled and removed to designated temporary disposal yards;
  - All above ground electrical, water and other service infrastructure and equipment to be removed and placed in a designated temporary salvage yard;

- Electrical, water and other services that are more than 400mm below ground surface shall remain;
- All subsurface cavities such as reinforced concrete tunnels under stockpiles and septic tanks will be backfilled;
- All water tanks not required for closure activity will be demolished and rubble sold to licensed recyclers. Once water is no longer required on site, the remaining tanks will be demolished.
- The yard areas (automated storage areas, lay down areas) will be closed and re-graded to control storm water runoff and erosion. The natural topography of the site required the construction of terraces for the working areas using cut or cut-and-fill techniques. Once the structures and foundations are demolished, removed, or buried, the yard areas will be inspected for any areas of hydrocarbon contamination. Any hydrocarbon contaminated soils will be managed as described below. The yard areas will then be partially re-graded to fill in any excavations remaining following the demolition activities utilizing material in berms and high walls of terraces. Compacted areas will be ripped to mitigate the effects of traffic. Growth medium will be imported and a 500mm layer placed, onto which vegetation can be established
- Septic tanks will be emptied and the sludge used as soil ameliorants where needed on reclaimed land;
- The tanks will be removed and disposed of;
- The excavation will be backfilled and the drain field will remain in situ;
- The storm water treatment will be emptied of sludge, with the sludge used as a soil ameliorant. Civil infrastructure will then be decommissioned as described earlier

3.17.2 Disposal of waste generated

During closure hazardous and non-hazardous waste will be managed in accordance with the procedures established during operation for the management of these types of waste (Table 3.8).

Building rubble shall be used to cover septic tanks and other hollow areas while equipment for potential resale as scrap will be sold to local licensed recyclers.

CHAPTER 4: DESCRIPTON OF THE ENVIRONMENT AND SOCIAL BASELINE

4.1 Introduction

The prevailing ecological condition of the environment within which the proposed cement and captive power plant will be sited, as well as the socio-economic and health profiles of the affected settlements are presented in this chapter. Components described include the physico-chemical environment (meteorology, geology, sediment/soil type and distribution, surface/groundwater characteristics), biological environment (location and distribution of benthos, plankton, fisheries flora and fauna characteristics), as well as socio-economic and health conditions describing the demographic structure, culture, heritage sites, social and health status of the people and their environment, including outcomes of consultations held.

The summary of baseline conditions is based on information sourced from literature as well as findings from a two season (wet and dry) field sampling program, laboratory analyses of samples obtained and socio-economic and health surveys specific to this EIA. The data acquired will be used in further environmental management decisions and future monitoring of changes, if any, in the environmental components.

4.2 Overall data collection methodology

The summary of baseline conditions is based on information sourced from literatures (see relevant sections) as well as findings from a one season (wet) field sampling program supplemented by secondary data from approved ESIA report (Proton Energy Limited (PEL) 150MW Gas Powered Plant Ogorode, Delta State, 2013-2014), laboratory analyses of samples obtained and socio-economic and health surveys specific to this ESIA. The data acquired will be used in further environmental management decisions and future monitoring of changes, if any.

A combination of data from existing literature and field sampling campaign was used to inform the preparation of the baseline chapter for various environmental and social components, in accordance with the approved ToR by the FMEnv for this project.

Considering that the proposed project is Category 2 and the availability of Base-line data from the project environment (Proton Energy Limited (PEL) 150MW Gas Powered Plant Ogorode, Delta State, 2013-2014), a one-season waiver was assigned for the project by the FMEnv (see appendix 1).

Field studies and data collection for characterization of the baseline conditions of the proposed project environment covered:

- Climate and meteorology
- Air quality and noise levels
- Geology/hydrogeology
- Surface and groundwater
- Soil and sediment
- vegetation & fauna wildlife
- Hydrobiology, fisheries and
- Socio economics/health impact, demography and community characteristics

The acquisition of data basically involved field data gathering, measurements and collection of representative samples used to establish baseline environmental conditions of the study area. This exercise involved a multi-disciplinary approach and was executed within the framework of a QHSE management system approach (details are spelt out in Appendix 2). This approach assured that the required data and samples were collected in accordance with agreed requirements (scientific and regulatory) using the best available equipment, materials and personnel. Elements of this approach include:

- review of existing reports that contain environmental information on the study area;
- designing and development of field sampling strategies to meet work scope and regulatory requirements;
- pre-mobilization activities (assembling of field team, sampling equipment/materials calibrations/checks, review of work plan and schedule with team, and job hazard analysis);
- mobilization to field; fieldwork implementation - sample collection (including positioning and field observations), handling, documentation and storage protocols and procedures; and

- demobilization from field; transfer of sample custody to the Mifor Consult laboratory, Calabar for analyses.

Desktop studies involved the acquisition of relevant background information on the environment study area. Materials that were consulted included approved reports on previous environmental surveys in the area, publications, textbooks, articles, maps, etc. on the area and similar environments. The list of materials consulted is specified in relevant sections.

In order to effectively characterize the ecology and meteorology of study area and determine seasonal variations of specific environmentally related parameters, a one season field data gathering exercise was performed between 3rd and 5th October, 2019.

The specific objectives of the ecological field sampling were to determine:

- ambient air quality and noise level of the study area;
- physicochemical and microbiological characteristics of the soil within the study area;
- physicochemical and biological characterization of water and sediment samples within the study area;
- hydrobiology and fisheries resources of the study area;
- wildlife abundance and diversity of the study area and environs;
- vegetation characteristics of the area; and
- Establish the socio-economic and health status of the host and impacted community.
- A summary of the information on the physical parameters sampled for the project and that of the secondary data (PEL 150MW Gas Powered Plant Ogorode, Delta State, 2013-2014) including dates of exercise and number of samples are presented in Table 4.1

Table 4.1 Data summary on the various parameters sampled for the project and that of the secondary data

	Secondary Report - Dry Season data PEL 150MW Gas Powered Plant Ogorode, Delta State (2013-2014)	Wet Season (based on data collected between 3rd and 5th October, 2019		
	No of samples			
Environmental/Social Component		Samples requested by	Actual No	Comments

		FMEnv	collected	
Climate and meteorology	10	Not specified	9	Air and noise quality samples points were same as for meteorology
Air quality and noise levels	11		9	
Soil	11		7	In all, 14 samples were collected and analysed
Groundwater	2		2	Two samples were collected
Surface water, Sediment, Hydrobiology	10		4	Samples were collected at 4 points, including a control point

PEL= Proton Energy Limited

4.3 Identification of the study area

The study area is the 1.5 km^2biophysical sphere of influence and 2.0km^2 for social component from the epicentre of the proposed factory site in Amukpe community, Sapele, Delta state, Nigeria. Details of the project location have been provided in Chapter three of this report.

4.4 Physical Environment

4.4.1 Climatic Condition of the Study Region

The project area falls within the tropical region of Southern Nigeria. The region exhibits two major seasons, longer rainy and shorter dry season. The rainy season usually begins in April and ends in October. The rainy season is caused by the South West Trade Wind. The dry season usually lasts for about four months from November to March and characteristically marked by Harmattan wind between December and February. The annual rainfall averages 2,768 mm. The relative humidity is usually high throughout the year (about 75%), reaching a maximum during the rainy season when values above 90% are recorded.

The key factors that influence temperature in the area are the movement of the sun, wind speed and direction, and land configuration. The temperature in the region is generally high all year round and usually range between 27-30^{0}C between June and December but can rise to 32-36^{0}C between January and April, with the last few months of the dry season marked by intense heat. A general assessment of the sunshine hours for the southern region revealed that the lowest sunshine hours of approximately 3.5 hours per day are recorded at the peak of the rainy season (July and August) while the brightest months occur in November where average sunshine hours of up to 7.5 hours.

The south-westerly wind which prevails during the wet season (July- October)accounting for about 33% of annual wind and the southerly winds dominating from March to June as well as the beginning of the dry season in November accounting for about 50% of annual winds. The north-easterly wind predominates during the dry season (December – January) and amounts to about 16% of the annual winds. The monthly mean wind speed varies from 3.4 to 4.6 m/s. Wind speed is strongest at the middle of the rainy season during August and September. The climatic data for Sapele, Delta state is presented in Table 4.2

Table 4.2: Climatic data for Delta State (1988-2018)

Parameter	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec
Rainfall (mm)	50	25	100	154	152	250	330	253	351	115	53	30
Comment	Delta State as in other states in Nigeria is influenced by two seasonal periods, namely the dry and rainy season. The dry season is characterized by the Tropical Continental Air Mass (North East Trade Wind) which blows across the Sahara Desert. It usually starts from January and ends around October. Delta state records significant levels of rainfall in June/July and ends in with the highest level in September. The mean rainfall ranged is 25mm to 358mm.											
Temperature range (^{o}C)	27.3	28.5	29	28.7	27.6	26.6	25.7	25.5	26	26.6	27.5	27.3
Comment	The mean monthly minimum temperature for Delta ranged between 22 ^{o}C and 24.2 ^{o}C while the monthly maximum temperature varies between 29.2 ^{o}C and 33.9 ^{o}C. This variance in temperature is particularly striking between areas of different altitudes. This contrast is clearer in the dry season than in the rainy season.											
Mean Rel Humidity (%)	71.1	72	80	80	82.5	85	90	88.1	88.1	86.1	86.1	78. 9
Comment	The relative humidity of Delta ranged from 71.1% during the month of January to as high as 90.0% during the month of July.											
Wind speed	4	3.8	3.9	4	4	3.9	4	4.7	4.5	3.8	3.5	3.5
Comments	Wind in the project area include; the south-westerly wind which prevails during wet seasons (July to October), accounting for 33 % of the year, and the southerly winds dominating from March to June as well as the beginning of the dry season in November accounting for 50% of the year.											

Source: NIMET (1988 – 2018) *Figures presented on the table are monthly averages

4.4.2 Micro Climatic Conditions (Meteorology Measurements) of the Study Area

Climate encompasses the statistics of temperature, humidity, wind, rainfall and other meteorological elements in a given region over long period of time (said 30-35 years). However, measurements of these climatic elements could be carried out in a smaller area over a shorter period. This is known as micro climatic measurements. In this study, temperature, Wind speed and direction and relative humidity were measured at eight (8) points plus a control point between 07:00 and 19:00hrs Nigerian time. Specific locations for measurements were selected with consideration for concentrations of human receptors such as residential areas, commercial areas, hospitals, churches, schools and farmlands.

The temperature, wind speed, wind direction and relative humidity were measured with the aid of Ambient Weather WM-4. This equipment was calibrated and held at arm-length towards the direction of the prevailing wind. The values of the weather elements were then read off directly from the machine.

Result presented in Table 4.3 showed that all microclimatic data obtained in the field conformed favourably to secondary data (PEL 150MW Gas Powered Plant Ogorode, Delta State, 2013-2014). Expectedly, they will be an increase in air temperature during the construction and operation phases due to heat generated from equipment on site. This phenomenon was factored in the ESMP designed for the proposed project (Chapter 7) and also for proffering mitigation measures in Chapter six.

Table 4.3: Result of On-Site Meteorological Measurement

SAMPLING CODE	LATITUDE (N)	LONGITUDE (E)	Elevation (m)	TIME	Wind speed (mps)	Temp. (^{o}C)	RH (%)	Wind direction
MET1	5.85974	5.73091	1	10:29	4.6	29.98	80.20	North-East
MET2	5.85961	5.73131	1	15:32	5.4	31.90	83.61	North-East
MET3	5.86095	5.73175	5	17:04	4.5	31.45	84.00	North-East
MET4	5.85781	5.72162	4	9:19	4.2	32.25	86.67	North-East
MET5	5.85810	5.73240	2	10:23	5.1	30.54	77.16	North-East
MET6	5.85846	5.73293	2	13:30	5.4	31.32	81.83	North-East
MET7	5.85944	5.73302	4	11:56	5.1	30.05	78.83	North-East
MET8	5.85657	5.73154	2	12:30	5.3	31.33	79.87	North-East
MET9	5.85606	5.73212	5	9:19	4.7	30.82	82.26	North-East
Minimum detection limit					0.3	-20^{o}C	5%	-

Source: MCNL Survey, 2019

4.4.3 Ambient Air Quality

Air generally contains water vapour, gases, and particulate matter in small but very variable quantities (Oguntoyinbo and Derek, 1987). Air pollution is the presence in the atmosphere of one or more contaminants in such quantities, characteristics, duration as to make them actually or potentially injurious to human, plant, or animal life or to property, or which unreasonably interfere with the comfortable enjoyment of life and property.

In this study, atmospheric gases were measured with the aid of Aeroqualaerocet 531 gas analyzer. The equipment was calibrated to 0.001 minimum detection limits and held at arm-length towards the direction of the prevailing wind. The concentration of NO_2, SO_2, CO, VOC, NH_3, CH_4 and SPM (2.5 & 10.0 µm) was read off directly from the machine screen. Air quality data were collected simultaneously and at same sampling points with meteorological (Table 4.1). Figure 4.1 is a map showing the sampling points location in the project area for air quality.

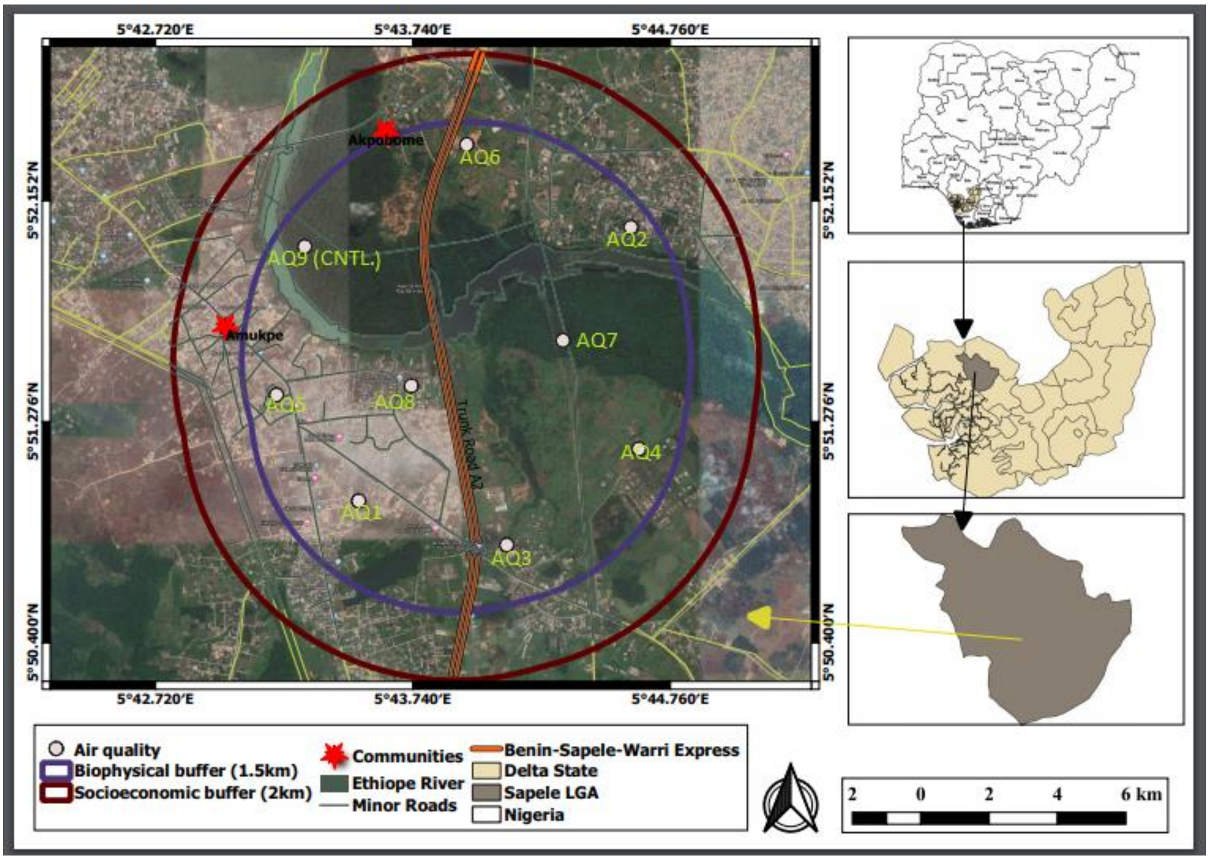


Figure 4.1: Air sampling location

The result is presented in Table 4.4. Particular attention was paid to the Greenhouse gases (GHG) like CO_2, NO_2 and CH_4.

Table 4.4 Ambient Air Quality measured in the study Area

SAMPLE ID	SO_2 (ppm)	NO_2 (ppm)	CO (ppm)	VOC (ppm)	NH_3 (ppm)	CH_4 (ppm)	SPM (ppm)	
							2.5µm	10 µm
AQ1	0.00	0.07	0.27	0.30	0.00	0.00	0.000	0.000
AQ2	0.00	0.07	0.28	0.10	0.00	0.00	0.001	0.001
AQ3	0.00	0.08	0.28	0.20	0.00	0.00	0.001	0.001
AQ4	0.00	0.07	0.28	0.10	0.00	0.00	0.000	0.001
AQ5	0.00	0.08	0.28	0.20	0.00	0.00	0.000	0.001
AQ6	0.00	0.09	0.28	0.30	0.00	0.00	0.001	0.003
AQ7	0.00	0.07	0.28	0.10	0.00	0.00	0.000	0.000
AQ8	0.00	0.08	0.28	0.20	0.00	0.00	0.001	0.001
AQ9 (CTRL)	0.00	0.09	0.28	0.10	0.00	0.00	0.001	0.002
Mean	0.00	0.08	0.28	0.17	0.00	0.00	0.012	0.002
PEL 150MW Gas Powered Plant Ogorode, Delta State (2013-2014)	<0.282	<0.203	<0.123	<0.10	<0.075	<0.01	0.002 – 0.026	NA
WHO/FMENV /NIOSH daily limit (ppm)	0.002	0.04-0.06	10- 20	-	*60	*3000	25	0.15-0.25

NA= Not available. *NIOSH standards

Source: MCNL, Survey 2019.

All parameters were within regulatory limits except for NO_2 where concentrations were above WHO regulatory limit across all sampling stations. The increase may be attributed to emissions from cars, trucks and buses, and off-road equipment in the study area. NO_2 interact with water, oxygen and other chemicals in the atmosphere to form acid rain. Acid rain harms sensitive ecosystems such as lakes and forests. High concentration of NO_2 in the air can irritate airways in the human respiratory system. Such exposures over short periods can aggravate respiratory diseases, particularly asthma, leading to respiratory symptoms.

Result also compared well with secondary data except for VOC in sample stations 1 and 6.The SPM emission is expected to increase slightly in the area when the project commences, and this will be factored into the air management plan in Chapter seven of this report.

4.4.4 Noise Quality Measurement

Noise is a periodic fluctuation of air pressure causing unwanted sound. Apart from causing disturbance to the affairs of man, long term exposure to excessive noise can damage health and have psychological effects (SIEP, 1995). Also, disturbance to wildlife is significant especially during breeding seasons and/or when rare species are present.

In this study, the ambient noise level was measured at the same time and the same sampling stations already established for meteorology and air quality measurements. The sound level was measured with the aid of a hand held Pulsar Sound Level Meter about 1.9 m. The meter was calibrated to 10 minimum detection limits and held at arm-length towards the direction of the prevailing wind. The noise level was read off from the LCD after about 2 to 3 minutes of display.

Table 4.5 shows the result of noise level measurement in the study area

Table 4.5: Noise Measurements in the Study Area

SAMPLING CODE	Noise dB(A)	LAF (dBA)	LMIN. (dBA)	LMAX. (dBA)
NQ1	56.8	68.7	28.33	55.6
NQ2	63.8	65.9	31.08	55.7
NQ3	59.5	76.2	31.16	59.2
NQ4	50.2	59.4	29.82	62.2
NQ5	64.2	55.1	28.72	69.7
NQ6	53.5	65.0	27.71	61.5
NQ7	62.5	60.4	28.76	40.9
NQ8	69.5	64.2	35.22	57.7
NQ9	59.4	52.0	22.60	57.5
Mean	59.9	63.0	29.3	57.8
PEL 150MW Gas Powered Plant Ogorode, Delta State, 2013-2014)	60.9	59.9	28.94	59.9
WHO/FMEnv Regulatory daily limit for Noise				
General Noise Level limit	- 105 db(A) per hour or 90dB(A) per day for prolonged exposure			
School	45 db(A) for day and 35db(A) for night			
Hospital	30 db(A) for day and Night			
Residential	45 db(A) for Day and 35 db(A) for Night time			
Farmlands	40 db(A) for Day and 45 db(A) for Night			

Source: MCNL survey, 2019

The results as presented in Table 4.5 indicated an elevated noise level above the day time threshold stipulated for the various environments (school, hospital, residential and farmlands) across the sampled points. Vehicular traffic, neighbourhood activities, construction and public works are the possible causes of elevated noise level in the study area during the day.

However, these results were within the general noise level of short exposure of 105dB (A) or that of prolonged exposure of 90dB (A).

The result also compared favorably with the secondary data. The ambient noise level is expected to rise slightly in the area when the project commences, and this will be factored into the noise management plan in Chapter seven of the report.

4.4.5 Geology

Delta state is predominantly underlain by sedimentary rocks with the following stratigraphic units underlying most part of the region: the Benin Formation, the Ogwashi - Asaba Formation, the Bende-Ameki Formation, Imo Shale Formation, Nsukka Formation and Ajali Formation(Akaolisa and Selemo, 2009; Nwosu *et al.,* 2010). The Benin Formation is overlain by lateritic overburden and underlain by the Ogwashi - Asaba Formation which is in turn underlain by the Ameki Formation of Eocene to Oligocene age (Mbonu *et al*., 1991). The Benin Formation consists of coarse-grained gravelly sandstones with minor intercalations of shale's and clay. The sand units which are mostly coarse grained; pebbly and poorly sorted contain lenses of fine grain sands (Onyeaguocha, 1980).

The Ogwashi-Asaba Formation is made up of variable succession of clays, sands and grits with seams of lignite. The Ameki Formation consists of greenish-grey clayey sandstones, shale sand mudstones with inter-bedded limestone. This Formation in turn overlies the impervious lmo Shale group characterized by lateral and vertical variations in lithology.

Figure 4.2 shows the geologic map of Delta State.

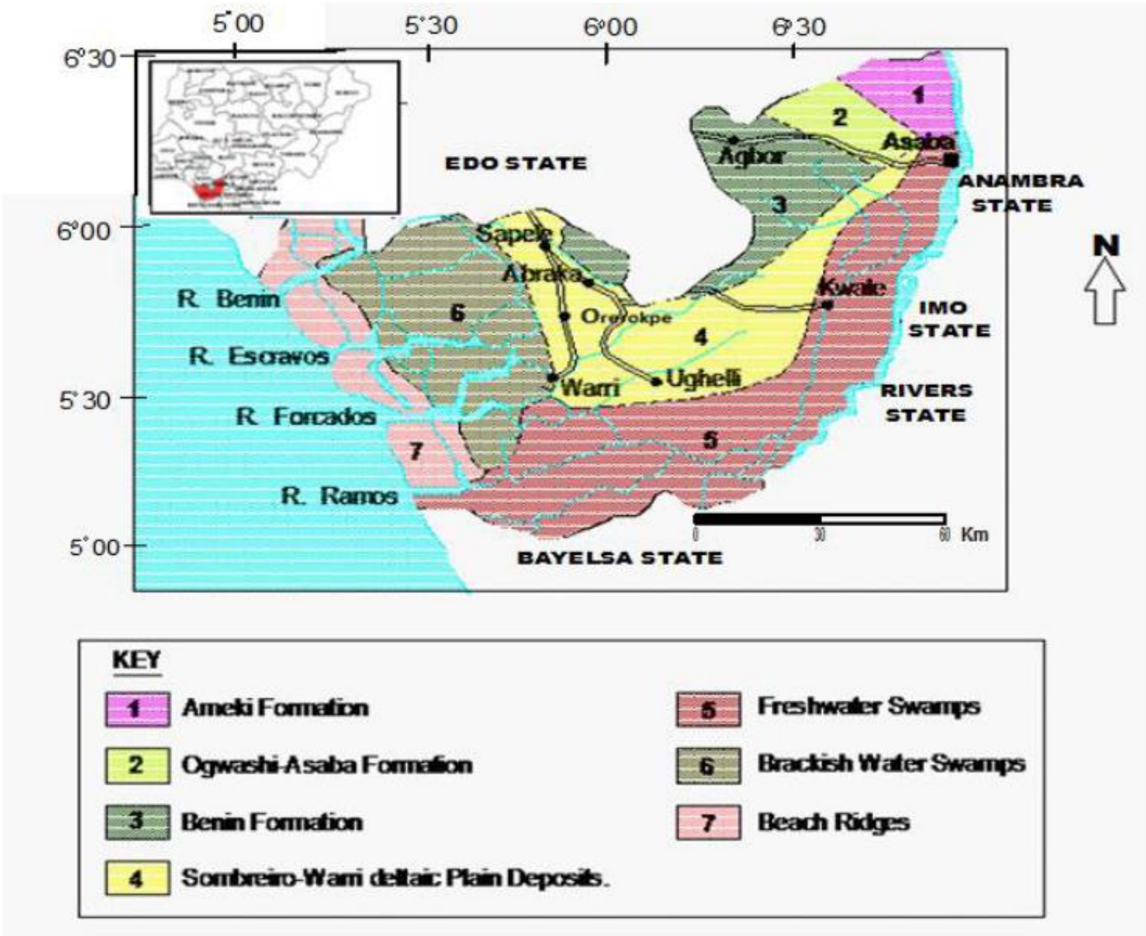


Figure 4.2: Geological Map of Delta State showing study area

Source: Orji and Egboka (2015)

4.4.6 Pedology

According to FAO soil taxonomy legends; there are thirteen (13) major soil types in Nigeria, which are all influenced by the climatic and vegetation zones of the country. This is expected because the degree of available moisture in the soil is an important factor in soil reactions fertility and productivity. In general, the soils are divided into four main groups. These are:

- the ferruginous tropical soils on crystalline acid rocks which occupy about two-fifth of the area to the south, south-west and south-east;
- the brown soils and latosols of the northern half;
- the brown and reddish-brown soils in the north eastern corner; and
- the juvenile and hydromorphic soils which occur along the alluvial channel complexes.

The soils largely reflect the influence of parent materials. Intensive use of the soils and the addition of manure and chemical fertilizers have altered their characteristics such as profile, texture, structure and chemical characteristics. The project area is made up of majorly alluvial soil.

4.5 Soil Quality

Soil resource is of vital importance for survival and welfare of the people. One of the most severe and widespread problems facing the agricultural industry is the degradation of soil quality due to changes and alteration to various physical and chemical parameters. Soil is a complex natural material made of disintegrated rocks and decayed organic material which provides nutrients, moisture, and support for land plants.

This soil is a very important component of the environment. Several activities of the woodland factory construction shall negatively impact the soil. These include; Potential erosion from vegetal clearing and creation of foundations for the factory; soil pollution and contamination from accidental oil & fuel leak from construction machineries and vehicles for transport of construction materials equipment. More so, the disposal of solid wastes by construction workers may contaminate the soil. Though most of these impacts are short term, the effects may be severe. However, mitigations measures have been proffered for these impacts, and they are well documented in chapter five of this report

4.5.1 Methodology

The soil sampling locations were distributed in grids that were already marked out and geo-referenced. The grids took into consideration the various land use systems and natural features of the area. These included forest areas, farm lands, uplands, lowlands and water courses. A total of seven (7) sampling stations plus a control station were established in the study area.

A stainless steel, handheld Dutch type Soil Auger was used to collect representative soil samples at each soil sampling station. At each sampling station, soil depth; 0-15 cm and 15-30 cm for top soil and sub soil levels respectively were collected. Soil samples for physical and nutrient elements analyses were sub sampled and appropriately labelled using masking tape and indelible ink to indicate sample location and soil depth level. Samples for hydrocarbon contents analyses were collected into amber glass bottles and labelled appropriately also using masking tape and indelible ink. Plate 4.1 shows soil sampling activity while Figure 4.3 is a map showing the soil sampling points.

Plate 4.1: soil sampling exercise

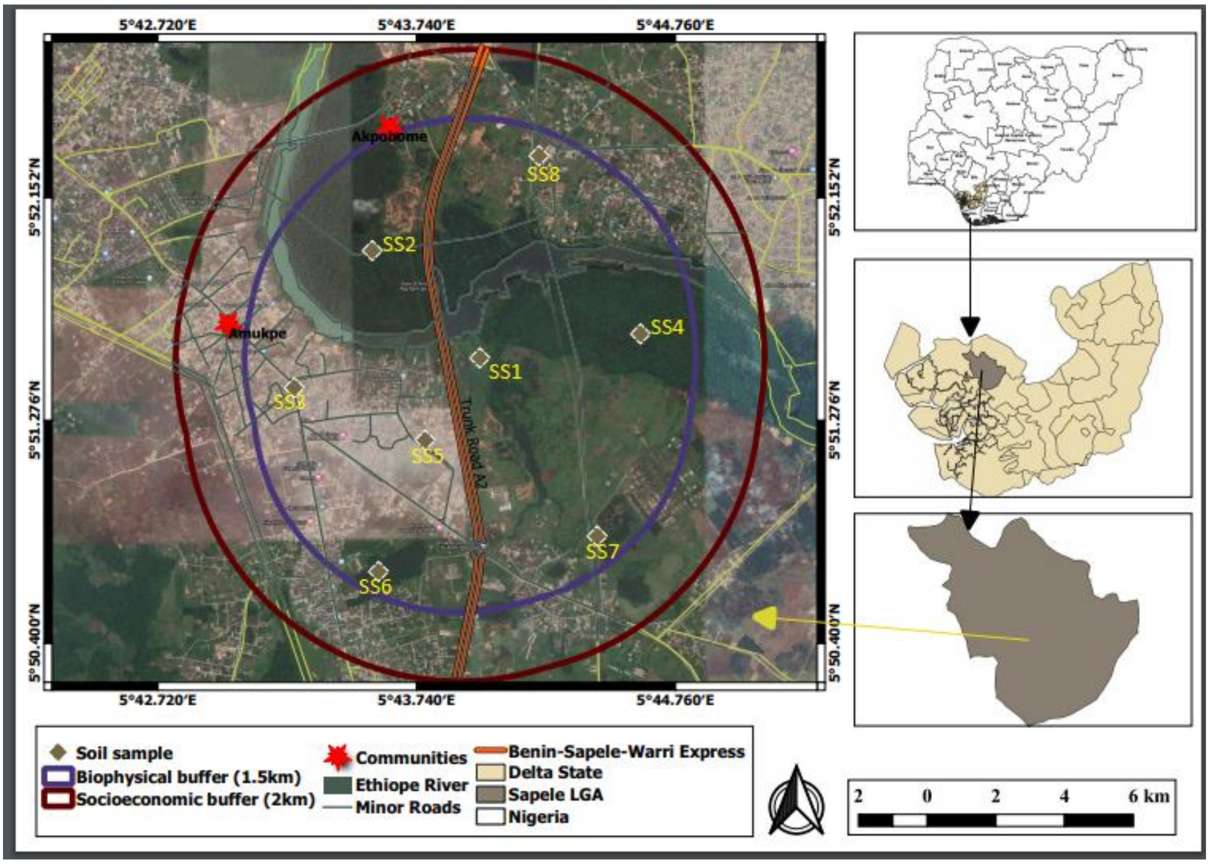


Figure 4.3: SOIL sampling location

4.5.2 Physicochemical characteristics of the study soils

Table 4.6 is the physicochemical characteristic of soils in the study area.

Table 4.6 Soil physicochemical characteristics

PARAMETERS		SAMPLE STATIONS									PEL 150MW Gas Powered Plant Ogorode, Delta State (2013-2014)	FMEnv, WHO limits
		Depth	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8		
pH		0cm - 15cm	5.17	5.42	5.76	5.95	5.56	5.59	5.15	5.20	5.30 – 7.30	5 – 8.0
		15 – 30cm	5.85	5.61	6.22	6.10	5.96	6.43	5.73	6.87	5.18 – 7.39	
Elect. Conductivity (µS/cm)		0cm - 15cm	87.76	92.14	84.68	84.03	77.15	90.83	86.35	90.83	121.53 – 121.77	-
		15 – 30cm	186.6	168.8	115.8	128.8	193.0	175.9	151.2	133.3	118.42 – 123.45	
Moisture Content (%)		0cm - 15cm	8.00	8.60	7.80	11.10	10.85	11.72	8.31	9.30	11.00 – 23.30	-
		15 – 30cm	13.20	14.04	18.07	15.96	15.10	17.08	12.45	15.49	10.39 – 22.80	
Porosity (%)		0cm - 15cm	39.88	42.59	39.73	46.07	39.92	37.02	43.09	48.90	37.02 – 48.90	
		15 – 30cm	38.72	40.15	38.33	42.91	38.61	36.60	41.10	46.03	36.60 – 46.03	
Permeability (mm/s)		0cm - 15cm	3.01	3.12	4.32	4.42	3.93	5.13	4.80	4.44	3.01 – 4.80	
		15 – 30cm	3.06	3.16	4.89	4.92	4.33	5.22	5.01	4.81	3.06 – 5.22	
Bulk Density (g/cm^3)		0cm - 15cm	2.10	2.34	1.94	2.02	1.88	1.63	2.11	1.65	1.63 – 2.34	
		15 – 30cm	2.22	2.56	2.01	2.33	1.91	1.85	2.18	1.66	1.66 – 2.56	
Particle Density (g/cm^3)		0cm - 15cm	1.55	2.12	1.75	1.64	2.45	2.95	2.15	1.88	1.55 – 2.95	
		15 – 30cm	1.38	2.01	1.71	1.56	2.44	2.57	2.13	1.75	1.38 – 2.57	
PSD (%)	Clay	0cm - 15cm	4.0	1.0	3.5	3.2	2.2	3.3	2.8	3.6	13.0 – 14.0	-
		15 – 30cm	10.6	11.2	12.5	9.2	12.2	7.3	12	7.6	11.67 – 16.03	
	Silt	0cm - 15cm	12.7	9.9	4.7	11.4	10.2	9.8	17.3	11.3	28.0 – 29.0	-
		15 – 30cm	16.7	19.9	16.7	18.4	15.2	15.8	17.3	18.3	27.8 – 28.8	
	Sand	0cm - 15cm	83.1	89.1	91.8	85.6	87.8	86.9	79.9	85.2	57.0 – 100	
		15 – 30cm	73.1	69.1	70.8	72.6	72.8	76.9	70.9	74.2	55.7 – 102.4	

Ext. Nitrate (mg/kg)	0cm - 15cm	4.05	3.31	4.46	4.60	3.27	3.81	4.34	4.58	0.09 – 0.47	500
	15 – 30cm	6.07	6.16	5.82	5.29	5.54	5.73	5.67	4.61	0.05 – 1.26	
Ext. Sulphate (mg/kg)	0cm - 15cm	21.65	21.60	22.78	22.08	22.17	22.18	19.91	22.72	145 – 320	500.00
	15 – 30cm	22.59	22.48	23.04	21.65	22.42	22.55	21.21	21.94	144.2 – 321.01	
Ext. Phosphate (mg/kg)	0cm - 15cm	2.44	3.27	2.13	2.66	1.62	1.38	2.20	1.57	16.9 – 33.8	
	15 – 30cm	1.54	1.49	0.12	0.25	2.65	0.42	1.24	1.85	14.47 – 35.0	
Phosphorous (mg/kg)	0cm - 15cm	12.48	14.45	11.53	12.92	18.55	17.53	19.09	12.31	13.99 – 14.03	
	15 – 30cm	13.09	16.06	17.41	16.21	9.55	14.74	14.34	10.80	11.68 – 13.55	
Calcium (mg/kg)	0cm - 15cm	5.32	4.32	6.36	6.35	4.39	4.96	5.64	6.30	4.93 – 4.98	
		5.35	3.90	5.34	4.60	6.66	4.37	3.85	5.64	3.33 – 5.12	
Magnesium (mg/kg)	0cm - 15cm	0.65	0.80	0.84	0.85	0.52	0.54	0.69	0.92	0.76 – 1.11	0.10-1.0
	15 – 30cm	0.91	0.82	0.65	0.94	0.82	0.66	1.00	0.61	0.61 – 2.9	
THC (mg/kg)	0cm - 15cm	ND	ND	ND	ND	ND	ND	ND	ND	-	30.00
	15 – 30cm	ND	ND	ND	ND	ND	ND	ND	ND	-	
Total chromium (mg/kg)	0cm - 15cm	0.59	0.68	0.89	0.68	0.83	0.69	0.85	0.73	1.03 – 1.50	100.00
	15 – 30cm	1.65	1.28	1.05	1.42	0.81	1.38	1.43	1.72	0.92 - 1.02	
Total iron (mg/kg)	0cm - 15cm	104.53	76.74	95.69	78.31	92.94	82.79	110.60	85.77	8,224 – 11,430	500-30000
	15 – 30cm	118.4	116.1	126.7	119.1	105.3	125.4	119.2	104.4	7,513 – 10,846	
Copper (mg/kg)	0cm - 15cm	4.97	4.12	5.26	5.69	6.43	6.44	4.34	5.92	1.50 – 89.2	36.00
	15 – 30cm	7.06	8.77	8.59	6.80	8.69	8.91	8.80	9.42	1.22 – 91.0	
Lead (mg/kg)	0cm - 15cm	0.16	0.24	0.22	0.20	0.22	0.23	0.28	0.17	8.10 – 60.3	85
	15 – 30cm	0.11	0.11	0.24	0.18	0.25	0.18	0.09	0.16	7.7 – 58.0	
Manganese (mg/kg)	0cm - 15cm	6.02	4.67	5.24	5.99	6.41	6.23	6.08	6.46	7.10 – 7.86	

	15 – 30cm	7.37	7.62	8.36	8.39	6.76	7.51	7.17	8.69	6.81 – 7.89	
Nickel (mg/kg)	0cm - 15cm	0.76	0.83	0.89	0.59	0.67	0.80	0.60	0.70	6.30 – 29.3	35.00
	15 – 30cm	0.76	1.19	1.07	1.00	0.77	0.91	0.78	0.94	5.24 – 30.35	
Zinc (mg/kg)	0cm - 15cm	1.12	1.05	1.11	1.00	1.16	1.23	1.09	1.18	15.1 – 69.8	
	15 – 30cm	0.97	0.97	0.92	1.01	0.74	0.92	0.79	1.64	14.3 – 67.2	
Arsenic (mg/kg)	0cm - 15cm	0.34	0.25	0.29	0.29	0.20	0.28	0.28	0.24	0.31 – 0.61	
	15 – 30cm	0.33	0.22	0.29	0.28	0.40	0.37	0.37	0.30	0.15 – 1.01	
Mercury (mg/kg)	0cm - 15cm	ND	ND	ND	ND	ND	ND	ND	ND	-	0.30
	15 – 30cm	ND	ND	ND	ND	ND	ND	ND	ND	-	
Vanadium (mg/kg)	0cm - 15cm	0.21	0.18	0.18	0.21	0.27	0.27	0.23	0.26	14.7 – 44.3	
	15 – 30cm	0.21	0.28	0.26	0.27	0.28	0.30	0.28	0.25	13.4 – 46.7	
Cadmium (mg/kg)	0cm - 15cm	0.31	0.72	0.74	0.40	0.64	0.75	0.58	0.43	0.65 – 0.82	
	15 – 30cm	0.54	0.40	0.48	0.72	0.54	0.59	0.49	0.86	0.28 – 1.75	
Boron (mg/kg)	0cm - 15cm	1.34	1.68	1.53	1.75	0.91	1.47	1.61	0.86	1.43 – 1.60	
	15 – 30cm	1.55	0.83	0.86	1.64	2.23	1.64	1.09	1.49	0.88 – 2.04	

PEL = Proton Energy Limited

All soil physicochemical parameters were within WHO/FMEnv threshold values. It was generally observed that the subsoil contains more clay and silt than the top soils. Conversely, the top soil was higher in porosity and particle density compared to subsoil. This indicated that the studied soils may be resistant to leashing; hence, accidental spill may not easily percolate. The baseline result compared well with the secondary data.

4.5.3 Soil Microbiology

The two groups of microorganisms studied from the sampled soils are the fungi and bacteria, which are the most important organic matter decomposers in the soil. Bacteria and fungi (microbes) counts provide information on the level of on-going biochemical activities in soil. Microbial counts under normal circumstances increases with an increase in soil the organic matter. About 1g of fertile soil should contain 1 x 10^6 to 1 x 10^8Cfu/g bacteria and fungi (Odu *et al*., 1985).

The soil samples were contained in sterile glass bottles were subsequently triturated and homogenized. To evaluate the microbial population, the samples were placed in contact with 0.35% NaCl solution (physiological saline) and shaken vigorously for 30 minutes, to release or extract the Protists present in the samples. The samples suspensions were serially diluted before used in the estimation of microbial densities.

Table 4.7 shows of the result of microbial assay in the soil samples.

Table 4.7: Summarized Soil Microbial Result

THB		HUB	
PRIMARY DATA (WET SEASON)			
Species	Counts (Cfu/ml)	Species	Counts (Cfu/ml)
Bacillus sp *Pseudomonas sp.,* *Proteus sp* *Arthrobacter sp* *Enterobacter sp* *Micrococcus sp* *Actinomyces sp* *Escherichia sp* *Klebsiella sp* *Serriatiasp* *Flavobacterium sp* *Staphylococcus sp* *Chromobacterium* sp	7.2 x 10^7	*Bacillus sp* *Pseudomonas sp* *Micrococcus sp* *Actinomyces sp* *Escherichia sp* *Proteus sp* *Klebsiellasp* *Arthrobacter sp* *Enterobacter sp*	5.79 x 10^5
SECONDARY DATA (DRY SEASON)- (PEL 150MW Gas Powered Plant Ogorode, Delta State 2013-2014)			

THB		HUB	
PRIMARY DATA (WET SEASON)			
Species	Counts (Cfu/ml)	Species	Counts (Cfu/ml)
Bacillus, *Pseudomonas,* *Proteus,* *Micrococcus,* *Flavobacterium,* *Streptomyces,* *Klebsiella,* *Arthrobacter,* *Nocardia*	45,000 – 750,000	*Micrococcus,* *Pseudomonas,* *Bacillus,* *Proteus,* *Staphylococcus*	8,500 – 53,000
THF		HUF	
Species	Counts (Cfu/ml)	Species	Counts (Cfu/ml)
Aspergillus sp *Mucor sp* *Penicillium sp* *Fusarium sp* *Rhizopus sp* *Candida sp* *Trichoderma sp*	7.3×10^6	*Mucor*sp *Aspergillus sp* *Fusarium sp* *Penicillium sp* *Trichoderma* sp	6.9×10^8
SECONDARY DATA (DRY SEASON) – (PEL 150MW Gas Powered Plant Ogorode, Delta State 2013-2014)			
Candida, *Rhodotorula,* *Fusarium,* *Penicillium,* *Aspergillus,* *Mucor,* *Trichoderma*	190 – 2,240	*Mucor,* *Fusarium,* *Candida,* *Penicillium,* *Aspergillus,* *Rhizopus*	150 – 1,980

Note: THB = Total Heterotrophic Bacteria, HUB = Hydrocarbon Utilizing Bacteria, THF = Total Heterotrophic Fungi, HUF = Hydrocarbon Utilizing Fungi, PEL= Proton Energy Limited.

Since microbes are known to grow on particular substrates, Table 4.8 is a matrix correlating species observed to possible waste stream based on observed and reviewed food sources in the project area.

Table 4.8: Microbial – Waste Substrate Matrix

Species	Broad spectrum media nutrients	Possible Substrate in Project Area
Bacillus sp	Nitrogen, carbohydrate	Meat, Groundnut, bread
Pseudomonas sp	vitamins, carbohydrates, nitrogen, and salts	Egg, bean and meat
Micrococcus sp	vitamins, carbohydrates, nitrogen, and salts	Rice, corn and bread
Escherichia sp	Sodium, chlorine, nitrogen	Meat, Groundnut, bread
Klebsiella sp	Nitrogen, carbon and sodium, ammonium phosphate	Egg, bean and meat

Proteus sp	Nitrogen, vitamins, lactose	Meat, Groundnut, bread Egg, bean and meat
Serriatiasp	Sodium, chlorine, nitrogen	Rice, corn and bread
Staphylococcus sp	vitamins, carbohydrates, nitrogen, and salts	Meat, Groundnut, bread
Enterobacter sp	Sodium, chlorine, nitrogen	Meat, Groundnut, bread Egg, bean and meat
Arthrobacter sp	Nitrogen, carbohydrate	Cassava tubers, corn
Actinomyces sp	Propionic acid, sodium salt, nitrogen	Meat, Groundnut, bread
Flavobacterium sp	Proteosepeptone, Casamino acids, Yeast extract, Dextrose, Soluble starch, phosphate, sulfate Sodium	Meat, fish, cheddar cheese
Mucor sp	Magnesium Sulfate, Monopotassium Phosphate, Peptone, glucose, Sodium, potassium, iron, calcium	Meat, Groundnut, bread Egg, bean and meat
Trichoderma sp		
Fusarium sp	Sodium, potassium, iron, calcium, glucose	Rice, beans and soya bean Yam, potatoes, Sugarcane, corn and wheat straw
Rhizopus sp		
Candida sp		
Aspergillus sp		
Penicillium sp		

Microbial diversity of the study area was generally uniform indicating similar substrate. However, a higher species diversity of THB, THF and HUB were recorded during the wet season. This was expected as soil temperatures, moisture contents and substrate availability tends to be more favourable for microbial growth during the wet season. Similarly, the presence of *Escherichia sp* during the wet season is indicative of anthropogenic interference on the soil. Open defecation is the major factor promoting the proliferation of *Escherichia sp*in the soil.

