ESIA

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

of the Proposed

SPECIAL AGRO-PROCESSING ZONE (SAPZ II) – AGRICULTURAL INDUSTRIAL HUB (AIH) PROJECT

At

GARI-MALAM COMMUNITY (LAU LGA) TARABA STATE

By

TARABA STATE GOVERNMENT

MAY 2024

Bolben Energy and Environmental Services Limited
B214, Zitel Plaza, Jabi Abuja
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Draft Report, May 2024

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

OF THE PROPOSED

AGRICULTURAL INDUSTRIAL HUB (AIH)
LAU LGA / SAPZ II

Report No.: TSG/SAPZ II-ATC/28052024/002

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LIST OF ACRONYMS AND ABBREVIATIONS

AC	-	Aggregation Centre
ACMV	-	Air Conditioning and Mechanical Ventilation
AfDB	-	African Development Bank
AIH	-	Agricultural Industrial Hub
ASTM	-	American Socienty for Testing and Materials
ATC	-	Agricultural Transformation Centre
BAT	-	Best Available Techniques
CAFÉ	-	Corporate Average Fuel Economy
CBOs	-	Community Based Organizations
CDC	-	Community Development Committee
CFU	-	Colony forming unit
CLO	-	Community Liaison Officer
CO	-	Carbon monoxide
CO_2	-	Carbo dioxide
CR	-	Community Relations
CSR	-	Corporate Social Responsibility
dBA	-	Decibel
DDT	-	Dichloro-Diphenyl-Trichloroethane
E&S	-	Environmental and Social Standards
EA	-	Environmental Assessment
EC	-	European Community