All microbial species assayed in the soil samples are important in nutrient recycling. Details of the composition, abundance and broad-spectrum media nutrients of the microbial species assayed in the various samples are suggestive of stable ecosystem.

4.6 Groundwater Quality

4.6.1 Sampling Methodology

Water samples were collected from two existing boreholes located at Amukpe Street within the project SoI. Plastic bottles were used for the collection and kept in cooler loaded with ice blocks, while samples meant for heavy metal analysis were preserved by the addition of concentrated nitric acid (5 ml to 1 L of water). Parameters like pH, temperature, electrical conductivity (EC) and dissolved oxygen were measured on *in-situ* with the aid of pH-conductivity-TDS meter (COMBO HI model 98130).

4.6.2: Result of groundwater quality

The results recorded for each physicochemical parameter were benchmarked with those from the PEL 150MW Gas Powered Plant Ogorode, Delta State, 2013-2014 report, and WHO/FMEnv regulatory limit, where one exists. Plate 4.2 shows groundwater sampling activity.

Plate 4.2: Groundwater sampling at Amukpe near the project site

Table 4.9 shows the geographical location of the boreholes sampled and the result for the physicochemical parameters measured.

Table: 4.9: Groundwater quality of the project area

Parameters	GW1 (5.855090N, 5.727820E)	GW2 (5.85570N, 5.719760E)	PEL 150MW Gas Powered Plant Ogorode, Delta State (2013-2014)	FMEnv limits	WHO limits
General appearance	Clear	Clear	Clear	Clear	Clear
pH @ 21.2^{o}C	5.2	5.6	4.06 – 4.53	6.5- 8.5	6.5-9.2
Temperature (^{o}C)	27.6	27.3	22.9 – 25.0		40 ^{o}C
Turbidity (NTU)	1.12	1.92	3.0 – 4.0		5
TDS (mg/l)	33.1	28.2	-		
TSS (mg/l)	182	83	2.0 – 4.0		
Conductivity (µS/cm)	0.47	0.11	15.1 – 16.9	1000	250
Total Hardness (mg/l)	6.44	8.23	1.63 – 1.83	150	
THC	ND	ND	-	0.3	0.05
PCB (ng/m3)	ND	ND	-		0.003
Mineral Oil (mg/l)	<1.00	<1.00	-		
BOD (mg/l)	1.21	1.54	6.0 – 10.0		10

COD (mg/l)		4.05	5.33	9.60 – 17.8		
Chloride (mg/l)		11.6	10	10.8-10.92		
Total Alkalinity (mg/l)		<1.00	<1.00	-		
Nutrients	Nitrate (mg/l)	2.32	1.63	0.02 – 0.04		10
	Phosphate (mg/l)	0.26	0.29	0.06 – 0.07		5
	Sulphate (mg/l)	0.26	0.29	0.69 – 0.78		500
Reactive Silica (mg/l)		6.1	10.6	8.4 – 9.2		
Cyanide (mg/l)		<0.01	<0.01	-		
Ammonium (mg/l)		<0.02	<0.02	-		
Aluminum (mg/l)		<0.10	<0.10	-		
Calcium (mg/l)		0.29	2.09	1.2 – 1.54		
Magnesium (mg/l)		1.39	0.22	0.8 – 2.0		
Sodium (mg/l)		2.77	4.79	3.8 – 3.9		
Potassium		0.35	0.3	0.10 – 0.11		10
Heavy Metals	Arsenic (mg/l)	<0.001	<0.001	-		
	Total Mercury (mg/l)	<0.0002	<0.0002	-		
	Selenium (mg/l)	<0.001	<0.001	-		
	Lead (mg/l)	<0.01	<0.01	<0.008		0.02
	Zinc (mg/l)	0.11	<0.05	0.1 – 0.13		
	Total Iron (mg/l)	<0.05	0.28	0.31 – 0.41		0.3
	Copper (mg/l)	<0.05	<0.05	<0.03		2.0
	Manganese (mg/l)	<0.10	<0.10	-		
	Cadmium (mg/l)	<0.002	<0.002	-		
	Total Chromium (mg/l)	<0.01	<0.01	-		
	Cobalt	0.03	0.03	0.03 – 0.16		
	Vanadium	ND	ND	-		
Total Coliform (Cfu/100ml)		2	$7.8x10^1$	2.0 – 2.57		
Faecal Coliform (Cfu/100ml)		0	$4.2x10^1$	-		
E-coli (Cfu/100ml)		0	0	-		
Faecal Streptococci (Cfu/100ml)		0	0	-		
Total Plate Count (Cfu/ml)		$1.41x10^3$	$1.121x10^3$	-		

Source: MCNL Survey, 2019. ND = Not Detected PEL = Proton Energy Limited

As shown in Table 4.9, all the physicochemical parameters analysed in the groundwater samples were within WHO/FMEnv threshold values. The result compared well with the secondary data. It is anticipated however, that the proposed project alters groundwater quality on site during the construction phase. Nevertheless, mitigations measures have been proffered for these impacts, and they are well documented in chapter five of this report

4.7 Hydrology and surface drainage of the project area

The project area is drained by Ethiope River which forms a major tributary to Benin River. Ethiope River takes its source from a spring at Umuaja and flows over 100km to empty into Benin River. This river serves as the terminal point for storm runoff in the project area. Inhabitants of the area rely on the river for activities such as washing, fishing, sand mining and inter-village transportation. Plate 4.3 shows the major water body in the project area.

Plate 4.3: Ethiope River flowing through the project area

4.8 Surface water quality of the study area

4.8.1 Sampling Methods

Four (4) surface water samples were collected from Ethiope River (Figure 4.4), using non-isokinetic water sampler. This involved immersion of the laboratory cleaned sample bottle below the surface of the water body. The exercise also involved in situ measurement of salinity, temperature, turbidity, pH, dissolved oxygen and conductivity. Water samples were collected for laboratory analyses using. 2-litre plastic bottle for water samples for physicochemical analysis; 2-litre plastic bottle for water samples for heavy metal analysis; 1-litre plastic bottle for water samples for microbiological analysis; and 1-litre glass bottle with Teflon seal cap for water samples to be analyzed for hydrocarbon content (oil and grease, etc.).

All water samples were preserved in ice blocked loaded boxes in the field and refrigerators on site prior to transmission on ice loaded coolers to Mifor Consult laboratory, Calabar.

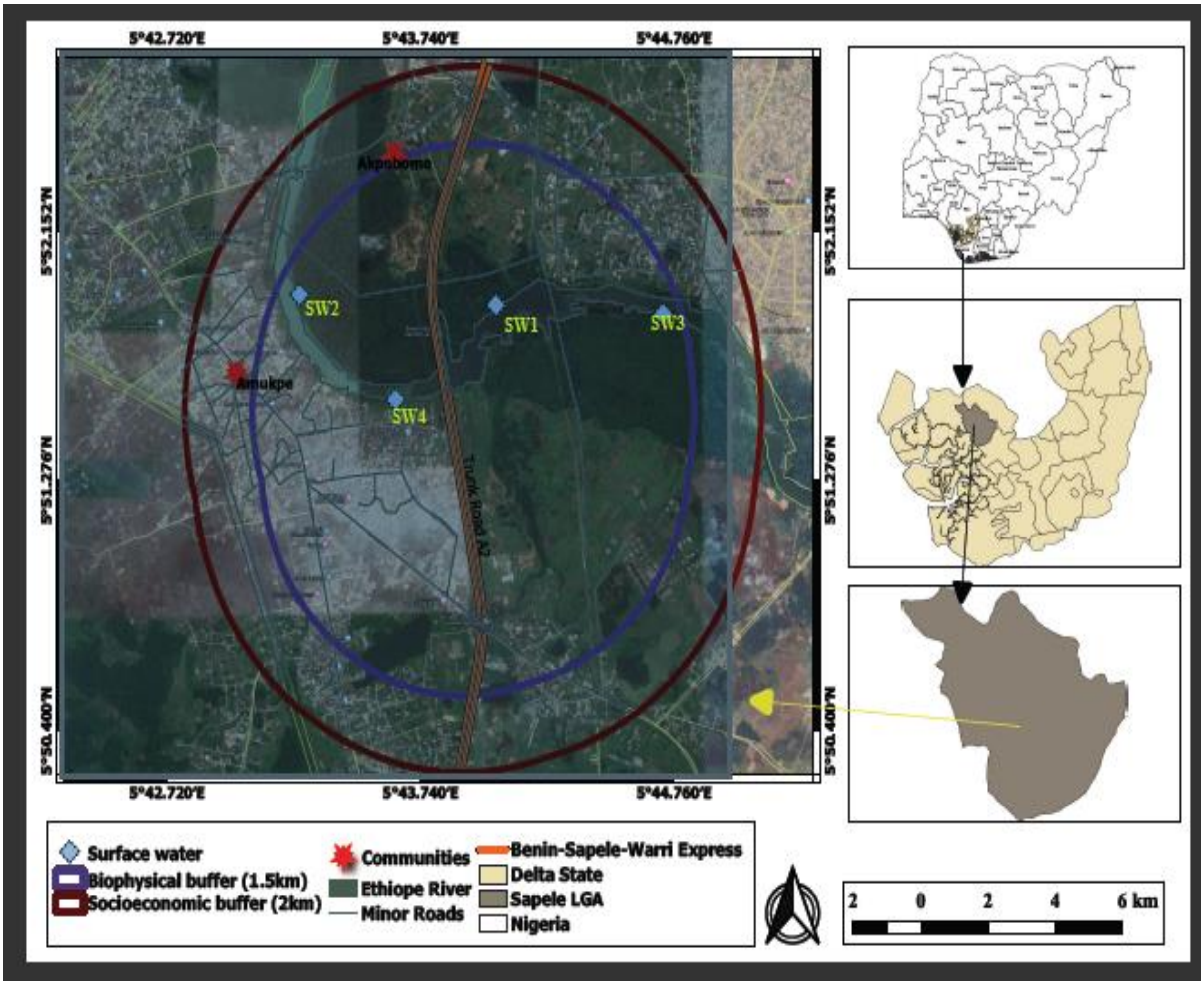


Figure 4.4: Surface water/sediment sampling location

4.8.2 Surface water physico-chemical parameters

Table 4.10resent the result of physico-chemical parameters assessed in samples obtained from surface water bodies within the proposed project areas.

Table 4.10: Summarized Surface Water Physico-chemical Characteristics

PARAMETERS	SAMPLE STATIONS AND COORDINATE				PEL 150MW Gas Powered Plant Ogorode, Delta State (2013-2014)	FMEnv/WHO (2011) limits for sustenance of Aquatic Lives
	SW1 (5.85980N, 5.73060E)	SW2 (5.86280N, 5.73250E) Contl.	SW3 (5.86150N, 5.72200E)	SW4 (5.85870N, 5.73380E)		
Colour	Clear	Cloudy	Clear	Clear	-	
Odour	Nil	Nil	Nil	Nil	-	Odourless
pH	5.2	5.6	5.9	5.5	5.02 – 5.82	4.8-9.2
Temperature (^oC)	25.8	27.3	26.3	27.0	21.1 – 25.4	40
Conductivity (µS/cm)	0.01	0.01	0.01	0.06	12.5 – 13.9	
Salinity (g/l)	0.97	1.03	0.99	0.37	<0.10	
DO (mg/l)	3.41	2.53	2.79	1.56	4.05 – 5.30	4 - 9
Turbidity (NTU)	13.33	26.82	15.28	17.21	1.0 – 7.0	<25
Total Dissolved Solids (mg/l)	193.8	143.2	214.0	269.3	7.50 – 8.34	
Total Suspended Solids (TSS)	16	16	18	50	1.0 – 7.0	
Oil & Grease (mg/l)	<1.00	<1.00	<1.00	<1.00	<0.40	
BOD (mg/l)	2.94	2.07	4.28	2.95	8.0 – 30.0	<10
COD (mg/l)	3.44	3.74	2.88	3.39	12.5 – 50.8	40
Chloride (mg/l)	77.40	76.18	75.31	76.17	76.86	
Nitrate (mg/l)	0.16	0.14	0.20	0.18	0.18	50
Phosphate (mg/l)	6.18	4.16	2.82	5.44	5.10	500
Sulphate (mg/l)	0.74	2.19	2.34	1.31	1.37	500
Phenol (µg/l)	0.03	0.03	0.03	0.03	0.03	
Magnesium (mg/l)	6.6	19.3	14.5	11.7	12.25	200
Potassium (mg/l)	4.71	2.96	1.99	1.68	3.98	10
Sodium (mg/l)	3.57	7.76	10.05	8.19	7.80	200
Calcium (mg/l)	3.71	3.88	6.12	7.82	4.25	200
Chromium (mg/l)	0.27	0.27	0.27	0.27	0.27	50
Manganese (mg/l)	<0.10	<0.10	<0.10	<0.10	-	100
Lead (mg/l)	<0.20	<0.20	<0.20	<0.20	<0.008	25
Zinc (mg/l)	<0.20	<0.20	<0.20	<0.20	<0.02 - <0.07	5000
Copper (mg/l)	<0.20	<0.20	<0.20	<0.20	<0.02	1500
Total Iron (mg/l)	0.33	1.22	1.57	0.85	0.27 – 0.73	300
Nickel (mg/l)	1.30	1.35	1.03	0.98	<0.06	88
Silver (mg/l)	<0.10	<0.10	<0.10	<0.10	-	
Cobalt (mg/l)	<0.01	<0.01	<0.01	<0.01	-	
Cadmium (mg/l)	<0.01	<0.01	<0.01	<0.01	-	0.03

Source: MCNL Survey, 2019 PEL= Proton Energy Limited

As shown in Table 4.10, all physico chemical parameters analyzed in the water samples were within threshold values, except for turbidity which was slightly above regulatory limit at the control station. This may indicate an elevated level of pollution at this point. The causes of high turbidity in a water body include clay, silt, very tiny inorganic and organic matter, algae, dissolved coloured organic compounds, and plankton and other microscopic organisms (Ebigwai *et al.,* 2014).

High concentrations of particulate matter affect light penetration and ecological productivity, recreational values, and habitat quality, and cause lakes. Also, increased turbidity can harm habitat areas for fish and other aquatic life. Particles also provide attachment places for other pollutants, notably metals and bacteria.

The surface water was slightly acidic across the sampled points; however, the values were within the regulatory limits to support aquatic life. The proposed Woodland activity is likely to impact on surface water quality during the construction and operation phases. However, the EMP designed for the project shall address the issue.

4.8.3 Surface Water Microbiology

The densities and taxa of microorganisms in the sampled water bodies are presented in Table 4.11 while the Substrate matrix for the sampled species is presented in Table 4.12.

Table 4.11: Summarized Surface Water Microbiology Result

	Total Heterotrophic Bacteria (THB)	Count (Cfu/ml)	Hydrocarbon utilizing Bacteria (HUB)	Count (Cfu/ml)	Total Heterotrophic Fungi (THF)	Count (Cfu/ml)	Hydrocarbon Utilizing Fungi (HUF)	Count (Cfu/ml)
	PRIMARY DATA (WET SEASON)							
SW1	*Micrococcus sp, Streptococcus sp Flavobacteriumsp, Alcaligenes sp Proteus sp, Escherichia sp*	5.03×10^6	*Flavobacterium sp, Proteus sp Alcaligenes sp Escherichia sp*	3.74×10^4	*Acremonium sp Rhizopussp*	3.56×10^2	*Candida sp Penicillium sp*	1.71×10^1
SW2	*Flavobacterium sp, Alcaligenes sp, Proteus sp, Escherichia sp, Actinomyces sp*	4.01×10^2	*Proteus sp Escherichia sp*	2.62×10^1	*Candida sp Rhodotorulasp Acremonium sp Fusarium sp Penicillium sp Aspergillus sp Mucor sp*	3.42×10^4	*Mucor sp Candida sp Penicillium sp Aspergillus sp Rhizopus sp Rhodotorulasp*	2.12×10^3
SW3	*Bacillus sp, Micrococcus sp Pseudomonas sp., Staphylococcus sp*	3.8×10^4	*Micrococcus sp Pseudomonas sp Staphylococcus sp*	2.33×10^2	*Fusarium sp Penicillium sp Rhizopussp*	3.47×10^3	*Penicillium sp Rhizopus sp*	2.03×10^1
SW4	*Streptococcus sp, Flavobacterium sp, Alcaligenes sp, Proteus sp Escherichia sp, Arthrobacter sp*	5.3×10^3	*Escherichia sp Arthrobacter sp*	2.85×10^1	*Mucor sp Trichoderma sp Acremonium sp*	3.8×10^2	*Aspergillus sp*	1.27×10^1
	DRY SEASON SECONDARY DATA (PEL 150MW Gas Powered Plant Ogorode, Delta State (2013-2014))							
	Bacillus, Pseudomonas, Proteus, Micrococcus, Flavobacterium, Staphylococcus, Actinomyces Chromobacterium,	440–6,100	*Micrococcus, Pseudomonas, Bacillus, Staphylococcus, Flavobacterium,*	5 -67	*Candida, Rhodotorula, Fusarium,, Aspergillus, Mucor,*	11 – 79	*Mucor, Fusarium, Candida, Penicillium, Aspergillus,*	3 –61

	Paenibacillus, Dactylosporangium		*Proteus, Arthrobacter*		*Trichoderma, Rhizopus*		*Rhizopus,*	

Source: MCNL Survey, 2019.   PEL= Proton Energy Limited

Table 4.12 Substrate matrix for Surface water microbial species

Species	Broad spectrum of growth media	Examples of local foods as possible growth medium
Bacillus sp	nitrogenous substance	Meat, Groundnut, bread
Pseudomonas sp	vitamins, carbohydrates, nitrogen, and salts	Egg, bean and meat
Micrococcus sp	Nutrient agar plate and broth	Rice, corn and bread
Proteus sp	Nitrogen, vitamins, lactose	Starch
Flavobacterium sp	Proteosepeptone, acids, Yeast, Dextrose, Soluble starch, phosphate, Magnesium Sodium	Meat, fish, cheddar cheese
Staphylococcus sp	vitamins, carbohydrates, nitrogen, and salts	Meat, Groundnut and Bread
Streptococcus sp	vitamins, carbohydrates, nitrogen, and salts	Meat, Groundnut and Bread
Escherichia sp	vitamins, carbohydrates, nitrogen, and salts	Meat, fish, cheddar cheese
Actinomyces sp	vitamins, carbohydrates, nitrogen, and salts	Meat, fish, cheddar cheese

Microbial diversity of the study water samples was generally uniform indicating similar substrate. However, a higher species diversity across the microbial groups were recorded during the wet season. This might be attributed to runoffs into water bodies from the metropolis.

The presence of faecal contamination indicator species such as *Escherichia sp* in SW1, SW2 and SW4 is suggestive of polluted water bodies. However, the samples were devoid of water-borne pathogens such as *Giardia lamblia* and *Vibrio cholera*. Details of the composition, abundance and broad-spectrum media nutrients of the microbial species assayed in the various samples are suggestive of contamination by food waste and runoff from fertilizer laden agricultural lands (Nitrogen source). All microbial species assayed in this study had been reported to play key ecological roles in various water systems especially nutrient recycling.

4.9 Sediment Quality

4.9.1 Sampling methodology

Sediment samples were obtained alongside the surface water sample. The sample was obtained with the aid of Eckman grab. The grab is made up of stainless steel that consists of two jaws that automatically closes when it is lowered into the river. On reaching the bottom of the water body, sediment is trapped in the jaws and is gradually pulled back to the surface. A single grab bite was collected per station. The surface of sediment (1 - 2cm) were collected in a stainless-steel basin and homogenized for the analysis of physicochemical parameters and Total Hydrocarbon Content (THC). The residual sediment was washed and collected in a plastic container for macro benthos analyses, while any residual sediment was thrown back into the river.

Samples for physicochemical analyses were collected in polythene bags and stored for analysis. *In-situ* measurements such as pH and temperature were carried out on sediment samples. The sediment samples for microbial analyses were collected in sterile plastic containers and stored in coolers containing ice block. After each sampling, the grab samples were washed thoroughly to remove any adhering particles from previous sampling.

4.9.2 Sediment Physico-Chemical parameters

Several physico-chemical parameters for recovered sediment samples from water bodies in the study area were conducted. Some of the parameters include pH, oil and grease, Total Hydrocarbon (THC), nitrates, phosphates, sulphate, chloride and about ten (10) species of heavy metals. Similarly, the regulatory limits and ranges of some of the parameters (where they exist) were used as the benchmark for determining existing status. Also, the results of the baseline study were compared with those reported for contiguous areas.

Table 4.13 shows the result of physico-chemical parameters analyzed in the sediment samples of the water bodies.

Table 4.13 physicochemical characteristics of the studied sediment

SAMPLE STATIONS	SD1	SD2	SD3	SD4	PEL 150MW Gas Powered Plant Ogorode, Delta State (2013-2014)	FMEnv	ISQG Limits
PARAMETERS	(5.85980N, 5.73060E)	(5.86280N, 5.73250E) Contl.	(5.86150N, 5.72200E)	(5.85870N, 5.73380E)			
pH	7.73	8.61	7.81	7.37	3.55 – 4.25	6.5-9	6.0-9.0
Oil and Grease (mg/kg)	<1.00	<1.00	<1.00	<1.00	-		
THC (mg/kg)	<5.00	<5.00	<5.00	<5.00	<5.00 – 3,990		
Chloride(mg/l)	74.92	76.05	73.45	77.16	75.69		
BOD (mg/l)	9.96	9.02	8.99	9.87	<0.5 – 20.0	4.0	
COD (mg/l)	10.9	9.79	10.00	10.15	3.83 – 35.1	-	

Ext. nitrate(mg/kg)	0.16	0.16	0.16	0.20	0.08 – 0.29		
Ext. phosphate(mg/kg)	2.93	0.93	3.54	3.15	10.0 – 76.4		
Ext. sulphate (mg/kg)	0.84	1.80	1.53	0.22	38.0 – 248		
Chromium (mg/kg)	0.24	0.24	0.22	0.19	<1.0 – 47.1	50	
Lead(mg/kg)	0.07	0.10	0.07	0.07	<1.0 – 57.9		
Zinc(mg/kg)	1.68	1.82	1.37	1.73	2.10 – 187	5000	120-540
Copper(mg/kg)	4.09	3.40	3.38	3.71	0.90 – 60.5	35.7	
Total iron (mg/kg)	1.25	0.68	1.50	1.49	5,078 – 10,760	300	
Nickel(mg/kg)	0.76	0.87	0.82	0.78	3.20 – 20.4	88	
Cobalt (mg/kg)	<0.01	<0.01	<0.01	<0.01	<3.0 – 22.5		123-540
Cadmium (mg/kg)	<0.01	<0.01	<0.01	<0.01	<0.1 – 12.0	5	0.6-3.5
Vanadium (mg/kg)	<5.00	<5.00	<5.00	<5.00	-		
Manganese (mg/kg)	0.991	1.31	1.331	1.086	32.4 – 144		

The result (Table 4.13) shows that the physico chemical parameters analyzed in the sediment samples were within ISQG and FMEnv threshold values.

4.9.3 Sediment microbiology

Table 4.14is the result of microbiology of the recovered sediments

Table 4.14: Microorganisms isolated from the studied sediments

	Total Heterotrophic Bacteria (THB)	Count (Cfu/ml)	Hydrocarbon utilizing Bacteria (HUB)	Count (Cfu/ml)	Total Heterotrophic Fungi (THF)	Count (Cfu/ml)	Hydrocarbon Utilizing Fungi (HUF)	Count (Cfu/ml)
PRIMARY DATA (WET SEASON)								
SW1	*Staphylococcus sp** *Micrococcus sp** *Actinomyces* *Pseudomonas sp** *Bacillus sp**	4.63×10^3	*Micrococcus sp* *Actinomyces* *Bacillus sp*	3.18×10^2	*Aspergillus sp* *Candida sp* *Rhodotorula sp* *Penicillium sp*	3.42×10^3	*Rhodotorulasp* *Penicillium sp* *Fusarium sp*	2.11×10^2
SW2	*Actinomyces* *Pseudomonas sp* *Bacillus sp* *Protuessp**	3.6×10^4	*Bacillus sp* *Pseudomonas sp* *Protuessp*	2.78×10^2	*Aspergillus sp, Candida sp Rhodotorulasp, Penicillium sp, Mucor sp, Fusarium sp*	2.38×10^3	*Rhodotorulasp* *FusariumspRhizopus,Penicillium sp*	1.85×10^3
SW3	*Staphylococcus* *Micrococcus sp* *Actinomyces* *Proteus*	5.23×10^6	*Actinomyces sp* *Micrococcus sp*	3.51×10^4	*Rhodotorulasp* *Penicillium sp* *Mucor sp* *Fusarium sp*	4.2×10^3	*Penicillium sp* *Mucor sp*	3.17×10^2
SW4	*Pseudomonas sp* *Bacillus sp* *Staphylococcus sp* *Micrococcus sp* *Actinomyces* *Proteus*	3.41×10^4	*Bacillus sp* *Staphylococcus sp* *Micrococcus sp*	2.14×10^2	*Aspergillus sp* *Candida sp* *Rhodotorulasp* *Penicillium sp*	3.03×10^3	*Aspergillus sp* *Candida sp* *Fusarium sp*	1.2×10^2
DRY SEASON SECONDARY DATA – (PEL 150MW Gas Powered Plant Ogorode, Delta State, 2013-2014)								
	*Bacillus** *Pseudomonas** *Proteus** *Micrococcus,**	17,000–650,000	*Micrococcus, Pseudomonas, Bacillus, Staphylococcus*	10 – 3,900	*Candida, Rhodotorula, Mucor, Trichoderma,*	90 – 1,210	*Mucor, Fusarium, Candida, Penicillium,*	40 –90

	*Flavobacterium, Staphylococcus**				*Ulocadium, Rhizopus*		*Aspergillus,, Rhizopus, Rhodotorula*	

Source: MCNL Survey, 2019. PEL= Proton Energy Limited

Table 4.15 presents the possible substrate matrix for the microbial species observed in the sampled sediments

Table 4.15. Possible species- substrate matrix for Sediment samples

Species	Broad spectrum of growth media	Examples of local foods as possible growth medium
Bacillus sp	Nitrogen, carbohydrate	Meat, Groundnut, bread
Pseudomonas sp	vitamins, carbohydrates, nitrogen, and salts	Egg, bean and meat
Micrococcus sp	vitamins, carbohydrates, nitrogen, and salts	Rice, corn and bread
Proteus sp	Nitrogen, vitamins, lactose	Starch, fufu
Actinomyces sp	Propionic acid, sodium salt, nitrogen	Meat, Groundnut, bread
Staphylococcus sp	vitamins, carbohydrates, nitrogen, and salts	Meat, Groundnut and Bread
Streptococcus sp		
Aspergillus sp	Sodium, potassium, iron, calcium, glucose	Rice, beans and soya bean, Yam, potatoes, t. Sugarcane, corn and wheat straw
Candida sp		
Penicillium sp		
Fusarium sp		
Mucor sp	Magnesium Sulfate, Monopotassium Phosphate, Peptone, glucose, Sodium, potassium, iron, calcium	Starch, fufu
Rhodotorula sp		

Source: MCNL, 2019.

The microbial composition of sediments is similar to those observed in the surface water samples, except for the absence of faecal contamination indicators. The presence of *Escherichia sp* in the surface water and subsequence absence in the sediment is suggestive of low volume of faecal input from the terrestrial environment and the presence of surface dwelling faecal consuming organisms in the water bodies. The microbial composition in the sediment samples was generally indicative of sewage contamination, especially from food sources (Table 4.15).

4.10 Hydrobiology of the study area

4.10.1 Macro benthos sampling

A pragmatic approach was taken in acquiring benthic macro fauna samples, as benthos were obtained by washing residual sediment samples through a 25 mm-mesh sieve using water obtained from the river at the site. This was carried in a manner so as not to destroy the integrity of the benthic organisms. The benthos samples obtained were placed in a plastic container and preserved in 20% buffered formal saline solution and stored in the ice coolers. After each sampling, the Eckman Grab was washed thoroughly with water from the river to remove remaining particles from previous sampling.

From the result obtained, a total of five (5) macro benthic species were counted in the sediment samples. Table 4.16 presents this information.

Table 4.16 Macro benthos Species Checklist

SPECIES	Benthos count				
	SW1	SW2	SW3	SW4	TOTAL
Glyceraconvulata	1	2	0	0	3
Nereis sp	0	0	4	0	4
Polydoraciliiata	0	0	2	0	2
Tubifex sp	0	2	0	3	5
Hydrobiaminuta	2	0	1	2	5

Source: MCNL 2019

Two pollution (heavy metal) sensitive species (*Nereis sp, Polydoraciliiata*) of the Polycheate group were assayed in the water samples specifically in stations 2 and 3. This result correlates well with the findings that heavy metal physicochemical conditions were within regulatory limits. Macro benthos have active role in biotic and abiotic interactions characterizing aquatic ecosystems.

4.10.2 Plankton Sampling

As part of the procedures taken to determine the type and nature of small living organisms surviving on the surface of the water, the MCNL Field monitoring team conducted zooplankton and phytoplankton sampling exercise across the surface water sampling points.

4.10.2.1 Zooplankton sampling

Zooplankton samples were collected by pulling plankton net of mesh size of 0.05 mm vertically on the surface of the river. A weight (iron rod) was attached to the cord holding the net, lowered into the water and then pulled back to the surface for collection of samples. After each tow, zooplanktons were collected using labeled wide mouth plastic containers and preserved with 40 % buffered formalin, the net was thoroughly washed so that particles adhering to the net were washed into the collecting bottle for analysis.

From the result, a total of 27 individuals in seven (7) Zooplankton species were sampled in the water samples collected. Table 4.17 present this information.

Table 4.17: Zooplankton Species Checklist

SPECIES	Group	Zooplankton count				
		SW1	SW2	SW3	SW4	TOTAL
Corycaeusobtusus	*Crustacea*	2	1	1	1	5
Trichocerca cylindrical	*Rotifera*	1	0	1	0	2
Temora sp	*Crustacea*	0	1	1	1	3
Keratella quadrata	*Rotifera*	2	0	0	1	3
Keratellacochlearis	*Rotifera*	0	1	1	2	4
Cyclopinalongicornis	*Crustacea*	1	0	0	2	3
Acartiaclausii	*Crustacea*	2	2	2	1	7

Source: MNCL 2019

Result of the study revealed the presence of three pollutant sensitive species (*Keratellacochlearis*, *Keratella quadrata* and *Trichocerca cylindrical*) which revealed the euthrophic nature of the water body. Possible sources of these nutrients are sewage and agricultural effluents from anthropogenic activities (Echaniz *et al.,* 2012). Crustacean dominated the observed zooplankton community with *Acartiaclausii* having the highest count.

4.10.2.2 Phytoplankton sampling

Phytoplankton sample collection was done by lowering the plankton net just below the water surface and dragged (horizontally). The phytoplankton samples were collected in clearly labeled containers and preserved in Lugol's iodine solution.

From the result obtained, a total of 197 individual counts in 14 phytoplankton species were recovered in the samples. This information is presented in Table 4.18.

Table 4.18 Phytoplankton Species Checklist

Species	Phytoplankton count				
	SW1	SW2	SW3	SW4	Total Abundance
Microcystis aeruginosa	5	0	0	0	5
Lyngbyalimnetica	1	4	5	8	18
Spirulina sp	5	3	9	5	22
Anabaena sp	7	0	0	0	7
Phormidium tenue	1	7	4	6	18
Lyngbyacontorta	3	0	0	0	3
Oscillatoria limnetica	2	4	2	9	17
Merismopedia elegans	3	4	5	3	15
Spirulina major	5	3	1	10	19
Phormidium fragile	8	7	5	2	22
Lyngbyacylindricum	4	0	0	0	4
Melosira granulate	8	3	5	2	18
Synedra ulna	4	2	4	5	15
Nitzschiasp	8	4	1	1	14

This result indicates a diverse community of phytoplankton species. The result also indicated a stable ecosystem as phytoplankton diversity and abundance out-weighted zooplankton (Blinn and Bailey, 2001). Phytoplanktons are primary producers in aquatic food detritus food chain. Specifically, *Spirulina sp* and *Phormidium fragile* dominated the phytoplankton community, having the highest counts. These taxa are reportedly antimicrobial and antifungal; their presence could deter lethal groups from the community.

4.10.2.3 Fishery

Traditionally, fish has been one of the major sources of food for the people of Delta. Key fish species in the area include Tilapia and the Bagrids. Fishing is a year-round activity that is pursued more vigorously in the wet season and early dry season. Economically fish provides an important source of food and income for some men and women and fishing has an important social and cultural position in the project community. Therefore, this report documents the Environmental and Social Impact Assessment (ESIA) of the Fisheries in Ethiope River within the project area.

4.10.2.3.1 Data Collection

Collection of information was based on a combination of methods: direct observation of what the fishermen catch in their canoe and nets at the fishing grounds and consultation in the field with fishermen. The study also involved focus group discussions (FGDs) with fish sellers within the study area. Fish samples observed were identified with flash cards, checklists, photographs and scientific identification keys. Some fishermen were interviewed at the river side. Also, relevant information on fish and fishery in the project area was obtained from ESIA report of Proton Energy Limited 150MW Gas Powered Plant in Ogorode, Delta State (2013-2014). All the data gathered were documented for use in the ESIA report.

Plate 4.4: Pictures of fish caught by fishermen in Ethiope River during the study at Amukpe

4.10.2.3.2 Result

The fish assemblages in the river are presented in Table 4.19 while Plate 4.5 presents some of their pictures.

Clarias gariepinus

Hemichromisfasciatus

Hepsetus odoe *Tilapia galilaeus*

Plate 4.5: Some Censored Fish Species of the Water Bodies in the Study Area

Table 4.19: Inventory of Fishery Resources in the Project Area

Family	Taxa	Common name	Relative abundance (%)	IUCN status	Tropic structure
PRIMARY DATA (WET SEASON)					
Cichlidae	*Chromidotilapiaguentheri* (Sauvage, 1882)*	Cichlid	Common	Least concern	Planktinovores/microcarnivores
	Tilapia galilaeus (Genvais, 1848)	Cichlid	Common	Least concern	Planktinovores/microcarnivores
	*Hemichromisfasciatus**	Banded jowelfish	Common	Least concern	Intermediate carnivores
Bagridae	*Auchenoglanis occidentalis* (Cuvier and Valenciennes, 1840)*	Catfish	Common	Least concern	Planktinovores/microcarnivores
	Chrysichthys nigrodigitatus (Lacepede, 1903)*	Silver catfish	Common	Least concern	Planktinovores/microcarnivores
Clariidae	*Clarias anguillaris* (Linnaeus, 1758)	Mud catfish	Common	Least concern	Predator
	Clarias gariepinus (Burchell, 1822)*	Mud catfish	Common	Least concern	Predator
	Marcuseniusihuysi (Steindachner, 1870)	Mormyrid	Rare	Least concern	Intermediate carnivores
Hepsetidae	*Hepsetusodoe* (Bloch, 1794)	African river pike	Rare	Least concern	Intermediate carnivores
Notopteridae	*Papyrocranusafer* (gunther, 1868)	African seetu	Rare	Least concern	Intermediate carnivores
Schilbeidae	*Polypterussenegalus* (Cuvier, 1829)	Sailfin	Rare	Least concern	Planktinovores/microcarnivores
Pomadasyidae	*Pomadasysjubelini* (Cuvier, 1830)	Grunter	Rare	Least concern	Intermediate carnivores
Monodactylidae	*Monodactylussebae* (Cuvier and Valenciennes, 1829)	African moony	Rare	Least concern	Intermediate carnivores
Atyidae	*Caridinagabonensis*	Shrimp	Common	Least concern	Planktinovores/microcarnivores
SECONDARY DATA DRY SEASON (Source: Proton Energy Limited 150MW Gas Powered Plant Ogorode, Delta State (2013-2014))					
	Chrysicthys nigrodigitatus, Synodontisnigrita, Electrophorus electricus, Oreochromis niloticus, Clarias gariepinus*, Heterotisniloticus, Tilapia zilli, Malapteruruselectricus, Latesniloticus, Hemichromisfasciatus*, Schilbemystus, Eutropiusniloticus, Parachanna obscura, Protopterusannectens, Brycinusmacrolepidotus, Tilapia dageti, Phagoloricatus, Hemichromisbimachulatus, Auchenoglanisoccidentalis*, Clarias macromystax, Erpetoichthyscalabaricus, Chromidtilapiaguentheri*, Brycinus nurse, Tilapia mariae.*				

Source: MCNL, 2019 * represent species that occur in both wet and dry seasons.

A total of fourteen (14) species of fish representing 9 families were collected in this study as against the twenty-four (24) species recorded in PEL 150MW Gas Powered Plant in Ogorode, Delta State (2013-2014).

The relatively low species richness can be traced to proximity of the studied water to human settlement and high intensity of fishing in the studied area. A greater number of the fish species were pelagic, which moved within the upper strata of the water column and are more likely to move away from environmental perturbation. The demersal occupy the lower stratum and could be more susceptible to habitat perturbation.

The fish community was numerically dominated by Planktinovores/micro carnivores followed by intermediate carnivores and predators. The presence of these micro carnivores could mount pressure o zooplankton community.

However, fish abundance and the biotic integrity are likely to be influenced by any habitat degradation including discharge of effluents and other solid wastes from the project activities. These would lead to fish mortality including adult, Juveniles and egg/larvae mainly through degradation in water quality and alteration of the food resources. Eventually, the recruitment pattern will be altered and drastically reduced resulting in lower fish abundance. Theses perceived impacts have been factored into the EMP presented in Chapter 7 of this report.

Breeding Habitat for fishes

Fisheries breeding habitat include the flood plains/ swamps and Creeks, which are rich in food resources. This is however threatened by the use of non-selective gears, which harvest both adult and juveniles and could reduce recruitment into stock. Such breeding habitats are sensitive environments and any degradation in water quality would affect fish abundance.

Threatened or Endangered Species

None of the species encountered in the present study is in IUCN Red list of threatened species as all the species counted are least concern.

4.10.2.4 Crafts Survey

The common fishing craft in the study area is the traditional dug - out canoe or half plank-constructed canoe. Fishing gears commonly used in fish exploitation include traps, set gill net and cast nets. The set gill net with mesh size ranging between 30 and 120mm are bottom set and used in the open water and Creeks. However, some of the fishers use selective and non-selective gears, which indiscriminately catch juveniles and could deplete the stock and reduce the sustainable yield.

4.10.2.5 Socio-economic status of Fishermen in the project area

There is actually no secluded location for fishermen in the project area as they live among other people of various trades and occupation in the study area. The educational qualification of these people ranged from non-formal educational to secondary education. The age structure of the fishermen was mostly in the range of 25 to 60 years old 75% of the households in the study area are headed by male members. Most of the fishermen in this area are monogamous with very few having two or more wives. Most of the Fishermen do not have any source of finance other than the money that accrues to them from the sale of their fish. At this time of the year a fisherman makes about N1, 000 to N3, 000 for the sale of fish per day depending on the total catch.

In the study area, the commonest fish processing and preservation method is smoke-drying Storage of processed fish is mostly done at artisanal level in this community.

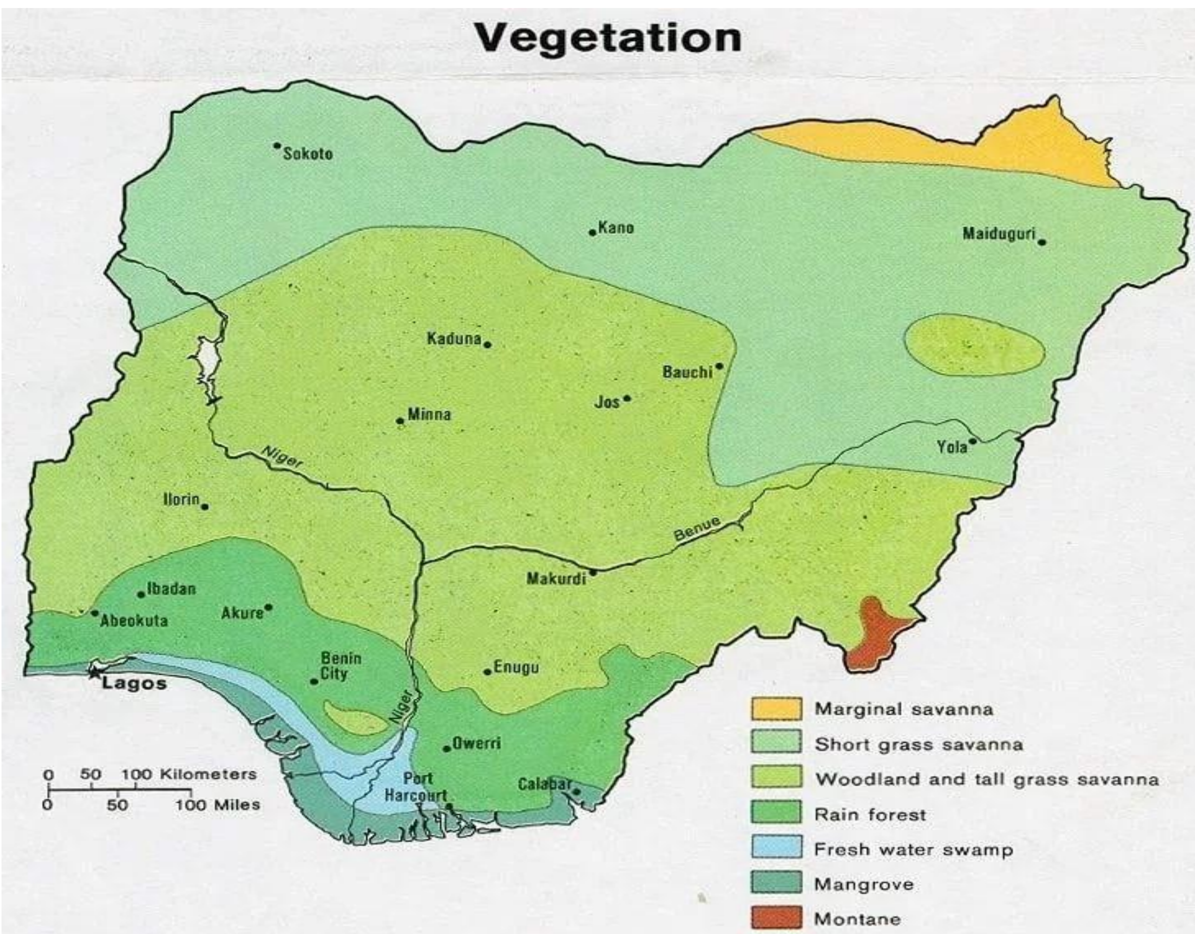
4.11 Terrestrial Biodiversity

4.11.1 General overview

There are nine distinct ecological zones in Nigeria which can be streamlined into five, namely (i) Sahel Savanna, (ii) Sudan Savanna, (iii) Derived/guinea Savanna, (iv) Swamp Forest (v) Tropical rainforest (Figure 4.5).

Delta state is covered by tropical forest, secondary forest, derived savanna and fresh water swamp. In addition to these habitats, Delta state is home to mangrove habitats also. The areas are currently experiencing seasonal and episodic flooding regimes.

Figure 4.5: Different Vegetation Belt of Nigeria



4.11.2 Vegetation/Flora

4.11.2.1 Sampling parameters and methods

Specific and standard methodology (See Table 4.20) was adopted for floral sampling. Some of the floristic parameters to be determined as shown in Table 4.20 include specific and family information (life forms, diversity richness, alien species inventory and indigenous uses. Three sampling points were delineated using plant species physiognomic conditions and habitat types (Table 4.21). An average of 40×40 m (1 acre) square transect was adopted as sampling size per sampling point. This resulted in a total sampled area of 3 acres. All the species within transect were manually enumerated and converted to the Blanquette scale. Habitat type as well as species information including species name, family, common name, DBH and growth habit were determined by an expert taxonomist and ecologist. Also, IUCN 2019 version 2 standard was used in computing IUCN status of the censured plant species while Odugbemi (2006) was used to identify the presence of alien and/or invasive among the censured species.

Table 4.20: Biodiversity Survey Methods and Procedures

Flora		
Sampling Parameter	Biodiversity survey details	Sampling Analytical Method
Habitat type		Field ecological characters used for habitat delineation include: canopy cover, presence of indicator species, litter fall and soil moisture content
Species and family identification		Field botanical characters used for identification include flowers, fruits, leaves, slash, exudates, and sometimes smell. Field guides include Letouzey 1986, Hutchinson and Dailziel, 1963, 1972. Hawthorne1993, Souane 1985, White and Abernethy 1997, Akobundu and Okezie 1998, Arbonnier 2006, Nyannanyo 2006 and Ebigwai 2012
Species richness		Species richness was evaluated by counting the number of species identified in each Whittaker transects.
Species Diversity Indices		H= -ΣPilnPi, Where H = Shannon's index, ln = log. E= EQ = -ΣPilnPi / lnS; Where EQ = equitability, S = total number of species (Begon, et al 1986))
Species Abundance	Project area	Abundance of species was evaluated by counting the number of individuals of a species in each Whittaker

		transects (Gauch, 1982).
Biomass density		Number of plant recorded Area of plot sampled
Species frequency		number of transect the species occurred total number of transect sampled
Indigenous uses	Ethno botanical questionnaires	The various indigenous uses of the recorded plant species were compiled in addition to plant species with the most diverse uses
Alien & invasive species	IUCN & Literatures and absence of local names	The presence of alien and invasive species was compiled based on list of alien/invasive plant species in Nigeria Odugbemi (2006)
Conservation status	IUCN Red List of 2019	Number of threatened species x 100 Total number of species
Protected species	IUCN database 2019 and CITES ACT 2016	-

Table 4.21 presents the sampling coordinates vegetation study while Figure 4.6 shows the sampling map

Table 4.21: Sampling Habitats and Coordinates

Sampling ID	Coordinates (transects)		Location relative to the proposed plant's site	Habitat type
1	5.85795	5.73166	Proposed plant site	Grassland
2	5.85872	5.73380	Proposed corridor (North-East)	Freshwater swamp
3	5.85605	5.73342	South-East	Secondary forest

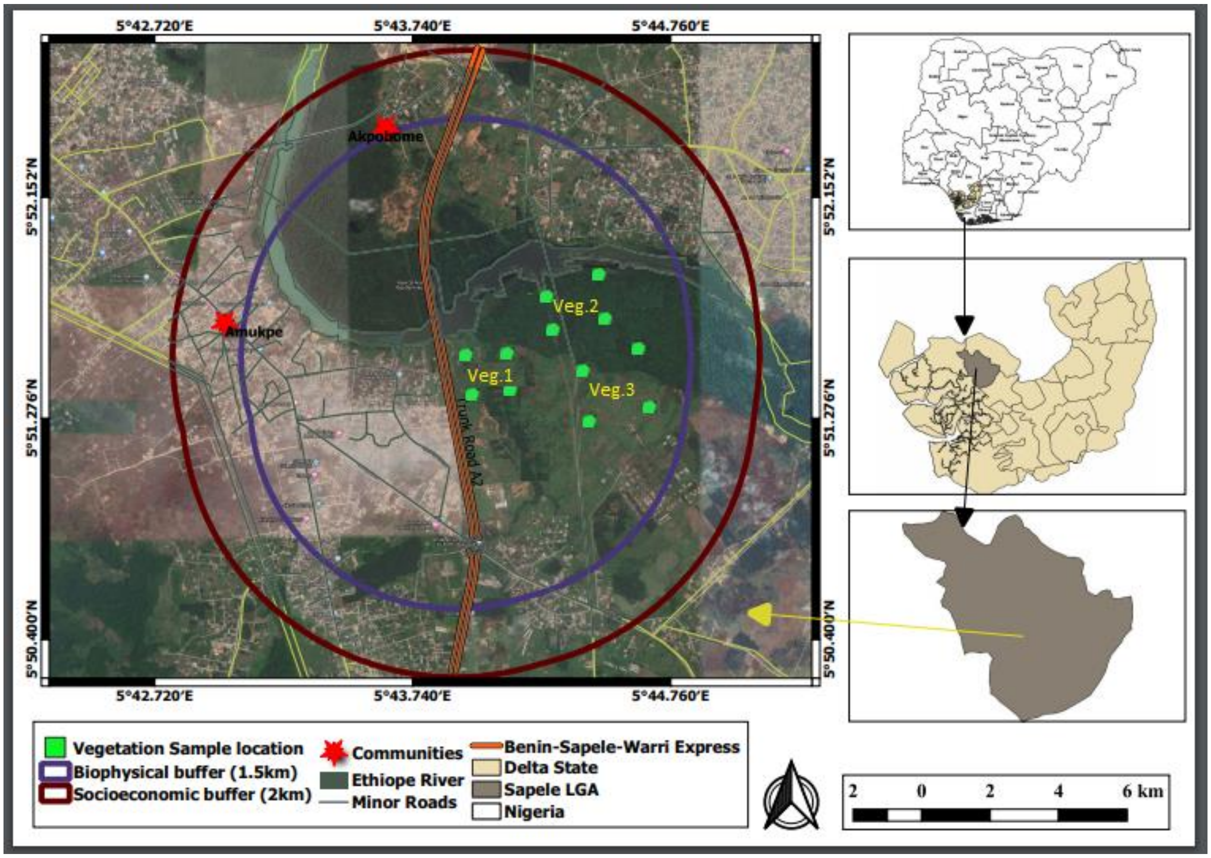


Figure 4.6: Map showing the sampling locations in the Project area for terrestrial Biodiversity

4.11.2.2 Result of flora studies

4.11.2.2.1 Habitat Types

Habitat study is essential to understanding spatio-temporal patterns in species distribution and hence significant towards implementing conservation efforts. The study area consists of three micro-habitats pattern. Secondary forest sampled constituted about 40.66% to the South-Eastern flank of the proposed project site, fresh water swamp made 31.87 % to the North-Eastern flak while grassland made up the remainder 27.47% mainly on the seat of the proposed plant. This implies that the proposed project will impact mainly on the grassland habitat. Plate 4.6 is a representative photograph of the habitat types in the study area.

Opened grassland at Transect 1

Fresh water forest at Transect 2

Secondary forest at Transect 3

Plate 4.6 Overview of Habitat types in the Study area

4.11.2.2.2 Species Richness and density

Richness is the total number of species censored in a defined area. It is often used as a criterion for ecosystem disturbance or stability. On the other hand, density refers to the number of species per given area. A total of 55 species were inventoried in the study area. A comprehensive list of the censored flora is shown in Appendix 2 while the summarized result is presented in Table 4.22

Table 4.22: Species Richness per sampled transect and per habitat

Sampling plot	Habitat characteristics	Species Richness per habitat/Plot	Species Density (per m2)
Veg. 1	Opened grassland	38	0.024
Veg. 2	Fresh water swamp forest	29	0.018
Veg. 3	Secondary vegetation	25	0.016
Entire study area		55	0.010

Source: MCNL 2019

Expectedly, routine vegetal clearing within the proposed plant site contribute significantly to the recorded sparse species in the study area. Also, the relatively higher species density recorded in the grassland habitat compared to fresh water and secondary forest habitats could be attributed habitat invasion by proliferating herbaceous species in this habitat in the study area.

4.11.2.2.3 Diversity indices

Shannon wiener index and evenness index were used to evaluate species diversity for the study area. A 3.69 and 0.92 Values were observed for Shannon and Equitability indices respectively in the entire study area. A breakdown of the result by sampling transects/habitat is presented in Figure 4.7.

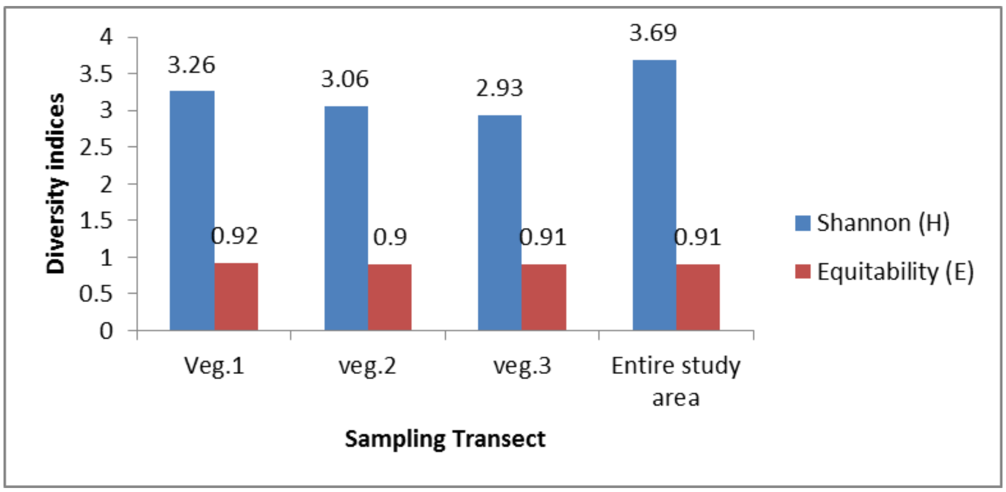


Figure 4.7: Diversity indices per sampled transect and per habitat

This is indicative of relatively higher species diversity and a fairly partial distribution of the species in the project area. However, abundance of each species has to be considered in determining the project impact.

4.11.2.2.4 Species abundance

This is the number of individual plants in a given area. It is used to determining the number plants in a given area; hence it provides information on vegetal waste expected from clearing a unit area of vegetation. In this study, a total of 2,866 individuals were censured in the entire sampled transects. This include the 1795 individuals' censure in transect 1 (grassland habitat), 717 in transect 2 (freshwater swamp forest) and 355 individuals in transect 3 (secondary forest). This information would be used in determining the expected plant biomass from vegetation clearing per sampled transect.

4.11.2.2.5 Community structure

This is the vegetation canopy formed by plants in a given area. It informs the level of anthropogenic influence in natural habitat. In this study, specie average Diameter at Breast Height (DBH) and height in the project area were used to determine vegetation structure of the study area. Result of Diameter at Breast Height (DBH) study shows that a greater proportion of the censured species (64 %) had their DBH below 20 cm. Similarly, 56 % of the species were 1 m in height. Table 4.23 presents this information.

TABLE 4.23: Community structure of the sampled area

Sampling plot	DBH (cm)			Canopy structure (m)		
	1-19 (%)	20 - 39(%)	≥40 (%)	≤1 (%)	1.1-4 (%)	>4 (%)
Veg. 1	81.6	18.4	0.0	73.7	21.1	5.3
Veg. 2	41.4	27.6	31.0	34.5	20.7	44.8
Veg. 3	28.0	36.0	36.0	36.0	16.0	48.0
Entire sampled area	63.6	18.2	18.2	56.4	16.4	27.2

Source: MCNL, 2019

This result implies that the highest proportion of species with DBH less than 20 cm were censured in transect 1 followed by transect 2. This indicates that transect 1 is the most disturbed in the project area.

Similarly, greater proportion of the censured species (56.4 %) was within the herbaceous canopy (0-1m). Transect 1 equally had the highest proportion of species in herbaceous canopy. The tree canopy (>4 m) dominated in transect 2 and transect 3 to North-East-Southern flank of the proposed plant site. This means that the vegetation at these points is relatively stable.

The herbaceous canopy is dominated by annual and biannual species; some of these species are Stachytarpheta *cayennensis, Mimosa pudica, Melochia corchorifolia, Ipomoea aquatic, Crotalaria retusa, Nephrolepisbiserrata* and *Eclipta alba*. On the other hand, *Mitragynale dermannii*, *Alstonia congensis*, *Elaeis guineensis*, and *Raphia hookeri* some of the tree canopy forming species in the study area.

This result implies that vegetation clearance at transect 1 will yield the least biomass volume; hence leaser vegetal wastes can be generated.

This information helps in vegetal waste quantification per acre as shown below:

Vegetal wastes = N (12 x 18)

Where N= number of individuals whose species average height was ≥12 m and an average DBH ≥18 m).

A total of 12 species, amounting to 234 individuals satisfies the stated criteria in the entire study area.

Therefore, waste stream resulting from clearing an acre plot in the study area is 234(12 x 18)/ 3 (No. of sampled plots in acre) = 16,848 tons.

However, none of the species censured within the proposed factory footprint and the area marked for clearing (transect 1) satisfies the stated criteria and hence vegetal waste from woodland clearing would be negligible.

4.11.2.2.6 Alien and Invasive species

Alien species are plant resources that are inadvertently introduced into an area while invasive species may or may not be alien except that they may out-compete other species and establish dominance. International Union for the Conservation of Natural Resources (IUCN) listed about 24 plant species that are alien to Nigeria, while the global invasive database listed the occurrence of 29 invasive floras in Nigeria. A review of the alien species data base for Nigeria showed that four (4) of these species (*Chromolaena odorata, Mimosa pudica, Mimosa invisa and Schrankia leptocarpa*) are invasive and also alien in the study area. All the species were censured in transect 1. The presence of these alien/invasive species in the study area signifies a disturbed ecosystem with fertile loci for proliferation.

Plates 4.7 are pictures of the species.

Chromolaena odorata (Invasive, Alien) *Mimosa invisa*

Schrankia leptocarpa *Mimosa invisa*

Plate 4.7: pictures of the alien and Invasive species encountered in the study area

4.11.2.2.7 IUCN Status

The IUCN status of the plant resources of studied area was evaluated using the IUCN red list version 2018 -2 criterion. The result showed that a single species (*Mitragynale dermannii*) in the study area is of conservation interest. The specie is in the vulnerable category in the IUCN Red List of Threatened Species (Version 2019). A total of 18 individuals of the species were encountered in transect 2 (fresh water swamp). The species is currently exploited for Fuel wood, timber and wrapping leaf in the project area. Plate 4.8 shows pictorial images of these threatened species.

Mitragynale dermannii

Plate 4.8: Picture of threatened species in the study area

Table 4.24 provides a reviewed data of the threatened species

Table 4.24: Threats and Conservation Actions of the Threatened Plant Taxa of the Study Area

Species	Common name	2019 IUCN Conservation status	Threats	Habitats and locations surveyed
Mitragynale dermannii	Abura	Vulnerable A1cd ver 2.3	Unsustainable harvest of timber; Deforestation and associated habitat degradation	Fresh water swamp located at the North-Eastern flank of the proposed factory footprint

Adeyemi, *et al*, (2015), Wahab, (2012), IUCN, (2019)

4.11.2.2.8 Habitats of higher ecological integrity

Important flora resources censored in this study were mapped as shown in Table 4.25. Criteria adopted for the mapping are plant species with high indigenous uses, invasive and alien species as well as those categorized under any of the Threatened classes.

Table 4.25: Ecologically sensitive species and their locations

Category	Species	Ecosystem Services			Transect sampled
		Medicine	Food	Raw Materials	
Species with high indigenous uses	*Albizia adantifolia*	√	√	√	3
	Alchornea cordifolia	√	√	√	1, 2 & 3
	Alstonia congensis			√	2 & 3
	Bambusa vulgaris			√	2 & 3
	Elaeis guineensis		√	√	2 & 3
	Mitragynale dermannii			√	2
	Spondias mombin	√	√	√	2 & 3
	Musa sapiantum		√		1 & 3
Vulnerable (VU)	*Mitragynale dermannii*				2
Alien Species	*Chromolaen aodorata*				1 & 3
Invasive Species	*Chromolaen aodorata, Mimosa pudica, Mimosa invisa and Schrankia leptocarpa*				1 & 3

Source: MCNL, 2019

4.11.2.2.9 Indigenous Uses of Plant Resources in the Study Area

The indigenous uses of the various plant resources censured in the study area were evaluated via interviews.

Table 4.26: provides information on the various indigenous uses of the flora resources inventoried

Table 4.26: percentage summary of Indigenous Uses of Censored Species

Indigenous Services	% of species used	Some representative species
Food, vegetables, nuts, fruits and	6.15	*Elaeis guineensis, Musa sapiantum,*

seeds		*Spondiasmombin, Afromomum sp.*
Fuelwood and charcoal	13.85	*Berlinia grandifloria, Musanga cecropioides, Albiziaadiantifolia, Mitragynale dermannii*
Medicinal	28.57	*Albizia adiantifolia, Alchorneac ordifolia, Anthocleista procera, Stachytarpheta spp*
Fodders	13.85	*Cyperusiria, Urenalobata, Triumfetta spp, Spondias mombin, Alchornea cordifolia*
Fibre	9.23	*Bambusa vulgaris, Elaeis guineensis, Raphia hookeri, Triumfetta spp*
Tannin	1.54	*Alstonia congensis*
Sundry products	6.42	*Costusafer, Elaeis guineensis, Raphia hookeri*
Wrapping leaves	7.69	*Musa sapiantum, Mitragynale dermannii, Alchornea cordifolia, Costusafer*
Wattles	7.69	*Piliostigmathon ningii, Elaeis guineensis, Urenalobata ,Triumfetta spp*
Pole	3.08	*Bambusa vulgaris, Mitragynale dermannii*
Green manure and soil reclamation/erosion control and shade from sun	26.15	*Albizia adiantifolia, Desmodium spp, Senna spp., Sida spp, Alstonia congensis, Spondias mombin*
Roof Trusses(Roof rafters) and Purloins	4.62	*Bambusa vulgaris, Elaeisguineensis, Raphia hookeri*
Frames for doors and windows and Stairs	7.69	*Albizia adiantifolia, Alstonia congensis, Mitragynale dermannii ,Pycanthus angolensis, Bambusa vulgaris*

Source: MCNL, 2019

Forty-seven (47) species representing about 72.31 % have indigenous uses. *Elaeis guineensis, Bambusa vulgaris, Albizia adantifolia, Mitragynale dermannii, Albizia adantifolia, Spondias mombin* and *Musa sapiantum* are the most used plant species in the study area as a result of the wide range of products they offer. This include; Medicine, fuel wood, raw material (wood for construction of bridge, houses and electric pole, etc.). On the other hand, *Clappertonia ficifolia, Crotalaria retusa, Eclipta alba, Hewittiasu blobata, Hydroleap alustris* and *Ipomoea asarifolia* were without use due to the lack of product they offer. The inventory of some species in one plot with reduced individuals is a worrying sign of over harvesting. Plate 6.9 shows some of the indigenous uses.

(a) Timber (b) Fuelwood (c) Charcoal

Plate 4.9 (a-c) Products from plant taxa censored

4.11.3 Fauna Study
4.11.3.1 Study Methodology

Direct sight

Diurnal expeditions to recognize evidence of fauna wildlife presence was undertaken. Formal transect surveys of Herpetofauna, Aves fauna and Mammalia fauna were conducted simultaneously, using transects already established for flora sampling (Table 4.20). The transect was walked slowly and all fauna encountered were carefully observed. Pictures of the trapped as well as the sighted fauna were taken where possible and identified to the lowest possible taxa by specialist at the Department of Zoology and Environmental Biology, University of Calabar.

In addition, small mammals were systematically surveyed by setting small Elliot traps; baited with rolled oats with a mixture of peanut butter and honey. Trapped individuals were marked on the ears to identify subsequent recaptures, and then released. Pictures of the trapped as well as the sighted mammals were taken where possible and identified to the lowest possible taxa specialist.

Also, small birds were systematically surveyed by setting small caging traps, baited with ripe fruits, seeds and grains. Trapped individuals were marked on the ears to identify subsequent recaptures, and then released. The trapped as well as the sighted birds were snapped where possible and identified to the lowest possible taxa specialist.

Appropriate field data sheets were employed to capture information like species list with scientific, common names, local names and abundance.

Indirect observations

The recorded evidence was represented both by direct (collections and observations) and indirect (tracks, footprints, scats/faces, feeding activity, tracks, holes/diggings or scratching and carcass). Local land users were also interviewed about fauna they had seen or hunted in the area, and these were identified from pictures in Powell (1993). The local language names were recorded. Other information gathered from the locals includes habitat history, faunal distribution pattern, seasonal migration, harvesting methods and threats to biodiversity in the study area.

Conservation Statuses

The global conservation status of all species was obtained from the IUCN Red List of Threatened Species Version 2019-1. IUCN categories rank the relative risk of individual taxa becoming extinct in the wild based on a set of standardized criteria.

4.11.3.2 Result

4.11.3.2.1 Herpetofauna

Result showed that herpetofauna species were censured across the three habitat types in the study area. Table 4.27 shows this information.

Table 4.27: Herpetofauna in the study area

Taxa	Species	Common name	IUCN status	Abundance		
				Tran.1 (GL)	Tran.2 (FS)	Tran.3 (SF)
Amphibian	*Limnonectes malesianus*	River frog	LC	2	3	1
	Ptychadena	Grass frogs	LC	4	1	

	oxyrhynchus					
	Hyperodius concolor	Tree frog	LC			3
	Rana lithobates	Frog	LC	5	1	3
	Leptopelis hyloides	African Tree Frog	LC		2	
	Amietophrynus maculata	Savannah Toad	LC	2		
Reptile	*Agama agama*	Common rainbow lizard	LC	7	2	2
	Mabuya spp	Skink	LC	2		1
	Panaspistogoensis	Togo Skink	LC		1	
	Bitis arietans	African puff adder	LC		2	
	Grayiasmythii	Smyth's Water snake	LC		2	

LC = Least concerned, Tran. = transect, GL = opened grassland, FS = freshwater swamp, SF = secondary forest

Source: MCNL, 2019

As could be seen in Table 4.27, grassland recorded the highest number of species and species abundance. This indicates the relative preference for this habitat by herpatofauna in the study area, especially the amphibian species. This could be attributed to the presence of lesser threat, sunlight for basking and the availability of food and breeding grounds provided by this habitat in the area.

In terms of species abundance, reptilian group recorded a lower attendance with 19 individuals compared to Amphibians with 25. Reptiles are biological predators of Amphibians; hence, the lower abundance of the former promotes habitat proliferation by the later. Also, reptiles are hunted by man and predatory birds, which might possibly, be responsible for their low diversity and abundance in the study area. Expectedly, the Common rainbow head lizard (*Agama agama*) was the most abundant herpetofauna species censored. A single individual of the Togo Skink was sighted.

There was no species of conservation interest in the study area. In situ conservation in reserves is suggested since this group of herpetofauna play important role in ecosystem balancing and moderation.

4.11.3.2.2 Avifauna

Species richness

Species richness is the number of different species represented in an ecological community. A total of seventeen (17) sighted avian species were censored. Some of the species censored include; *Milvus migrans, Necrosyrtesmonachus, Polyboroid estypus, Streptopellas emitoquata and Turturbrehemeri*. Table 4.28 is a summarized avian check list for the study.

Table 4.28: checklist Ave fauna in the study area

Species	Common name	IUCN status	Abundance		
			Tran.1 (GL)	Tran.2 (FS)	Tran.3 (SF)
Milvus migrans	Black kite	LC	*	1	
Necrosyrtes monachus	Hooded vulture	LC		*	*
Polyboroidestypus	African harrier hawk	LC		1	2
Rallusca erulescens	African rail	LC		2	
Cypsiurusparvus	African palm swift	LC		1	1
Apus affinis	Little swift	LC		2	2
Muscicapacassini	Cassins flycatcher	LC		2	
Muscicapaocreata	African flycatcher	LC			1
Streptopelias emitoquata	Red eyed dove	LC		1	
Turturbrehemeri	Blue headed wood dove	LC			1
Treron calvus	African green fruit pigeon	LC		1	
Numida Meleagris	Guinea fowl	LC	*		*
Tyto alba	barn owl	LC	*	1	
Strix alba	Owl	LC			*
Milvus migrans	Black Kite	LC		2	
Tockus fasciatus	African Pied Hornbill	LC		*	2
Turturbrehemeri	Wood dove	LC		2	

Ploceus philippinus	Weaver bird	LC	3	2	2
Passer domesticus	Sparrow	LC	6	1	4
Pycnonotus barbatus	Garden bulbul	LC	2	7	4

* = sampled via indirect evidence, LC=Least concern, Tran. = transect, GL = opened grassland, FS = freshwater swamp, SF = secondary forest

Source: MCNL, 2019

Freshwater swamp (Transect 2)is host to 76 % of the bird diversity. Their preference for this habitat could be linked to food resources and breeding grounds offered by the relatively closed vegetation cover at the site.

Plate 4.10 is a representative picture of the avian taxa.

Milvus migrans *Turtur brehemeri* *Streptopella*s emitoquata

Plate 4.10: Representative avian taxa censored

Species abundance

A total of 56 individuals were censored across the stations. The findings revealed that *Pycnonotus barbatus*as the most abundant species accounting for about 23% of the total counts. Backland 1994 recorded similar species abundance and attributed their dominance to adaptability to a variety of habitats.

Species Frequency

Bird species frequency was also evaluated. *Ploceus philippinus*, *Passer domesticus* and *Pycnonotus barbatus* were the most frequent taxa, being observed across the three transects sampled. On the other hand, *Rallusca erulescens*, *Muscica paocreata*, *Streptopelias emitoquata*, *Turturbrehemeri and Treron calvus* were some of the taxa sited only once. The species observed in at least two different transects are usually highly adaptable to wider habitat variation and food source. Those observed in only one habitat are highly specific and enjoy territorial dominance. However, they encounter declining population and range when their habitat is challenged with threats.

Migratory Species

Some avian species are known to migrate. Avian migration is either regular or irregular (Nomadic interruption or invasions) seasonal movement between north and south. Avian migration is usually driven by food, habitat and changes in weather conditions. These movements are usually between breeding and wintering grounds (Veen *et al.*, 2014). In Nigeria as in other countries in the Northern hemisphere, migratory birds commence this movement between February, March and April to warmer areas and return between August, September and October to winter grounds. Migratory movement often results in high mortality and predation. In this study, *Polybroides typhus* was the sole migratory specie sighted. Details are shown in Table 4.29.

Table 4.29: Details of migratory birds censored in the project area

Species	Local Name	IUCN status	Habitat	Nesting Grounds	Breeding season	Major threats	Conservation actions
Polyboroides typus	African harrier hawk	LC	SSF	Tree tops and branches	September to march	Habitat loss.	Colony protection

Source: MCNL, 2019

Plate 4.11 is a picture of the *Polyboroides typus*

Polyboroides typus

Plate 4.11: Migratory Species of the study area

Raptors

A diurnal predatory bird that hunts and feed on rodents, insects and small animals exerts strong biodiversity in fluencies on the ecosystem. In such environments, they act as key stone species by regulating their prey population. Some are known as 'Earth Cleaners; for their role in eating up dead carcasses. Raptors are members of Accipitridae, Pandionidae, Sagittaridae, Falconidae and Cathartidae of Acciptriformes, Apodidae and Falconiformes orders (Fowler *et al.*, 2009). *Polyboroides typhus* and *Necrosyrtesmonachus* the only raptor species censored in the study. Table 4.30 shows details of this species.

Table 4.30: Raptors of the Study Area

S/N	Species	Common Name	Prey
1	*Polyboroides typus*	Harrier hawk	Rodents, bats, birds, amphibians, lizards and insects
2	*Necrosyrtesmonachus*	Hooded vulture	Carcass, rodents, bats, birds, amphibians, lizards and insects

Source MCNL, 2019

Species of Conservation Interest

Analysis for the conservation status of the species censored in the project area was conducted using the IUCN 2018-2 Red List of Threatened species. *Necrosyrtesmonachus* is the only species of conservation interest as it is categorized as Vulnerable (VU) by the IUCN.

Necrosyrtesmonachus

Plate 4.12: Migratory Species of the study area

4.11.3.2.3 Mammals

Species Diversity

This is the record of all censored taxa in a sampled area. A total of eleven (11) Mammalian species were censured in the study area. These include six sighted species and the 5 species censured via indirect evidences. Table 4.31 shows details of the findings.

Table 4.31: Result of Mammalian fauna in the study

Species	Common name	Family	IUCN status	Abundance		
				Tran.1 (GL)	Tran.2 (FS)	Tran.3 (SF)
Civetticuscivetta	African civet	*Molosidae*	LC		*	
Nandinabinotata	African palm civet		LC		*	
Potamocho erusporcus	Red River Hog		LC		*	

Tragelaphus spekii	Sitatunga or marshbuck	*Nycteridae*			*	
Tragelaphus scriptus	Bush buck	*Sciuridae*	LC		1	
Heliosciurus rufobrachium	Red-legged sun squirrel	*Hystricidae*	LC		2	1
Cricetomys Gambianus	Northern Giant Pouched Rat	*Soricidae*	LC		*	*
Chaerephon nigeriae	Nigerian free-tailed bat	*Thryonomyidae*	LC		3	
Chaerephon pumilus	Little Free-tailed Bat	*Herpestidae*	LC		1	
Ratturattus	Common rat	*Muridae*	LC	2		1
Chrotomyswhiteheadi.	striped shrew-rat		LC	4	1	2

* = sampled via indirect evidence, LC=Least concern

Source: MCNL, 2019

The species sighted in the study area were *Tragelaphus scriptus, Heliosciurus rufobrachium, Chaerephonnigeriae*, *Chaerephonpumilus*, *Ratturattus* and *Chrotomyswhiteheadi*. Except for *Ratturattus* and *Chrotomyswhiteheadi* that were sighted at transect 1 (grassland), the remainder species were censored in either the secondary forest or fresh water habitats. The freshwater was the preferred habitat for mammals in the study area, since three of the six sighted species were sighted solely in this habitat. Availability of food, breeding grounds, vegetative cover and the absence of predation and noise are possible attractive features as they provides luxurious habitat for mammals.

Species Abundance

The total number of individual sighted where twenty-four (24) with *Chrotomyswhiteheadi* accounts for seven (7), *Ratturattus* and *Heliosciurus rufobrachium* accounting for three (3) individuals.

All three individuals of the Nigerian free-tailed bat were censored in the fresh water (Transect 2). The presence of fruit producing tree species could be the causal factor of their preference for this habitat. The abundance of bats population in relation to pollinators and as prey for important bird species is imperative for efficient ecosystem functioning. However, bats are specifically vulnerable to habitat change such as illumination and physical obstructions caused by electrocution.

IUCN Status

All sighted species were of Least Concern (LC) status using the IUCN Red list 2019 version one criterion. The major threat for all the species is hunting. No endemic mammalian species was recorded.

4.11.4 Protected Areas

Across Nigeria, there are at least 23,608.34km2 (or 2,360,800hectares) of land that are designated by national authorities as scientific reserves with limited public access, national parks, natural monuments, nature reserves or wildlife sanctuaries, protected landscapes, and areas managed mainly for sustainable use.

There was no protected area in the project area.

4.11.5 Key Ecological Problems

Commencement and operations of developmental projects shall result in the following ecological problem:

- the direct removal or disturbance of plants, animal
- increased flooding of the area as the area is prone to flooding
- Species migration occasioned by developmental activities (noise) and poor enforcement of Woodland

4.12 Social Environment

4.12.1 Political context

Nigeria is a Federal Republic made up of 36 States and a Federal Capital Territory. Nigeria became an independent state in 1960 and a republic in 1963. It started off with three regions namely Eastern, Northern and Western regions until a fourth; the Mid-West region was created in 1963. Nigeria experienced the first military coup in 1966, and a thirty-month civil war from 1967 to 1970. The military government created 12 states from the four regions in 1967. Between 1967 and 1996, the 12 states were further divided into 19, then 21 and finally 36 states. Delta State was created in 1991 out of the then Bendel State. Delta State currently has 25 LGAs, including Sapele. Sapele LGA as in all others in the State, is run by an elected Executive Chairman and elected Counsellors. The Chairman appoints cabinet to assist in performing the executive functions of the Local Government.

Table 4.32: administrative structure of Nigeria and the project affected area

<table>
<tr><td colspan="3">System of Government
Nigeria operates a Three tier arms of government. Federal, State and Local Government Area. She operates a Presidential System of Government</td></tr>
<tr><td rowspan="5">Federal Arm</td><td colspan="2">Executive - Implementation of laws, maintenance of law and order, initiates bill into parliament. It is headed by a President</td></tr>
<tr><td colspan="2">Legislature- Nigeria operates a bicameral (Senate and House of Representatives) legislature. They make laws, approves annual budget, ratification of treaty negotiated by the executive and conduct over sight functions on government activities. The senate is headed by Senate President and the House of Representative is headed by a Speaker</td></tr>
<tr><td>Senatorial District</td><td>House of Representative</td></tr>
<tr><td>There are 109 senatorial districts in Nigeria. The project area is represented by a senator representing the Central Senatorial (Delta state).</td><td>There are 360 House members in the national assembly. Delta State has ten members. The project is located in Amukpe and it is under Sapele/Okpe/Uvwie federal constituency.</td></tr>
<tr><td colspan="2">Judiciary - There is the supreme court, appeal court, federal courts, Industrial court, customary courts of appeal and magistrate court. They Interprets laws, protects the right of individuals. It is headed by a Chief Justice</td></tr>
<tr><td rowspan="3">State Arm of Government</td><td colspan="2">Executive- There are 36 states in Nigeria and the Federal Capital Territory. The Executive arm of the state government is headed by an elected Governor. The proposed project is located in Delta State.</td></tr>
<tr><td colspan="2">Legislature - Each state operate a unicameral system headed by a Speaker.</td></tr>
<tr><td colspan="2">Judiciary - There is the State High court, customary courts, and Magistrate courts. The head of the state judiciary arm is the Chief Judge.</td></tr>
<tr><td rowspan="2">Local Government Arm of Government</td><td colspan="2">Executive- The executive arm is headed by a Chairman. This arm performs similar functions to that of the President and Governor at federal and State levels respectively.</td></tr>
<tr><td colspan="2">Legislature - The legislature is formed by at least ten wards in each LGA. The make bye laws for the LGA. It's headed by the Leader of the House. Each Local Government is represented at the State House of Assembly by an elected member of the Local Government.</td></tr>
<tr><td>Amukpe Community</td><td colspan="2">The traditional administration in Amukpe is headed by His Royal Majesty (also called Duke) and His cabinet which comprises of the Chiefs-in-Council and Elders-in-Council. The administration also recognizes the Women Leader and the Youth Chairman who administer justice in the women and youth folk respectively and report regularly to the Duke</td></tr>
</table>

4.12.2. Demography

Table 4.33 provides information on demography of the project area; and Table 4.34 relates the relevant livelihood indices in the project state.

Table 4.33: Demography of the project area

<table>
<tr><td colspan="2"></td><td>General statistics in Nigeria</td><td>Delta State</td><td>Sapele LGA</td></tr>
<tr><td colspan="2">Total population (2006 Census)</td><td>140,431,790</td><td>4,112,445</td><td>174,273</td></tr>
<tr><td colspan="2">Projected population (2020 based on an exponential growth rate of 3.2%)</td><td>219,803,838</td><td>6,436,798</td><td>272,772</td></tr>
<tr><td colspan="2">Total Area of Land</td><td>923,763km2</td><td>17,698km2</td><td>450km2</td></tr>
<tr><td colspan="2">Population Density</td><td>198.6/km2</td><td>17,108 km²</td><td>533.3 persons/km2</td></tr>
<tr><td colspan="4">Population Distribution</td><td></td></tr>
<tr><td colspan="2">Men</td><td>71,345,488</td><td>2,069,309</td><td>86,167</td></tr>
<tr><td colspan="2">Women</td><td>69,086,302</td><td>2,043,136</td><td>88,106</td></tr>
<tr><td colspan="2">Children (age 0-14)</td><td>41.8%</td><td>31.8%</td><td>67,446</td></tr>
<tr><td colspan="2">15–29</td><td>25.4%</td><td>26.0%</td><td rowspan="2">99,798</td></tr>
<tr><td colspan="2">30 -44</td><td>18.0%</td><td>21.9%</td></tr>
<tr><td colspan="2">Elderly (>65)</td><td>3.2%</td><td>4.45%</td><td>7,029</td></tr>
<tr><td colspan="2">Population (2010)</td><td>159,538,079</td><td>4,112,445</td><td></td></tr>
<tr><td colspan="2">Literacy rates</td><td>59.6</td><td>69.9%</td><td></td></tr>
<tr><td colspan="2">infant mortality level</td><td>64.8/1000 live births</td><td>0.00648%</td><td></td></tr>
<tr><td colspan="2">life expectancy</td><td>55 years</td><td>49Years</td><td></td></tr>
<tr><td rowspan="2">Youth Literacy in any Language</td><td rowspan="2">Female</td><td>63.7</td><td>90.4</td><td></td></tr>
<tr><td>79.3</td><td>85.4</td><td></td></tr>
</table>

Source: National Population Commission of Nigeria

Table 4.34 Relevant livelihood indices in the project states

<table>
<tr><td>Livelihood Indices</td><td>Nigeria</td><td colspan="2">Delta state</td></tr>
<tr><td>Population (2010)</td><td>159,538,079</td><td colspan="2">4,112,445</td></tr>
<tr><td>Literacy (%)</td><td>59.6</td><td>Male</td><td>Female</td></tr>
<tr><td>Youth Literacy in any language</td><td>72.8</td><td>90.4</td><td>85.4</td></tr>
<tr><td rowspan="2">Adult literacy in English language</td><td rowspan="2">53.8</td><td>Male</td><td>Female</td></tr>
<tr><td>83.8</td><td>74.5</td></tr>
<tr><td>Infant Mortality</td><td>64.8/1000 live births</td><td colspan="2">38/1000live births</td></tr>
<tr><td>Life expectancy</td><td>55 years</td><td colspan="2">49 years</td></tr>
</table>

Source: NBS (2012)

4.12.3 Community and Household Consultation

Community consultation is an inclusive and culturally appropriate process which involves sharing information and knowledge, seeking to understand the concerns of others project affected persons and building relationships based on collaboration. It allows the community to understand the risks, impacts and opportunities of the project in order to achieve positive outcomes. It involves information dissemination and interaction/dialogues with the host community of the proposed project.

4.12.4 Conflict Resolution

Civil cases in the community are arbitrated by the Royal Majesty (Duke) with His Chiefs-in-Council and Elders-in-Council, -religious leaders, traditional priests, age grade, women groups or family heads. On the other hand, inter-communal conflicts are resolved by the representatives (Chief) of the communities involved. If it cannot be resolved at that level, the case is taken to the Paramount ruler for adjudication.

Criminal cases are referred to the government law enforcement agents. It is of interest to note that this community has never recorded any case of security threat. Nevertheless, the community members have themselves into vigilante groups to compliment the security architecture provided by the State.

With respect to the project, predicted sources of conflicts include

- Non-recognition of community as critical stakeholders
- Border land disputes
- Agitation for employment/contracts
- Perceived intimidation of the community
- Perceived "divide and rule tactics"
- Ineffective communication channels

This study did not find any specific current issue that could conceivably lead to full blown conflicts with the Wood Land Project.

4.12.5 Socio Economic Sampling Approach

Socio economic information was gathered from three sources: Key Informant Interview (KII), Focus Group Discussion (FGD) and Household Questionnaires.

The KII was organized with the chief and elders of host community (Amukpe) at the Amukpe town Hall. In a similar manner, FGD meetings were held with representatives from the youths, women, traders/business owners, famers/hunters and fisher men from Amukpe community.

The household questionnaires were administered on a Household basis. The questionnaires were administered to about 75% of the 125 available homesteads within the project area. The people were assisted (mainly in pidgin and local dialects) in responding to the questionnaires. A total of 94 questionnaires were administered and 85 were retrieved representing a success rate of 90%.

Table 4.35: Socio Economic Sampling Protocols

Group /Nature of Interview	Relevance	No of Households/ Community	Household/ Community Number Interviewed	Number and % of Questionnaires retrieved	Date of Interview	Venue
Household hold questionnaires	To obtain socio economic profile of households found on 1 km sphere of the proposed project site	125	94	85(90%)	4th to 6th October 2019	Homestead of each persons within the $2km^2$ radius
Issues discussed at Scoping workshop (3rd October) and during ESIA (4^{th} – 6^{th} October 2019)						

<table>
<tr><td>Key Informant Interview (KII)</td><td>To obtain indepth information from professionals and residents</td><td colspan="2">Issues discussed with Amukpe elders' forum include the impacts of the project on the community as well as the implementation of the MOU signed by woodland with the stakeholders.</td><td rowspan="5">4th October 2019</td><td rowspan="5">Hampshire Hotel and Resort No 5/8 Miller Close GRA, Sapele</td></tr>
<tr><td rowspan="4">Focus Group Discussion</td><td rowspan="4">This was done to harvest specific information affecting youths, women, farmers and fisher men of the project area</td><td>Women in Amukpe</td><td>They called for livelihood restoration programs for those who will be affected by the re construction activities</td></tr>
<tr><td>Youths in Amukpe</td><td>They called on employment opportunities business</td></tr>
<tr><td>Fishermen in Amukpe</td><td>They expressed their worries over the future of their business when woodland commences operation Business</td></tr>
<tr><td>Market women in Amukpe</td><td>They called for them to be allowed to supply foods in the base camps and expressed optimism that their turn-over will increase due to increased population in the area</td></tr>
</table>

Source: MCNL, 2019

4.12.6 Population and Sex

The population distribution of the respondents according to gender and age in the project area are presented in Table 4.36

Table 4.36: Respondent population age and sex

Age Bracket	Number/ % of male	Number/ % of female
1-18	10 (11.8)	9 (10.6)
19-39	20 (23.5)	14 (16.5)
40-65	8 (9.4)	13 (15.3)
>65	5 (5.9)	6 (7.0)

Source: MCNL, 2019

Persons within the age bracket of 19 and 39 years formed the bulk of the population (40%), while those above 65 year of age were the least (below 13 %) represented in the project area.

This implies that the community has able-bodied labour force that could participate actively in the various activities that will take place during the construction and operation phase of the wood processing factory.

However, according to the Annual Abstract of Statistics 2012, persons within the age bracket (0-18) form the bulk of Nigerian population. This was in line with present study as most of the respondents indicated to have housing between 2 – 4 minors in their houses. Igwe (2019) attributed urban pull factors as a determining criterion in age bracket configuration in Niger Delta.

4.12.7 Gender of Heads of Household

Information on the gender of household heads in the project area revealed a 4:1 ratio for male to female heads of households respectively.

The 80% male household head is less than the Nigerian average of 85.7% but competes favourably with 76.6% for South-South states. This implies lesser female house heads in the project area compared to the 23.4 % South-south average. This further confirmed the lower life expectancy for men in Delta State in relation to the average for the South-South states.

4.12.8 Marital Status of Head of Household

Table 4.37 shows the marital status of heads of household.

Table 4.37 Marital status of heads of household in percentage

GENDER	Single	Married	Widowed	Divorced/Separated	TOTAL
Respondents (%)	27	60	10	3	100

Source: MCNL, 2019

The married status of respondents of 70% (60% married and 10% widowed) recorded in the project area is less than the Nigerian average of 77.4% but slightly higher compared to the South-South average of 65.7%.

It was observed that most of the household heads that are widowed are females. In addition, there are more married and single household heads in the project area that the average for Nigeria.

Furthermore, it was observed that 66.5 % of the respondents in the project area practice polygamous marriages; above the Nigerian and South-South averages of 60.7 and 57.7% respectively. The culture of the people as espoused by the respondents, which does not prohibit men from more than one wife, is a contributory factor.

4.12.9 Household Size

Information on household size of the respondents in the project area is presented in Table 4.38

Table 4.38Household Size of Respondents

Range of household Size	Number of Households	%
1-2	13	15.29
3-5	52	61.18
6-10	19	22.35
11-15	1	1.18
>15	0	0.00

Source: MCNL, 2019

The dominant household sizes among the respondents are those made up of 3-5 persons followed by those with 6-10 persons; which together accounted for about 83 % of the households. The findings are in tandem with 2012 NBS statistics which put the average family size in Delta State at approximately 4 persons. At the national level, the number of persons in the size class 3-5 was about 43million as against 93 million for those with 6 - 8 people's size class. The data also revealed a linear correlation between natures of households' marriages with family sizes.

4.12.10 Ethnic Composition

Nine ethnic groups were observed to be present within the project area. These ethnic groups and their respondent populations in the project area is presented in Table 4.39

Table 4.39 Ethnicity of the respondent in the Project Area

Afemai	Anioma/ibo	Edo	Isoko	Ijaw	Itsekiri	Okpe	Urhobo	Yoruba	Hausa/Fulani
1.4%	5.2%	2.7%	12.3%	2.7%	5.2 %	44.1%	23.8%	1.4%	1.2%

Source: MCNL, 2019

Data revealed the dominance of the Okpe and Urhobo people in the project area. The results also revealed high relationship between the dominant groups among the respondents and the contiguous ethnic groupings. This was evident in the presence of Anioma/ibo, Iteskiri, Ijaw, Afemai and Isoko. The presence of Yoruba and the Hausa/Fulani ethnic groups reflects the cosmopolitan nature of the project area. The assortment of ethnic groups in the project area implies the hospitable nature of the host community.