EHS - Environmental, Health, and Safety

EIA - Environmental Impact Assessment

EMP - Environmental Management Plan

EMS - Environmental Management System

EPA - Environmental Protection Agency

EPR - Extended Producer Responsibility

ESAP - Environmental and Social Assessment Procedures

ESMP - Environmental & Social Management Plan

ESMS - Environmental and Social Management System

ESSP - Earth System Science Partnership

ETP - Effluent Treatment Plant

FAOSTAT - Food and Agriculture Organization Corporate Statistical Database

FBOs - Faith Based Organizations

FEPA - Federal Environmental Protection Agency

FGD - Focus Group discussion

FGN - Federal Government of Nigeria

FMAFS - Federal Ministry of Agriculture and Food Security

FMARD - Federal Ministry of Agriculture and Rural Development

FMEnv - Federal Ministry of Environment

FRSC - Federal Road safety Corps

GBV - Gender Based Violence

GHG - Green House Gases

GIS - Geographic Information System

GRC - Grievance Redress Committee

GRM - Grievance Resolution Mechanism

H_2S - Hydrogen Sulfide

HA - Hectare

HAZMAT - Hazardous Materials

HBC - Heterotopic Bacteria Count

HBP - High Blood Pressure

HFC - Heterotopic Fungi Count

HIV/AIDS - Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome

HSE - Health, Safety and Environment

HSEQ - Health, Safety, Environment and Quality

HSSE - Health, Safety, Security, and Environment

HUBC - Hydrocarbon Utilizing Bacteria Count

HUFC - Hydrocarbon Utilizing Fungi Count

IEC - International Electric Codes

IESIA - Integrated Environmental and Social Impact Assessment

IFAD - International Funds for Agricultural Development

IFC - International Finance Corporation

IFCS - Intergovernmental Forum on Chemical Safety

ILO - International Labour Organisation

ILO - International Labour Organization

IMM - Impact Mitigation and Compliance Monitoring

IoT - Internet of Things

IPCS - International Programme on Chemical Safety

IRM - Independent Review Mechanism

IsDB - Islamic Development Bank

ISS - Integrated Safeguards System

KIIs - Key Informant Interviews

Km - Kilometer

L&FS - Life and Fire Safety

LEMP - Local and Employment Management Plan

Leq - Equivalent Continuous Sound Level

LEV - Local Exhaust Ventilation

LEV - Local Exhaust Ventilation

LFN - Laws of the Federation of Nigeria

LGA - Local Government Area

LGs - Local Governments

LTI - Lost Time Injuries

M - Meter

MDAs - Federal Ministries, Departments and Agencies

MSDS - Material Safety Data Sheet

MSMEs - Micro, Small and Medium-Sized Enterprises

MT - Metric Ton

MT/ha - Metric Ton/Hectare

MW - Mega Watt

NAERLS - National Agriculture Extension and Research Liaison Services

NAFDAC - National Agency for Food and Drug Administration and Control

NDCs - Nationally Determined Contributions

NEC - National Electric Codes

NEDEP - National Enterprise Development Programme

NESREA - National Environmental Standards and Regulatory Enforcement Agency

NGOs - Non-Governmental Organizations

NIRP - Nigerian Industrial Revolution Plan

NIRSAL - Nigerian Incentive-based Risk Sharing for Agricultural Lending

NMA - Nigerian Maritime Administration

NOX - Nitrogen oxides

NPSWM - National Pricing strategy for Waste Management

NPSWM - National Pricing strategy for Waste Management

NSDWQ - Nigeria Standard for Drinking Water Quality

NURTW - National Union of Road Transport Workers

OECD - Organization for Economic Co-operation and Development

OHS - Occupational Health and Safety

OHSP - Occupational Health and Safety Plan

OSs - Operational Safeguards

PDO - Project Development Objective

PDR - Post Decommissioning Report

PEBEC - Presidential Enabling Business Environment Council

PLCS - Programmable logic controllers

PM - Particulate Matter

POPs - Persistent Organic Pollutants

PPE - Personal Protective Equipment

PtW - Permit to Work

PWD - People with physical Disabilities

QA/QC - Quality Assurance / Quality Control

SAPZ - Special Agro-industrial Processing Zone

SCPZ - Staple Crop Processing Zone

SDGs - Sustainable Development Goals

SEA - Sexual Exploitation and Abuse

SECAP - Social, Environmental and Climate Assessment Procedures

SEIA - Socio-economic Impact Assessment

SMEs - Small and Medium Enterprises

SON - Standard Organization of Nigeria

SoW - Scope of Work

SOX - Sulfur oxides

SSO - Social Safeguard Officer

STDs/STIs - Sexual Transmitted Diseases / Sexual Transmitted Infections

STP - Sewage Treatment Plant

SWM - Solid Waste Management

TA	-	Technical Assistance
TDS	-	Total Dissolved Solids
TEPA	-	Taraba Environmental Protection Agency
THC	-	Total Hydrocarbon Content
ToR	-	Terms of Reference
TRSG	-	Taraba State Government
TSMAFS	-	Taraba State Ministry of Agriculture and Food Security
TSMEnv & CC	-	Taraba State Ministry of Environment & Climate Change
UNCED	-	United Nations Conference on the Environment and Development
UNEP	-	United Nations Environment Programme
UNFCCC	-	United Nations Framework Convention on Climate Change
USD	-	United State Dollars
WEEE	-	Waste for Electrical and Electronic Equipment's
WHO	-	World Health Organization
WMP	-	Waste Management Plan
WMS	-	Waste Management System
WTO	-	World Trade Organization

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EXECUTIVE SUMMARY

ES 4.0 Description of Existing Environment

The existing environmental and socio-economic conditions in the Project area are establishing obtaining a baseline for evaluating potential project impacts. This baseline is essential for the Environmental and Social Impact Assessment (ESIA), aiding in impact prediction, evaluation, and mitigation, as well as in environmental monitoring and decision-making throughout the project lifecycle.

The assessment covers:
1. Physical Environment: Meteorology, geology, soil types, and water characteristics.
2. Biological Environment: Distribution of flora and fauna.
3. Socio-Economic and Health Conditions: Demographics, culture, social and health status of affected communities, and stakeholder engagement outcomes.