4.12.11 Religion

The study revealed that the people in the project area observe three religions. These are Christianity, African Traditional Religion (ATR) and Islam. Christianity was the most practiced religion with about 86 % of the respondents in the project area. This was followed by ATR with 11.2 %. While about 2.8 % were adherents of the Islamic Faith. This information is presented graphically in Fig 4.8

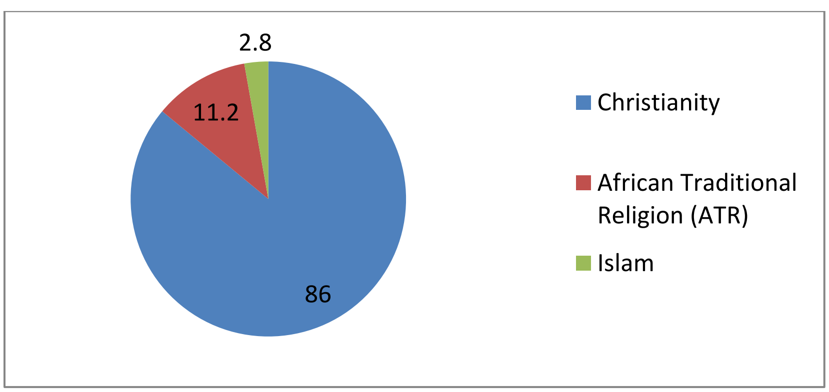


Figure 4.8: Main religious groups in the project area

The adherents of these various religions observe one festival or the other. For example notable African traditional festivals in the project area is the Igbe. The Islamic and Christianity adherents in the area observe the world wide traditional Muslim and Christian festivals respectively.

4.12.12 Existing Infrastructures

4.12.12.1 Educational Facilities

Field survey, information from questionnaires, and responses during FGD's revealed that five schools are present within the project concession area. Table 4.40 showed the names, category and ownership of these schools.

Table 4.40: Education facilities within the project sphere of influence

S/N	Name of school	Category	Ownership
1	First Oxford College	Primary	Private
2	Sapele Technical College, Amukpe	Secondary	Public
3	Okpe Grammar School, Amukpe	Secondary	Public
4	Merit Mixed secondary school	Secondary	private
5	Delta state school of midwifery	Tertiary	public

Source: MCNL, 2019

From the Table, about 60 % of these schools are publicly owned, with affordable tuition fees. The baseline study revealed a commendable manpower in virtually all the schools in the project area. About 60% of the schools have basic facilities like water supply and toilet. However, the teachers reported inadequate instruction materials.

Field expeditions also revealed the presence of several primary schools and secondary schools around Amukpe community. A good number of them are privately owned and charges high tuition fees that many of the households cannot afford. In addition, privately owned adult literacy schools and skill acquisition centres are available in the project area; which improves the literacy level among adults and enhances availability of middle level man power. Plate 4.13 showed pictures of some schools in the project area.

Sapele Technical College, Amukpe   Delta State School of Midwifery, Amukpe

Plate 4.13: Some Schools in the project sphere of influence

4.12.12.2 Water facilities

This refers to any improvements used in the collection, treatment, or distribution of water for the beneficial uses including uses for domestic, municipal, irrigation, power, and industrial purposes. Information on the number of boreholes as well as protected streams in the study area revealed that privately owned boreholes is the dominant source of water supply compared to communally owned boreholes. Less than 10 % of the respondents depend on communal borehole for their water needs.

4.12.12.3 Household Facilities

Several facilities were surveyed among households within the projects sphere of influence. These include power generators, televisions, cars/trucks and refrigerators (Table 4.41).

Table 4.41: Household Facilities among Respondents

Facilities	Power generator	Gas/ Kerosene stove	Refrigerator	Television	Radio/cassette/music system	Car/Truck	Motor Cycle	Bicycle	House in town	Land in town
% of respondents	41	76	32	41	65	7	21	5	9	12

**N/B the percentage may not sum up to 100 as some respondents may possess more than one household facility
Source: MCNL, 2019

Result on the survey of these facilities revealed that power generator, gas stove/kerosene, television, radio cassette player and refrigerator were the most common facilities among households in the project area. Cars and Motor cycle are the common means of transportation while the combined percentage of persons that own houses and/or land is less than 25% of the sampled population.

4.12.12.4 Household Construction Materials

The types of materials used in constructing household dwellings were also surveyed. These materials are those used in roofing, walling and flooring. These parameters are an indirect index of life quality of the respondents in the project area.

Roofing materials

Results on the roofing materials is presented in Table 4.42

Table 4.42: Roofing Materials

Material	Corrugated Iron Sheets	Asbestos	Aluminum roofing	Uncompleted roof
% of the respondents	65	4	30	1

Source: MCNL, 2019

The use of iron sheets, asbestos and aluminium accounted for about 95% of the roofing materials. The least used roofing material is asbestos, accounting for about 4%. The low percentage of uncompleted building in the area is indicative of the prevailing economic situation of the area. The data do not reveal any building with Bamboo/reed roofing.

Walling Materials

Results of household walling materials are presented in Table4.43

Table 4.43: Walling materials of respondent houses in the project area

Walling Material Type	Number	(%)
Mud	6	7.1
Concrete (blocks)	79	92.9

Source: MCNL Survey, 2019

As could be seen, mud and concrete were the walling material in the study area as revealed by the respondents. This indicates an urban status of the project area.

Plate 4.14: walling materials in the project area

Flooring Material

Table 4.44 is the results of flooring material from the study.

Table 4.44: Flooring materials of respondent houses in the project area

Material type	Number of houses	(%)
Earth/sand/dirt/straw	15	17.4
Smooth cement	30	35.3
Ceramic tiles	40	47.1

MCNL, Survey 2019

Earth/sand/dirt/straw, smooth cement and ceramic tiles are the flooring materials used in the study area as revealed by the respondents. Ceramic tile was the most used, indicating an urban living condition.

4.12.12.5 Transport Facilities

The project area is traversed by three main roads: The Benin- Warri express way, Eku-Oviri Road and Old Warri - Sapele Road as well as other smaller feeder roads linking the major roads within the project community, and unpaved roads connecting small villages and settlements
Public buses, cars and motorcycles are the major means of transportation in the project area. Public motor vehicles ply roads that link the project area to major towns while motorcycle transport is used for shorter distances and unpaved roads.

4.12.12.6 Communication Facilities

The people in the project area have access to mobile communication through fixed wireless lines provided by communication service providers like MTN, GLO, AIRTEL and NAIJAMOBILE. There are no postal services in the area but the inhabitants obtain news about other parts of Nigeria and the world through radio, television and the mobile handsets.

4.12.13 Health

This section presents the baseline health data based on information generated from sampled groups in the study area. Data obtained were subsequently compared with state and National data and averages that are available.

4.12.13.1 Health Facilities

The health facilities in the project comprise of Four (4) Primary Health Centres (PHC); namely, Amukpe Primary Health Centre (private), Oghenechuvwoko Clinic (Public), Sussy Clinic (Public) and Uyo Clinic (private). The grossly inadequate health facilities provide both out-patient and in-patient services. Principle cases are referred to Sapele central Hospital, Sapele Hope Clinic and Eternit Clinic available outside the project community.

4.12.13.2 Prevalence of Diseases in the Study Area

This study was conducted via visit to two health centers in Amukpe. It was revealed that the commonest and most prevalent diseases affecting all age groups in the area are Malaria Fever (32.8%), Upper Respiratory Tract Infection (21.8%), Typhoid Fever (11.7%), Diarrhoea/vomiting (10.5%) and Rheumatism (7.5%). Other common ailments include Worm Infestation, Diabetes Mellitus, Lower Respiratory Tract Infection, and Arthritis. The high prevalence rate of malaria could be explained by the following factors:

The abundance of mosquitoes (the insect vector of malaria, which consists predominantly of *Plasmodium falciparum*, and less of *Plasmodium vivax* and *Plasmodium malariae*);

- Presence of stagnant water;
- Absence of pest control practices, and
- Inadequate prophylactic drug supply.

4.12.13.3Traditional Medical Practice

The practice of traditional medicine was common in the area. Their practice commonly involved the use of herbs and body charms, body massaging and scarification were also common. The services offered by these practices are shrouded in secrecy. Traditional birth attendants are also popular. About 67% of respondents claimed they have either visited or are still visiting herbal homes for medical recipes.

4.12.13.4 Sexual Activities and Knowledge of Sexually Transmissible Infections (STI)

Human Immunodeficiency Virus (HIV) and Acquired Immune Deficiency Syndrome (AIDS) have become very important public health concern in Nigeria. However, there are no data on sexual practices, knowledge and beliefs about HIV/AIDS and other Sexually Transmissible Infections (STIs) in the study area. Therefore, several questions were included in this study to ascertain the level of their awareness about these health problems. Both men and women were asked about their sexual practices. They were also asked about what they believed was the mode of transmission of HIV and where they sought treatment for STIs. Condom use and availability were also reported. Expectedly, the respondents did not disclose information on the number of sexual partners they keep.

4.12.13.5Condom Availability and Use

Condoms serve as a good barrier to the transmission of HIV and other sexually transmissible infections. Respondents were asked about condom use. The data presented is limited to those who have had sexual intercourse. Condom was readily available in over 90% of the chemist stores. However, the average number used weekly could not be accurately verified. Survey across the project area indicate that overall, less than 30% of males and 35% of females aged above 15 years had never used condom before while over 20% of males and 30% females claimed they used condom only occasionally, mainly either for prevention of pregnancy or STI. Only less than 10% of sexually active males and 2% females use condom all the time (i.e. during every episode of sexual intercourse).

4.12.13.6Immunization Status in Children

The proportion of children under 5 years old immunized against DPT, BCG, OPV and Measles were 75% in the area. This figure was above the national target of 70% (BCG and TT for pregnant women) and over 65% for the other antigens in the National Programme on Immunization. Oral Polio Vaccine (OPV) was the most commonly received vaccine in the project community. This may partly be due to the OPV given during the National Immunization days (NIDs) set aside by the Federal Ministry of Health through the National Programme on Immunization every year. Each child below 5 years is expected to receive two drops of OPV during each round of NID. The fact that the few health facilities available in the community had inadequate record of immunization is an indication of the low practice of routine immunization.

4.12.14 Land planning and uses

Land ownership in the project area is either by community or family. However, by virtue of the Public Lands Acquisition Law, the state government may acquire land compulsorily for public purpose from individual land owners subject to the payment of compensation to such landowners. A lot of grazing activities is also practiced by the Fulani pastorals.

The population in the area is predominately made up of low and middle with few high-income earners. The residential areas and the surrounding sub-places consist largely of single unit residential homes. On the other hand, the rural settlements are sparsely populated with low cost, single unit dwellings on small stands. Majority of the inhabitants of the area live on lower income (see discussion on livelihood).

4.12.15 Educational Attainment

The educational attainment among respondents in the project area is presented in Table 4.45

Table 4.45: Educational attainment of the respondents

Education levels	No formal education	Primary	Secondary	CoE and polytechnic	University Degree
% of respondents	4.1	10.6	40.3	25	20

Source: MCNL, 2019

The high literacy level in the project area is exemplified by about 85.3% of the respondent population having secondary school or tertiary education. Those with having no formal education or primary education summed up to be 14.7%.

4.12.16 Occupation

The economic life of the community revolves mainly around trading and fishing. The percentage occupational distribution of the people is shown in Table 4.46

Table 4.46 Occupational distribution of respondents in the study area

Occupation	Farming	Pastoralist	Self-employed	Private employee	Public employee	Trading and Fishing
% of respondent	6	2	9	15	28	40

Source: MCNL, 2019

It is clear from the above that majority of the inhabitants in the project area are traders/fisher folks public and self-employee. Farming accounts for about 6% and the most commonly cultivated crops in the project area are cassava, maize, banana, okra, pepper and vegetables. Fruit trees are also cultivated in this area. They include mango, cashew, and guava among others. The area is also blessed with oil palm products. Those engaged in brewing of local gin jokingly referred to as Sapele Water.

4.12.17 Household Income levels

The income generating activities of the people in the project area include crop farming, trading, artisanship, livestock rearing, processing of farm produce, hunting, and fishing and self-employment... About 88% of the respondents in the area earn below N500, 000 per annum while 12% earned above N500, 000 per annum from all sources combined (See Table 4.47).

Table 4.47 Income Level in the project area

Annual Income (N)	Less than 100,000	100,000 – 199,999	200,000 – 299,999	300,000 – 399,999	400,000 – 499,999	500,000 +
Frequency (%)	15	20	18	26	9	12

Source: MCNL, 2019

The major hindrances to the economic development identified in the study area include low patronage of crop farming produce, lack of storage facilities for safe keeping of unsold farm produce, inadequate credit facilities to expand businesses, absence of electricity, poor access road that hinder intra mobility and inadequate safe drinking water. The rural access roads are usually inaccessible during the wet seasons thereby hindering movement to market. This results into large scale post-harvest loss.

4.12.18 Households' Main Source of Energy

The result on the survey of the sources of energy used by household in the project area is summarized in Table 4.48. A total of ten (10) energy sources for both lighting and cooking were identified in the area.

Table 4.48: Respondents Households' Main Source of Energy (%)

	Main electricity	Solar	Gas	Paraffin/ kerosene	Charcoal	Wick lamp	Candles	Firewood (biomass)	Generators	Touch light
Cooking	27	0	56	66	39	0	0	46	0	0
Lighting	88	1	0	13	0	12	2	0	41	87

Source: MCNL Survey, 2019

Electricity from the national grid is the main source of lighting in the project area. Other frequently used energy sources for lighting are generator and touch lights. Conversely, solar, candles and wick lamp were the least sources of energy used by the households.

On the other hand, kerosene followed by gas was the most used energy source for cooking. Generally, over 65% of the households in the project area use kerosene for cooking their meals. In addition, electricity was the least patronized energy source in the project area used for cooking.

4.12.19 Households' Main Source of Potable Water

A total of seven (7) portable water sources were reported to be used by households in the project area (water vendors, tanker trucks, bottled water, and surface water, boreholes, well water and Rivers). Result on the percentage usage of each of the water sources revealed that, water from boreholes was the most used by households in the project area. About 66% of households in the project area use water from boreholes. Other frequently used water sources are wells, water vendors and tanker trucks. The least used water sources were piped water, rain water, bottles water, surface water and rivers.

4.12.20 Waste Disposal by Households

4.12.20.1 Refuse disposal

The respondents in the project area get rid of their solid wastes by two means: open dumping and burning. Figure 4.9 shows the proportion of respondents in the two categories.

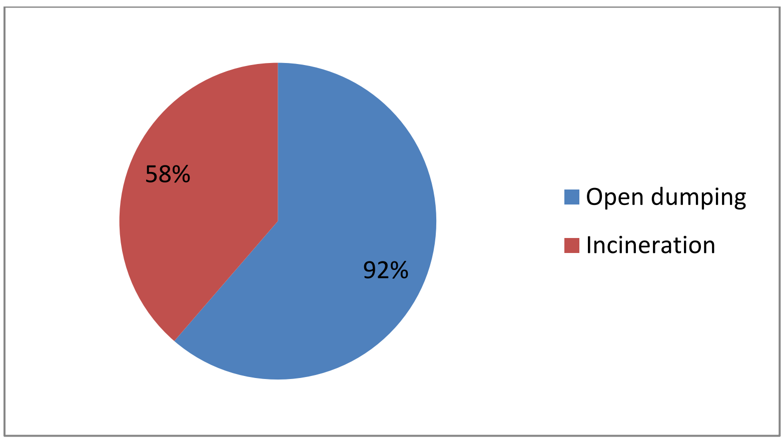


Figure 4.9: Refuse disposal methods by households

As could be seen, open dumping is the prevalent refuse disposal method in the area followed by refuse incineration though some households practice both methods.

4.12.20.2 Sewage disposal

Respondents employ three means to dispose their domestic sewage. These were water closet (WC), pit latrine and bush. Figure 4.10 showed the proportion of respondents in each category.

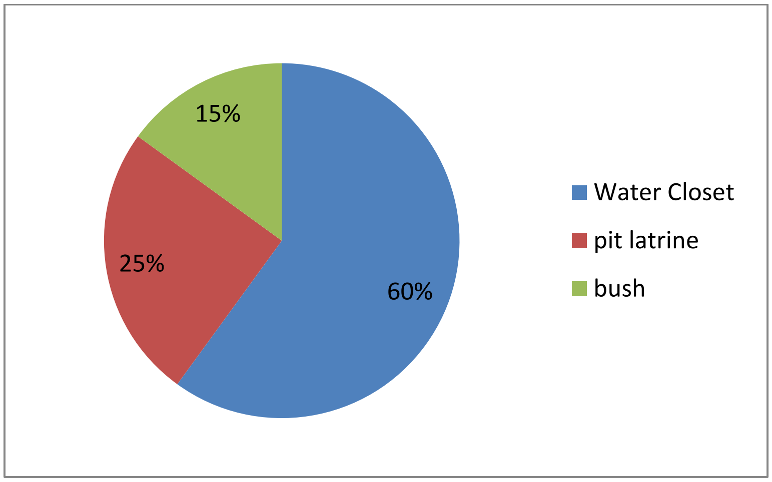


Figure 4.10: Sewage disposal methods by households

From the Figure 4.10, most of the residents in the area use water closet in their households followed by pit latrine and bush with the least.

4.12.21 Indigenous People

The IFC Performance Standard 7 recognizes Indigenous Peoples as social groups with identities that are distinct from mainstream groups in national societies. The survey showed that Okpe are the indigenous people in the study area.

4.12.22 Cultural Heritage Resources

There are no cultural heritage sites within 2 km^2 radius of the proposed project site.

4.12.23 Gender Issues

Data relating to gender issues were obtained using questionnaires. Male and female folks were separated and assisted in responding to the gender indicators parameter in the questionnaire. Result is represented in Table 4.49.

Table 4.49: Gender Parameters in Project Area

	Circumcision	Land ownership	Access to credit	Decision making at household	Decision making at community level
Male (%)	98	59	67	85	90
Female (%)	15	25	30	36	11

SOURCE: MCNL, 2019

4.12.24 Circumcision

The non-therapeutic alteration of children genitals is typically discussed in two separate ethical discourses; one for girls in which such alteration is conventionally referred to as Female Genital Mutilation (FGM) and one for boys which is conventionally referred to as male circumcision.

There is an increased risk of adverse health outcome with increase severity of FGM. Health agencies and medical practitioners are opposed to all forms of FGM and is emphatically against the practice being carried out by health care providers. Some of the effects of FGM include; severe pain, excessive bleeding, shock, genital tissue swelling and infection.

In the project area 15 % of the female respondents were circumcised which shows the need for increased FGM sensitization. This position was supported by Immigration and Refugee board (Okeke et al 2012). It was however observed that 88% of the circumcised female gender were above 50 years of age. Nigeria average for circumcision for male is 93.2% while for female is 27.8%. Personal communications in the field suggested sensitization on FGM as main reason for lower circumcision rate among female gender whose ages were less than 50 years.

4.12.25 Land ownership

There is a higher ratio of male land owners than female in project area. This is related to the culture of preferentially giving wealth to men over women on inheritance. It was reported by the respondents that it is customary for female folks to be excluded in sharing inherited properties. Nonetheless, the Nigerian average (NBS 2012) which showed a 5:1 in favour of the male folks closely mirror the findings of this report.

4.12.26 Access to credit

Banks and lending agencies including local thrift societies in the project area often establish one set of criteria for male folks and another, including a male surety for the female folks. The imperativeness to fulfil this criterion is perhaps a factor why obtained data do not correlate strongly with the Nigerian average which was put at 55:45 by NBS 2012.

4.12.27 Decision making at Household

Socio-cultural and religious bias in favour of the male folks in household decision process is evident in the data obtained. Households with proportionate decision-making process between the male and female partner reported degree of exposure educational background and working status of the female gender as influencing factors. The Nigerian average is almost at 1:1 (NBS 2012).

4.12.28 Decision making at community level

Same reasons adduced for decision making at household levels pertains here also. However, reserve of some exclusive traditional titles and roles for the female folks in the project area accounted for the higher proportionate representations in this parameter than the former. The data obtained in this report bettered the Nigeria average of 6:1 due perhaps primarily to the strong traditional institutions within the project area.

4.12.29 Consultation of stakeholders

Invitation to Scoping Workshop and Notification of Project

A letter was prepared introducing the Project proponents, the Project and inviting attendance and participation to the Scoping Workshop. These letter notifications were distributed to key stakeholder groups. Table 4.46 showed the concerns and expectations of the stakeholders raised during the scoping workshop organized by woodland Nig. Ltd at Hampshire Hotel, Sapele on the 3rd of October, 2019.

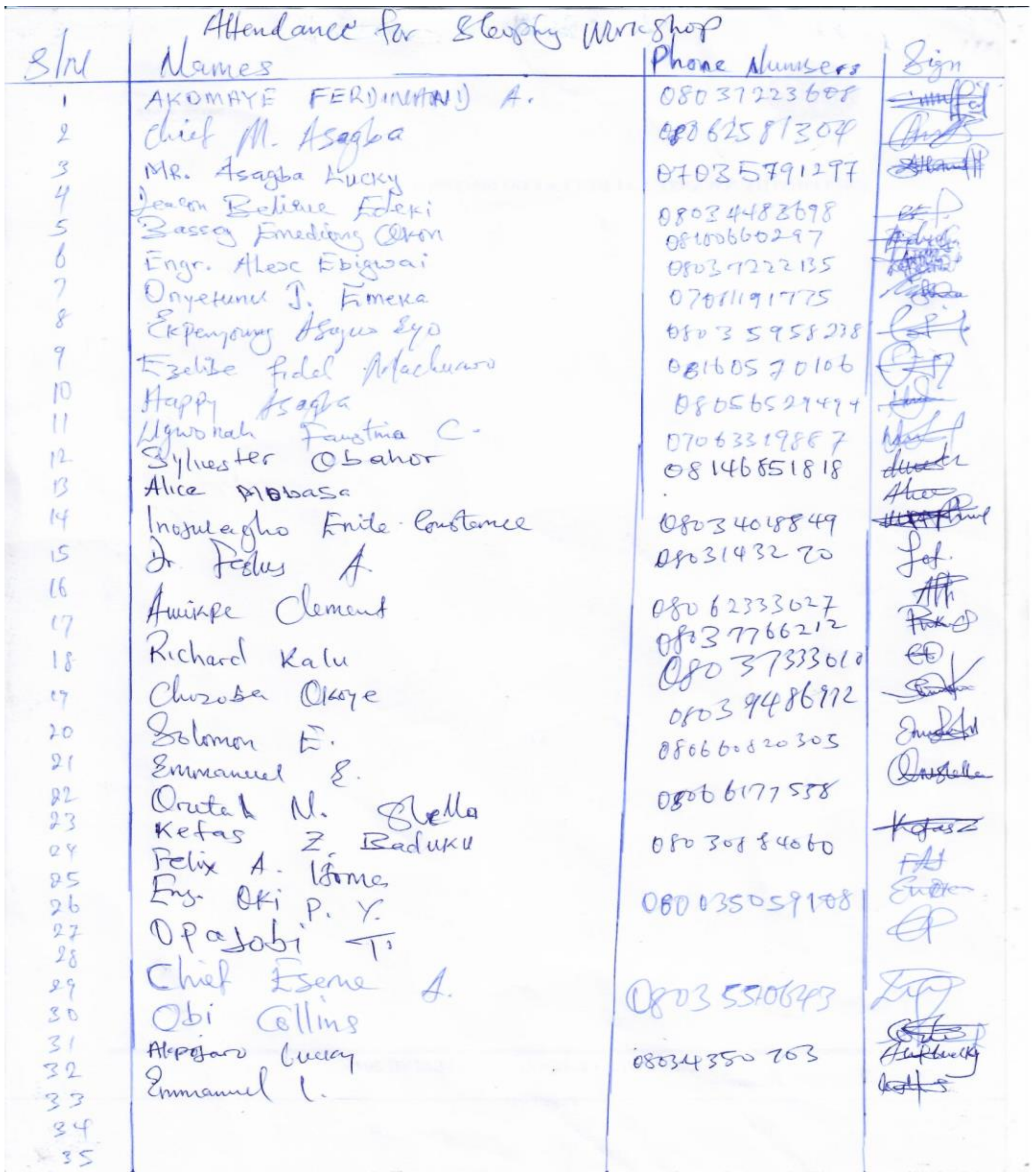
Table 4.50: Basic Questions/comments and response during the scoping workshop

NAMES	COMMENTS/QUESTIONS
MR. HAPPY ASAGBA (Vice chairman of Amukpe community)	I am optimistic that this project will work. Other companies that have settled here in the past care less for the community, but I hope Woodland would do better in this aspect: You are welcome to Amukpe
CHIEF M. ASAGBA (A.G Duke, Amukpe)	I am happy that this development is coming to Amukpe community; but I want to know more about the impacts on the community. Response by Mr. Onyetenu Emeka (FME): The project has been rated grade 2 by FME, so the impact is anticipated to be only within the factory. However, the impact may be significant on the community during the construction phase due to vehicular movement but Woodland would be advised by the ministry to recruit only professional drivers and install caution sign. We are not expecting any significant changes both on the environment and community
ONYETENU J. EMEKA (Federal Ministry of Environment, Asaba)	I understand from your presentation that Woodland will acquire her raw material from cut rubber plantations, but what are your restoration plans and the mode of transporting the raw material to the factory? Response By Engr. Alex Ebigwai: Wood land plan is that only designated areas with over-aged stands will be cut down and since the wood would be obtained from vendors, the plantation owner will be responsible for the replanting of cut trees. However, it takes about 6-7 years for rubber trees to regrow and Woodland will have agreement will plantation owners to make sure that deforested areas are restored. On mode of transportation, it will be mainly by road; however, visibility studies will be carried out to consider the water transportation On power, the company will her internal generator plant as the primary source
DEACON BELIEVE EDEKI (Secretary of Amukpe)	I am happy about the coming of Woodland to Amukpe. The companies that settle here before did not follow the due process that was why they did not last here, so I

	advised Woodland to follow due process and sign an MOU with the community so we can be happy with each other.
MR. ASAGBA LUCKY (Youth chairman of Amukpe)	I appreciated you people for coming to Amukpe. On behalf of the youths in Amukpe, I accept and welcome Woodland company to our community. I assured you that peace will reign as long as you will do the right thing.
CHIEF M. ASAGBA (A.G Duke, Amukpe)	I thank you all for the wonderful deliberation; I also recommend that an MOU be sign between the company and Amukpe on employment ratio, so that the youth can be engaged. Secondly, the company has to schedule a visit to the Palace and meet with the Royal Majesty that is currently away.
ENGR. ALEX EBIGWAI (Woodland)	I thank you all for the comment, reactions and contributions. I specially appreciate your wholesome acceptance of Woodland to your community. The company will strive to adhere to the local content policy in employment and a visit will be scheduled to meet with the stakeholders in the community where an MOU will be signed before the commencement of work on the site.

Plates 4.15 - 4.18 shows stakeholder engagements at various stages

Plates 4.15: Showing stakeholder engagement at Hampshire Hotel during scooping workshop



Attendance for Scoping Workshop

S/N	Names	Phone Numbers	Sign
1	AKOMAYE FERDINAND A.	08037223608	[signature]
2	Chief M. Asagba	08062581304	[signature]
3	MR. Asagba Lucky	07035791297	[signature]
4	Deacon Believe Edeki	08034483698	[signature]
5	Bassey Emediong Okon	08100660297	[signature]
6	Engr. Alex Ebigwai	08037222135	[signature]
7	Onyekwelu J. Emeka	07081191775	[signature]
8	Ekpenyong Asuquo Eyo	08035958238	[signature]
9	Ezelibe Fidel Afachunwo	08160570106	[signature]
10	Happy Asagba	08056529494	[signature]
11	Ugwonah Faustina C.	07063319887	[signature]
12	Sylvester Obahor	08146851818	[signature]
13	Alice Abobasa		[signature]
14	Inojuleagho Enite Constance	08034018849	[signature]
15	Dr. Festus A.	08031432270	[signature]
16	Awikpe Clement	08062333027	[signature]
17		08037766212	[signature]
18	Richard Kalu	08037333610	[signature]
19	Chizoba Okoye	08039486912	[signature]
20	Solomon E.	08066080303	[signature]
21	Emmanuel E.		[signature]
22	Orutal N. Stella	08066177558	
23	Kefas Z. Baduku	08030884060	[signature]
24	Felix A. Ifome		[signature]
25	Eng. Oki P. Y.	08010350591 08	[signature]
26	Opajobi T.		[signature]
27			
28	Chief Eseme A.	08035506893	[signature]
29	Obi Collins		[signature]
30			
31	Akpofaro Lucky	08034350763	[signature]
32	Emmanuel I.		[signature]
33			
34			
35			

Plate 4.16: Attendance registers during scoping workshop

Plates 4.17: Consultation with stakeholders at Amukpe Town Hall

Plates 4.18: Cross section of ESIA team with the Amukpe youth leaders and Woodland HSE manager during site visit prior to field data gathering exercise

CHAPTER 5: ASSOCIATED AND POTENTIAL IMPACT

5.1 Introduction

This chapter provides information on the assessment of potential environmental and socio-economic impacts from the proposed Woodland Project. The impacts from both short-term (initial preconstruction, construction and decommissioning phases) and the long-term (operational phase) were considered. Provision of the assessment methodology used in evaluating impact significance, taking into account impact magnitude and sensitivity of receptors and resources affected is also outlined.

As part of the impact assessment process, the primary Project activities (source of potential impacts) considered as well as the environmental and social aspects and receptors assessed for potential impacts during the pre-construction, construction and operational phases of the development are presented in Table 5.1.

Table 5.1 Indicative project activities and environmental/social receptors assessed

	Phases	Activities
Indicative project activities	Pre- Construction Phase	Vegetation clearance Transportation of men & materials Construction of temporal facilities in laydown areas (e.g. security post, storage site)
	Construction Phase	Transportation of men & construction materials Assembly of machinery and equipment Construction of plant and other ancillary facilities Installation of machines and equipment Installation of systems (gas, fire, water, and waste management systems) Use of natural resources (water, energy sources)

		Disposal of waste materials and wastewater
	Operation Phase	Operation of the wood processing plant which will include the following: Rubber wood Lumbering Transportation of logs/finished products Grading Sawmilling Treatment Seasoning Composition Finishing Packaging Distribution Routine maintenance of machines and equipment
	Decommissioning Phase	Dismantling of machine and equipment Waste management
Environmental indicators, resources or receptors considered in the impact assessment	Construction, Operations and Decommissioning	Biophysical Environment Air quality; Noise, vibration; Soils and geology; Water resources; Terrestrial and aquatic ecology. Human Environment

		Visual amenities; Community level impacts Community health, safety and security; Labour and working conditions; Infrastructure; Traffic and safety; Employment and economy

For each of the above-mentioned environmental component, the associated potential impacts of Project activities are identified and significance of the impacts assessed.

A summary table of all potential impacts with their significance is presented in Tables 5.5 to 5.6

5.2 Impact Assessment Methodology

This section describes the overall approach used for the assessment of impacts. Topic-specific methodologies are described under each section of the impact assessment ISO14001:2015 was used as the general impact assessment methodology for impact characterization. In general, the assessment of impacts will pass through an iterative process involving the following four key elements:

- Prediction of potential impacts and their magnitude (i.e., the consequences of the proposals on the natural and social environment);
- Evaluation of the importance (or significance) of impacts taking the sensitivity of the environmental resources or human receptors into account;

- Development of mitigation measures to avoid, reduce or manage the impacts or enhancement measures to increase positive impacts; and Assessment of residual significant impacts after the application of mitigation and enhancement measures.
- Where significant residual impacts remain, further options for mitigation may be considered and impacts re-assessed until they are as low as reasonably practicable for the Project.

There are a number of ways that impacts may be described and quantified. Table 5.2 provides definitions of terms used in this section.

Table 5.2. Definition of impacts

1	NATURE OF IMPACT: An impact is essentially any change to a resource or receptor brought about by the presence of a project component or by the execution of a project related activity. Negative – an impact that is considered to represent an adverse change from the baseline or to introduce a new undesirable factor. Positive – an impact that is considered to represent an improvement to the baseline or to introduce a new desirable factor.
2	TYPE OF IMPACT: Direct (or primary) – impacts that result from the direct interaction between a planned project activity and the receiving environment (e.g., between digging foundation and injury to the worker). Secondary – impacts that result from the primary interaction between the Project and its environment because of subsequent interactions within the environment. Indirect – impacts that result from other activities that are encouraged to happen because of the Project.
3	TEMPORAL SCALE OF IMPACT: Temporary - impacts are predicted to be of short duration, reversible and

	intermittent/occasional in nature. The receptor will return to a previous state when the impact ceases or after a period of recovery. Short-term - impacts that are predicted to last only for a limited period (i.e., during construction) but will cease on completion of the activity, or because of mitigation measures and natural recovery (e.g., non-local construction workforce-local community interactions). Long-term - Impacts that will continue for the life of the project but cease when the project stops operating (i.e. 50years or when there is improvement in technology which requires replacement). These will include impacts that may be intermittent or repeated rather than continuous if they occur over an extended time period.
4	SPATIAL SCALE OF IMPACT: On-site – impacts that are limited to the Project site. Local - impacts that affect locally important environmental resources or are restricted to a single (local) administrative area or a single community. For this ESIA, local impacts are restricted to the Project site and adjacent areas. Regional - impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries. National - impacts that affect nationally important environmental resources; affect an area that is nationally important/protected; or have macro-economic consequences (i.e. Nigeria). International - impacts that affect internationally important resources such as areas protected by International Conventions. Trans-boundary - impacts that are experienced in one country as a result of activities in another.

5.2.1 Magnitude of Impact

The term 'magnitude' covers all the dimensions of the predicted impact to the natural and social environment, including:

- The nature of the change (what resource or receptor is affected and how);

- The spatial extent of the area impacted, or proportion of the population or community affected;
- Its temporal extent (i.e. Duration, frequency, reversibility); and
- Where relevant (accidental or unplanned events),
- The probability of the impact occurring.

For social impacts, the magnitude considers the perspective of those affected by taking into account the likely perceived importance of the impact, the ability of people to manage and adapt to change and the extent to which a human receptor gains or losses access to, or control over socio-economic resources (1) resulting in a positive or negative effect on their well-being (a concept combining an individual's health, prosperity, their quality of life, and their satisfaction).

5.2.2 Sensitivity of resources and receptors

Sensitivities are defined as aspects of the natural or social environment which support and sustain people and nature. Once affected, their disruption could lead to a disturbance of the stability or the integrity of that environment.

For ecological impacts, sensitivity can be assigned as low, medium or high based on the conservation importance of habitats and species. For habitats, these are based on naturalness, extent, rarity, fragility, diversity and importance as a community resource.

For socio-economic impacts, the degree of sensitivity of a receptor is defined as ‘a stakeholder’s (or groups of stakeholders’) resilience or capacity to cope with sudden changes or economic shocks. The sensitivity of a resource is based on its quality and value/importance, for example, by its local, regional, national or international designation, its importance to the local or wider community, or its economic value.

5.2.3 Likelihood

Terms used to define likelihood of occurrence of an impact are explained in Table 5.3

Table: 5.3 Explanation of terms used for likelihood of occurrence

Definition of likelihood		
High probability	Refers to a very likely impact	Refers to very frequent impacts
Medium probability	Refers to a likely impact	Refers to occasional impacts
Low probability	Refers to a very unlikely impact	Refers to rare impacts

5.2.4 Impact Evaluation

The third stage in the assessment procedure involved the evaluation of the impacts identified in order to determine their significance. This was based on the methodological framework set by ISO 14001, Determining Significance developed by the University of Bristol in 2015.The evaluation of impact significance was based on the following clearly defined criteria:

- Environmental Legislation and Policy
- Stakeholders' Concern and Interest
- Severity of Environmental and Social Impacts
- Magnitude/Scale of Impacts
- Frequency of Occurrence of Impacts

The above criteria and the rating adopted for the evaluation are described in Table 5.4.

Table 5.4: Impact Evaluation Criteria and Ratings

	Consequence		
A	Environmental legislation and corporate Policy	Is there any legislation affecting the aspect?	Score
		The impact is covered by legislation & Policy	3
		The impact is covered by legislation	2
		The impact is covered by Policy	1
		The impact is not covered by legislation or Policy	0
B	Stakeholder concern / interest	What stakeholder concern or interest does the impact raise?	Score
		The impact raises considerable global, national and local interest or would have serious detrimental effect on the reputation of the client	3
		The impact raises some interest and may have some detrimental effect on the reputation of the client	1
		The impact raises no interest and would have no effect on the reputation of the client	0
		The impact raises some interest and may have some positive effect on the reputation of the client	-1
		The impact raises global, national and local interest or would have a significant positive effect on the reputation of the client	-3
C	Severity of	What is the severity of environmental impacts?	Score

	Environmental Impact		
		The impact has a moderate detrimental effect on the environment or a scarce, non-renewable resource. Long Term/ Irreversible Impact.	3
		The impact has a moderate detrimental effect on the environment or a scarce, non-renewable resource. Impact not reversible within a year.	2
		The impact has a minor detrimental effect on the environment and on scarce, non-renewable resource. Impact reversible within a month to a year.	1
		The impact has no known effect on the environment	0
		The impact has a minor positive effect on the environment and on scarce, non-renewable resource.	-1
		The impact has a moderate positive effect on the environment and on scarce, non-renewable resource.	-2
		The impact has a major positive effect on the environment or a scarce, non- renewable resource	-3
D	Scale of Impacts	What is the scale of the impact?	Score
		The negative impact occurs in high or large quantities	3
		The negative impact occurs in medium quantities	2
		The negative impact occurs in low or small quantities	1
		The positive impact occurs in low or small quantities	-1
		The positive impact occurs in medium quantities	-2
		The positive impact occurs in high or large quantities	-3

	LIKELIHOOD		
Z	Frequency	How frequently does the impact occur?	Score
		The impact occurs on a daily basis	5
		The impact occurs on a weekly basis	4
		The impact occurs on a monthly basis	3
		The impact occurs on an annual basis	2
		The impact is unlikely to occur	1

5.2.5 Overall Significance Ranking

Following the evaluation of each impact using the criteria highlighted in Tables 5.1 to 5.4 above, the identified environmental impacts are categorized and scored according to Table 5.5aand the equation below.

Consequence (A+ B + C + D) X Likelihood (Z) = Significance evaluation score

Table 5.5. Significance Level Categories

Impact Significance	Score
Negligible impact significance	<1
Minor Negative Significance	1 – 25
Moderate Negative Significance	26 – 50
High Negative Significance	> 50
Positive Significance	< -1

5.3 Assessment of Significance

There is no statutory definition of 'significance' and its determination is therefore necessarily partially subjective. For the purposes of this ESIA, the following definition of significance has been adopted:

"An impact is significant if, in isolation or in combination with other impacts, it should, in the judgment of the ESIA team, be taken into account in the decision-making process, including the identification of mitigation measures (by the Project) and consenting conditions (from Regulators and Stakeholders)."

Criteria for assessing the significance of impacts stem from the following key elements:

Status of compliance with relevant Nigerian legislation, policies and plans and any relevant Nigerian industry policies, standards or guidelines;

The magnitude (including nature, scale and duration) of the change to the natural or socio-economic environment (e.g. an increase in noise, an increase in employment opportunities), expressed, wherever practicable, in quantitative terms. The magnitude of all impacts is viewed from the perspective of those affected by taking into account the likely perceived importance as understood through stakeholder engagement;

The nature and sensitivity of the impact receptor (physical, biological, or human). Where the receptor is physical, the assessment considers the quality, sensitivity to change and importance of the receptor. For a human receptor, the sensitivity of the household, community or wider societal group is considered along with their ability to adapt to and manage the effects of the impact; and

The likelihood (probability) that the identified impact will occur. This is estimated based upon experience and/or evidence that such an outcome has previously occurred.

For social impact assessment, the perceptions of stakeholders, expressed as opinions around certain issues, can be as important as actual impacts. Consequently, the concept of perception is explicitly brought into the evaluation of significance after an impact is evaluated. When an impact is of significant stakeholder concern, this may be cause to raise the significance rating. This prompts the formulation of more rigorous and appropriate mitigation measures which focus on the source of the impact and also address stakeholder perceptions. The risk of not addressing stakeholder perceptions is that reputational damage could arise, resulting in the loss of a 'social license to operate'.

5.3.1 Air Quality

5.3.1.1 Pre-construction/Construction Phase

Emissions from vehicles and equipment (SO_2, CO, NOx, CO_2, PM)

The movement of vehicles for the construction will result in PM, SO_2, CO, NOx, CO_2 emissions. It is noteworthy to mention that the quantity of emissions is dependent on the vehicle type, amount and their conditions. Light-duty petrol vehicles not equipped with pollution control devices have the highest exhaust emissions during acceleration, followed by deceleration and idling cycles. Frequent cycle changes characteristic of congested urban traffic patterns thus tends to increase pollutant emissions. At higher cruise speeds HC and CO emissions decrease, while NOx and CO_2 emissions increase. Emissions from diesel-fuelled vehicles include particulate matter, NOx, SO_2, CO and HC, the majority of which occurs from the exhaust. Operating at higher air-fuel ratios (about 30:1 as opposed to 15:1 characteristic of petrol-fuelled vehicles with electronic fuel injection engines), diesel-powered vehicles tend to have low HC and CO emissions, despite having considerably higher particulate emissions.

Particulates emitted from diesel vehicles consist of soot formed during combustion, heavy HC condensed or adsorbed on the soot and sulphates. In older diesel-fuelled vehicles the contribution of soot to particulate emissions is between 40% and 80%. The black smoke observed to emanate from poorly maintained diesel-fuelled vehicles is caused by oxygen deficiency during the fuel combustion or expansion phase. Particulate emissions from petrol-driven vehicles are usually negligible. Such emissions when they do occur would result from unburned lubricating oil, and ash-forming fuel and oil additives.

The impact of emissions arising from vehicles and equipment's associated with construction activities is considered to be Moderate due to the relatively low number of vehicles and equipment and the relatively short duration of the construction phase.

Dust emission from land preparation, Installation activities and operation of construction equipment and machines

The dust emissions arising from this Project phase are as a result of land preparation activities, vehicle movements and installation activities. Dust emissions have the potential to create impact on the close receptors due to the physical appearance, deposition on the roof of the residential areas and creating nuisance for the surrounding community. Fugitive dust is generated during the clearing of material, as well as from wind-blown dust generated from cleared land and exposed material stockpiles. Dust problems can also be generated during the transportation of the material, usually by truck, to the stock piles. This dust can take the form of entrainment from the vehicle itself or due to dust blown from the back of the trucks during transportation the impact of this phase on air quality is of Moderate significance

Climate change impact due to construction activity

A series of stages are involved in estimating the climate change impact of a wood processing factory. During the pre-construction and construction stages, the following activity is considered for climate change impact.

Process from material production

GHG will be emitted from the manufacturing process of construction material though it is an indirect impact of the project, but still necessarily considered as part of lifecycle of the project see chapter three for calculation.

Energy use in the construction activity

There is on-site energy use in the actual construction of a wood processing plant, primarily in the form of transport fuel for construction vehicles and the shipping of components. This energy use could be considered a component of direct non-generation emissions, because it is at the project site, even though it occurs before the actual operation of the wood processing plant. This source of emissions is likely to be very small due to the lifetime energy and emissions impacts of the project phase.

Land Clearing

Clearing of land for the construction processes will affect carbon stored in biomass and soil which will result in a one-time release of the carbon stored in the vegetation. GHG will be emitted from material production as well as energy use in construction activity. In addition, there will be carbon loss due to the forest clearance. The large portion of GHG emission is due to manufacture of construction materials, which is an indirect impact and accounts for 97% of the total. Since limited land will be cleared to avoid and minimize the forest area as reasonably practical as well as the fact that the GHG emission during construction stage is short and temporally, the impact on climate change is considered to be Moderate.

5.3.1.2 Operation phase

Air Quality

The operation of the wood processing plant will cause impairment of the surrounding air from the following operational activities in addition to some spelt out in the construction phase; smokes from operating engines, odour from wood processing, treatment and preservation and odour from the storm waters treatment pond. The duration for this impairment is longer than that of the construction phase however, the predicted impacts are Moderate.

Climate change impact during operational stage

During operation vehicle emissions and emissions from the saw milling machines and other machineries will release some GHG into the atmosphere. The amounts to be generated by this means are likely to be low. However, considering the duration of the project, the climate change impact during the operational stage is considered to be Moderate.

5.3.2 Noise and Vibrations

5.3.2.1 Pre-construction/Construction Phase

During these phases, construction activities, traffic, as well as the use of construction equipment and machinery are likely to lead to a temporary increase in noise levels that may disturb the neighbourhood and local fauna.

Noise impacts will be more predominant within 500 m of the activity areas. People living within few meters of the construction perimeter will be disturbed during construction. The area may be considered noisy due to vehicular traffic, music/video CD vendors, etc. hence, the need to minimize additional noise discharge, considering the baseline noise levels has exceeded the WHO guideline for community noise of 50-55dBA for outdoor living. There will be some noise generated from the movement of tractors and trucks transporting the materials and equipment but the traffic volumes are expected to be occasional.

Considering the construction activity schedule, nature of construction and duration of this phase, overall noise impact on nearby sensitive receptors will be of Moderate significance.

5.3.2.2 Operation Phase

Noise during the operation phase arising from lumbering, sawmilling falling of metallic object against another, transportation of logs and finished products as well as from equipment maintenance activities will lead to an increase in noise levels which may disturb the neighbourhood. Considering the fact that the baseline noise level is already above regulatory limits and the duration of the project, the overall, noise-related impacts during the operation phase are expected to be High.

5.3.2.3 Decommissioning Phase

Decommissioning activities; dismantling of buildings, uninstallation of machines, and the use of vehicles in conveying the dismantled materials will add to the noise level of the area. However, this phase is short-lived and with implementation of mitigation measures the noise level is expected to be at a Minor level.

5.3.3 Geology and Soils

5.3.3.1 Pre-construction/Construction Phase

Impact on Geology and Soil Structure

Change in soil structure (erosion and compaction), Potential contamination of soil from inadvertent release of hazardous or contaminating material (liquid fuel, solvents, lubricants, aluminum oxide paint, etc. during the construction phase, clearing of access roads, digging of building foundation for building of the work area, storage rooms, other ancillary facilities and offices are the main activities likely to affect soil structure and quality. Foundations will be dug up to variable depths, depending upon the building type and soil characteristics.

Excavation works and removal of vegetation, especially on steep slopes, would render soils unstable and more vulnerable to erosion. Soil quality may also deteriorate as a result removal of vegetation.

Although existing roads and tracks will be used to access the area, vehicle movement around the project area can lead to soil compaction in those areas where soils are clayey or highly saturated. Application of specific mitigation measures such as de-compaction of soils following construction as well as avoiding construction activities during times when soils are saturated will help reduce adverse effects resulting from soil compaction in areas covered by this soil type. Considering that only small areas are exposed and the short duration of the project phase as well as the sensitivity of the receptor medium the impact significance is Moderate.

Potential contamination of soil from inadvertent release of hazardous or contaminating material

Finally, soils can be contaminated during the construction phase by accidental oil/fuel spills from heavy machinery either at storage yards, other chemicals on work sites. In the event of an accidental spill, the proportion of soil contamination will depend on the magnitude of these accidental events. Considering the medium magnitude of this activity and medium receptor sensitivity, the impact is Moderate.

5.3.3.2 Operation Phase

Impact on Geology and Soil Structure

Vehicular movements during transport of raw materials and products, packaging and storage of finished products are the main activities likely to affect soil structure and quality during operation and maintenance. This effect is likely to affect the soil in the project area, considering the fact that this impact is likely to occur throughout the project's life span it is rated Moderate.

Potential contamination of soil from inadvertent release of hazardous or contaminating material

During the operation phase, oil leaks resulting from equipment breakdown and/or accidental spills from machinery used for maintenance purposes could lead to soil contamination. During wood treatment processes there is likelihood of boric acid spill in the oil. Considering the project life span the potential impact on soil quality during operation is considered Moderate

5.3.4 Water Resources

5.3.4.1 Preconstruction/Construction Phase

Impact on water resources

Sources of impacts to water resources are removal of vegetation which aids runoff, accidental spill from construction machines on sites and excavation/piling for structures and machinery installation. Vegetation removal in swampy areas can increase soil erosion in erosion prone areas, causing sediment to be deposited into the Ethiope River, especially during rain events. This shall likely add to the baseline surface water Turbidity levels which are above threshold limits Baseline surface water turbidity levels were above regulatory limits at the Ethiope River. Poor waste management practices are likely to have an effect on water quality (e.g. improper waste disposal in surface waters). The risk of accidental oil spills from heavy machinery during construction phase could result in surface water contamination. This shall likely add to the baseline surface water BOD levels since hydrocarbon utilizing microbes are known to increase BOD levels in water. However, the contamination level resulting from accidental spills will depend on their magnitude which in this case is small but the receptor is very sensitive leading to a Moderate Impact Rating.

5.3.4.2 Operation Phase

Accidental spills of fuel, spent oil and chemical (boric acid from wood preservation processes) and from machines and equipment maintenance are the possible source of impacts on water resources in the project area. However, the impact is rated Moderate.

5.3.5 Impact on Biodiversity

5.3.5.1 Preconstruction/Construction Phase

During these activities, there shall be faunal disturbance in the area vegetation losses represent habitat loss for local fauna and flora. Small fauna species especially from the reptilian taxon are more susceptible to be impacted by habitat loss. Mortality could occur during vegetation clearing and construction work. This impact though short termed is rated Moderate.

Faunal migration

Noise and vibration arising from construction machines as well as vehicles conveying products will have a negative impact on the fauna species and is rated Minor.

Spread of alien/invasive flora species

There is possibility of redistributing alien and invasive flora species to new loci in the area during material transport (sand, gravel). The proliferation of invasive species can have negative impacts on local species, by outcompeting native taxa. Alien invasive species have the potential to substantially modify wildlife habitat which can impact associated fauna populations.

Chromolaena odorata, Mimosa pudica, Mimosa invisa and *Schrankia leptocarpa* listed as invasive to Nigeria were found in this study. This impact though short termed is rated Moderate.

Impact on Ecosystem Service

Some species censored in the study offers Provisioning Services, some provide food/fibre/energy and others are sources of raw materials and medicinal services. Furthermore, *Albiziaadantifolia, Alchornea cordifolia, Alstonia congensis, Bambusa vulgaris, Elaeis guineensis, Mitragynale dermannii, Spondias mombin* and *Musa sapiantum* are some of the species found in the study area, that are applied to addressing carbon sequestration and storage, regulation of water flow, local climate regulation, erosion prevention and maintenance of soil fertility, and biological control.

Many of these species will be cleared during this activity. However, due to the medium receptor sensitivity and low sensitivity, this impact is Moderate

5.3.5.2 Operation Phase

During these activities, there shall be faunal disturbance in the area vegetation losses represent habitat loss for local fauna and flora. Small fauna species especially from the reptilian taxon are more susceptible to be impacted by habitat loss. Mortality could occur during lumbering activity. This impact due to its longer duration, medium receptor sensitivity and low severity the overall impact is rated Moderate.

5.3.6 Aquatic ecology

5.3.6.1 Construction Phase

Construction activities could cause an increase in suspended solids in wetlands and aquatic environments, which could result in siltation of feeding sites and breeding grounds of some species, particularly for fish species. Furthermore, an increase of organic matter in aquatic environments could lead to an increase in biochemical oxygen demand (BOD) and a decrease in dissolved oxygen that could be locally harmful for aquatic fauna species. Water could also become contaminated by accidental oil and hydrocarbon spills. The impact on aquatic and semi-aquatic habitats will be local and the magnitude will be low. Since these areas is not highly sensitive the duration of this phase is short-lived, the impact significance is Minor.

5.3.6.2 Operational Phase

Aquatic ecology impact during the operation phase is likely as a result of runoffs from wood treatment process, accidental spills and leakages from machines and equipment. Considering the duration of the impact, the overall severity is Moderate.

5.3.7 Visual Amenities

5.3.7.1 Construction Phase

Site clearance and site development

Aesthetic impacts during the construction phase will be limited to work zones. Deforestation of the area will change the landscape of the area, which is very limited. To minimize the impacts of the construction activities on the landscape, the existing access roads will be used whenever possible. Finally, all temporary work zones will be restored after construction.

Construction Derived Waste

Since no construction camp will be required, domestic waste will be limited to waste generated from construction workers. Domestic waste might be disposed to construction area, creating visual impact. Construction waste will be disposed at authorized sites as applicable.

Such impact is likely to be experienced by the villagers inhabiting near the construction area. Though the duration of the construction activity is short term in nature, the sensitivity of the area is moderate. The potential impact on Visual and aesthetics is considered to be of Moderate significance.

5.3.7.2 Operation Phase

The presence of an operational facility is likely to have a visual impact in the project area. However, with an increased duration however the impact severity is considered Moderate.

5.3.8 Community Health, Safety and Security

5.3.8.1 Construction Phase

Safety issues associated with processing plant activities involve improper handling, storing and disposing of fuels, oils, lubricants and some agricultural chemicals as well as accidents occurring with the operation of moving equipment. A significant amount of pollutants can be subsequently introduced to the environment. While the magnitude of this impact is difficult to quantify, they can be divided into two categories, those confined with onsite and offsite workers, as occupational hazards, and those expanding to affect the general population, as a consequence of environmental pollution. On the other hand, occupational health hazards can vary from site to site according to the technologies and adopted methods. The project activities could prove harmful to human health with the lack of proper measures. However, based on the impact rating criteria used, this impact is rated High.

Safety risk due to transportation

The increase in traffic in the villages and the roads could also be a source of accidents. The contractor will develop appropriate strategies to minimize the need for transportation of supplies and will ensure compliance with all applicable laws, such as maximum load restriction and speed limits amongst others (see chapter six). These measures will minimize the risk of accidents that could be caused by the project related traffic. As this is a temporary activity with limited transportation movements, this risk is considered Moderate due to its high sensitivity.

Health risk due to influx of workers

During the construction phase, the working population in the project area may increase temporarily, increasing the pressure on local health systems. The influx of foreign workers in local communities can increase the risk of communicable diseases such as the transmission of HIV/AIDS. To avoid this impact, the contractor in charge of work will implement a prevention program for communicable diseases among workers and local communities. However, this impact remains low since the passage of these workers will be only short duration.

Also, workers' camp(s) can be a source of pollution and various disturbances of the surrounding environment: (waste and wastewater) if not properly managed. The impact is considered High.

5.3.8.2 Operational Phase

Impact during this is similar to that recorded in the construction phase and with extended project duration the impact is rated High.

5.3.9 Labour and Working Conditions

The workforce engaged on the project will vary during the construction program and will be dependent on the specific activities underway. Working hours will include work outside normal construction hours and will include night time and weekend periods as required. All construction activities that are likely to generate noise shall not be undertaken during night time. The contractors shall ensure compliance with the following laws and regulations to minimize impacts arising from labour and working conditions.

- The Factories Act, 1987
- Wages Board and Industrial Council Act, 1974
- Workers' Compensation Act, 1987
- IFC Performance Standard 2: Labour and Working Conditions
- International Labour Organizations (ILO) requirements

5.3.9.1 Construction Phase

Occupational accident risk

In the construction phase there will be job opportunities for construction workers for clearing and the installation of equipment and machines. At this moment in time the number of workers required has not been assessed yet. The majority of the employees required during construction will be unskilled and semi-skilled labourers. To manage construction traffic and parking needs, transport will be provided. Since there is quite some unemployment among the people, and especially the youth, living in the community near the project area, there will be quite some eagerness to find temporary employment in the construction of the project. This creates the risk that the Contractor may get tempted to recruit labour force against insufficient labour and working conditions to save costs.

In the construction, occupational accidents may occur particularly among unskilled labour force, ranging between minor incidents such as cuts and major incidents related with working at height, building collapse and the risk of electrocution. Also, around there would be possible hazards, like snake bite and scorpion sting in the clearance of the vegetation. In view of the number of construction workers, the use of quite some unskilled labour, albeit internationally managed, the risk of occupational accidents is considered High for all the project phases

Equally, in addition to the occupational accident risk listed for the construction phase possible drowning in the storm water treatment pond, providing breeding grounds for disease vectors, fire explosions and chemical spills on workers are possible occupational accidents during the operational phase of the project. The risk of occupational accidents is considered High for all this project phase.

Security risk

With the construction activities, valuable materials and equipment and the presence of a labour force will come to the construction site. Opportunistic people (possibly local youth) or organized crime may be tempted to steal materials from the site, to raid construction workers or force to obtain some benefits from the Project in another way. There is also a potential of kidnapping of construction workers and a possible fire explosion. These security risks may threaten all staff working at the construction site, the risk is considered High for all the project phases.

5.3.10 Employment and Economy

5.3.10.1 Construction Phase

There will be no significant adverse impacts on local and regional economy during the construction. On the other hand, the project could generate some temporary jobs during construction. Overall, the impact on economic activities and livelihood is a positive impact.

5.3.10.2 Operation Phase

The most important benefit generated by the project certainly is the improved availability and reliability of finished wood products. The project will also generate jobs for the operation and maintenance of the processing plant.

Improving the availability and reliability of timber products in the region will include improving the storage and processing of agricultural products and increasing market value These improvements may add value to agricultural products and in the long term, generate better income for farmers. Overall, the project will bring Positive impacts to the local economy and livelihoods of people both directly (new employment) or indirectly (increased access to reliable timber products).

5.3.11 Infrastructure

5.3.11.1 Construction Phase

Concerning public infrastructures, roads, electricity and telecommunication infrastructures were studied. There will be no significant impact on the operation of nearby telecommunication antennas during construction. However, transport of construction materials and equipment using existing roads can increase traffic and may increase risks to road damage. An impact on existing infrastructures is Moderate for all project phases.

5.3.12 Traffic and safety

5.3.12.1 Construction Phase

Increase in traffic during material and personnel transport could also be a source of accidents. This impact is rated Moderate significance, and implementation of the mitigation measures shall reduce the impact to a Minor Level.

Transportation of wastes, men and materials offsite shall add to the load of traffic laden roads of the project area. This impact is rated Moderate significance, and implementation of the mitigation measures shall reduce the impact to a Minor Level.

5.3.12.2 Operation Phase

Traffic and safety impacts for the operation and maintenance phase are same as that of the construction phase however with a longer duration.

5.3.13 Cultural Heritage

5.3.13.1 Construction Phase

During the project no cultural heritage site such as; grave, mausoleum, ancestral altars, palaces and shrine was linked to project site. However, during the construction activities, unknown archaeological sites or objects can be discovered and partially destroyed by the machinery used. If archaeological or historic remains are discovered, the construction works will immediately stop, the National Commission for Museums and Monuments (NCMM) and the Sapele LGA authority and the State Ministry responsible for culture in Delta State should be informed. Overall, the impact is considered to be Minor since no cultural heritage sites is in the project area

5.3.13.2 Operation Phase

Like for the construction phase, potentially the maintenance works generating additional traffic, noise and dust may interact with these cultural festivals, affecting the experience and value of these festivals. However, this is a Minor impact.

5.4 Cumulative Impacts

5.4.1 Defining Cumulative Impacts

In theory, any development such as the proposed Project may be taking place at the same time as other developments, causing impacts affecting the same resources or receptors, such that the impacts on these resources and receptors from all potential development will be cumulative. According to the Performance Standard, cumulative impacts can be defined as impacts that:

"result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted."

Generally, Cumulative Impacts are considered to be impacts that act with impacts from other projects such that:

- The sum of the impacts is greater than the parts; or
- The sum of the impacts reaches a threshold level such that the impact becomes significant.

The types of cumulative impacts that may be of relevance are detailed below:

Accumulative: the overall effect of different types of impacts at the same location. An example would be fugitive dust emissions, construction noise and construction traffic all impacting the local communities as a nuisance/ disturbance.

Interactive: where two different types of impacts (which may not singly be important) react with each other to create a new impact (that might be important) (e.g. water abstraction from a watercourse might exacerbate the impacts caused by increased sediment loading).

Additive or In-combination: where impacts from the primary activity (i.e. the construction and operation of the Project) are added to impacts from third party activities e.g. other major projects in the vicinity of the Project which are already occurring, planned or may happen in the foreseeable future.

5.4.2 Identification of Relevant Development(s)

The focus of the cumulative impact assessment is on the combination effects of the Project with potential future development in the immediate area around the Project site. Our assessment cumulative impacts regarding the potential project in view, depends on the status of other projects and the level of data available to characterize the magnitude of the impacts.

In view of the paucity of available information regarding such future developments, this assessment follows a generic pattern and focuses on key issues and sensitivities for this project and how these might be influenced by cumulative impacts with a combination of other developments. Consultations with local and state authorities and identification of relevant and significant developments via searches of relevant documents provided invaluable assistant in this assessment. The main developments identified are cumulative impacts from other projects within 2km SoI. The list of projects around the sphere of influence (SOI) is highlighted in Table 5.6

Table 5.6: Existing projects and businesses within 2km Sphere of Influence (SoI)

S/n	Name of Business	Nature of Activity	Environmental/Social Impact	Remark
1	Pure oil and gas services	Business facility	Because of the high demand of petroleum products on daily basis, there is bound to be traffic congestion in and around the filling station as well as release of gaseous emissions from the exhaust of vehicles	The released of pollutants that are harmful to human health will add up to that which will be generated from the woodland activities. Hence this will further deteriorate the environment
2	Jesus Christ covenant mission	Religious facility	Due to the activities within the church premises, there will be increased noise pollution and traffic congestion which will result to the release of gaseous emissions from the exhaust of vehicles	The release of consistent noise and pollutants that are harmful to human health will add up to that which will be generated from the woodland activities. Hence this can cause hearing impairment and further deteriorate the environment
3	Okes unisex boutique	Business facility	Due to the frequent use of generator as source of power, there will be release of gaseous emissions into the environment	The gaseous emissions will add up to that which will be generated from the woodland company. Hence this will further deteriorate the environment
4	Mintt pharmacy	Business facility	Due to the frequent use of generator as source of power, there will be release of gaseous emissions into the environment	The gaseous emissions will add up to that which will be generated from the woodland company. Hence this will further deteriorate the environment
5	St. Mary Catholic	Religious	Due to the activities within the church premises, there will be increased noise	The release of consistent noise and pollutants that are harmful to human health will add up to that which

	church	facility	pollution and traffic congestion which will result to the release of gaseous emissions from the exhaust of vehicles	will be generated from the woodland activities. Hence this can cause hearing impairment and further deteriorate the environment
6	Ebis hotels	Lodging facility	Because of the nature of the facility, there will be high amount of energy consumption which will in turn lead to the release of harmful pollutants. Also, there will be toxic waste generation due to the excessive use of chemicals in laundry as well as increased waste generation	The high energy consumption and waste generation will further be contributed to the deterioration of the environment when added to that which will be generated from the woodland activities. Hence the woodland activities will not in any way contribute to the toxic waste generated due to the excessive use of chemicals in laundry
7	Overflow chapel	Religious facility	Because of the activities within the church premises, there will be increased noise pollution and traffic congestion which will result to the release of gaseous emissions from the exhaust of vehicles	The release of consistent noise and pollutants that are harmful to human health will add up to that which will be generated from the woodland activities. Hence this can cause hearing impairment and further deteriorate the environment
8	First oxford schools	Educational facility	Due to the activities within the school premises, there will be increased noise pollution and traffic congestion which will result to the release of gaseous emissions from the exhaust of vehicles	The release of consistent noise and pollutants that are harmful to human health will add up to that which will be generated from the woodland activities. Hence this can cause hearing impairment and further deteriorate the environment
9	Divine will restoration	Religious facility	Because of the activities within the church premises, there will be increased noise pollution and traffic congestion which will	The release of consistent noise and pollutants that are harmful to human health will add up to that which will be generated from the woodland activities.

	church		result to the release of gaseous emissions from the exhaust of vehicles	Hence this can cause hearing impairment and further deteriorate the environment
10	Eco bank	Business facility	Due to the proximity of the bank to the road, there will be traffic congestion from customers and other road users. Hence this will increase the emission of harmful pollutants into the environment	The frequent release of harmful pollutants will add up to that which will be generated from woodland activities. Hence this will lead to the continuous deterioration of the environment
11	Elect world	Business facility	Due to the frequent use of generator as source of power, there will be release of gaseous emissions into the environment	The gaseous emissions will add up to that which will be generated from the woodland company. Hence this will further deteriorate the environment
12	SambolEson hotel and suite	Lodging facility	Because of the nature of the facility, there will be high amount of energy consumption which will in turn lead to the release of harmful pollutants. Also, there will be toxic waste generation due to the excessive use of chemicals in laundry as well as increased waste generation	The high energy consumption and waste generation will further be contributed to the deterioration of the environment when added to that which will be generated from the woodland activities. Hence the woodland activities will not in any way contribute to the toxic waste generated due to the excessive use of chemicals in laundry

5.5 Summary of Impacts

Tables 5.7 and 5.8 presents the summary of various activities involved in the project development and the significant impacts associated with each of them on the environment and social.

Table 5.7 Summary of potential an associated impact during site preparation and construction

Indicator	Potential impact	Impact activities	Impact Significance						Significance
			Legislation	Stakeholder concern	Severity	Scale	Frequency	Overall rating	
Air quality	Localized impairment of air quality	Exhaust emissions from vehicles, equipment and other construction engines (SO_2, CO, NOx, CO_2, PM)	3	3	2	2	4	40	Moderate
	Elevated dust levels	Dust raised by vehicle movements and handling of dusty construction materials	3	3	1	2	4	36	Moderate
Climate Change	Emission of GHG	During construction activities vehicle emissions and emissions from other construction machines will release some GHG into the atmosphere also, the issue will further be compounded as carbon is loss due to vegetal clearance	3	3	2	1	4	36	Moderate

Indicator	Potential impact	Impact activities	Impact Significance						Significance
			Legislation	Stakeholder concern	Severity	Scale	Frequency	Overall rating	
Noise and vibration	Elevated noise level	Noise and vibration from vehicles and construction engines will add to the base line noise level of the area which was all above regulatory limit	3	3	2	1	5	45	Moderate
Soils, geology and land-use	Change to soil structure	Change in soil structure (erosion and compaction) as a result of excavation, backfilling and vegetal clearance will affect the soil structure	3	3	2	1	4	36	Moderate
	Potential contamination of soil	Inadvertent release of liquid fuel, solvents, lubricants from vehicles and construction engines during maintenance.	3	3	2	1	3	27	Moderate
Water resources	Potential surface and groundwater contamination and exploitation of water resources	Accidental spills and improper disposal of waste and wastewater Abstraction of water from nearby Ethiope River	3	2	2	1	4	32	Moderate

Indicator	Potential impact	Impact activities	Impact Significance						Significance
			Legislation	Stakeholder concern	Severity	Scale	Frequency	Overall rating	
Biodiversity	Fauna migration	Noise and vibration arising from the operation of the construction machines as well as vehicles conveying products in addition to odor from the seasoned woods will have a negative impact on the fauna species	3	3	2	1	1	9	Minor
	Flora impact	Dust generated by vehicular movements may hinder pollination rate thereby affecting the photosynthetic rate of the floral population in the area. There is potential for the spread of alien and invasive flora species in the area.	3	3	2	2	5	50	Moderate
Aquatic ecology	Degradation of aquatic species	Run off of spent oils from the construction engines during maintenance will have a negative impact on the nearby Ethiope River	3	3	2	2	2	20	Minor
Ecosystem Services	Species that provide services to the	Vegetal clearance and construction	3	3	3	2	4	44	Moderate

Indicator	Potential impact	Impact activities	Impact Significance							Significance
			Legislation	Stakeholder concern	Severity	Scale	Frequency	Overall rating		
	community will be cleared								
Visual amenities	Visual effects	Temporary presence of an active construction site with storage of materials and equipment	3	3	2	2	3	30	Moderate
Community Health, Safety and Security	Increased risks of traffic safety incidents on public roads	Movement of vehicle conveying men, materials and equipment for construction	3	3	3	1	5	50	High
	Tensions between outside labour and local population Increase in prevalence of sexually transmitted diseases and other	Temporary influx of outside workers into the community	3	3	3	1	3	30	

Indicator	Potential impact	Impact activities	Impact Significance						Significance
			Legislation	Stakeholder concern	Severity	Scale	Frequency	Overall rating	
	communicable diseases.								
Labour and working conditions	Exploitation of workers	Site clearing and installation of equipment and machines, operation and maintenance of construction equipment and machines	3	3	2	2	1	10	Minor
	Risk of injuries amongst labour force,	Minor incidents such as cuts and major incidents such as loss of life alongside theft is likely to occur during the construction activities	3	3	3	2	5	55	High
Employment and economy	Creation of temporary jobs for locals residents and Nigerian nationals with skilled trades	Employment of local residents of the project area and Nigerian nationals							Positive
	Supply chain	Supply of installation materials needed by the factory							Positive

Indicator	Potential impact	Impact activities	Impact Significance						Significance
			Legislation	Stakeholder concern	Severity	Scale	Frequency	Overall rating	
	opportunities for Nigerian companies								
Infrastructure	Increased pressure on social infrastructures	Influx of outside workers during construction activities will add to the already existing load on social infrastructures such as road network, electricity, water and health care facilities of the project area	3	3	2	1	3	27	Moderate
Traffic and safety	Risk of accidents to locals and traffic congestion	Transportation of men and construction materials on and offsite will add to the already existing traffic load in the area	3	3	2	1	5	45	Moderate
Cultural heritage	Risk of interactions between construction works and cultural belief systems	Influx of outside workers with different cultural belief systems may lead to clash of culture	3	1	2	1	1	7	Minor

Table 5.8Summary of Potential Impacts during Operation and Maintenance

Aspect	Potential impact	Impact activities	Impact Significance						Significance (pre-mitigation)
			Legislature	Stakeholder concern	Severity	Scale	Frequency	Overall rating	
Air quality	Localized impairment of air quality	Exhaust emissions from vehicles during transportation of rubber and finished products. Odour arising from wood treatment process and from the storm water treatment pond.	3	3	2	2	5	50	Moderate
	Elevated dust levels	Vehicle movements through unpaved roads	3	3	1	2	5	45	Moderate
Climate Change	Emission of GHG	During operation vehicle emissions and emissions from other machines will release some GHGs into the atmosphere also, the	3	3	2	1	4	36	Moderate

Aspect	Potential impact	Impact activities	Impact Significance						Significance (pre-mitigation)
			Legislature	Stakeholder concern	Severity	Scale	Frequency	Overall rating	
		issue will further be compounded as carbon is loss due to vegetal clearance							
Noise and vibration	Elevated noise level	Noise and vibration arising from the operation of the lumbering machines, grading machines as well as vehicles conveying logs and finished products	3	3	3	2	5	55	High
Soils, geology and land-use	Change to soil structure (erosion and compaction)	vehicular movements during transport of raw materials and products are the main activities likely to affect soil structure and quality	3	3	2	1	4	36	Moderate
	Potential contamination of soil	Inadvertent release of boric acid during the wood treatment processes or spent oil from machine and equipment maintenance.	3	3	2	1	4	36	

Aspect	Potential impact	Impact activities	Impact Significance						Significance (pre-mitigation)
			Legislature	Stakeholder concern	Severity	Scale	Frequency	Overall rating	
Water resources	Potential contamination of the Ethiope River	Runoff of spent oil and other hazardous chemicals from facility to water body during wood treatment processes, percolation of storm waters from treatment pond into groundwater	3	3	2	1	3	27	Moderate
Biodiversity	Fauna migration	Noise and vibration arising from the operation of the lumbering machines, grading machines as well as vehicles conveying products in addition to odour from the seasoned woods will have a negative impact on the fauna species	3	2	2	1	4	32	Moderate
	Photosynthesis	Dust generated by vehicular movements may hinder pollination rate thereby affecting the photosynthetic rate of the							

Aspect	Potential impact	Impact activities	Impact Significance						Significance (pre-mitigation)
			Legislature	Stakeholder concern	Severity	Scale	Frequency	Overall rating	
		floral population in the area.							
Aquatic ecology	Degradation of aquatic species	Run off of spent oils from machine maintenance, and boric acid during wood treatment would have a negative impact on the aquatic ecology of the Ethiope River.	3	2	2	1	4	32	Moderate
Ecosystem Services	Species that provide services to the community will be cleared	Logging activities	3	3	3	2	4	44	Moderate
Visual amenities	Visual effects	Presence of an operational facility with the constant movement of men and materials in and out of the facility will generate a visual effect	3	3	2	2	3	30	Moderate
Communit	Increased risks of traffic	Movement of vehicle conveying feed and	3	3	3	2	5	55	High

Aspect	Potential impact	Impact activities	Impact Significance						Significance (pre-mitigation)
			Legislature	Stakeholder concern	Severity	Scale	Frequency	Overall rating	
y Health, Safety and Security	safety incidents	products into and out of the facility respectively.							
	Potential increase in prevalence of sexually transmitted diseases and other communicable diseases.	Temporary influx of outside workers into the community							
Labour and working conditions	Exploitation of workers	Operation and maintenance of equipment and machines	3	3	3	2	5	55	High
	Occupational H&S risks in operation and maintenance	Minor incidents such as cuts during sawmilling and wood lumbering, accidental spills during wood treatment as well as major incidents such as road accidents, drowning, and fire explosions which may							

Aspect	Potential impact	Impact activities	Impact Significance						Significance (pre-mitigation)
			Legislature	Stakeholder concern	Severity	Scale	Frequency	Overall rating	
		lead to loss of life during the operation phase.							
Employment and Economy	Creation of jobs for locals residents and Nigerian nationals	Employment of local residents of the project area and Nigerian nationals in the operation and maintenance of the equipment and machines, processing of the raw materials (rubber wood) into finished products.							Positive
	Opportunities for Nigerian companies	Supply of machines and equipment needed by the factory from other companies							Positive
Infrastructure	Increased pressure on social infrastructure	Influx of outside workers will add to the already existing load on social infrastructures such as road network, electricity, water and health care facilities	3	3	2	1	3	27	Moderate

Aspect	Potential impact	Impact activities	Impact Significance						Significance (pre-mitigation)
			Legislature	Stakeholder concern	Severity	Scale	Frequency	Overall rating	
		of the project area							
Traffic and safety	Risk of Accidents to locals and traffic congestion	Transportation of men, feeds, products and materials on and off the facility will add to the already existing traffic load in the area	3	3	2	2	5	50	Moderate
Cultural heritage	Interactions between maintenance works and cultural belief systems	Influx of outside workers with different cultural belief and system may lead to clash of culture	3	1	2	1	1	7	Minor

CHAPTER 6: MITIGATION MEASURES

6.1 Introduction

As presented in Chapter 5, the proposed woodland plant and associated Projects has the potential to impact the various components of the biophysical, health and social environment of the project area. The identified negative impacts have been ranked variously as minor, moderate and high. To preserve the environment, a number of steps have been taken to mitigate the significant, high and moderate ranking negative impacts, as well as enhance those impacts identified as positive. The mitigation measures proffered for the predicted impacts of the proposed project activities took cognizance of the following:

- Environmental laws and regulations in Nigeria, with emphasis on permissible limits for waste streams (FMEnv (formerly FEPA), 1991);
- Best available Technology for sustainable Development;
- Feasibility of application of the proposed mitigation measures;
- View and concerns of stakeholders as expressed during extensive consultations carried out during the study.

The residual effects that may remain after the application of the impact mitigation measures have also been discussed for further reduction of residual impacts to as low level as possible.

6.2 Mitigation Methodology

6.2.1 Definition of Mitigation Measures

Mitigation measures are developed to avoid, reduce, remedy or compensate for any negative impacts identified, and to create or enhance positive impacts such as environmental and social benefits. In this context, the term “mitigation measures” includes operational controls as well as management actions. These measures are often established through industry standards and may include:

- ✧ changes to the design of the project during the design process (e.g. changing the development approach);
- ✧ engineering controls and other physical measures applied (e.g. waste water treatment facilities);
- ✧ operational plans and procedures (e.g. waste management plans)

For impacts that are assessed to be of Major significance, a change in design or layout is usually required to avoid or reduce these. For impacts assessed to be of Moderate significance, specific mitigation measures such as engineering controls are usually required to reduce these impacts to As Low As Reasonably practicable (ALARP) levels. This approach takes into account the technical and financial feasibility of mitigation measures. Impacts assessed to be of Minor significance are usually managed through good industry practice, operational plans and procedures. And Negligible impacts require no mitigation action, other than those already included in the project design.

In developing mitigation measures, the first focus is on measures that will prevent or minimize impacts through the design and management of the Project rather than on reinstatement and compensation measures.

6.2.2 Assessing Residual Impacts

Impact prediction considers any mitigation, control and operational management measures that are part of the project design and project plan. A residual impact is the impact that is predicted to remain once mitigation measures have been designed into the intended activity. The residual impacts are described in terms of their significance in accordance with the categories identified in Chapter 5.

Social, economic and biophysical impacts are inherently and inextricably interconnected. Change in any of these domains will lead to changes in the other domains. This section looks at how the local way of life might change as a result of the proposed project. Potential changes to local culture, livelihoods, health and well-being, personal and communal property rights are examined.

Woodland shall ensure full compliance and implementation of all mitigation measures outlined in this report as applied for each phase of the project.

6.3 Air Quality

6.3.1 Preconstruction/Construction Phase

Air Pollutant Emission

Regarding impacts of emissions from vehicles and equipment engines the following mitigation measures are recommended:

- Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations;
- Proper waste treatment and management procedures shall be followed by woodland company
- Cover properly loose materials and keep top layers moist;
- Use binder material for erosion and dust control for long term exposed surfaces;
- Regular cleaning of equipment, drains and roads to avoid excessive build-up of dirt;

- Spray surfaces prior to excavation;
- Use covered trucks for the transportation of materials that release dust emissions; and
- Speed limits on-site of 25km/hr on unhardened roads and surfaces.

With the implementation of the above measures the residual air quality impacts is expected to be Minor.

Green House Gas Emission

In consideration of the Climate Change under the construction phase, the impact of vegetation clearing, resulting to reduction of carbon sink ability of the environment and the use of equipment and vehicles during the construction resulting to the release of GHG gases shall be mitigated through the use of good international practice, including maintaining and operating all vehicles and equipment engines in accordance with manufacturers recommendations, restriction of vegetation clearing to only the required area and the use of experienced drivers and fuel efficient equipment, vehicles and machineries during construction activities. Even the implementation of above mitigation measure, GHG emission cannot be avoided. Therefore, the impact on climate change can be reduced to a Minor significance.

6.3.2Operation Phase

Same mitigation measures apply for pollutant and GHG emissions in the operational phase as that of the construction. However, for climate change the impact of GHGs shall be mitigated through the improvements in the leak rate of new equipment, refurbishing older equipment, and the use of more efficient operation and maintenance techniques. These measures are expected to reduce the impact to a Minor significance.

6.4 Noise and Vibration

6.4.1 Construction Phase

The following recommendations for mitigation measures are outlined below:

- Woodland shall develop a detailed plan that relates to noise control for relevant work practices and discuss this with construction staff during health & safety briefings;
- Selection of 'low noise' equipment or methods of work shall be adopted and implemented by woodland contractors;
- Woodland shall ensure the use of temporary noise barriers for equipment (e.g. sound proofing walls around stationary power generating sources);
- Dropping materials from height shall be avoided by woodland contractors where practicable;
- Avoid metal-to-metal contact on equipment;
- Maintain and operate all vehicles and equipment in accordance with manufacturer's recommendations;
- Woodland shall ensure periods of respite are provided in the case of unavoidable maximum noise level events;
- Woodland shall inform all potentially impacted residents of the nature of works to be carried out; the expected noise levels and duration, as well as providing the contact details of the woodland Community Relation Officer;
- Noisy activities (activities that can be heard in neighbourhood) should be restricted to day-time working hours.

With the implementation of the above measures the residual impacts are expected to be reduced to Minor.

6.4.2 Operation Phase

The high impact of noise emissions during operation can be reduced by applying following measures;

- Providing permanent soundproofing of noisy machines and equipment during operational phase;
- Dropping materials from height shall be avoided by woodland contractors where practicable;
- Avoid metal-to-metal contact on equipment;
- Maintain and operate all vehicles and equipment in accordance with manufacturer's recommendations;
- Woodland shall ensure periods of respite are provided in the case of unavoidable maximum noise level events;
- Woodland shall inform all potentially impacted residents of the nature of works to be carried out; the expected noise levels and duration, as well as providing the contact details of the woodland Community Relation Officer;
- Noisy activities (activities that can be heard in neighbourhood) should be restricted to day-time working hours.

However, since noise emission cannot be completely blocked, because it also depends on weather conditions also considering the duration of the project phase, the residual impact will be Moderate.

6.5 Geology and Soil

6.5.1 Preconstruction/Construction Phase

Impact on Geology and Soil Structure

The following mitigation measures to reduce impacts on soil structure from compaction and erosion are recommended:

- ✧ Backfill foundation pits by the excavated soils which will resemble the order of the original soil layers;
- ✧ Vegetal clearance should be reduced to project footprint to prevent soil erosion
- ✧ Protect excavated soil materials from erosion;
- ✧ Ensure that the land is physically restored (include revegetation where possible) before the next rainy season; and
- ✧ Use of existing track for transport of man and material to the extent possible;

With the implementation of the above measures the residual impacts can be expected to reduce to Minor

Potential Soil Contamination

With regards to soil contamination impacts, the following measures will be implemented:

- ✧ Minimize bare ground and stockpiles to avoid silt runoff;

- Bonding of areas where hazardous substances are stored (e.g. fuel, waste areas);
- Regular checking and maintenance of all plant and equipment to minimize the risk of fuel or lubricant leakages;
- Training of relevant staff in safe storage and handling practices, and rapid spill response and clean-up techniques;
- Set-up and apply procedure regarding dealing with contaminated soils;
- Development and implementation of a Waste Management Plan (as part of the ESMP) to ensure that waste is disposed off correctly; and
- Spread sheet underneath structures prior to the start of any painting activity.

With the implementation of the above measures the residual soil and geology quality impacts can be expected to reduce to Minor.

6.5.2 Operation Phase

The impact during operation can be reduced by applying the following mitigation measures in addition to the mitigation measures spelt out for the construction phase:

- Maintain and operate all equipment and machines in accordance with the manufacturer's manual;
- During wood treatment process boric acid should be handled with care to avoid spillage.
- Storm water should be treated properly before discharge

With the implementation of these mitigation measures the residual impacts can be expected to reduce to Minor.

6.6 Water Resources

6.6.1 Preconstruction/Construction Phase

Impact on Hydrogeology

The potential contamination of groundwater and surface water from release of hazardous or contaminating material (liquid fuel, solvents, lubricants, paint, etc), can be mitigating by the following actions:

- The construction of drainage around project area
- Avoiding storage of materials that are likely to leach into soil in the open
- Maintain and operate all oil using equipment and machines in accordance with the manufacture's manual
- Construction of bund wall around fuel and oil storage areas

With the implementation of these actions, the impact is expected to be reduced to Minor.

Potential contamination on water resource

Same as in section soil and geology for the prevention of spills and leakage of hazardous substances to surface water. The residual impacts on surface and groundwater can be expected to be Minor.

6.6.2 Operation Phase

Impact on Hydrogeology

The potential contamination of groundwater and surface water from release of hazardous or contaminating material (liquid fuel, solvents, lubricants, paint, etc), can be mitigating by the following actions:

- The construction of drainage around project area
- Construction of wastewater treatment ponds as measures for treating wastewater discharge
- Avoiding storage of materials that are likely to leach into soil in the open
- Maintain and operate all oil using equipment and machines in accordance with the manufacture's manual
- Storm water should be treated properly before discharge
- Construction of bund wall around fuel and oil storage areas

With the implementation of these actions, the impact is expected to be reduced to Minor.

Potential contamination on water resource

Same measures as in section soil and geology for the prevention of spills and leakage of hazardous substances to surface water. The residual impacts on surface and groundwater can be expected to be Minor.

6.7 Biodiversity

6.7.1 Construction Phase

Impact on Terrestrial flora and Fauna

The following recommendations for mitigation measures are outlined below:

- Limit site clearance to project footprint;
- Sensitivity training to staff and anti-poaching policy; and
- Activities which may affect these flora and fauna resources should be regularized
- Herbicides should not be used for vegetation clearing
- Revegetation should use species locally native to the site and not use any environmental weeds for erosion control
- Implementation of the invasive species management plan as part of the Vegetation Management Plan presented in Chapter 7.
- Retention of native species where possible
- Clearing should be minimized and restricted to the area required for construction purposes only and disturbance to adjacent vegetation and/or remnant trees within the project area should be strictly controlled.
- A monitoring program of invasive species propagation should be instituted.
- A monitoring program of threatened species propagation should be instituted

- Noise affects fauna existence serving as disturbance to then thus causing them to migrate, thus mitigation measures applied for noise applies here as well

The residual impact on terrestrial ecology is expected to be reduced to Minor after applying the above mitigation measures.

Impact on Ecosystem Service

Impacts on ecosystem services are expected to be reduced to Minor after implementing the following actions.

- Preserve species that provide ecosystem services as much as possible
- Allow species that do not cause harm around the project area

6.7.2Operation Phase

Similar mitigation measures stated out in the construction phase applies to the operation phase for biodiversity impact.

6.7 Aquatic Ecology

6.7.1 Construction Phase

The following measures shall be implemented during construction in order to minimize impacts on aquatic ecology during construction.

- Natural flow of a River shall not be blocked
- Conduct activities during the dry season to minimize disturbance of sensitive wetland areas
- Perform all vegetation clearing work manually along the Ethiope River.

- ✧ Based on an appropriate project design, avoid erecting structures within wetlands. If unavoidable, select the most optimized site for each
- ✧ Avoid equipment and vehicle movements in floodplains and wetland areas. If unavoidable, reduce access to a minimum length in wetlands and floodplains and select the most optimized site for the access considering human uses and areas of higher ecological integrity

Implementing these measures is expected to reduce the impact to Negligible.

6.7.2Operation Phase

In addition to some measures listed in construction phase the following shall be applied;

- ✧ Proper handling of hazardous chemicals;
- ✧ Storm water should be treated properly before discharge

With these the residual impact will be reduced to Minor due to the longer duration of the operational phase compared to the construction phase

6.8 Visual Amenities

6.8.1 Construction Phase

The impact of the change in visual amenities can be reduced by maintaining the construction site in orderly condition and do not distribute material over many sites before usage. Following mitigation measure will be implemented.

- ✧ Provision of education to construction workers for waste management

- ✧ Construction waste will be appropriated managed at the site and disposed by licensed company

The residual impact will be Minor.

6.8.2 Operation Phase

To reduce the permanent impact on the visual amenities of the landscape, smaller trees and vegetation (<3 m) shall be kept, so that there is still green scenery present. However, since the presence of factory changed the landscape in the area, especially forest area, the residual impact is still considered Minor.

6.9 Community Health, Safety and Security

6.9.1 Construction Phase

To reduce the potential adverse impacts and risks of the construction works on the community health, safety and security, the following mitigation measures should be implemented.

- ✧ Contractor should implement a traffic safety plan including design of access point, signalization, speed limits, training of drivers, use of traffic guards, procedures for transport of oversized loads (e.g., engines), maintain log of traffic related incidents, sensitization of road users and people living close to the construction site. If this plan is thoroughly implemented, this residual risk can be Minor.

To reduce the risk of an increase in STD prevalence, awareness raising material and condoms should be provided to all workers. Herewith the risk can be mitigated to a Minor level.

6.9.2 Operation Phase

To reduce the external safety risks for the people living close to the operational factory the following measures in addition to that listed for the construction phase should be implemented:

To prevent as much as possible emergencies and to manage the response to emergencies when they occur in the operation phase of the Project an emergency response plan should be developed and implemented. This plan should be coordinated with woodland and the Local Government;

Annually a safety audit should be performed to identify potential safety risks in an early stage and keep maintenance at high standards; and

With the serious implementation of the above measures the residual safety risks can be expected to be reduced to a Minor level.

6.10 Labour and Working Conditions

6.10.1 Construction Phase

To prevent the exploitation of the workforce, the Contractor should comply with the provisions in the Labour Act of Nigeria. The following items apply specifically for this Project:

- ✧ Develop transparent human resources policies and procedures for recruitment process, working conditions, terms of employment wages, worker-employer relations, non-discrimination policy, monitoring, roles and responsibilities;
- ✧ Provide reasonable, and if applicable negotiated, working terms and conditions;
- ✧ Establish worker's grievance mechanism, so that potential conflicts can be dealt with in an early and proper way;
- ✧ No use of child labor (workers under age 18) or forced labour is allowed;

- Provisions to ensure compliance with labor standards by supply chain and subcontracts, including training if required;
- A worker's grievance mechanism will be in place.
- If indeed the Contractor implements their human resources procedures in line with the Nigerian Labour Act through their construction contract, the risk of exploitation of the labor force can be kept to a Minor level.

Security risks can be mitigated by preparing and implementing a security and emergency response plan in close cooperation with the local security forces. If security measures are well implemented these risks can be reduced to a Minor level.

To prevent and respond effectively to occupational health & safety incidents a project specific health and safety procedures needs to be developed and implemented, based on woodland's HSE guidelines, including provisions for training and certifications to be followed by all workers including subcontractors. Consult with local health facilities to be prepared in case of incidents that need medical help.

To prevent and manage occupational health & safety risks the following measures need to be implemented:

- Ensure proper design, construction and installation of equipment, machines and associated facilities;
- Train staff regularly and thoroughly in prevention and response of electrocution incidents, monitor and keep record;
- Audit management of accident incidents;
- Emergency prevention and management;

- ✧ Provide and maintain first aid facilities at strategic places and train staff to use these; and
- ✧ Provide and use personal protection equipment.

When all measures mentioned above are well implemented, the risk of occupational health & safety incidents can be kept to a Minor level. However, these incidents cannot be prevented at all times.

6.10.2 Operation Phase

Security risks can be mitigated by preparing and implementing a security and emergency response plan in close cooperation with the local security forces. If security measures are well implemented these risks can be reduced to a Minor level.

To prevent and respond effectively to occupational health & safety incidents a project specific health and safety procedures needs to be developed and implemented, based on woodland's HSE guidelines, including provisions for training and certifications to be followed by all workers including subcontractors. Consult with local health facilities to be prepared in case of incidents that need medical help.

To prevent and manage occupational health & safety risks the following measures need to be implemented:

- ✧ Train staff regularly and thoroughly in prevention and response of electrocution incidents, monitor and keep record;
- ✧ Audit management of accident incidents;
- ✧ Implementation of emergency prevention and management plan;
- ✧ Provide and maintain first aid facilities at strategic places and train staff to use these; and

- ✧ Provide and use personal protection equipment.

These will reduce the risks of labour force exploitation and the risks of occupational health & safety, to a Minor level.

6.11 Employment and Economy

6.11.1 Construction Phase

To enhance the positive impact of employment opportunities for local residents a local content plan needs to be prepared to enhance the ability to locate local hires and Nigerian nationals. This plan should include provisions for hiring women and youth and for “equal pay for work of equal value”. A local hiring office (or offices) to be set-up for use by all contractors to advertise positions, receive applications, and provide guidance to applicants.

To enhance the positive impact of opportunities for local businesses and entrepreneurs the local content plan should also facilitate identification and selection of qualified local and Nigerian companies to provide needed supplies and services. This plan should include provisions for advance notice to local companies, along with selection criteria including health and safety, to allow them to prepare for upcoming opportunities.

6.11.2 Operation Phase

The positive impact is of an important contribution to the nation’s economy, enhancing socio-economic development in the country, can only be reached in addition to those stated for construction phase, when the factory is kept in good order ensuring consistence supply of quality finished products.

6.12 Infrastructure

6.12.1 Construction Phase

In the preparation and execution of the construction works the Contractor should coordinate with medical posts and emergency services about the potential of an increase demand of these services.

Proper and independent facilities for water supply, sanitation, solid and liquid waste need to be installed at the construction site, so that pressure on community infrastructure is limited.

By implementing both measures the impact of construction activities of the Project can be managed to a Minor level for all project phase

6.13 Traffic and Safety

To reduce the traffic safety incidents to a Minor significance level for all project phases, the following mitigation measures shall be implemented:

- ✧ Implement a traffic safety plan including design of access point, signalization, speed limits, training of drivers, use of traffic guards, procedures for transport of oversized loads (e.g., engines),
- ✧ Maintain log of traffic related incidents, sensitization of road users and people living close to the construction site.
- ✧ Periodic maintenance of transport vehicles
- ✧ The contractor will develop appropriate strategies to minimize the need for transportation of supplies and will ensure compliance with all applicable laws, such as maximum load restriction and speed limits.

- An awareness program for truck drivers to speed limits and other precautionary

6.14Cultural Heritage

The impact was of a negligible significance for both project phases hence, no mitigation measures are required. However, during the construction activities, unknown archaeological sites or objects can be discovered and partially destroyed by the machinery used. If archaeological or historic remains are discovered, the construction works will immediately stop, the National Commission for Museums and Monuments (NCMM) and the LGA authorities and the State Ministry responsible for culture in Delta State should be informed.

6.15 Summary of Mitigation Measures

Tables 6.1 and 6.2 presents the summary of mitigation measures on various activities involved in the project development and the significant impacts associated with each of them.

Table 6.1 Summary of Mitigation Measures during Construction

Indicator	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Air quality	Localized impairment of air quality	Exhaust emissions from vehicles, equipment and other construction engines (SO_2, CO, NOx, CO_2, PM)	Moderate	Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations; Cover properly loose materials and keep top layers moist; Use binder material for erosion and dust control for long term exposed surfaces; Regular cleaning of equipment, drains and roads to avoid excessive build-up of dirt; Spray surfaces prior to excavation; Use covered trucks for the transportation of materials that release dust emissions; and Speed limits on-site of 25km/hr on unhardened	Minor
	Elevated dust levels	Dust raised by vehicle movements and handling of dusty construction materials	Moderate		

Indicator	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				roads and surfaces.	
Climate Change	Emission of GHG	During construction activities vehicle emissions and emissions from other construction machines will release some GHG into the atmosphere also, the issue will further be compounded as carbon is loss due to vegetal clearance	Moderate	Maintain and operate all vehicles and equipment engines in accordance with manufacturers specifications, restriction of vegetation clearing to only the required area	Minor
Noise and vibration	Elevated noise level	Noise and vibration from vehicles and construction engines will add to the base line noise level of the area which was all above regulatory limit	Moderate	Develop a detailed plan that relates to noise control for relevant work practices and discuss this with construction staff during health & safety briefings; Select 'low noise' equipment or methods of work; Use temporary noise barriers for equipment (e.g.	Minor

Indicator	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				sound proofing walls around stationary power generating sources); Avoid dropping materials from height, where practicable; Avoid metal-to-metal contact on equipment; Maintain and operate all vehicles and equipment in accordance with manufacturers recommendations; Ensure periods of respite are provided in the case of unavoidable maximum noise level events; Inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as providing the contact details of the woodland Community Relation Officer;	

Indicator	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				Noisy activities (activities that can be heard in neighbourhood) should be restricted to day-time working hours.	
Soils, geology and land-use	Change to soil structure	Change in soil structure (erosion and compaction) as a result of excavation, backfilling and vegetal clearance will affect the soil structure	Moderate	Construction of building foundations to be undertaken in the dry season; Backfill foundation pits by the excavated soils which will resemble the order of the original soil layers; Vegetal clearance should be reduced to project footprint to prevent soil erosion Protect excavated soil materials from erosion; Ensure that the land is physically restored (include revegetation where possible) before the next rainy season; and Use of existing track for transport of man and	Minor

Indicator	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				material to the extent possible;	
	Potential contamination of soil	Inadvertent release of liquid fuel, solvents, lubricants from vehicles and construction engines during maintenance.	Moderate	Minimize bare ground and stockpiles to avoid silt runoff; Bonding of areas where hazardous substances are stored (e.g. fuel, waste areas); Regular checking and maintenance of all plant and equipment to minimize the risk of fuel or lubricant leakages; Training of relevant staff in safe storage and handling practices, and rapid spill response and clean-up techniques; Set-up and apply procedure regarding dealing with contaminated soils; Development and implementation of a Waste Management Plan (as part of the ESMP) to	Minor

Indicator	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				ensure that waste is disposed off correctly; and Spread sheet underneath structures prior to the start of any painting activity.	
Water resources	Potential surface and groundwater contamination and exploitation of water resources	Accidental spills and improper disposal of waste and wastewater Abstraction of water from nearby Ethiope River	Moderate	The construction of drainage around project area Avoiding storage of materials that are likely to leach into soil in the open Maintain and operate all oil using equipment and machines in accordance with the manufacture's manual Construction of bund wall around fuel and oil storage areas	Minor
Biodiversity	Fauna migration	Noise and vibration arising from the operation of the construction machines as well as vehicles conveying	Minor	Limit site clearance to project footprint; Sensitivity training to staff and anti-poaching	Negligible

Indicator	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
		products in addition to odour from the seasoned woods will have a negative impact on the fauna species		policy; and Activities which may affect these flora and fauna resources should be regularized Herbicides should not be used for vegetation clearing	
	Flora impact	Dust generated by vehicular movements may hinder pollination rate thereby affecting the photosynthetic rate of the floral population in the area. There is possibility of creating fertile loci for alien and invasive flora species being introduced to the area during material transport (sand, gravel).	Moderate	Revegetation should use species locally native to the site and not use any environmental weeds for erosion control Implementation of the invasive species management plan as part of the Vegetation Management Plan presented in Chapter 7. Retention of native species where possible. Clearing should be minimized and restricted to the area required for construction purposes only and disturbance to adjacent vegetation and/or	Minor

Indicator	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				remnant trees within the project area should be strictly controlled. A monitoring program of invasive species propagation within the right-of-way should be instituted and, if present, must be removed. Noise affects fauna existence serving as disturbance to then thus causing them to migrate, thus mitigation measures applied for noise applies here as well	
Aquatic ecology	Degradation of aquatic species	Run off of spent oils from the construction engines during maintenance will have a negative impact on the nearby Ethiope River	Minor	Natural flow of a River shall not be blocked Conduct activities during the dry season to minimize disturbance of sensitive wetland areas Perform all vegetation clearing work manually along the Ethiope River. Based on an appropriate project design, avoid	Negligible

Indicator	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				erecting structures within wetlands. If unavoidable, select the most optimized site for each Avoid equipment and vehicle movements in floodplains and wetland areas. If unavoidable, reduce access to a minimum length in wetlands and floodplains and select the most optimized site for the access considering human uses and areas of higher ecological integrity	
Ecosystem Services	Species that provide services to the community will be cleared	Vegetal clearance and construction	Moderate	Preserve species that provide ecosystem services as much as possible Allow species that do not cause harm around the project area	Minor
Visual amenities	Visual effects	Temporary presence of an active construction site with storage of materials and	Moderate	Provision of education to construction workers for waste management Construction waste will be appropriated managed	Minor

Indicator	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
		equipment		at the site and disposed by licensed company Smaller trees and vegetation (<3m) shall be kept, so that there is still green scenery present.	
Community Health, Safety and Security	Increased risks of traffic safety incidents on public roads	Movement of vehicle conveying men, materials and equipment for construction	High	Implement a traffic safety plan including design of Access point, signalization, speed limits, training of drivers, use of traffic guards, procedures for transport of oversized loads (e.g., engines), maintain log of traffic related incidents, sensitization of road users and people living close to the construction site.	Moderate
	Tensions between outside labour and local population Increase in prevalence of	Temporary influx of outside workers into the community		A Local Content Plan should be prepared to facilitate involvement of local labour. Provide STI awareness material to all workers. Provide condoms to workers.	Minor

Indicator	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
	sexually transmitted diseases and other communicable diseases.			Develop a code of behaviors for workers. All workers to receive training on community relations and code of behaviour.	
Labour and working conditions	Exploitation of workers	Site clearing and installation of equipment and machines, operation and maintenance of construction equipment and machines	High	Develop transparent human resources policies and procedures for recruitment process, working conditions and Terms of Employment wages, worker-employer relations, Grievance Mechanism, non-discrimination, monitoring, roles and responsibilities following Nigerian Labour Law and ILO conventions. Provide reasonable, and if applicable negotiated, working terms and conditions. Establish worker's grievance mechanism, so that potential conflicts can be dealt with in an early	Moderate

Indicator	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				and proper way. No use of child labours (workers under age 18) or forced labour. Provisions to ensure compliance with labour standards by supply chain and subcontracts, including training if required. Provide proper work place facilities for water/sanitation/rest rooms. If case of retrenchment needs first viable alternatives are analyzed and then adverse impacts of retrenchment on workers are reduced as much as possible. A transparent retrenchment plan will be prepared. A worker's grievance mechanism will be in place.	

Indicator	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
	Risk of health & safety incidents amongst labour force,	Minor incidents such as cuts and major incidents such as loss of life alongside theft is likely to occur during the construction activities	High	Develop project specific health and safety procedures based on Wärtsilä's standard health and safety procedures, including provisions for training and certifications to be followed by all workers including subcontractors. ensure proper design, construction and installation of equipment, machines and associated facilities; train staff regularly and thoroughly in prevention and response of electrocution incidents, monitor and keep record; audit management of accident incidents; emergency prevention and management; provide and maintain first aid facilities at strategic places and train staff to use these; and	Moderate

Indicator	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				provide and use personal protection equipment	
Employment and economy	Creation of temporary jobs for locals residents and Nigerian nationals with skilled trades	Employment of local residents of the project area and Nigerian nationals	Positive	To enhance the positive impact of employment opportunities for local residents a local content plan needs to be prepared to enhance the ability to locate local hires and Nigerian nationals. This plan should include provisions for hiring women and youth and for "equal pay for work of equal value". A local hiring office (or offices) to be set-up for use by all contractors to advertise positions, receive applications, and provide guidance to applicants.	Positive
	Supply chain opportunities for Nigerian companies	Supply of installation materials needed by the factory	Positive	To enhance the positive impact of opportunities for local businesses and entrepreneurs the local content plan should also facilitate identification and selection of qualified local and Nigerian companies to provide needed supplies and services. This plan should include provisions for	Positive

Indicator	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				advance notice to local companies, along with selection criteria including health and safety, to allow them to prepare for upcoming opportunities.	
Infrastructure	Increased pressure on social infrastructures	Influx of outside workers during construction activities will add to the already existing load on social infrastructures such as road network, electricity, water and health care facilities of the project area	Moderate	Coordinate with medical posts and emergency services to prepare for water supply, waste management and incidents. Install proper and independent facilities at construction site for water supply, sanitation, solid and liquid waste, so that pressure on community infrastructure is limited.	Minor
Traffic and	Risk of Accidents to locals and	Transportation of men and construction materials on and offsite will add to the	Moderate	Implement a traffic safety plan including design of access point, signalization, speed limits, training of drivers, use of traffic guards,	Minor

Indicator	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
safety	traffic congestion	already existing traffic load in the area		procedures for transport of oversized loads (e.g., engines), Maintain log of traffic related incidents, sensitization of road users and people living close to the construction site. Periodic maintenance of transport vehicles The contractor will develop appropriate strategies to minimize the need for transportation of supplies and will ensure compliance with all applicable laws, such as maximum load restriction and speed limits. An awareness program for truck drivers to speed limits and other precautionary	
Cultural	Interactions between construction works	Influx of outside workers with different cultural belief and system may lead to	Minor		Negligible

Indicator	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
heritage	and cultural festivals	clash of culture			

Table 6.2Summary of Mitigation Measures during Operation and Maintenance

Aspect	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Air quality	Localized impairment of air quality	Exhaust emissions from vehicles during transportation of rubber and finished products.	Moderate	Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations;	Minor
	Elevated dust levels	Vehicle movements through unpaved roads	Moderate	Cover properly loose materials and keep top layers moist; Use binder material for erosion and dust control for long term exposed surfaces; Regular cleaning of equipment, drains and roads to avoid excessive build-up of dirt; Spray surfaces prior to excavation;	Minor

Aspect	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				Use covered trucks for the transportation of materials that release dust emissions; and Speed limits on-site of 25km/hr on unhardened roads and surfaces	
Climate Change	Emission of GHG	During operation vehicle emissions and emissions from other machines will release some GHG into the atmosphere also, the issue will further be compounded as carbon is loss due to vegetal clearance	Moderate	For climate change, the impact of GHGs shall be mitigated through the improvements in the leak rate of new equipment, refurbishing older equipment, and the use of more efficient operation and maintenance techniques	Minor
Noise and vibration	Elevated noise level	Noise and vibration arising from the operation of the lumbering machines, grading	High	Develop a detailed plan that relates to noise control for relevant work practices and discuss this with	Moderate

Aspect	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
		machines as well as vehicles conveying products		construction staff during health & safety briefings; Select 'low noise' equipment or methods of work; Use temporary noise barriers for equipment (e.g. sound proofing walls around stationary power generating sources); Avoid dropping materials from height, where practicable; Avoid metal-to-metal contact on equipment; Maintain and operate all vehicles and equipment in accordance with	

Aspect	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				manufacturers recommendations; Ensure periods of respite are provided in the case of unavoidable maximum noise level events; Inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as providing the contact details of the woodland Community Relation Officer; Noisy activities (activities that can be heard in neighbourhood) should be restricted to day-time working hours.	

Aspect	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
Soils, geology and land-use	Change to soil structure (erosion and compaction)	vehicular movements during transport of raw materials and products, digging of building foundations offices are the main activities likely to affect soil structure and quality	Moderate	Construction of building foundations to be undertaken in the dry season; Backfill foundation pits by the excavated soils which will resemble the order of the original soil layers; Vegetal clearance should be reduced to project footprint to prevent soil erosion Protect excavated soil materials from erosion; Ensure that the land is physically restored (include revegetation where possible) before the next	Minor

Aspect	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				rainy season; and Use of existing track for transport of man and material to the extent possible;	
	Potential contamination of soil	Inadvertent release of boric acid or spent oil during the wood treatment processes and machine maintenance		Minimize bare ground and stockpiles to avoid silt runoff; Bonding of areas where hazardous substances are stored (e.g. fuel, waste areas); Regular checking and maintenance of all plant and equipment to minimize the risk of fuel or lubricant leakages; Training of relevant staff in safe storage and handling practices, and	Minor

Aspect	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				rapid spill response and clean-up techniques; Set-up and apply procedure regarding dealing with contaminated soils; Development and implementation of a Waste Management Plan (as part of the ESMP) to ensure that waste is disposed off correctly; and Spread sheet underneath structures prior to the start of any painting activity	
Water resources	Potential contamination of	Runoff of spent oil and other hazardous chemicals from	Moderate	The construction of drainage around project area	Minor

Aspect	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
	the Ethiope River	facility to water body		Avoiding storage of materials that are likely to leach into soil in the open Maintain and operate all oil using equipment and machines in accordance with the manufacture's manual Construction of bund wall around fuel and oil storage areas	
Biodiversity	Fauna migration	Noise and vibration arising from the operation of the lumbering machines, grading machines as well as vehicles conveying products in addition to odor from the seasoned woods will have a	Moderate	Limit site clearance to project footprint; Sensitivity training to staff and anti-poaching policy; and Activities which may affect these	Minor

Aspect	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
		negative impact on the fauna species		flora and fauna resources should be regularized	
	Photosynthesis	Dust generated by vehicular movements may hinder pollination rate thereby affecting the photosynthetic rate of the floral population in the area..		Herbicides should not be used for vegetation clearing Revegetation should use species locally native to the site and not use any environmental weeds for erosion control Implementation of the invasive species management plan as part of the Vegetation Management Plan presented in Chapter 7. Retention of native species where possible. Clearing should be minimized and	Minor

Aspect	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				restricted to the area required for construction purposes only and disturbance to adjacent vegetation and/or remnant trees within the project area should be strictly controlled. A monitoring program of invasive species propagation within the right-of-way should be instituted and, if present, must be removed. Noise affects fauna existence serving as disturbance to then thus causing them to migrate, thus mitigation measures applied for noise applies here as well	
Aquatic	Degradation of	Run off of spent oils from	Moderate	Natural flow of a River shall not	Minor

Aspect	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
ecology	aquatic species	machine maintenance, and boric acid during wood treatment would have a negative impact on the aquatic ecology of the Ethiope River		be blocked Conduct activities during the dry season to minimize disturbance of sensitive wetland area Perform all vegetation clearing work manually along the Ethiope River. Based on an appropriate project design, avoid erecting structures within wetlands. If unavoidable, select the most optimized site for each Avoid equipment and vehicle movements in floodplains and wetland area. If unavoidable, reduce access to a minimum length	

Aspect	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				in wetlands and floodplains and select the most optimized site for the access considering human uses and areas of higher ecological integrity	
Ecosystem Services	Species that provide services to the community will be cleared	Logging activities	Moderate	Preserve species that provide ecosystem services as much as possible Allow species that do not cause harm around the project area	Minor
Visual amenities	Visual effects	Presence of an operational facility with the constant movement of men and materials in and out of the facility will generate a visual effect	Moderate	To reduce the permanent impact on the visual amenities of the landscape, smaller trees and vegetation (<3m) shall be kept, so that there is still green scenery present.	Minor

Aspect	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				Provision of education to construction workers for waste management Construction waste will be appropriated managed at the site and disposed by licensed company	
Community Health, Safety and Security	Increased risks of traffic safety incidents	Movement of vehicle conveying feed and products into and out of the facility respectively.	High	To reduce traffic accident risks the Contractor should implement a traffic safety plan including design of access point, signalization, speed limits, training of drivers, use of traffic guards, procedures for transport of oversized loads (e.g., engines), maintain log of traffic related incidents,	Moderate

Aspect	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				sensitization of road users and people living close to the construction site	
	Potential increase in prevalence of sexually transmitted diseases and other communicable diseases.	Temporary influx of outside workers into the community		To reduce the risk of an increase in STD prevalence, awareness raising material and condoms should be provided to all workers	Moderate
Labour and working conditions	Exploitation of workers	Operation and maintenance of equipment and machines	High	Develop transparent human resources policies and procedures for recruitment process, working conditions, terms of employment wages, worker-employer relations, non-discrimination policy, monitoring, roles and	Moderate
	Occupational H&S risks in operation and maintenance	Minor incidents such as cuts during sawmilling and wood lumbering, accidental spills during wood treatment as well			

Aspect	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
		as major incidents such as accidents which may lead to loss of life during the transportation of products, possible drowning and fire explosion.		responsibilities; Provide reasonable, and if applicable negotiated, working terms and conditions; Establish worker's grievance mechanism, so that potential conflicts can be dealt with in an early and proper way; No use of child labour (workers under age 18) or forced labour is allowed; Provisions to ensure compliance with labour standards by supply chain and subcontracts, including training if required;	

Aspect	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				A worker's grievance mechanism will be in place.	
Employment and Economy	Creation of jobs for local residents and Nigerian nationals	Employment of local residents of the project area and Nigerian nationals in the operation and maintenance of the equipment and machines, processing of the raw materials (rubber wood) into finished products.	Positive	To enhance the positive impact of employment opportunities for local residents a local content plan needs to be prepared to enhance the ability to locate local hires and Nigerian nationals. This plan should include provisions for hiring women and youth and for "equal pay for work of equal value". A local hiring office (or offices) to be set-up for use by all contractors to advertise positions, receive applications, and provide guidance to applicants.	Positive

Aspect	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
	Opportunities for Nigerian companies	Supply of machines and equipment needed by the factory from other companies	Positive	To enhance the positive impact of opportunities for local businesses and entrepreneurs the local content plan should also facilitate identification and selection of qualified local and Nigerian companies to provide needed supplies and services. This plan should include provisions for advance notice to local companies, along with selection criteria including health and safety, to allow them to prepare for upcoming opportunities.	Positive
Infrastructure	Increased pressure on social infrastructure	Influx of outside workers will add to the already existing load on social infrastructures such as road network,	Moderate	Coordinate with medical posts and emergency services to prepare for water supply, waste management	Minor

Aspect	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
		electricity, water and health care facilities of the project area		and incidents. Install proper and independent facilities at construction site for water supply, sanitation, solid and liquid waste, so that pressure on community infrastructure is limited.	
Traffic and safety	Risk of Accidents to locals and traffic congestion	Transportation of men, feeds, products and materials on and off the facility will add to the already existing traffic load in the area	Moderate	Implement a traffic safety plan including design of access point, signalization, speed limits, training of drivers, use of traffic guards, procedures for transport of oversized loads (e.g., engines), Maintain log of traffic related incidents, sensitization of road users and people living close to the	Minor

Aspect	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
				construction site. Periodic maintenance of transport vehicles The contractor will develop appropriate strategies to minimize the need for transportation of supplies and will ensure compliance with all applicable laws, such as maximum load restriction and speed limits. An awareness program for truck drivers to speed limits and other precautionary	
Cultural heritage	Interactions between maintenance	Influx of outside workers with different cultural belief and system may lead to clash of	Minor		Negligible

Aspect	Potential impact	Impact activities	Significance (pre-mitigation)	Mitigation or enhancement measures	Significance (post-mitigation)
	works and cultural festivals	culture			

CHAPTER 7: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

7.1 Introduction

This chapter provides the ESMP for the Wood land Project. Elements of this plan will be taken forward and incorporated into a comprehensive project Environmental and Social Management System (ESMS) that will be used to deliver the Project's HSE regulatory compliance objectives and other related commitments.

This ESMP is a delivery mechanism for environmental and social Impact mitigation and enhancement measures made in the ESIA Report. The purpose of the ESMP is to ensure that the recommendations for environmental and social Impact mitigation are translated into practical management actions which can be adequately resourced and integrated into the Project phases. The ESMP is, therefore, a management tool used to ensure that undue or reasonably avoidable adverse impacts of construction and operation are prevented or reduced and that the positive benefits of the Projects are enhanced (Lochner, 2005).

The ESMP has been developed to meet international standards on environmental and social management performance. The ESMP is intended to cover those activities described in Chapter 3 of this ESIA report. It covers project activities during construction and operation and will be subject to thorough reviews prior to the commencement of activities to ensure completeness. However, the ESMP did not include measures for activities related to equipment and facility fabrication being done offsite. It should be noted that this provides the outline requirements for environmental management. Provision will be made for updating the outlined ESMP once the detailed project design is completed and for adapting the ESMP to relevant project stages as part of the overall ESMS.

The plan details the mitigation and enhancement measures wood land have committed to implement through the life of the Project and includes desired outcomes; performance indicators; targets or acceptance criteria; monitoring and timing for actions and responsibilities. Woodland will have principal responsibility for all measures outlined in the ESMP for the construction phase. Woodland is responsible for the implementation of the measures in the operation phase; but may delegate responsibility to its contractors, where appropriate.

In cases where other individuals or organizations have responsibility for mitigation or enhancement measures, this is clearly indicated in Tables 7.2 and 7.3. Capacity building and training requirements are also described, where these relate to specific skills required to deliver the ESMP action in question.

7.2 Objectives of the ESMP

The ESMP is needed to successfully manage the project's environmental and social performance throughout its lifecycle. It provides integration of environmental and social management with overall project engineering, procurement, construction, and operations. The ESMP is prepared to achieve the following objectives.

- ✧ promote environmental and social management in the project implementation in all phases;
- ✧ ensure that all relevant stakeholders are aware of their respective responsibility - promoter, contractors, regulators and other relevant agencies;
- ✧ incorporate environmental and social management into project design and operating procedures and activities;
- ✧ serve as an action plan for environmental and social management for the project;

- provide a framework for implementing environmental and social commitments described in chapter seven;
- prepare and maintain records of project environmental performance for monitoring and evaluating performance.

7.3 Institutional Framework for Implementation

Responsibilities in the implementation and monitoring of the ESMP are shared between multiple stakeholders, including Woodland management, the contractors, regulatory and concerned agencies. The Managing Director in collaboration with the managers and contractors shall responsible for implementation of the ESMP. Overall regulatory agencies at National State and Local Government levels are responsible for the monitoring of the ESMP implementation. Figure 7.1 illustrates the structure of the institutional arrangements.

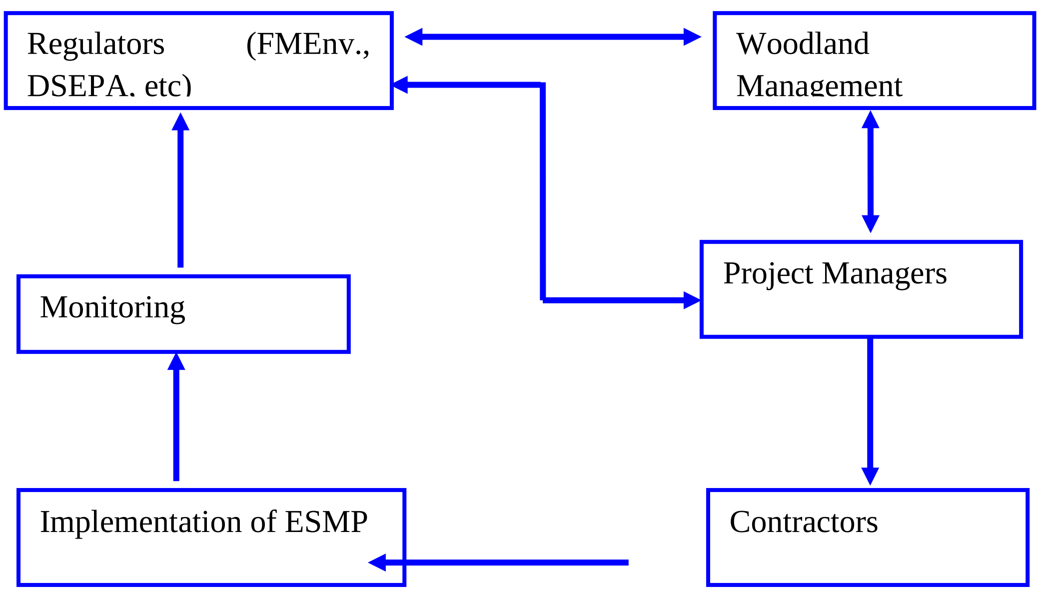


Figure 7.1 Institutional Arrangements for ESMP Implementation

7.3.1 Woodland Management and Organizational structure

Woodland is the implementation agency for this project. Hence, has the overall responsibility for its success. The Managing Director has been appointed by the Woodland Management to handle this responsibility as described in Table 7.1.

7.3.2 General management

Figure 7.1 shows the general organizational structure for management. Direct and indirect reporting lines are shown as blue. It is clear that numerous staff members will have defined responsibilities for managing sustainability issues; ultimately it is the Managing Director that is responsible for making it happen, and will report directly to the Board, subsequently, the Board will be accountable to shareholders for sustainability performance. The managers of the various units (site manager, operational manager, HSE manager) will be responsible for implementing the policy and strategy, and reports primarily to the Managing Director.

7.3.3 Responsibilities and reporting lines of key staff members and governance bodies

Responsibility for sustainability management in particular the implementation of the management system falls under the responsibilities of numerous levels and functions in the organization as shown in Figure 7.1.

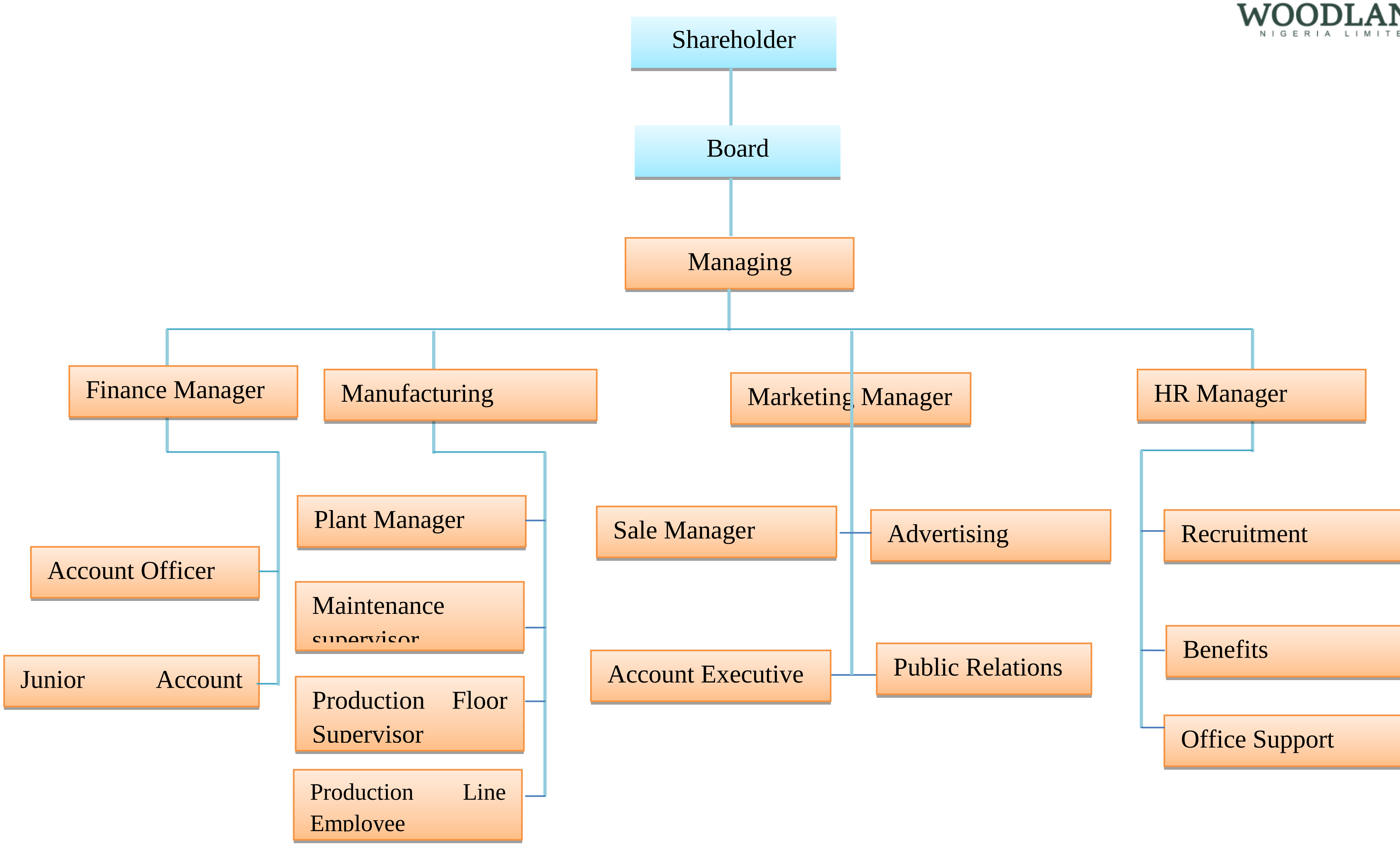


Figure7.2: Organizational structure showing staff involved in sustainability management

Accountabilities, reporting lines and responsibilities of key staff members and governance bodies are indicated in Table 7.1.

Table 7.1: Responsibilities and reporting lines

Position/structure	Accountable to/ reporting line	Responsibilities
Board		
Chairman	Stakeholders	Has ultimate accountability for sustainability performance at Woodland Ensures that sustainability is integrated into company strategy, governance and decision-making
Board Committee on Sustainable Development	Chairman Stakeholders	Approve policy and strategy related to sustainability Provides oversight of sustainability management Ensure the company takes a stakeholder approach to governance and decision making Oversee the production and disclosure of a public annual report on sustainability performance to stakeholders Ensure that the company's risk strategy, policy and management incorporate sustainability issues, both positive and negative
Board Committee on Audit	Chairman Stakeholders	Oversee the company's risk strategy and management Recommend an external assurance provider for the disclosure of performance on material sustainability issues Review the public disclosure of sustainability issues in the annual/sustainability report and public disclosures to ensure that it is reliable and does not conflict with the financial information.
Senior Management		
Managing Director	Board of Directors	Ensure sustainability is integrated into company management and decision-making processes such as management meetings and reporting, and risk management Ensure sustainability is integrated into numerous operational functions such as operation of the plant and quarry, human resources, supply chain (including security), sustainable development, finance and legal. Allocate adequate human and financial resources to enable effective functioning and continual improvement of the Sustainability Management System Establish and maintain a governance system to monitor performance of the Sustainable Development team Attend stakeholder forums such as community meetings, as appropriate, to demonstrate senior management support
Site Manager	Managing	Implement the sustainability management system in the

	Director	construction activities, which will include the environmental and social management plan and action plan, and other components. Hold the contractors and their teams in the site responsible for sustainability performance.
Manufacturing Manager	Managing Director	Implement the sustainability management system in the manufacturing operations, which will include the environmental and social management plan and action plan, and other components. Hold the managers and their teams in the plant responsible for sustainability performance, notably the Plant Manager and Maintenance Supervisor. Ensure sustainability is integrated into plant management and decision-making processes such as management meetings and reporting, and risk management Attend stakeholder forums such as community meetings, as appropriate, to demonstrate senior management support
Finance Manager	Managing Director	Incorporate financial resources related to the implementation of the sustainability management system (e.g. salaries, skills development and training, equipment, liabilities including rehabilitation and closure, social development initiatives, independent audit/assurance etc.) into company financial systems
Marketing Manager	Managing Director	Integrate ethical, social, and environmental and gender equality criteria, and health and safety, in marketing and contracting policies and practices. In particular assess human rights issues, including child and forced labour, in supplier selection and management. Development and implementation of a supplier and contractor code of practice for sustainability management, in liaison with the Human Resources Manager. Carry out appropriate due diligence and monitoring of suppliers to ensure compliance or movement towards compliance with company policies and plans. Work with suppliers to improve sustainability performance through awareness raising and capacity building
Human Resources Manager	Managing Director	Implement workplace policies, procedures, and management plans, notably recruitment, severance arrangements, skills development, training and awareness and retrenchment. Ensure that policies and procedures incorporate the provisions of national labour law and international standards such as those of the International Labour Organization, ISO26000, IFC Performance Standard 2 on Labour and Working Conditions, and the World Bank Group Environmental, Health and Safety

		Guidelines. Implementation of the policies will cover direct, contracted and supply chain workers, and will include provisions covering human rights, non-discrimination, fair remuneration, equal opportunity, vulnerable people, skills development, grievance management, health and safety, forced and child labour, and the right to collective bargaining. Implement a transparent and non-discriminatory grievance procedure to manage workplace concerns

7.4 Regulatory Agencies and Other Concerned Authorities

The Federal Ministry of Environment (FMEnv) has the responsibility for the implementation of the EIA Act 86 of 1992. Furthermore, State Ministries for Environment and the affected LGA have certain oversight roles, which they perform under coordination of the FMEnv.

Responsibilities for the ESMP and its implementation are shared between multiple stakeholders, including concerned ministries, competent authorities, Woodland and the contractors. These include the following;

- ✧ Federal Ministry of Environment
- ✧ Federal Ministry of Industry, Trade and Investment
- ✧ National Environmental Standards and Regulations Enforcement Agency (NESREA)
- ✧ Standards Organization of Nigeria (SON)
- ✧ Delta State Ministry of Environment
- ✧ Delta State Environmental Protection Agency (DSEPA)
- ✧ Delta Waste Management Authority
- ✧ Delta State Ministry of Lands, Survey & Urban Development
- ✧ Delta State Ministry of Women Affairs and Social Development

- ✧ Sapele Local Government Authority (LGA):

The responsibilities and roles of each of the institutions are discussed below.

7.4.1 Federal Ministry of Environment

The Federal Ministry of Environment is responsible for the overall environmental policy of the Country. It has the responsibility for ESIA implementation and approval, in accordance with the EIA Act. It has developed certain guidelines and regulations to protect the environment and promote sustainable development. It will monitor the implementation of mitigation measures, when the project commences. And they can issue directives to the project on specific actions related to the environment in the project area. The Ministry normally involves the states and sometimes local governments in this responsibility depending on the specific activity.

7.4.2 Federal Ministry of Industry, Trade and Investment

Federal Ministry of Trade and Investment was created to help diversify the resource base of the economy by promoting trade and investment with special emphasis on increased production and export of non-oil and gas products that will lead to wealth and job creation, poverty reduction and ensure enhanced service delivery in a manner that will stimulate the growth of the domestic economy for self-reliance and export and its integration into the global market taking full advantage of globalization

The ministry was to help reduce dependency on the oil and gas industry but rather to promote production that will stimulate the growth of the local economy through Exports thereby creating jobs and reducing poverty. The main objective is to reposition commerce as the hub of the nation’s economy.

7.4.3 National Environmental Standards and Regulations Enforcement Agency (NESREA)

NESREA has responsibility for the protection and development of the environment, biodiversity conservation and sustainable development of Nigeria’s natural resources in general and environmental technology including coordination and liaison with relevant stakeholders within and outside Nigeria on matters of enforcement of environmental standards, regulations, rules, laws, policies and guidelines.

7.4.4 Standard Organisation of Nigeria (SON)

The Standard Organisation of Nigeria (SON) is the apex body in charge of standardization in Nigeria. Standardization is the process of developing and implementing of technical standards based on the agreement of different entities that include governments, standard organisations, firms, interest groups, and users. They are in charge of all the products, processes and scientific study of measurement standards in Nigeria.

7.4.5 Delta State Ministry of Environment

Delta State Ministry of Environment is charged with the obligation of developing and creating environmental policies, environmental protection and control, environmental technology including efficient implementation of research and development. The ministry also carries out different task of Planning, Designing and Constructing of Ecological and environmental facilities, environmental sanitation and urban waste disposal and management and the Provision of Natural Preservation which includes Forestry, Conservations, Ecology, and Sanitation. It also supervises the activities of Delta State Environmental Protection Agency (DSEPA), Waste Management Board and takes the responsibility for liaising with companies on pollution and environmental matters.

7.4.6 Delta State Ministry of Lands, Survey & Urban Development

This ministry is responsible for the issuance of certificate of occupancy (C of O) for the proposed factory sites Delta State. Other functions of the Agency include

- Preparation and issuance of Certificates-of-Occupancy and other certificate evidencing titles.
- Preparation and issuance of Right-of-Occupancy.
- Production and printing of Titled Deed Plan (TDP).

- Street naming and house numbering.
- Provision of Geospatial information infrastructure.
- Property search and verification of land record.
- Land application processing and administration.

7.4.7 Delta State Ministry of Women Affairs and Social Development

It has the responsibility

- To promote the survival, protection, participation and development of children
- To promote family harmony and reduce juvenile delinquency
- To provide care, support, rehabilitation and empowerment for the vulnerable groups(challenged persons, older persons, destitute and the likes)
- To collaborate and network with Non-Governmental Organizations, Professional Institutions and other MDAs on issues affecting women, children/vulnerable ones.

7.4.8 Sapele Local Government Council

The project site is located in Sapele Local Government Council. The LGC would be responsible for the legislation of environmental issues as they affect the LGC especially on waste management and community health and safety. The LGC will also have roles in the administration of lands in rural areas and hence, will be involved in the decision-making process.

Table 7.2: Responsibilities for Implementation and Monitoring of Mitigation Measure during the Construction and Operation Phases

Indicator	Potential impact	Receptor	Significance	Mitigation or enhancement measures	Significance (post-mitigation)	Responsibilities		
						Mitigation Action	Implementation Action	Monitoring Action
Air quality	Localized impairment of air quality by exhaust emissions from vehicles and equipment engines (SO_2, CO, NOx, CO_2, PM)	Affected community in area of influence Construction work	Minor	✧ Maintain and operate all vehicles and equipment engines in accordance with manufacturers recommendations; ✧ Regular cleaning of equipment, drains and roads to avoid excessive build-up of dirt; ✧ Water sprays for dust suspension ✧ Timing with respect to wind direction ✧ Use covered trucks for the transportation of materials that release dust emissions; ✧ Avoid overloading ✧ Speed limits on-site of 25km/hr. on unhardened roads and surfaces ✧ Cover properly loose materials and keep top layers moist ✧ Use binder material for erosion and	Negligible	Woodland contractors	HSE Dept and Site Manager	FMEnv, DSMEnv and Sapele LGA
	Elevated dust levels in nearby community as a result of dust raised by vehicle movements, wind, and handling of dusty material	Affected community in area of influence, Construction workers	Minor		Negligible	Woodland contractors	HSE Dept and Site Manager	FMEnv, DSMEnv and Sapele LGA

Indicator	Potential impact	Receptor	Significance	Mitigation or enhancement measures	Significance (post-mitigation)	Responsibilities		
						Mitigation Action	Implementation Action	Monitoring Action
				dust control for long term exposed surfaces ✧ Implement re-vegetation action plan				
Climate Change	GHG will be emitted from construction material production, energy use in construction activity	Global warming	Minor	✧ Impact of GHGs shall be mitigated through the improvements in the leak rate of new equipment, refurbishing older equipment, and the use of more efficient operation and maintenance techniques.	Negligible	Woodland contractors	HSE Dept and Site Manager	FMEnv, DSMEnv and Sapele LGA
Noise, vibration	Nuisance noise and vibration from construction activities	Affected community in area of influence Construction workers	Moderate	✧ Develop a detailed plan that relates to noise control for relevant work practices and discuss this with construction staff during health & safety briefings ✧ Select 'low noise' equipment or methods of work ✧ Restrict construction activities to day time ✧ Avoid dropping materials from height, where practicable	Minor	Woodland contractors	HSE Dept and Site Manager	FMEnv, DSMEnv and Sapele LGA

Indicator	Potential impact	Receptor	Significance	Mitigation or enhancement measures	Significance (post-mitigation)	Responsibilities		
						Mitigation Action	Implementation Action	Monitoring Action
				✧ Avoid metal-to-metal contact on equipment ✧ Inform all potentially impacted residents of the nature of works to be carried out; the expected noise levels and duration,				
Soils, geology and land-use	Change to soil structure (erosion and compaction) as a result of excavation and backfilling and removal of vegetation	Soil in and around the project area	Moderate	✧ Construction of foundations to be undertaken in the dry season. ✧ Backfill foundation pits by the excavated soils which will resemble the order of the original soil layers. ✧ Protect excavated soil materials from erosion. ✧ Ensure that the land is physically restored (include revegetation where possible ✧ The metallic structures should be protected against corrosion. ✧ Accidental spills from machine maintenance shall be properly managed	Minor	Woodland contractors	HSE Dept and Site Manager	FMEnv, DSMEnv and Sapele LGA
	Potential contamination of soil from inadvertent release of hazardous or contaminating material (liquid		Moderate		Minor	Woodland contractors	HSE Dept and Site Manager	FMEnv, DSMEnv and Sapele LGA

Indicator	Potential impact	Receptor	Significance	Mitigation or enhancement measures	Significance (post-mitigation)	Responsibilities		
						Mitigation Action	Implementation Action	Monitoring Action
	fuel, solvents, lubricants, aluminium oxide paint, etc)			✧ Develop project specific waste management plan and ensure proper implementation ✧ Provide adequate containers for waste collection ✧ Periodically audit contractor activities to check the level of compliance to regulatory waste management requirements ✧ Ensure engagement of government approved waste management contractors ✧ Safe operating practices are enforced during construction				
Water resources	Potential surface and groundwater contamination from accidental spills and improper disposal of waste and wastewater	Local groundwater and the Ethiope River	Moderate	✧ Ground water shall be used for construction in place of surface water ✧ Use of trained workers ✧ Rivers and streams shall not be dammed for the purpose of water abstraction	Minor	Woodland contractors	HSE Dept and Site Manager	FMEnv, DSMEnv and Sapele LGA

Indicator	Potential impact	Receptor	Significance	Mitigation or enhancement measures	Significance (post-mitigation)	Responsibilities		
						Mitigation Action	Implementation Action	Monitoring Action
	Exploitation of water resources, sourced from nearby water bodies through tanks			✧ Accidental spills from machine ✧ maintenance shall be properly managed ✧ Continuous training of workers on HSE protocols ✧ Conducting daily safety briefings				
Biodiversity	Disturbance to habitats, fauna and flora arising from dust, air emissions, light, noise and vibration, traffic, accidental spillages and sediment run-off	Flora and fauna and habitat in the area of influence	Minor	✧ Restrict construction activities, including vehicle movements and material storage, within the project foot print ✧ Promote the use of existing roads for transporting material to the construction sites in order to reduce the project's footprint and minimize the need for new access roads	Negligible	Woodland contractors	HSE Dept and Site Manager	FMEnv, DSMEnv and Sapele LGA
	Vegetation clearing will cause habitat disturbances that could create suitable conditions for invasive species	Flora and fauna within construction site	Moderate	✧ Re-vegetation should use species locally native to the site and not use any environmental weeds for erosion control	Minor	Woodland contractors	HSE Dept and Site Manager	FMEnv, DSMEnv and Sapele LGA

Indicator	Potential impact	Receptor	Significance	Mitigation or enhancement measures	Significance (post-mitigation)	Responsibilities		
						Mitigation Action	Implementation Action	Monitoring Action
	to spread							
	Loss of vegetation due to clearing for construction which will cause habitat disturbances and further aggravate loss of succulents for pastoralist	Construction site	Moderate		Minor	Woodland contractors	Woodland Site Manager d MD	FMEnv, DSMEnv and Sapele LGA
Aquatic ecology	Degradation of aquatic habitats due to construction activities around surface water bodies would further compound source of water for herds and irrigation farming	Ethiope River	Moderate	✧ Conduct activities during the dry season to minimize disturbance of the water body ✧ Avoid vegetation clearing along stream shores and on steep slopes. ✧ Based on an appropriate project design, avoid erecting towers within water bodies. If unavoidable, select the most optimized site for each tower considering human uses and areas of higher ecological integrity. ✧ Prohibit construction of permanent	Minor	Woodland contractors	Site Manager	FMEnv, DSMEnv and Sapele LGA

Indicator	Potential impact	Receptor	Significance	Mitigation or enhancement measures	Significance (post-mitigation)	Responsibilities		
						Mitigation Action	Implementation Action	Monitoring Action
				structures along river banks or in areas where soils are saturated				
Visual amenities	Temporary presence of an active construction site with storage of materials and equipment within the site.	People living close to the construction sites.	Moderate	✧ Rehabilitate disturbed areas as soon as practically possible after construction. This should be done to restrict extended periods of exposed soil. ✧ Restore temporal work zones	Minor	Woodland contractors	Site Manager	FMEnv, DSMEnv and Sapele LGA
Community Health, Safety and Security	Increased risks of traffic safety incidents on public roads	People living close to access roads and road users		✧ Provide workers with personal protective equipment ✧ Provide safety signs, labels and stripes to avoid hazards and accidents ✧ Raise worker awareness of chemicals used, storage and disposal ✧ Provide spill kits and train workers on their use ✧ Provide first aid kit, fire		Woodland contractors	Site Manager	FMEnv, DSMEnv and Sapele LGA
	Temporary influx of outside workers in the communities, risking tensions between outside	Affected community in area of influence				Woodland contractors	Site Manager	FMEnv, DSMEnv and Sapele LGA

Indicator	Potential impact	Receptor	Significance	Mitigation or enhancement measures	Significance (post-mitigation)	Responsibilities		
						Mitigation Action	Implementation Action	Monitoring Action
	(partly possibly expatriate) labour and local population, due to differences in wealth and culture.			extinguishers, alarm bells and emergency numbers ✧ Provide transportation signs and speed limits ✧ Train workers on routine check- ups and ✧ maintenance of equipment ✧ Provide workers with health care and required vaccines ✧ Delineate free spaces during cutting, sawing,				
	Potential for increase in prevalence of sexually transmitted diseases in local communities and other communicable diseases.	Affected community in area of influence			Minor	Woodland contractors	Site Manager	FMEnv, DSMEnv and Sapele LGA
	Risk of erosion into creeks, which are used as source of domestic water for the communities	Affected community in area of influence			Minor	Woodland contractors	Site Manager	FMEnv, DSMEnv and Sapele LGA

Indicator	Potential impact	Receptor	Significance	Mitigation or enhancement measures	Significance (post-mitigation)	Responsibilities		
						Mitigation Action	Implementation Action	Monitoring Action
Labour and working conditions	Exploitation of workers	Labour force	Moderate	✧ Develop transparent human resources policies and procedures for recruitment process, working conditions and Terms of Employment wages, worker-employer relations, Grievance Mechanism, non-discrimination, monitoring, roles and responsibilities following Nigerian Labour Law and ILO conventions. ✧ Provide reasonable, and if applicable negotiated, working terms and conditions. ✧ Establish worker's grievance mechanism, so that potential conflicts can be dealt with in an early and proper way. ✧ No use of child labours (workers under age 18) or forced labour. ✧ Provisions to ensure compliance with labour standards by supply	Minor	Woodland contractors	HR Dept. and Site Manager	FMEnv, DSMEnv and Sapele LGA
	Activities and staff at site may create security risks	All staff working at the construction site						
	Risk of health & safety incidents amongst labour force, including minor incidents such as cuts and major incidents such as loss of life	Construction labour force				Woodland contractors	HSE Dept. and Site Manager	FMEnv, DSMEnv and Sapele LGA

Indicator	Potential impact	Receptor	Significance	Mitigation or enhancement measures	Significance (post-mitigation)	Responsibilities		
						Mitigation Action	Implementation Action	Monitoring Action
				chain and subcontracts, including training if required. ✧ Provide proper work place facilities for water/sanitation/rest rooms. ✧ If case of retrenchment needs first viable alternatives are analyzed and then adverse impacts of retrenchment on workers are reduced as much as possible. A transparent retrenchment plan will be prepared. ✧ A worker's grievance mechanism will be in place. ✧ Make security plan and emergency response and contacts with security forces. ✧ Develop project specific health and safety procedures based on Wärtsilä's standard health and safety procedures, including provisions for training and certifications to be followed by all workers including				

Indicator	Potential impact	Receptor	Significance	Mitigation or enhancement measures	Significance (post-mitigation)	Responsibilities		
						Mitigation Action	Implementation Action	Monitoring Action
				subcontractors. Especially slip-trip and fall hazards with tower erection and electrocution need attention.				
Employment and economy	Creation of temporary jobs for locals' residents and Nigerian nationals with skilled trades	Local residents of the project area and Nigerian nationals	Positive	✧ Prepare a local content plan to facilitate identification and selection of qualified local and Nigerian companies to provide needed supplies and services. Include provisions for advance notice to local companies, along with selection criteria including health and safety, to allow them to prepare for upcoming opportunities	Positive	Woodland contractors	HR Dept. and Site Manager	FMEnv, DSMEnv and Sapele LGA
	Supply chain opportunities for Nigerian companies that can provide goods and services needed by the factory	Nigerian companies and local SMEs	Positive		Positive	Woodland contractors	HR Dept. and Site Manager	FMEnv, DSMEnv and Sapele LGA
Infrastructure	Influx of outside workers may pose additional pressure on social infrastructure, like	Affected community in the area of influence	Negligible	✧ The provision of alternative facilities for workforce e.g. medical services, fire-fighting equipment etc. ✧ Funding of local community projects to compensate for impacts.	Negligible	Woodland contractors	HR Dept. and Site Manager	FMEnv, DSMEnv and Sapele LGA

Indicator	Potential impact	Receptor	Significance	Mitigation or enhancement measures	Significance (post-mitigation)	Responsibilities		
						Mitigation Action	Implementation Action	Monitoring Action
	medical posts, emergency services, water supply, solid waste management							
Cultural heritage	Potential interactions between construction works and cultural festivals due to traffic, noise and/or vibration impacts	Affected community	Negligible	NA	Negligible	Woodland contractors	HR Dept. and Site Manager	FMEnv, DSMEnv and Sapele LGA

Table 7.3: Responsibilities for Implementation and Monitoring of Mitigation Measure (Construction Phase)

Component	Parameters to be Monitored	Method	Standards/Targets	Location	Frequency	Responsibility	Cost Estimates (NGN)
Air quality	SO_2, NOx, CO_2, CO, VOC, PM, SF_6	Visual inspection of operational sites, access roads; verification of equipment and machinery Ambient air quality measurements	Avoid significant degradation of baseline conditions. WHO and National ambient air quality standards (FMEnv)	Within the project area	Monthly	HSE Dept and Site Manager	600,000
Noise, vibration	Noise Levels	Noise level measurements	Avoid significant degradation of baseline conditions. WHO and FMEnv noise standards	Within the project area	Monthly	HSE Dept and Site Manager	600,000
Soils integrity	Visual signs of contamination Status of drainages, bund walls, stockpiles, etc.	Visual inspection of operational sites and access roads	Avoid the use of erosive processes or control them Reduce soil compaction Avoid soil profile structure destruction Avoid any soil contaminations	Within the project area	Monthly	HSE Dept. and Site Manager	1,150,000
	Soil biological, physical and chemical properties	Sampling and analyses of soils	Avoid significant degradation of baseline conditions. FMEnv soil quality standards	Within the project area	Monthly	HSE Dept and Site Manager	

Component	Parameters to be Monitored	Method	Standards/Targets	Location	Frequency	Responsibility	Cost Estimates (NGN)
Water quality	Water physico-chemical and microbiological - pH, temperature, TSS, turbidity, phosphorus, metals, sulphate, BOD, COD, coliform, fungi, etc.	Analysis of surface and ground water samples Visual detection of pollution signs (presence of oil, waste, etc.)	Avoid significant degradation of baseline conditions WHO and FMEnv water quality standards	At surface water bodies and ground water around Project area	Bi-weekly	HSE Dept and Site Manager	1,600,000
Aquatic ecology	Same as water quality Fish catch yield	Visual inspection of rivers and streams Interview with fishermen Inspection of new access roads in swampy areas	Avoid equipment and vehicle movements in rivers and swamps.				
Vegetation integrity and Fauna protection	Vegetation cover Pictorial comparison (before and after) Fauna species, age, number of individuals sighted	Visual inspection of operational sites, adjacent habitats and access roads	Avoid significant degradation outside the factory footprint. Protection of flora species with conservation status Avoid habitat loss and disturbances for local fauna	Within the project area	Monthly	HSE Dept and Site Manager	250,000
Visual amenities	Orderliness and cleanliness of sites	Visual inspection of operational sites and	Good housekeeping practice Site clearance activities to be	Within the project area	Bi-weekly	HR Dept. and Site Manager	150,000

Component	Parameters to be Monitored	Method	Standards/Targets	Location	Frequency	Responsibility	Cost Estimates (NGN)
Land planning and use	disturbance outside factory footprint	access roads	restricted to the minimum required area. Provision of predefined route, barriers or boundary markings to prevent incursion of machinery and workers into neighbouring areas				
Stakeholder relations Management	No of complaints/ concerns received Status of grievance resolutions	Interview neighbouring communities Stakeholder meetings Inspection of complaints/grievance log book	Grievances are resolved effectively Complaints and issues are addressed timely	Within the project area	Monthly	HR Dept. and Site Manager	150,000
Health, Safety and Security	Incidences	Inspection and review of incidence log	ILO requirements and Factories Act minimum labour standards	Within the project area	Bi-weekly	HSE Dept and Site Manager	300,000
Employment and economy	Proportion of employees from local community materials procured from local community made in Nigeria materials used	Inspect employee records Random interview with workers on site Inspection of procurement records	Semi-skilled and non-skilled labour employed from local community Materials available in the communities are used Made in Nigeria products are utilized, except where not available	Work sites	Monthly	HR dept. and Site Manager	500,000

Component	Parameters to be Monitored	Method	Standards/Targets	Location	Frequency	Responsibility	Cost Estimates (NGN)
		Interview with suppliers and vendors					

Table 7.4 Environmental and Social Monitoring Plan (Operations Phase)

Component	Parameters to be Monitored	Method	Standards/Targets	Location	Frequency	Responsibility	Cost Estimates (NGN)	Monitoring action
Noise, vibration	Noise Levels	Noise level measurements	Avoid significant degradation of baseline conditions. WHO and FMEnv noise standards	Project area	Annually	Woodland-HSE Dept.	880,000	FMEnv, DSMEnv and Sapele LGA
Soils integrity	Visual signs of contamination Status of drainages, bund walls, stockpiles, etc.	Visual inspection of tower sites and access roads	Avoid the use of erosive processes or control them Reduce soil compaction Avoid soil profile structure destruction Avoid any soil contaminations	Project area	Annually	Woodland-HSE Dept.	1,900,000	FMEnv, DSMEnv and Sapele LGA

Component	Parameters to be Monitored	Method	Standards/Targets	Location	Frequency	Responsibility	Cost Estimates (NGN)	Monitoring action
	Soil biological, physical and chemical properties	Sampling and analyses of soils	Avoid significant degradation of baseline conditions. FMEnv soil quality standards	Project area	Annually	Woodland-HSE Dept.		
Water quality	Water physico-chemical and microbiological -pH, temperature, TSS, turbidity, phosphorus, metals, sulphate, BOD, COD, coliform, fungi, etc.	Analysis of surface and ground water samples Visual detection of pollution signs (presence of oil, waste, etc.)	Avoid significant degradation of baseline conditions WHO and FMEnv water quality standards	At surface water bodies and ground water around Project area	Annually	Woodland-HSE Dept.	3,700,000	FMEnv, DSMEnv and Sapele LGA
Aquatic ecology	Same as water quality Fish catch yield	Visual inspection of rivers and streams Interview with fishermen Inspection of new access roads in swampy areas	Avoid equipment and vehicle movements in rivers and swamps.					

Component	Parameters to be Monitored	Method	Standards/Targets	Location	Frequency	Responsibility	Cost Estimates (NGN)	Monitoring action
Vegetation integrity and Fauna protection	Vegetation cover Pictorial comparison (before and after) Fauna species, diversity and number of individuals sighted	Visual inspection of areas along access roads and around the factory	Avoid significant degradation outside the factory footprint and undeveloped areas. Protection of flora species with conservation status Avoid habitat loss and disturbances for local fauna	Project area	Every 3 years	Woodland-HSE Dept..	350,000	FMEnv, DSMEnv and Sapele LGA
Visual amenities Land planning and use	Orderliness and cleanliness of sites disturbance outside acquired sites	Visual inspection of areas around along the factory	Good housekeeping practice Site clearance activities to be restricted to the minimum required area. Provision of predefined route, barriers or boundary markings to prevent incursion of machinery and workers into neighbouring areas	Project area	Annually	Woodland-HSE Dept..	350,000	FMEnv, DSMEnv and Sapele LGA

Component	Parameters to be Monitored	Method	Standards/Targets	Location	Frequency	Responsibility	Cost Estimates (NGN)	Monitoring action
Stakeholder relations Management	No of complaints/ concerns received Status of grievance resolutions	Interview neighbouring communities Stakeholder meetings Inspection of complaints/grievance log book	Grievances are resolved effectively Complaints and issues are addressed timely	Project area	Annually	Woodland-HSE Dept..	500,000	FMEnv, DSMEnv and Sapele LGA
Health, Safety and Security	Incidences	Inspection and review of incidence log	ILO requirements and Factories Act minimum labour standards	Project area and neighbouring communities	Monthly	Woodland-HSE Dept.	350,000	FMEnv, DSMEnv and Sapele LGA
Employment and Economy	Proportion of employees from local community materials procured from local community made in Nigeria materials used	Inspect employee records Random interview with workers Inspection of procurement records Interview with suppliers and vendors	Semi-skilled and non-skilled labour employed from local community Made in Nigeria products are utilized, except where not available	neighbouring communities	Annually	Woodland-HSE Dept.	200,000	FMEnv, DSMEnv and Sapele LGA

7.5 Management Subplans/Programs

The ESIA study did triggered development of specific management plans to with;

- Air Quality Management Plan
- Waste Management Plan;
- Biodiversity Management Program;
- Community Health and Safety Management Plan
- Traffic Management Plan
- Construction Management Plan

Each plan outlines developmental and implementable procedures as part of the overarching ESMS to be developed and implemented by woodland and the Contractor, as applicable.

Furthermore, the Contractors required to develop and implement the following Construction triggered Management Plan

- Access Roads Location and Management Plan;
- Soil and Erosion Management Plan;
- Update the Traffic Management Plan;
- Training and Skill Transfer Program;
- Worker's Health and Safety Management Plan;
- Environmental and Social Code of Conduct;
- Contractors' GRM for Communities and Workers;

- ✧ Method Statements, including, but not limited to: erosion control, work in heights, and others that may be required by the Contractor.

These specific management plans will be drafted by the Contractor, based on the requirements presented in this ESMP, and submitted to Woodland for approval in consultation with stakeholders prior to activity kick off.

7.5.1 Air Quality Management Program

7.5.1.1 Justification and Objectives

Generation of particulate matter and emission of GHG is expected mainly in all phases of the project. When super imposed on the ambient condition, baseline levels above regulatory limits for microenvironment are likely. This plan is aimed at controlling GHG emissions and PM generation particularly at the construction phase. No significant impacts on air quality were identified for the operational phase while the 50-year operational period before decommissioning makes it untenable to have included decommissioning in the Plan.

7.5.1.2 Legal Framework

Legislative safeguards for air quality in Nigeria are enshrined in FMEnv. 2004 document on regulatory limits as outlined in Table 4.5.

7.5.1.3 Actions and Implementation Schedule

Tables 7.4 provides applicable control and actionable mitigation measures during the initial construction phases (various applicable activities were spelt out in Table 8.6), in order to reduce the emission footprint of GHG and PMs. It also provides in-built design systems to achieve emission reduction. Implementation of the spelt-out mitigation measures shall address GHG emissions and PM generation concerns.

Table 7.5 Air quality management program – actions, description and implementation schedule

Control and Mitigation Actions	Description	Implementation Schedule	Responsibility for Implementation	Supervision
Control emissions of dusts and pollutant gases	Movement of men and machineries to be planned to avoid residential areas, hospitals and schools as practicably possible	During construction and operation	Woodland Contractor, HSE Dept.	FMEnv, DSMEnv. and Sapele LGC
	Schedule maintenance of machineries shall be strictly adhered to avoid release of avoidable noxious gases. Scheduled daily equipment working hours, operator's training program and weekly safety briefings shall be some factors in the internal monitoring system.	During construction and operation	Woodland Contractor, HSE Dept.	FMEnv, DSMEnv. and Sapele LGC
	Minimizations of hauling distances by sourcing construction materials near-by as much as possible. An allowable 0.2- 0.4 m space is left unloaded for any construction materials carrying trucks.			
	Trucks carrying dusty materials needed be adequately covered;			
	Stockpiles of granular materials need be water proofed protected and/or sprinkled with water constantly			
	Use of water as dust suppressants shall be employed in every work front with un paved surfaces twice per week in wet seasons and daily during dry seasons.	Twice weekly in wet seasons and daily (in the dry season, during construction and operation	Woodland Contractor, HSE Dept.	FMEnv, DSMEnv. and Sapele LGC
	The construction lay down area shall be sprinkled with water twice a week during wet seasons and daily during dry seasons.		Woodland Contractor, HSE Dept.	FMEnv, DSMEnv. and Sapele LGC

7.5.1.4 Follow-up Monitoring on Mitigation effectiveness and Grievance Receipt

Air quality monitoring actions shall be developed during the initial decommissioning and construction phase in areas less than 250m to residential areas and 100m to hospitals and schools. Parameters to be measures are CO, CO_2, SO_X, NO_X and CH_4. A bi weekly frequency monitoring is planned.

Table 7.6 summarizes the follow-up and monitoring actions and the implementation schedule.

Table 7.6 Air quality management program - follow-up and monitoring actions, description and implementation schedule

Follow-up or Monitoring Action	Description	Implementation schedule
Periodic air quality monitoring	Air quality monitoring stations shall be established during construction phase at the defined threshold distances near three sensitive receptors, Homes, schools and hospitals.	Monthly during construction
Air quality monitoring in response to complaints	If complaints from the local population regarding air quality are registered, (i) Corrective actions for simple complaints such as need for additional or more frequent watering program for dust control, traffic speed issues shall be implemented ASAP and (ii) Air quality monitoring will be undertaken near the affected sensitive receptors, to verify the ambient air quality levels and define additional mitigation, if required.	When necessary

7.5.1.5 Corrective Actions

In the event that the air quality values recorded exceed FMEnv regulatory limits, or if complaints from the local communities are lodged, causal factors for such elevated concentrations shall be identified and corrected. Elevated concentrations normally result from failure to adhere to any or some of the mitigation measures listed in Table 7.2.

In the event of non-compliances, additional mitigation, measures shall be defined on case by case basis ranging from warning, verifiable evidences of vehicle having been serviced and increase frequency of training and safety briefings.

A monitoring campaign will be undertaken in areas where non-compliances were recorded, to verify the resolution of the issue.

7.5.1.6 Reporting

Performance Indicators

Table 7.7 lists the performance indicators to be monitored for the Air Quality Management Program:

Table 7.7: Performance indicators for Air Quality Management Program

Indicator	Target	Trend
Number of TPM exceeded during periodic monitoring	<10% of monitored sites with recorded elevated concentrations above FMEnv standard	% of recorded TPM concentrations above FMEnv regulatory limits decreases bi-weekly
Concentration of SOX, CO, CO2, CH4 exceeds FMEnv regulatory limit during periodic monitoring	<10% of monitored sites should exceed FMEnv regulatory limits	% of recorded measured gases decreases bi weekly
Number of community complaints regarding air quality	1 complaint per month per near sensitive receptor	Number of complaints decreases bi weekly
Number of verification monitoring campaigns in response to complaints	Equal to number of complaints	NA
Number of additional air quality mitigation measures undertaken in response to complaints	Equal to or greater than number of complains	NA

Note: NA. – Not Applicable.

The performance indicators results shall be compiled quarterly

Table 7.8 summarizes the documental records that will be kept, to control the execution of this specific environmental management program. These documents will be prepared, archived and maintained by the HSE department.

Table 7.8: Record Documents for the Air Quality Management Program

Document Title	Document Type	Frequency of Record or Report
Record of periodic air quality monitoring	Record	Quarterly
Record of air quality associated community complaints	Record	On occurrence

Record of air quality monitoring in response to complaints and mitigation responses	Record	On occurrence
Performance Report	Report	Quarterly

7.5.2 Water Resources Management Program

7.5.2.1 Justification and Objectives

The purpose of the Water Resources Management Program is to guarantee conservation of the water resources present in the Project area. The plan includes control and mitigation actions to protect water resources, namely actions to prevent their siltation, abstraction and their contamination by effluents generated during the proposed activities.

7.5.2.2 Legal Framework

The present plan takes into consideration both the Nigerian legislation referring to water resources, including Harmful Waste (Special Criminal Provisions) Act, Cap H1, LFN 2004, Rivers Basin Development Authority Act, Ca R9, LFN 2004, Water Resources Act, Cap W2, LFN 2004, National Environmental Standards and Regulation Enforcement Agency (NESREA) Act, 2007 as well as applicable international guidelines.

7.5.2.3 Actions and Implementation Schedule

Table 7.9 lists the control and mitigation measures to be applied during construction, in order to minimize impacts on surface and groundwater resources.

Table 7.9 Water Resources Management Program – actions, description and implementation schedule

Control and Mitigation Actions	Description	Implementation Schedule	Responsibility for Implementation	Supervision
Minimize the changes on natural	✧ The Contractor is required to submit method statement for the water body in the project area for FMEnv approval;	During construction and	Contractor	Site manager

run-off patterns	✧ Avoid dumping or water abstracting water from the river/dams for construction activities (including movement of machinery), as much as possible; ✧ Whenever possible, carry out works on river/dams' areas, in the dry season, ✧ Do not obstruct water channels, even if temporary. Ensure that suitable transversal culverts, viaducts, etc. are in place; ✧ Any river/dams affected accidently shall be rehabilitated as close to its pristine state as possible; ✧ Temporary stream diversions will be big enough to allow free flow of water without damming and submerging freshwater vegetation for long periods; ✧ Use of sand bags, Use of fiber rolls, reno-mattresses, and plastic liners where appropriate shall be employed as erosion control measures in sloppy or temporary stream diversion areas. ✧ Minimize the clearance of Freshwater vegetation. Clearing of freshwater vegetation shall be done in stages, as working areas progress. Trees, shrub and grass species will be retained wherever possible. The affected areas will be rehabilitated, using native species on completion of works. ✧ Water channels will be kept free from obstruction at all times. Any erosion damage will be repaired as soon as possible.	operation		
Control and Mitigation Actions	Description	Implementation Schedule	Responsibility for Implementation	Supervision

Prevent water quality contamination/abstraction	✧ No soil, vegetation, waste or construction materials will be discharged on watercourses; ✧ Natural water resources, including sources, streams or open water bodies, will not be abstracted any reason, Any activity requiring washing shall only be conducted in within lay down area; ✧ Prohibit workers to use natural waterways for recreational purposes, bathing or washing;	During construction and operation	Contractor	HSE dept., Site manager
Prevent water quality contamination	✧ Store oils, fuels and other hazardous and potentially pollutant products in bonded walls or in impervious structures; ✧ Dedicated impervious surface and containment structures (situated not less than 100m from residential areas) shall be provided for equipment and vehicles maintenance. ✧ Defined parking lots shall be inspected daily for spillage and cleaned up immediately if spills occur. ✧ Provide an impervious surface and containment structures for fuel supply. Perform scheduled routine maintenance on vehicles to prevent oil leaks.	During construction and operation	Contractor	HSE dept., Site manager
Prevent water quality contamination	✧ Develop a plan for prevention and containment of spills. Ensure spill preventive training of all site staff. Immediate spills containment, abstraction of freed products and appropriate soil remediation efforts should be conducted. ✧ Use of circumferential hydrologic barriers or hydraulic barrier walls should be developed to prevent ground water contamination ✧ The lay down area for any water usage activity such as equipment washing should be sapped to a vacuum-packed invulnerable secluded withholding sink far away from natural drain channels to prevent inadvertent spills from polluting soil and water components. Ensure non- absolution of produced waste in the receptive environment through collecting and channelling to oil and grease separation pits	During construction and operation	Contractor	HSE dept., Site manager
Prevent turbidity and	✧ Sites of over burden stockpiling should not be established on or nearby or along water drainage			

sedimentation rate into water bodies	routes. Soil over burden should be covered during wet seasons; ✧ When possible, removal of vegetation should be conducted in phases.	During construction and operation	Contractor	HSE dept., Site manager

7.5.2.4 Remedial Actions

Remedial actions are affected when and if deviations from the expected outcomes are observed during the follow-up and monitor actions. The extent, scale and pattern of the remedial actions or supplementary mitigation measures shall be case specific. Table 7.9 outlines the proposed remedial actions. Table 7.11 is a drawn –up follow up monitoring program for the WRM.

Table 7.10 – Water Resources Management Program – Remedial actions, description and implementation schedule

Follow-up or Monitoring Action	Description	Implementation Schedule	Responsibility for Implementation	Supervision
Monitor rate of turbidity and sedimentation of water bodies	Planned on the spot assessment of water bodies to determine sedimentation and turbid-metric load	Monthly during construction and operation (when working near water bodies)	contractor	HSE dept., Site manager
Monitor occurrence of spillages in water resources	Conduct planned spillage assessment of parking lots, fuel supply areas, and other lay down areas for spill occurrence; Document all assessment schedules including cleaning protocols Record all accidental spillages occurring in water resources. Record the date, location, approximate volume of each spillage and implemented corrective measures.	During Construction Phase, weekly and operation When applicable	contractor	HSE dept., Site manager
Remedy erosion damage to	Any undue erosion damage or risks to water bodies shall be corrected using consolidating ingredients or other	Whenever necessary	Contractor	

shorelines and divans, and blockage of water flow channels	suitable techniques; Extreme sedimentation to water courses shall be corrected using siltation/dredging technique where blockage of flow is the causal factor.			HSE dept., Site manager
Act on significant increases of water bodies sedimentation	If situations of high sediment loads inputs are observed, locally appropriate remedial measures such as: Silt fences can be placed around affected areas to sifter dregs; Patterned weirs should be placed in the erosive paths to reduce erosion; Temporary ditches, berms, and pit lakes or ponds could be constructed to collect runoff so that entrained deposits could settle out of the water prior to being released from the site into water bodies.	Whenever necessary	Contractor	HSE dept., Site manager
Act on accidental spillages	Containment and clean- up operations should be instituted if any accidental spill is detected. Determine the causal factor(s) responsible for the spill and implement preventive measures to avoid future occurrence	Whenever necessary	Contractor	HSE dept., Site manager

7.5.2.5 Performance and Reporting

Table 7.12 lists the performance indicators to be monitored for the Water Resources Management Program:

Table 7.11 – Performance indicators for Water Resources Management Program

Indicator	Target	Trend
Number of rivers/streams where significant sedimentation increases or erosion damage were detected	< 2 per quarter	Number of events decreases quarterly

Number of remedial actions implemented in response to river sedimentation increase or erosion damage	Equal to number of events detected	NA.
Number of accidental spills	< 1 per quarter	Number of events decreases quarterly
Number of remedial measures implemented in response to accidental spills	Equal to number of spills	NA.

Note: NA– Not Applicable

The performance indicatorsresultsshallbedeterminedandcompiledinquarterlyreports,as indicated in the following section.

7.5.2.6 Reports

Table 7.13 summarizes the documental records that will be kept to control the execution of this environmental management program. These documents will be prepared, archived and maintained by the PIU, in order to document the results of the program implementation. Records of relevant events will be made following the occurrence and a quarterly Performance Report will be prepared and submitted to the FMEnv.

Table 7.12 – Record documents for the Water Resources Management Program

Document Title	Document Type	Frequency of Record or Report
Record of periodic effluent water quality monitoring	Record	Monthly
Record of periodic visual inspection of rivers and stream sedimentation	Record	Monthly
Record of periodic spill inspections	Record	Weekly
Record of accidental spill	Record	On occurrence
Performance Report	Report	Twice a year

7.5.3 Waste Management Plan

7.5.3.1 Justification and Objectives

The purpose of this plan is to provide guidance to personnel and Contractors on management of miscellaneous hazardous and non-hazardous waste generated during the Life of the Project particularly during construction and operation.

The waste management approach focuses on the implementation of the three "R"s (Reduce, Reuse and Recycle) as defined by the FMEnv. Waste management comprises the collection, conditioning, transportation and deposition at a legally designated final place.

Adequate waste management is basic to prevent soil and water resources contamination. It is also important to maintain community and occupational health of workers and indigenes by avoiding proliferation of pests and diseases.

The present program takes into consideration the Nigerian as well Woodland EHS General Guidelines.

7.5.3.2 Scope and Responsibilities

These procedures apply to those units and their personnel that are involved in the management of hazardous and non-hazardous wastes. The Waste Management Plan is applicable to all construction activities. The operational phase is also expected to generate relevant amounts of waste. Waste management procedures shall also be applied in construction sites.

The responsibility for implementing the proposed waste management actions and procedures falls with the various Contractors involved in the Project's construction phase, which will need to use the guidelines provided in this plan to develop specific waste management procedures applicable to their activities. Woodland is responsible for auditing the Contractors' activities, to ensure that best practice waste management procedures are being followed.

7.5.3.3 Availability of Waste Disposal Facilities

The development of this plan and its upgrade by the Contractor took/shall take into consideration availability of waste facilities in Delta State.

Waste management in the project area is the responsibility of the Delta State Waste Management Board (DSWMB). No public landfills exist in the Project area, rather many municipal waste sites.

As for hazardous waste, there is one licensed facility in the project area (Mawe Services Ltd, Warri, and Delta State). This facility is an adequate final destination for the small volumes of solid and hazardous waste likely to be generated by the Project.

7.5.3.4 Waste Management Actions

Table 7.14 below summarizes the proposed waste management actions.

Table 7.13 – Waste management actions

Waste management actions	Description	Implementation Schedule	Responsibility for Implementation	Supervision
Reduce waste production	✧ Working sites must be kept clean, neat and tidy at all times; ✧ Avoid leaving garbage unattended to in order to avoid attracting pests and nocturnal carnivores; ✧ Implement daily cleaning routines to minimize waste; ✧ Promote the recycling and recovery of waste in coordination with municipal authorities ✧ Use materials which can be reused easily; ✧ List and estimate the volume of waste that can be reused, recycled or re-process (example, wood scraps, metal scraps, soils, none used materials); ✧ Ensure that the quantities of construction materials on site are as accurate as possible, to avoid surpluses that could result in construction waste.	During construction and operation	Contractor	HSE dept., Site manager

Waste management actions	Description	Implementation Schedule	Responsibility for Implementation	Supervision
Non-hazardous waste segregation	✧ Provide specific color coded containers of appropriate sizes (according to the expected waste volume) for the placement of waste in different working areas. The segregation will be carried out as close as possible to the place of production. These shall ensure adequate hygiene and sealing conditions; ✧ Strictly prohibit littering with plastic or other wastes by all project personnel; ✧ Provide different containers for each type of waste that can be reused, recycled or re-processed. Containers will be clearly identified according to their categorization and classification, allowing to clearly identifying its contents; ✧ Waste segregation must be carried out accordingly, ensuring that waste does not exceed the top of containers; ✧ The containers must be constructed of an appropriate material to prevent leakage, clean and always closed; ✧ All produced waste will be sorted according to its type. Waste segregation will be initially done by workers; ✧ Produced waste will be removed daily and temporary stored in Temporary Store Facilities until transported to final destination.	During construction and operation	Contractor	HSE dept., Site manager
Temporary storage	✧ Non-hazardous waste must be temporarily stored, prior to final destination, at only one designated area. This area must be duly delimited and signed ("Waste Storage Area"). The area should have a firm water-proof base that is protected from the ingress of storm water from surrounding areas. It must also have an effective drainage system to a waterproof	During construction and operation	Contractor	HSE dept., Site manager

Waste management actions	Description	Implementation Schedule	Responsibility for Implementation	Supervision
facilities for non-hazardous waste	spillage collection area, where any spillage can be recovered and suitably treated. This area must be clearly demarcated and should not be accessible to un authorized persons. The containers should not be easily corrodible but rodent-resistant, insect-resistant and have handles at the sides and tight-fitting overlapping covers. ✧ Inert waste may be stored in the open without the need for a water proofing floor in a designated and			
	delimited area; ✧ Location of waste Temporary Storage Facilities must be at least 50 m from water courses and ground depressions; ✧ Maintain a good organization of space and cleaning of waste storage areas; ✧ Waste materials that can be reused by the community, such as removed soil and stones, cut wood and other building materials could be made available for pickup in an orderly fashion and with proper safety arrangements.			
Non-hazardous waste final destination	✧ Prior to transport, an FMEnv certified laboratory shall confirm it to be non-hazardous. If confirmed as non-hazardous, a waste manifest detailing content, volume, the generating company should be produced in duplicate and a copy handed to the driver. The transport of waste must be carried out in an appropriate vehicle, capable of containing the waste, and in good operating condition. These vehicles must be easily washable; ✧ Transfer operations of waste containers	During construction and operation	Contractor,	HSE dept., Site manager

Waste management actions	Description	Implementation Schedule	Responsibility for Implementation	Supervision
	must be carried out safely: without compromising its segregation, and without causing leaks or spills and originating dust; ✧ The final destination and transport of waste are the responsibility of Contractor; ✧ Non-hazardous waste will be removed on a weekly basis; ✧ The final destination and transport of waste must be agreed and authorized by the State waste management authorities. The necessary licenses must be obtained; ✧ Prohibit the burial or dump of any type waste in unauthorized location ✧ Use accredited waste vendors from the states ✧ Prohibit on-site waste incineration; ✧ Site manager/construction manager and the Contractor will agree on and document the final disposal site for the waste ensuring that it meets FMEnv, states and Woodland environmental and social safeguards guidelines detailed in it ✧ Integrated Safeguards Standards (ISS) requirements, and will keep records of the delivery of the waste at such facilities.			
Hazardous waste segregation	✧ Provide containers for segregation of hazardous waste. Ensuring that waste does not exceed the top of containers and have an appropriate size. Containers will be made of appropriate material so that they are not damaged by their content and that damaging or dangerous substances are formed. They shall ensure adequate hygiene and sealing; ✧ Provide different colour coded	During construction and operation	Contractor,	HSE dept., Site manager

Waste management actions	Description	Implementation Schedule	Responsibility for Implementation	Supervision
	containers for each type of hazardous waste to be produced. ✧ Hazardous waste will not be mixed with other types of waste; ✧ Containers will be placed on wooden pallets or plastic pails; ✧ Maintain containers clean and always closed; ✧ All produced waste will be sorted and placed in the corresponding container.			
Temporary Storage Facilities for Hazardous waste	✧ Hazardous waste will not be stored at the work fronts, and must be transported daily to Temporary Storage Facilities built by the Contractor for this purpose or hired through a certified service provider; ✧ Hazardous waste must be temporarily stored, prior to final destination, at only one designated area. This area must be duly delimited and signed ("Hazardous Waste Storage Area") and with restricted access. The area must be roofed, properly ventilated and have impermeable surface floor; ✧ Location of the Waste Temporary Store Facilities must be away (100 m) from water courses and ground depressions; ✧ No smoking will be allowed in the vicinity of hazardous waste storage area. Place appropriate symbolic signage (No smoking, No naked light and danger); ✧ Provide extinguishers near the waste storage areas; ✧ Maintain a good organization of space	During construction and operation	Contractor,	HSE dept., Site manager

Waste management actions	Description	Implementation Schedule	Responsibility for Implementation	Supervision
	and cleaning of waste storage areas.			
Transport of Hazardous Waste	✧ The transporting vehicle/medium within the site of generation must be water proof and of high mechanical stability. The vehicle must display the hazard sign, the remedial measures/first aid sign during accidental discharge, telephone number of contact person(s) need be boldly inscribed on the vehicle. ✧ The transport of hazardous waste, within the facilities of the Contractor up to the storage location, will be made resorting to appropriate equipment or vehicles capable of containing the waste and in good operating conditions. These vehicles must be easily washable. The transport vehicle will be dully identified with signs for the transportation of hazard material; ✧ Hazardous waste must be transported (internal transportation) in containers. The transport must have steel clamps for securing the containers and guarantee safe transport; ✧ The transportation of hazardous waste transport outside the facilities of the Contractor can only be made by an entity licensed by DWMP ✧ When the hazardous waste is collected, a manifest, in four copies, will be completed, indicating the quantities, quality and destination of the collected waste; one copy is kept by the waste generating entity, another copy is kept by the waste transporting entity, the	During construction and operation	Contractor,	HSE dept., Site manager

Waste management actions	Description	Implementation Schedule	Responsibility for Implementation	Supervision
	third copy is kept by the entity receiving the product and the fourth copy is sent to DWMP and EEWMB ✧ Provide the workers responsible for the handling of hazardous waste with adequate PPEs (work wear, gloves, boots and masks).			
Hazardous Waste Final Destination	✧ The final disposal of hazardous waste will be made at an infrastructure licensed by REMASAB and KEPA for storage, treatment and/or final disposal of hazardous waste. The nearest such infrastructure is the Mawe Services Ltd, located in Warri, Delta state ✧ Whenever possible, enforcement of the buy-back policy with the suppliers should be invoked.	During construction and operation	Contractor,	HSE dept., Site manager
Workers training	✧ Workers must be briefed on the behavioural aspect of waste reduction. The use of disposable products (such as plates or plastic or paper cups, products with excessive packaging) will be limited as much as possible, and the use of reusable products will be promoted; ✧ Workers must be trained on the classification, correct sorting and handling of waste; ✧ Workers responsible for hazardous waste ✧ Handling must be trained on the classification, correct sorting, handling and transport of hazardous waste. Workers must be briefed on the use of individual protection equipment	During construction and operation	Contractor,	HSE dept., Site manager

7.5.3.5 Follow-up Actions

Table 7.15 summarizes the follow-up and/or systematic and/or periodic verification actions proposed for waste management.

Table 7.14 – Waste Management Follow-up Actions

Follow-up and/or verification action	Description
Inspection of the waste storage areas	Perform daily visual inspections of the hazardous and non-hazardous waste storage areas, to verify if the existing containers are adequate to the volume of waste produced, the correct waste sorting and conditioning is being carried out. Also ensure zero spill processes is continually in place, and that any accidental spill is promptly contained and clean- up operations instituted immediately. Verify the integrity of the containers and other environmental control systems/equipment.
Inspection of working areas	Perform daily visual assessment of work areas for organizational sanctity and site cleanliness
Verification of final disposal sites	Undertake annual due diligence visits to the final disposal sites to confirm that final elimination is in compliant with applicable Woodland and FMEnv environmental and social safeguards guidelines detailed in its Integrated Safeguards Standards (ISS)

7.5.3.6 Remedial Actions

Table 7.16 summarizes the corrective actions and their implementation schedule.

Table 7.15 – Waste Management Plan - corrective actions, description and implementation schedule

Corrective Actions	Description	Implementation Schedule
Spill mitigation actions	Removal of substances accumulated in the spill containment trays sinks; Repair or change the damaged container that leaks.	When applicable
Response to complaints	In response to workers or community complaints about odours or pest's proliferation, increase the frequency of waste collection.	When applicable

Corrective action for improper waste storage	Provide or increase the quantities of proper containers in the storage areas where waste increases are evident. Increase the frequency of waste collection.	When applicable
Corrective action for littering and illegal dumping	Increase awareness about waste management.	When applicable

7.5.3.7 Performance and Reporting

Table 7.17 lists the performance indicators to be monitored for the Waste Management Plan.

Table 7.16 – Performance indicators for Waste Management Plan

Indicator	Target	Trend
Weekly volume of waste produced, by type (hazardous and non-hazardous)	Volumes will be recorded. No target is applicable (as volumes will depend on activity).	Volume of waste per workday decreases quarterly (showing efforts to reduce waste production)
Weekly volume of waste transported to final deposition	Equal to weekly volume of waste produced.	NA
Number of improper waste management procedures detected	< 5 per quarter	Number of events decreases quarterly
Number of adopted corrective actions in response to detection of improper waste management procedures	Equal to number of improper waste management procedures detected	NA.

Note: NA. – not applicable.

The performance indicators results will be determined weekly and compiled in quarterly reports, as indicated in the following section.

7.5.3.8 Reports

Table 7.18 summarizes the documental records that will be kept to control the execution of the waste management plan. These documents will be prepared, archived and maintained by the contractor, in order to document the results of the plan's implementation.

Table 7.17 – Record documents for the Waste Management Plan

Document Title	Document Type	Frequency of Record or Report
Weekly volume of waste produced, by type	Record	Weekly
Weekly volume of waste by category transported to final deposition	Record	Weekly
Weekly volume of waste recycled or reused	Record	Monthly
Record improper waste management procedures detected and remediation actions undertaken	Record	Weekly
Performance Report	Report	Quarterly

7.5.4 Biodiversity Management Program

7.5.4.1 Justification and Objectives

The construction and operation of the proposed Project will result in some biodiversity impacts, on vegetation (Freshwater Habitat) and wildlife, particularly *Polybroides typhus* (A raptor and migratory avian species). Baseline result showed one threatened flora species (*Mitragynale dermannii*) in the project area. Alien/invasive species (*Chromolaena odorata, Mimosa pudica, Mimosa invisa* and *Schrankia leptocarpa*) were also censored. Monitoring and management actions for these biodiversity components are required, so as to continuously evaluate the Project's impacts and the efficacy of the proposed mitigation. The PIU will prepare a Biodiversity Management Program (BMP). The BMP will establish baseline values for the managed/monitored activities, implementation schedule, and responsibility for carrying out the monitoring and corrective actions, supervision responsibilities, budget estimates, and source of funding.

7.5.4.2 Monitoring and Management Actions and Implementation Schedule

Table 7.19 lists:

- ✧ The scope of the BMP, which includes: (a) invasive species; (b) deforestation rate in riparian habitats and wildlife poaching activities, biodiversity monitoring and management actions; and (c) IUCN threatened species monitoring

- Brief description of the actions to the implemented;
- Implementation schedule;
- Responsibilities for implementation of management and monitoring program; and
- Supervising agency(ies)

For each activity in Table 7.19, the BMP will identify:

- Baseline values (including direct and indirect/induced impacts);
- Monitoring indicators (including direct impact of the infrastructure constructed, as well as indirect/induced impacts of the area of influence, access roads, and other ancillary infrastructure);
- List of potential remedial actions and their triggers;
- Estimated costs / indicative budget; and
- Source of funding.

Details on the monitoring methodology are provided in the following section.

Table 7.18 – Biodiversity monitoring and management actions, description and implementation schedule

Monitoring and Management Actions	Description	Implementation Schedule	Responsibility for Implementation	Supervision
Invasive flora species monitoring and management	Monitor the presence and proliferation of invasive flora species (including but not limited to *Chromolaena odorata*, *Mimosa pudica*, *Mimosa invisa* and *Schrankia leptocarpa*) around the project area, access road, lay down areas, lay down area and borrow pit areas.	Once in every three months during construction and twice per year during the first	Contractor (during the construction phase) Operational manager (during the operation phase) to be carried out by	HSE dept.

	Use cultural practices to remove invasive/alien species if observed.	five years of operation	Independent Biodiversity Consultant financed by Woodland	
IUCN flora species monitoring and management	Monitor the population and regeneration potential of the threatened species (including but not limited to *Mitragynale dermannii*) at the riparian habitat If the population of these species appears to be below baseline value	Once in every three months for the first ten years after construction phase	Operational manager (operation) to be carried out by Independent Biodiversity Consultant financed by Woodland	HSE dept.
IUCN and migratory fauna species monitoring and management	Monitor the population and movement of the threatened and migratory species (including but not limited to *Polybroides typhus*)	Once in every three months for the first ten years after construction phase	Operational manager (operation) to be carried out by Independent Biodiversity Consultant financed by Woodland	HSE dept.
Deforestation rate and the extent of wildlife poaching monitoring and management –including remedial actions of impacts on riparian habitat, on both flora	Establish the baseline for present deforestation rates and wildlife poaching activities prior to the start of clearing; Monitor the direct and indirect / induced impacts on natural and critical natural habitat. Establish deforestation and poaching monitoring and development of corrective actions; Register the presence of people and/or structures in	Once in every three months during construction and during the first five years of operation	Contractor, site manager (construction) Operational manager (operation) to be carried out by Independent Biodiversity Monitoring and Management Consultant	HSE dept.

and fauna	and near the project area and the actions taken by local authorities to prevent illegal logging, poaching or encroachment. These impacts should be accessed through ground monitoring, as possibly via GIS mapping. If activities with significant negative impacts are observed, on natural and/or critical habitat on flora and fauna, mitigation measures such as targeted protection, reforestation and anti-poaching programs shall be developed and enforced	Biannually during the next 5 years of operation.	financed by Woodland	

7.5.4.3 Code of Conduct

The BMP shall specify or cross-reference all the biodiversity-related environmental rules that all contractors and project workers will be expected to follow, along with the required induction training prior to beginning work and the penalties for non-compliance.

7.5.4.4 Implementation Arrangements

For each planned activity, the BMP will indicate (i) expected implementation schedule (during construction and operation); (ii) institutional responsibilities for implementation (PIU, FMEnv, Contractor, and/or collaborating governmental entity or NGO); and

(iii) Indicative budget and expected source of funds for each key BMP activity during construction and operation (funding would be from Woodland).

7.5.4.5 Monitoring Methodology

Invasive Species

The invasive flora species monitoring plan will start with the construction phase and at that time patches or individuals of invasive flora species as indicated in the baseline, will be identified and geo-referenced. The identified patches/individuals will be removed and their potential for regrowth will be monitored monthly during construction and twice per year during operation phases (at least during the first 5 years), or until no patches are detected.

If new locations of flora invasive species are detected along the corridor, access roads or lay down areas, or borrow pit areas during maintenance, those will be monitored, and removed or controlled as well.

The expansion of the monitored invasive species will be evaluated and if needed and new measures to control them will be proposed.

Threatened Species

The threatened species monitoring plan will start after the construction phase. There is potential for deforestation of riparian habitats by locals on site clearance and Access Road opening, especially for fuel wood as indicated in the baseline. The HSE department shall organize sensitization programs in the project area on the adverse impacts of logging threatened species. Monitoring shall be carried out every three months to assess the regeneration potential of the riparian habitats. If in five year, the population of the IUCN species decreases from the baseline population, the HSE shall cause replanting to be carried on those habitats.

Induced Impacts

The following actions will be developed as part of the BMP:

- ✧ Establishment of a baseline for present deforestation rates and wildlife poaching activities within 500 m on site via ground-trotting, and possibly using GIS models

- ✧ In case monitoring of the BMP observed significant negative impacts on the riparian habitats, HSE department will re-vegetate or put in place targeted species manage, solve or reduce these problems, rather than only continue to watch them. The problems areas will be referenced via GPS;

- ✧ Minimizing Factory and Access Road Induced Impacts. Besides providing options for reforestation or targeted protection of natural habitats and increased poaching, the BMP shall seek to prevent and minimize such impacts in the first place. Effective strategies for doing this should include, as feasible, (i) Restrict clearing only to project footprint (ii) Avoid clearing riparian habitats as practically possible

7.5.4.6 Corrective Actions

Table 7.20 presents the main remedial actions.

Table 7.19 – Corrective actions, description and implementation schedule

Corrective Actions	Description	Implementation Schedule
Act on expansion of invasive flora species	If invasive Area of Occurrence (AOO) and/or Extent of Occurrence (EOO) are observed to be increasing and threatening native species and habitats, actions to control and remove these patches will be implemented after being properly evaluated.	Whenever necessary
Clearing of IUCN species	If the baseline population of these species reduces, replanting programs shall be initiated	Whenever necessary
Act on high levels of impacts on natural habitat, flora and fauna	If deforestation and poaching in post opening up of the project area doubles the initial rate prior to commencement of pre-construction/construction, reforestation or targeted protection and anti-poaching measures need be instituted.	Whenever necessary

7.5.4.7 Performance and Reporting

Table 7.21 lists the performance indicators to be monitored:

Table 7.20 – Performance indicators for Biodiversity Management Program

Indicator	Target	Trend
Number and extent of invasive flora species patches	Zero increase from pre-project conditions.	Number of invasive flora decreases between successive monitoring periods.
Deforestation of natural habitat areas and wildlife poaching activities	Deforestation and impacts on riparian habitat and wildlife poaching activities should not significantly exceed (by double or more) the pre- project levels.	Deforestation impacts on natural and critical natural habitat and wildlife poaching stabilized after the application of additional mitigation measures.
Clearing and migration of IUCN threatened plant and fauna species	Population of threatened plant migratory species are stable or increase the baseline	Population of the species continues to flourish with high regeneration and recruitment potentials

Theperformanceindicatorsresultswillbedeterminedandcompiledinquarterlyreports, as indicated in the following section.

7.5.4.8 Reports

Table 7.22 summarizes the documental records that will be kept, to control the execution of this monitoring and management program.

Table 7.21– Record Documents for the Biodiversity Management Program

Document Title	Document Type	Frequency of Report
Invasive species monitoring report	Report	Semi-annually (twice per year)
IUCN flora species	Report	Quarterly
Baseline Report. Monitoring Report and Management Report of impacts on natural and critical natural habitat, on both flora and fauna (deforestation rates and wildlife poaching activities)	Report	Semi-annually
Polyboroidestypus migration monitoring report	Report	Quarterly

7.5.5 Community Health and Safety Management Plan

7.5.5.1Justification and Objectives

The construction of the proposed Project could result in the increase of community health and safety hazards, due to increased light, noise and dust emissions, increased traffic, workforce mobilization, population influx and security personnel. Management of these risks will require implementation of the mitigation measures proposed in the chapter seven of this report regarding these issues, which are compiled in this Community Health and Safety Management Plan.

7.5.5.2 Scope and Responsibilities

The HSE is the ultimate responsible party for the implementation of all mitigation and management measures. Note that much of the mitigation will involve a strong participation of the Contractor, through the development of additional management plans and the management of day to day activities in the field, as detailed here. However, the PIU will continuously guide and supervise the Contractor, in all issues that are related to engagement with communities and minimization of impacts on their health and safety.

7.5.5.3 Proposed Actions and Implementation Schedule

Table 7.24 presents the main actions for the implementation of the Community Health and Safety Management Plan.

Table 7.22 Community Health and Safety Management Plan actions, description and implementation schedule

Actions	Description	Implementation Schedule	Responsibility	Supervision
Minimize noise nuisance on communities	✧ Construction activities, in particular the noisier ones, will be limited to the daytime period (between 08:00 and 05:00) and to working week days, avoiding working during the night-time and on weekends, whenever near residential areas; ✧ The contractor will avoid placing fixed equipment in proximity to sensitive receptors; ✧ If noise complaints are received from local communities in the morning or evening periods, despite compliance with the previous measures, and if the following investigation confirms the noise impact, then further reduce the work schedule in those periods. In such cases, the work schedule will be defined in a participatory manner, through consultation with affected communities;	During Construction and operation	Contractor, site manager, operation manager	HSE dept.

Ensure good practices in labor management and minimize risks of social conflicts with workforce	✧ The Contractor will develop and implement a Local Recruitment and Working Conditions Plan, which will include the following principles: ✧ Create mechanisms to ensure that the recruitment and hiring procedures are conducted in a transparent and just manner, are coordinated with the community leaders and LGA Administration, maximize local employment including women and young workers and transfer technical skills to the local labour force; ✧ Forbid workers from hunting or buying bush meat. Inform workers of these restrictions in the induction sessions and enforce and monitor them appropriately ✧ Give priority to hire local workers, provided applicants have the necessary skills; ✧ Employment opportunities will be adequately advertised, so as not to limit application opportunities; ✧ The process of contracting staff will be transparent and follow pre- established and accepted criteria and a process coordinated with local leaders that aims to maximize opportunities for the local workforce; ✧ Avoid hiring at the gate–establish local and regional recruitment centres and provide pick up points for applicants from communities;	Planning and During Construction and operation	Contractor, site manager, operation manager	HR dept.
Actions	Description	Implementation Schedule	Responsibility	Supervision
	✧ Ensure respect for local labour laws and worker rights, and together with the labour policy, Health and Safety Management Plan, ensure safe and fair working conditions; ✧ Develop and implement a worker's grievance management system.	During Construction and operation	Contractor, site manager, operation manager	HR dept.

Minimize risks of social conflicts with workforce	✧ Policy and sanctions against violence or exploitation, including of a sexual nature(for example the prohibition of the exchange of money, employment, goods, or services for sex, including sexual favours or other forms of humiliating, degrading or exploitative behaviour); ✧ Protection of children (including prohibitions against abuse, defilement, or otherwise unacceptable behaviour with children, limiting interactions with children, and ensuring their safety in project areas); ✧ Policy and sanctions against sexual relations with anyone under the age of 18 (except if married prior to employment); ✧ Description of disciplinary measures for infringement of the code and company rules. If workers are found to be in contravention of the CoC, which Contractor will explain to them and require them to sign at the commencement of their contract, workers must face proportionate disciplinary procedures; ✧ Failure to keep by these standards will be stated in the contracts as grounds for contract termination. Inform all hired workers of these restrictions and the possible consequences of breaking them. The Contractor will further be expected to: ✧ Publicize the CoC in settlements potentially around the project area. This will help ensure that the local residents are aware of the expected behaviour of the construction staff;	Preconstruction and During Construction and operation	Contractor, site manager, operation manager	HR. Dept.
Actions	Description	Implementation Schedule	Responsibility	Supervision
	✧ Provide schedule and transportation that allows workers to visit their families or to have leisure time in urban centres at reasonable intervals.			

	✧ The Contractor will require its subcontractors to subscribe and adhere to this code and will diligently supervise its implementation at all levels, including engaging the community in confidentially and actively identifying any inappropriate behaviour.			
GBV/SEA prevention and response framework	✧ Site manager and the Contractor will work together to continuously assess risks and identify and implement prevention, response and referral processes with respect to any cases involving Sexual Exploitation and Abuse/Gender Based Violence (SEA/GBV). This will focus on: ✧ training of HR and Contractor personnel, (ii) community and worker awareness, (iii) making available safe and confidential channels of communication and complaints, and (iv) a referral system and mechanism for survivors of GBV/SEA; ✧ HR manager will develop and implement a GBV/SEA prevention and response framework that will address the following elements: ✧ How the project will put in place the necessary protocols and mechanisms to address the SEA/GBV risks; ✧ How to address any GBV incidents that may arise; ✧ A policy against GBV/SEA including a CoC and agreed sanctions. These will be provided by the contractor and consultants as part of the Contractor ESMP. Have all employees of contractors (including sub-contractors), supervision consultants and other consultants with a footprint on the ground in the project area sign CoCs; ✧ For purposes of the construction and operational phases of the project, develop an induction program, including a CoC, for all workers directly related to the project.	During Construction and operation	Contractor, site manager, operation manager	HR Dept

Actions	Description	Implementation Schedule	Responsibility	Supervision
GBV/SEA prevention and response framework	✧ Awareness Raising Strategy, which describes how workers, local community and Project personnel will be sensitized to SEA/GBV risks, and the worker's responsibilities under the CoC; ✧ Referral Pathway: Identification of qualified GBV service providers (NGOs) and setting up are referral pathway so GBV survivors will be referred, and the services will be available (health, legal, psychosocial, safety planning, etc.);	Prior to mobilization of construction and operation	Contractor, site manager, operation manager	HR Dept/ Third party auditor per Action Plan
	✧ Specific arrangements for the project by which GBV risks will be addressed, including: ✧ Establish a SEA/GBV Accountability and Response Framework, to be finalized with input from the contractor, which will include at minimum: ✧ Allegation Procedures: How the project will provide information to employees and the community on how to report cases of SEA/GBV, CoC breaches to the GRM; ✧ SEA/GBV Allegation Procedures to report SEA/GBV issues to service providers, and			

	✧ internally for case accountability procedures which will clearly lay out confidentiality requirements for dealing with cases; ✧ Mechanisms to hold accountable alleged perpetrators associated to the Project; ✧ Disciplinary action for violation of the CoC by workers. It is essential that such actions be determined and carried out in a manner that is consistent with local labour legislation and applicable industrial agreements; ✧ The supervision consultant TOR and the training plan will include provisions to promote monitoring and reporting on the implementation and effectiveness of the SEA/GBV Action Plan to prevent and mitigate SEA/GBV risks associated with the project; Reporting on the Framework implementation will be done on a monthly basis.			

Actions	Description	Implementation Schedule	Responsibility	Supervision
Minimize community security hazards due to interaction with security personnel	✧ Contractor will develop a Security Management Plan, detailing the security arrangements to be deployed at lay down areas and construction sites, or any location with Project presence. This plan will be compliant with Woodland operational safeguards. ✧ This plan will include mandatory training for all security personnel, in what regards human rights, proportionate force use and adherence Co contractor's code of conduct; ✧ Security will be supplied by Woodland; PIU will make an effort to engage with the authorities, so that any engagement with the communities is in compliance with the Voluntary Principles on Security and Human Rights.	Planning / During Construction and operation	Contractor, site manager, operation manager	HR Dept

Minimize workforce and community health risks	✧ Make provision for awareness, counselling and testing for all Project personnel, including voluntary testing for STDs and HIV/AIDS as part of any health screening program (workers will not be denied employment or discriminated against in any way based on their HIV status); ✧ Provide guidance and counselling to workers with HIV/AIDS to access treatment through existing health facilities or NGO campaigns or programs; ✧ Ensure that all Project personnel are given specific HIV and STD prevention training; ✧ Undertake information, education and communication campaigns around safe sexual practices and transmission of STDs and HIV/AIDS as well as condom distribution at stopping locations on key transport routes targeting commercial sex workers and truck drivers; ✧ Support public health or NGO initiatives to reduce STD transmission including working through schools, women's and youth groups; ✧ The Contractor will provide non-local workers with a schedule and transportation that avoids limiting off-time activities at nearby areas; ✧ Conduct community awareness campaigns in the area	During Construction and operation	Contractor, site manager, operation manager	HR Dept

7.5.6 Traffic Management Program

7.5.6.1 Justification and Objectives

The Project is expected to generate relatively high volumes of traffic during the construction as well as the operational phases of the project. It is therefore important to ensure that traffic is managed in a manner that facilitates efficiency as well as ensuring the safety of personnel and the local community. The vehicular traffic generated as a result of the Project not only requires management on Site itself, but also insofar as traffic impacts may be experienced along local road networks and in urban/residential areas. The outline TMP has also been prepared for the purpose of identifying appropriate and safe methods of access for construction and operation traffic to the proposed development.

The objectives of this outline TMP are to:

- Outline minimum road safety measures to be undertaken at site access / exit locations, during the works and including approaches to such access / egress locations;
- Demonstrate to the developer, contractor and supplier the need to adhere to the relevant guidance documentation for such works; and
- Provide the basis for the preparation of a final TMP by the contractor appointed to carry out the works.

The Site manager and the HSE department shall be responsible for ensuring that the contractor manages the construction and operation activities in accordance with this outline TMP. The contractor will prepare a final TMP which is fully in accordance with the outline TMP.

Objectives and measures are also included for the management, design and construction of the project to control the traffic impacts of construction insofar as it may affect the environment, local residents and the public in the vicinity of the construction works.

The final TMP will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned by the Board

7.5.6.3 Traffic Management Signage

The contractor shall undertake consultation with the relevant authorities for the purpose of identifying and agreeing signage requirements. Such signage shall be installed prior to works commencing on site.

Proposed signage may include warning signs to provide warning to road users of the works access / exit locations and the presence of construction traffic. All signage shall be provided in accordance with the Nigerian Highway Code Part 2, Section B- road signs, signals, and markings

In summary, the contractor will be required to ensure that the following elements are implemented:

- Consultation with the relevant authorities for the purpose of identifying and agreeing signage requirements;
- Provision of temporary signage indicating site access route and locations for contractors and associated suppliers; and
- Provision of general information signage to inform road users and local communities of the nature and locations of the works, including project contact details.

7.5.6.4 Programming

In order to reduce impacts on local communities and residents adjacent to the proposed sites, it is proposed that:

- The contractor will be required to liaise with the management of other construction projects and the local authorities to co-ordinate deliveries.
- The contractor will be required to schedule deliveries in such a way that the construction/operation/deliveries activities do not run concurrently which may result in build-up of traffic on road network.
- The contractor will be required to schedule deliveries to and from the proposed feed points to the project area such that traffic volume on the surrounding road network is kept to a minimum.
- Construction/operation phase program of works shall be developed by the contractor in liaison with the relevant local authorities, specifically taking into account potential road repair works that are included in the FRSC road works schedule. In particular, works should be programmed where possible such that any road works are carried out following the presence of construction traffic for the proposed development.

- Heavy Duty trucks deliveries to the development site will be suspended on the days of any major traditional festivals that have the potential to cause larger than normal traffic volumes.

- The contractor will be required to interact with members of the local community to ensure that deliveries will not conflict with sensitive events such as traditional festivals

- Heavy Duty trucks (HDT) deliveries will avoid passing schools at opening and closing times where it is reasonably practicable.

- Construction activities will be undertaken during daylight hours for all construction stages. It is not anticipated that construction works will be carried out on Friday or that any construction works will be carried out in hours of darkness.

7.5.6.5 Licensing

The PIU and contractor shall ensure that:

- All Project vehicles comply with relevant traffic and transport licensing requirements (such as with regard to licensing requirements relating to the transportation of over-sized loads or hazardous materials, including hazardous waste).

- All drivers of vehicles used during the Project shall have the requisite licenses to operate any vehicle (or machinery) operated by them on Site or on any public roads.

- All Project vehicles shall have valid roadworthy certificates and licenses.

7.5.6.6 Routing and direction of traffic and site access

The movement of all vehicles to and from Site shall be along designated Federal roads, state roads and site access roads. Most materials for the construction works shall be transported from the Lagos port down to the project site. The most appropriate route for large Project vehicles (such as HDT, Light Duty Trucks and buses) transporting equipment, materials and employees (along public roads) to and from the Site shall be determined by the contractor and PIU in consultation with the FRSC, local road traffic authorities and the local community. A copy of the approved routes must be maintained on Site together with this Plan (this is the responsibility of the Contractor and his Site Manager). As a measure to reduce traffic volume on the Benin-Sapele road close to Benson Idahosa University, the Old Warri-Sapele road as well as the Eku- Iviri road shall be used as an alternative route during material transport.

Any anticipated or scheduled traffic delays occasioned by Project vehicles (such as abnormal loads, i.e. the transformers) shall be coordinated with FRSC and local traffic authorities in advance.

7.5.6.7 Recommended Traffic Management Speed Limits

Adherence to posted / legal speed limits will be emphasized to all staff / suppliers and contractors during induction training.

Drivers of construction vehicles / HDT s will be advised that vehicular movements in sensitive locations, such as local community areas, shall be restricted to 60 km/h. Special speed limits of 30 km/h shall be implemented for construction traffic in sensitive areas such as school locations. Such recommended speed limits will only apply to construction traffic and shall not apply to general traffic. It is not proposed to signpost such speed limits in the interest of clarity for local road users.

7.5.6.8 Vehicle Cleaning

It shall be a requirement of the works contract that main contractor will be required to provide wheel washing facilities, and any other necessary measures to remove mud and organic material from vehicles exiting tower construction sites. In addition, the cleaning of delivery trucks such as concrete delivery trucks shall be carried out at the lay down area and shall not be undertaken at the tower site locations.

7.5.6.9 Road Condition

The extent of the heavy vehicle traffic movements and the nature of the load may create problems of:

- Fugitive losses from wheels, trailers or tailgates; and
- Localized areas of sub grade and wearing surface failure.

The contractors shall ensure that:

- Loads of materials leaving each site will be evaluated and covered if considered necessary to minimize potential dust impacts during transportation.
- The transportation contractor shall take all reasonable measures while transporting waste or any other materials likely to cause fugitive loses from a vehicle during transportation to and from site, including but not limited to: (i) Covering of all waste or material with suitably secured tarpaulin/ covers to prevent loss; and (ii) utilization of enclosed units to prevent loss.
- The roads forming part of the haul routes will be monitored visually throughout the construction period

In addition, the contractor shall, in conjunction with the PIU:

Undertake additional inspections and reviews of the roads forming the haul routes one month prior to the construction phase to record the condition of these roads at that particular time.

Such surveys shall comprise, as a minimum, a review of video footage taken at that time, which shall confirm the condition of the road corridor immediately prior to commencement of construction. This shall include video footage of the road wearing course, the appearance and condition of boundary treatments and the condition of any overhead services that will be crossed. Visual inspections and photographic surveys will be undertaken of bridges and culverts that are along the haul roads.

Where requested by the local authority prior to the commencement of construction operations, pavement condition surveys will also be carried along roads forming part of the haul route. These will record the baseline structural condition of the road being surveyed immediately prior to construction.

Throughout the course of the construction of the proposed development, ongoing visual inspections and monitoring of the haul roads will be undertaken to ensure any damage caused by construction traffic is recorded and that the relevant local authority is notified. Arrangements will be made to repair any such damage to an appropriate standard in a timely manner such that any disruption is minimized.

Upon completion of the construction of the proposed development, the surveys carried out at pre-construction phase shall be repeated and a comparison of the pre and post construction surveys carried out. Where such comparative assessments identify a section of road as having been damaged or as having deteriorated as a result of construction traffic, the road will be repaired to the pre-construction standard or better by the woodland.

7.5.6.10 Road Closures

During the course of the works, it is not envisaged that road closures will be required. In areas where existing carriageways are narrow, it is envisaged that Traffic Management measures such as temporary traffic lights will be utilized to facilitate traffic.

It is envisaged however that temporary road closures will be required at guarding locations for the purpose of removal following construction. The most notable of these temporary road closures will be on the Old Benin Sapele Road. These closures will be short in duration, with road closure times and appropriate measures to be agreed with the FRSC and other relevant stakeholders prior to the removal of guarding. It is envisaged that road closures will be undertaken during night time when traffic volumes are at their lowest, subject to agreement with the FRSC and other relevant stakeholders.

7.5.6.11 Enforcement of Traffic Management Plan

All project staff and material suppliers will be required to adhere to the final TMP. As outlined above, the principal contractor shall agree and implement monitoring measures to confirm the effectiveness of the TMP and compliance will be monitored by the resident engineer on behalf of woodland. Regular inspections / spot checks will also be carried out to ensure that all project staff and material supplies follow the agreed measures adopted in the TMP.

7.5.6.12 Details of Working Hours and Days

Construction of the proposed development is envisaged to be undertaken during daylight hours for all construction stages. It is not anticipated that construction works will also be carried out on Sundays, or Bank Holidays or that any construction works will be carried out in hours of darkness.

7.5.6.13 Pedestrian and Passenger Safety

All construction personnel transported to and from the Site shall be safely accommodated in appropriate passenger vehicles. No employee shall be transported on the back of open trucks. The Contractor’s Construction Safety Officer shall ensure that this requirement is adhered to at all times.

All vehicles transporting employees shall be appropriately maintained and shall not carry more passengers than the number of persons for whom seating accommodation is provided.

Assembly points for local construction workers embarking passenger vehicles shall be located a safe distance from areas/routes of high vehicle traffic. Those residing in hotels shall be picked up daily from their various hotels. Roads and areas used by construction vehicles shall, as far as possible be avoided by all personnel. Designated pedestrian routes shall be demarcated where appropriate.

Vehicle and pedestrian safety shall be emphasized in the Safety Induction Training required to be provided by the Contractor. All employees and construction personnel shall be trained and informed as to the dangers and risks posed by construction and other traffic, such training shall also include appropriate precautionary measures required to be undertaken to facilitate safe and efficient traffic management (e.g. checking for traffic before crossing roadways and utilizing designated pedestrian routes). Drivers shall be adequately trained in the recognition and avoidance of road hazards, vehicle maintenance and safety requirements.

7.5.6.14 Emergency Procedures during Construction and Operation

The contractor shall ensure that unobstructed access is provided to all emergency vehicles along all site accesses.

The contractor shall provide to the local authorities and emergency services, contact details of the contractors personnel responsible for traffic management.

In the case of an emergency the following procedure shall be followed:

- Emergency Services will be contacted immediately;
- Exact details of the emergency / incident will be given by the caller to the emergency line operator to allow them to assess the situation and respond in an adequate manner;

- The emergency will then be reported to the Site Team Supervisors and the Safety Officer;
- All traffic shall be notified of the incident (where such occurs off site);
- Where required, appointed site first aiders will attend the emergency immediately; and
- The Safety Officer will ensure that the emergency services are en route.

7.5.6.15 Communication

The contractor shall ensure that close communication with the relevant local authorities and the emergency services shall be maintained throughout the construction phase. Such communications shall include:

- Submissions of proposed traffic management measures for comment and approval;
- On-going reporting relating to the condition of the road network and updates to construction programming; and
- Information relating to local and community events that could conflict with proposed traffic management measures and construction traffic in order to implement alternative measures to avoid such conflicts.

The contractor shall also ensure that the local community is informed of proposed traffic management measures in advance of their implementation. Such information shall be disseminated by sensitization and delivering leaflets/flyers to houses in the affected areas. Sensitization shall be done in Urhobo, pidgin and English. The flyers shall contain contact information for members of the public to obtain additional information and to provide additional knowledge such as local events, traditional festivals and religious celebrations which may conflict with proposed traffic management measures.

7.5.6.16 Construction and Operation Methodologies

The contractor shall take cognizance of the construction methodology as detailed in chapter four of this report in the preparation of the final TMP.

The contractor shall provide detailed traffic management arrangements for all construction stages and submit for approval to the relevant local authorities and the FRSC.

The contractor shall submit for approval to the Woodland and to the Local Authority, as part of their final TMP, details in relation to construction/operation staff vehicle pooling and parking.

This Traffic Management Plan (TMP) will form part of the construction contract and is designed to reduce possible impacts which may occur during the construction of the proposed development.

The outline TMP shall be used by the appointed contractor as a basis for the preparation of a final TMP and shall detail, at a minimum, the items detailed in this outline TMP and any subsequent requirements of the FRSC and local authorities.

Woodland's PIU shall be responsible for ensuring that the contractor manages the construction activities in accordance with this outline TMP and shall ensure that any conditions of planning are incorporated into the final TMP prepared by the appointed works contractor.

7.5.7: Construction management Plan (CMP)

7.5.7.1 Justification and Objectives

Unsustainable construction activities will have adverse health, social and environmental effects. It may eventually halt the project implementation processes. This plan therefore, outlines Woodlands' approach to managing the execution of the proposals to construct a wood processing factory. The Plan covers site establishment, logistics and the process of managing the overall local environment. It seeks to ensure that the works cause the minimum practicable disruption to residents including by achieving a safe working and living environment. The Plan shall enable contractors to understand the nature of the scope of their works and the various construction activities associated with the development.

This Plan will be used as the template for developing the construction phase health and safety plan, in tandem with the construction method statement. Many of the matters identified will be developed in more detail and dealt with at the appropriate construction stage by detailed site-based method statements. Method statements will be prepared and agreed for all major site operations in advance of the relevant works commencing. This is particularly for the groundwork excavation and structural works.

7.5.7.2 Construction Environmental Management and Monitoring

Prior to construction activities taking place, a Construction Environmental Management Plan (CEMP) would be prepared to address the management of potential environmental impacts associated with construction activities. The CEMP would include as a minimum management measures to address the following environmental aspects during the construction phase:

- Surface Water;
- Soils and groundwater;
- Air quality and odour;
- Noise;
- Waste;

7.5.7.3 Communication

Woodland seeks to maintain good relationships with the project community. Such relations are assisted greatly by good communication, and by keeping host community and appropriate third parties regularly informed of site activities likely to impact on adjoining residents. The contractors and the management team will be receptive to all reasonable concerns of the local community and will demonstrate a considerate and professional approach, so as to maintain a well-balanced relationship with the local public during project execution.

Notices shall be posted on the site hoarding to keep locals advised of anticipated events, general progress of the works and any requirements for any abnormal works. Appropriate signage and information boards will be displayed on the hoarding.

7.5.7.4 Considerate Constructors Scheme

In selecting the appropriate constructors, Woodland shall assess their project track record and management procedures to ensure capability to deliver a project safely and with minimum practicable disruption and inconvenience to the environment and local residents. The appointed constructor will be registered and comply with the requirements of the Considerate Constructors Scheme for the duration of the project. The works will be carried out in accordance with the Considerate Constructors Scheme and in such a way as to minimise the impact on the local environment and amenities.

Throughout the works the constructors will be required to provide relevant method statements and risk assessments for the works. Benchmarking against relevant Key Performance Indicators will be used to monitor the constructor's performance against the qualities in this plan. A contact board will be displayed outside the site providing contact details. This will include names and telephone numbers of key construction staff so that the general public can make contact should they have cause to do so.

A complaints / contact book will be kept on site, which will be used to record details of any complaints. This will include the name of the person making the complaint, the date, time and nature of the complaint and the action necessary to resolve the complaint. The complaints book will be regularly reviewed by the constructor and the Woodland site manager to ensure that any complaints are dealt with and resolved promptly.

7.5.7.5 Site Establishment

The space available within the proposed site will be utilized for storage of construction materials and security post and this will enable the execution of the project development. Onsite borehole will be utilized for all construction water demands while onsite power will be provided by the contractors. Access will be maintained for the duration of the works via front entrance from Warri-Benin Road. A parking lot will be created onsite to accommodate delivery Lorries and to restrict parking along the Warri-Benin Road.

During large volume concrete works, a mobile concrete pump may be positioned on site and the parking bays on the site shall be suspended for these specific activities. All necessary permits and licences will be obtained in appropriate time from the Federal Ministry of Works (FMW) and Delta state Ministry of Work (DSMW). During the excavation for foundations, the excavation spoil will be barrowed to skips on the road. During the period of bulk excavation for equipment installation, there may be a continuous transfer of excavation spoil to muck away Lorries.

7.5.7.6 Construction work

As part of the CMP, construction work on site will be carefully managed to minimize disruption to the baseline social and environmental condition and also to incidence to workers. All activities on site will be undertaken with appropriate regard paid to:

7.6.1 Working Hours

Working hours will be 07.00 – 17.00 Monday to Saturday only, in accordance with the National Building Code of Nigeria (NBCN) most recent code of Construction Practice –2006. They shall be no work on Sundays and public holidays.

7.6.2 Fire and Emergency Procedures

Contact names and telephone numbers will be made available in case of 'out of hours' emergencies relating to the site. This information will be displayed on the hoarding. The constructor shall implement procedures to protect the site from fire. The site manager shall assess the degree of fire risk and formulate a Site Fire Safety Plan, which will be updated as necessary as the works progress and will also include the following:

- Hot Work Permit regime.
- Installation of the site fire-fighting equipment e.g. establishing fire points and installing and maintaining fire extinguishers etc.
- Evacuation alarm.
- Material storage and waste control.
- Fire Brigade access.

7.6.3 Security

All site personnel will have to sign in on arrival and sign out before leaving the site. This will be incorporated into the Site Rules and included as part of the site induction process.

The front hoarding will be regularly inspected to ensure that it remains secure. All hoardings will remain closed when the site is not operational. The access gate to the site will be controlled to only allow access for authorized personnel.

4.5.4 Health and Safety

A Construction Health and Safety Plan will be prepared for the works in accordance with the Construction design and management (CDM) regulations, 2015. Risk Assessments will be developed and agreed. Sub- constructors' detailed method statements will also be produced and safe methods of work established for each element of the works.

Site inductions will be held for all new site personnel to establish the site rules and to enforce safety procedures. All site personnel will be required to read the emergency procedures when signing in for the first time, and sign to the effect that they have read the procedures. These will include any relevant communal issues.

7.6.5 Scaffolding

As already noted, scaffolding will be required for the construction of store house. Scaffolding will be used to provide workers with a safe temporary work platform. It will be planned, erected, inspected and tagged by competent persons and will be regularly inspected to ensure there are no risks to safety and will comply with the requirements of HSE regulations.

7.6.6 Good Housekeeping

The site will be kept in a clean and safe condition. The following practices shall be maintained:

- The areas adjacent to the site will be regularly inspected and any site rubbish removed.
- The adjacent road and pavement will be kept clean.
- The perimeter hoarding will be repainted from time to time and will be kept in a neat and tidy condition.
- Any graffiti will be quickly removed from the hoardings.
- Offloading will generally be direct from vehicles onto the site.
- Materials will not be stored on public footpaths or roads.
- Waste and rubbish will be regularly removed from site and not allowed to accumulate so as to cause a safety or fire hazard.
- Welfare facilities will be provided within the site to discourage operatives from frequenting the interface between the site and public areas.

7.6.7 Environmental Matters

The selected constructor shall operate an environmental policy in which supports the following values, to:

- Conduct their activities with proper regard to the protection of the environment.
- Comply with all relevant regulatory and legislative requirements and codes of practice.
- Communicate with local communities to ensure the work causes the minimum disturbance and disruption.

- Ensure that staff have a good understanding of the environmental impacts of construction work and how to minimise these impacts.
- Ensure their suppliers and sub- constructors apply similar standards to their own work.
- During the early stages of the project the constructor shall carry out the following activities will be carried out to deal with environmental management:
- Prepare a Project Environmental Plan.
- Prepare and consult with the client and statutory authorities to obtain relevant approved licences and consents
- Prepare a Site Waste Management Plan and consultation with supply chain partners and the design team to design out or minimise waste.

7.6.8 Waste and Material Management
A site waste management plan has been drafted (see Section 7.3.3).

7.6.9 Dust, Noise and Vibration
Detailed AQMP has been proposed in Section 7.3.1. But as per matter of good practice in construction, the following practicable mitigate shall be observed:

Dust

- Demolition activities will use water as a dust suppressant;
- Adjacent road surfaces will be frequently swept clean;
- All loads delivered to or collected from the site will be covered where appropriate;
- All road vehicles will be requested to comply with set emission standards;
- Skips will be securely covered
- The air quality within the site will be continually monitored

Noise and Vibration

- The constructor shall take reasonable steps to minimise any noise disruption to adjacent residence and fauna habitats.
- Operatives working in noisy areas will be monitored to ensure they are wearing the necessary protective equipment and that they are not exceeding their permitted exposure periods.
- Electrically operated plant will be used where practical.
- Try to ensure all plant used on the site is effectively silenced.
- No externally audible radios or other audio equipment will be allowed on site.

CHAPTER 8: DECOMMISSIONING/ABANDONMENT

8.1 Decommissioning/Closure.

Most development projects have useful lives, beyond which they are no longer economically viable either as a result of competing technology or irredeemable unforeseen circumstances. Upon the completion of useful life cycle, there is a need to abandon and/or decommission such projects. Planning abandonment activities in advance is the key to a safe, environmentally friendly, and efficient decommissioning/abandonment programme in accordance with the Nigerian regulatory requirements. Furthermore, removal must be carried out with due regard for protection of the immediate environment.

Therefore, adequate plans will be put in place to decommission the wood processing factory in a cost-effective and environmentally-friendly manner.

8.2 Plan Structure

A decommissioning plan incorporating the reclamation plan shall be submitted to Federal Ministry of Environment before the cessation of wood processing factory operations. The Decommissioning Plan shall:

- Nominate the end use(s) of all lands affected by the project
- Nominate the end use(s) of all buildings, houses and other infrastructure components;
- Describe the steps to make the area safe;
- Describe the type and duration of post decommissioning monitoring.

The fate of each of the project infrastructure listed will be dependent upon the nominated end land uses, which will be agreed with the local communities and the federal government agencies.

These items will then be set out in detail within the final decommissioning plan to be presented to the Federal Ministry of Environment before the cessation of wood processing factory operations (if and when it becomes necessary).

8.3 Reporting

A Post Decommissioning Report shall be prepared as required by statutory regulations and submitted to regulators. The report will provide the following details.

- Overview of decommissioned facilities.
- Details of methods used for decommissioning.
- Nature of decommissioning (whole or partial).
- Records of consultation meetings.
- Details of recyclable/reusable facility components.
- Decontaminated facilities.
- Decommissioning schedule.
- State of the surrounding environment.
- Waste Management Plan.
- Plans for restoration/remediation where necessary.

CHAPTER 9: CONCLUSION AND RECOMMENDATION

The Environmental Impact Assessment study of the proposed Woodland factory was carried out with strict adherence to the guidelines and regulations of the Federal Ministry of Environment. The study has identified the environmental issues/impacts associated with the proposed project activities on the immediate environment. And, in order to minimize these impacts appropriate mitigation has been proffered.

On the socio-economic impacts, potentially, the project will provide social and economic opportunities capable of enhancing the economic growth of the Delta State in particular and the country in general.

Thus, in view of the fact that the stakeholder communities shall be carried along during the project construction and operation, and that there is no stern environmental, health, social or cultural issues that may warrant the cancellation of the proposed project, it is therefore strongly recommended that the project be embark upon as proposed.

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APPENDIX 1

FEDERAL MINISTRY OF ENVIRONMENT

Environment House
Independence Way South, Central Business District, Abuja - FCT.
www.environment.gov.ng, ea-environment.org
Email:ea@ead.gov.ng, www.ead.gov.ng

ENVIRONMENTAL ASSESSMENT DEPARTMENT

FMENV/EA/EIA/5135/Vol.1/37
24th July, 2019

The Managing Director,
Woodland Nigeria Ltd,
No 1 Woodland Drive,
GRA, Sapele,
Delta State.

RE: ENVIRONMENTAL IMPACT ASSESSMENT (EIA) OF THE PROPOSED ULTRA-MODERN RUBBERWOOD PROCESSING FACTORY IN AMUKPE COMMUNITY, SAPELE LGA, DELTA STATE

Please refer to your letter dated 21st June, 2019 and our letter Ref:FMEnv/EA/EIA/5135/Vol.1/19 dated 25th June, 2019 on the above stated project.

2. Following the conclusion of the site verification exercise, the Ministry has placed the project in category Two (2) with One (1) season baseline data gathering exercise. You are required to conduct a scoping workshop involving relevant stakeholders in attendance. Also regulators from the Federal and State Ministries of Environment shall participate as observers.

3 Furthermore, you are requested to submit to the Ministry a report of the scoping workshop and the projects Terms of Reference (ToR) incorporating significant issues raised at the scoping workshop and the environmental parameters to be sampled for approval before proceeding to the next stage of the EIA process.

4. You may wish to contact M.B Ajai on GSM number **08023228544** to confirm the receipt of this letter and for any clarification, please.

5. Thank you for your co-operation.

Abbas O. Suleiman
For: Honourable Minister

Appendix 2: Floral checklist

SPECIES	FAMILY	Habit	DBH (CM)	IUCN	Abundance			Ecosystem Services																			
					1	2	3	Medicine	Food	Fuelwood	Charcoal	Fruits and Seeds	Nuts	Vegetables	Fodders	Fibres	Tannins	Sundry products	Wrapping leaves	Wattles	Poles	reclamation shade from sun	Shade from sun	erosion	Roof Trusses(roof rafters) and Purloins	windows	Stairs
Afromomum sp.	*Zingiberaceae*	H	4	NE		49		*				*															
Albiziaadiantifolia	*Mimosoideae*	T	26	NE			4	*		*	*			*								*		*		*	*
Alchorneacordifolia	*Euphobiaceae*	S	16	NE	11	38	32	*							*				*					*			
Alstonia congensis	*Apocyanaceae*	T	28	NE		4	2			*							*						*			*	*
Anthocleistaprocera	*Gentianaceae*	T	25	NE		5	8	*																			
Anthonotha macrophylla	*Caesalpinoideae*	S	17	NE	5	8	11			*																	
Asystasiagangetica	*Acanthaceae*	H	3	NE	47			*																			
Bambusa vulgaris	*Poaceae*	T	8	NE		79	16	*								*					*	*			*		*
Berliniagrandifloria	*Casalpinioideae*	T	17	NE		7	9				*																
Brideliaretusa	*Phyllanthaceae*	T	21	NE	4	13	7				*																
Chromolinaodorata	*Asteraceae*	H	4	NE	56	23	38	*														*		*			
Clappertoniaficifolia	*Tiliaceae*	H	2	NE	102																						
Costusafer	*Zingiberaceae*	H	5	NE	16	58		*										*	*								
Crotalaria retusa	*Papilionoideae*	H	2	NE	34		11																				
Cyperusiria	*Cyperaceae*	H	3	NE		43									*												
Desmodiumscorpiurus	*Papilionoideae*	H	3	NE	38										*							*		*			
Desmodiumtortuosum	*Papilionoideae*	H	3	NE	41																	*		*			
Eclipta alba	*Asteraceae*	H	2	NE	34																						
Elaeisguineensis	*Arecaceae*	T	31	NE		4	6		*			*	*			*		*		*					*		
Ficus barteri	*Moraceae*	T	21	NE		4	2																				
Hewittiasublobata	*Convolvulaceae*	H	3	NE	31																						
Hydroleapalustris	*Hydrophyllaceae*	H	3	NE	27																						

Ipomoea aquatica	*Convolvulaceae*	C	4	NE	18	29	21																				
Ipomoea asarifolia	*Convolvulaceae*	C	2	NE	24	9	17																				
Lasimorphase negalense	*Araceae*	H	5	NE		48		*																			
Ludwigiaabys sinica	*Onagraceae*	H	4	NE	14	38	11																				
ludwigiadecu rrens	*Onagraceae*	H	4	NE	28	32	18																				
Mallotusoppo sitifolius	*Euphobiaceae*	H	3	NE	16																						
Musa sapiantum	*Musaceae*	T	13	NE	3		6		*			*							*								
Melochiacorc horifolia	*Sterculaceae*	H	3	NE	45																						
Mimosa invisa	*Mimosoideae*	H	3	NE	174	14	23																				
Mimosa pudica	*Mimosoideae*	H	6	NE	88		46																				
Mitragynaled ermannii	*Rubiaceae*	T	31	VU		18				*	*								*		*					*	*
Musanga cecr opioides	*Urticaceae*	T	34	NE		14		*			*								*					*			
Nephrolepisbi serrata	*Oleandraceae*	F	3	NE		46																					
Oxyanthus speciosus	*Rubiaceae*	S	17	NE		8	3	*																			
Piliostigmath onningii	*Caesalpinoideae*	S	15	NE	3															*				*			
Pycanthusang olensis	*Myristaceae*	T	38	NE		7	3			*																*	*
Raphia hookeri	*Arecaceae*	T	31	NE		34										*		*							*		
Rauvolfiavom itora	*Apocyanaceae*	S	38	NE	4	9	18	*																			
Schrankialept ocarpa	*Mimosoideae*	H	3	NE	157																						
Sclerianauma nniana	*Cyperaceae*	H	3	NE	23	41																					
Senna ' obtusifolia	*Caesalpinoideae*	H	4	NE	44																	*					
Senna alata	*Caesalpinoideae*	S	5	NE	9			*														*		*			
Senna hirsuta	*Caesalpinoideae*	H	4	NE	56																	*					
Senna occidentalis	*Caesalpinoideae*	H	4	NE	40																	*					
Sidacordifoli a	*Malvaceae*	H	3	NE	86																	*		*			
Sida rhombifolia	*Malvaceae*	H	3	NE	132																	*		*			
Spondiasmom bin	*Anacardaceae*	T	46	NE		3	5	*	*	*	*				*							*	*				
Stachytarphet acayennensis	*Verbenaceae*	H	3	NE	102			*							*												
Stachytarphet	*Verbenac*	H	3	N	12			*							*												

ajamaicensis	*eae*			E	7																						
Tabernaemontanapachysiphon	*Apocyanaceae*	S	16	NE	8	32	21																				
Triumfettacordifolia	*Tiliaceae*	H	4	NE	55		17								*	*				*							
Triumfettarhomboidei	*Tiliaceae*	H	4	NE	43										*	*				*							
Urenalobate	*Malvaceae*	H	4	NE	50										*	*				*							