The Area of Influence (AoI) for the Special Agro-Processing Zone (SAPZ) – Agro-Industrial Hub (AIH) Project at Lau includes the 339-hectare project area and a 5-kilometer surrounding radius, affecting nearby communities such as Garin Dogo, Garin Mallam, Kaudat, Minda, and Riggi. Data was gathered from site visits and relevant literature to ensure accurate environmental and socio-economic impact assessment.

ES 4.1 Baseline Sampling Methodology Framework

The methods used to collect and document the environmental baseline conditions of the project area are defined, and crucial for evaluating the potential impacts of the proposed Special Agro-Processing Zone (SAPZ) – Agro-Industrial Hub (AIH) Project at Lau. The baseline was established through literature review and field data collection, followed by laboratory analyses, adhering to FMEnv and international standards.

Baseline Sampling Methodology

1. **Development of EIA Terms of Reference (ToR):**
    - Defined the scope and objectives for the environmental impact assessment.
2. **Site Verification:**
    - Confirmed the project's location and conditions through site visits.
3. **Field Sampling Strategy:**
    - Designed a sampling plan to meet regulatory requirements.
4. **Pre-mobilization Activities:**

    - Conducted calibration checks and job hazard analysis before fieldwork.
5. **Sample Collection and Handling:**
    - Gathered field samples and ensured proper handling and storage.
6. **Onsite Supervision:**
    - Oversight by regulators during field activities.
7. **Sample Analysis:**
    - Transferred samples to FMEnv accredited laboratories for analysis.

Study Area Definition

- **Location:** Northern Taraba State at Garin Malam in Lau LGA.
- **Coordinates:** Between longitudes 11°18′30″E and 11°20′30″E, latitudes 09°05′30″N and 09°07′00″N.
- **Size:** 339 hectares with a perimeter of 7.90 kilometers.

Baseline Data Collection

a. **Environmental Baseline Sampling:**

- Field surveys assessed air quality, water quality, soil characteristics, flora and fauna.
- Used remote sensing and GIS to map land cover and ecological habitats.

b. **Socio-economic Baseline Sampling:**

- Engaged local communities through interviews, focus groups, and meetings.
- Conducted household surveys to gather demographic and socio-economic data.
- Identified key social assets and cultural heritage sites.

Stakeholder Engagement

- Established communication with local communities, government agencies, NGOs, and other stakeholders.
- Conducted consultations to incorporate local knowledge and address concerns.

Data Analysis and Interpretation

- Analyzed data to establish baseline conditions and trends.
- Identified environmental and social sensitivities and areas of concern.
- Used statistical and spatial modeling techniques for data analysis.

Quality Assurance and Control

- Ensured data accuracy, reliability, and validity through rigorous quality measures.
- Followed standardized protocols for data collection and analysis.
- Validated results through peer review and expert consultation.

Previous Literature Review and Environmental Reports

- Reviewed international and national environmental standards and previous relevant studies.
- Consulted secondary public data sources like the National Population Census and Nigeria Demographic and Health Survey.

Reporting

- Compiled data and analysis into a comprehensive Baseline Sampling Report.
- Presented findings with maps, tables, and graphs.
- Documented limitations and proposed further studies if needed.

This structured baseline sampling methodology supports informed decision-making and proactive impact management throughout the project's lifecycle, ensuring environmental and social sustainability.

ES 4.2 Number of Samples or Parameter

A representative number of samples across various environmental and social parameters were selected for a comprehensive assessment, summarized as follows:

- **Environmental Parameters**

Air Quality: Pollutants such as PM10, PM2.5, NOx, SO2, and VOCs were measured at strategic locations.

Noise Quality: Noise levels were monitored using sound level meters at various strategic points, recorded in decibels (dB).

Water Quality: Samples from surface and groundwater were analyzed for pH, dissolved oxygen, turbidity, nutrients, heavy metals, and organic pollutants.

Soil Characteristics: Soil samples were analyzed for texture, organic matter, nutrient levels, pH, and contaminants.

Biodiversity: Ecological surveys documented species diversity, abundance, and distribution patterns.

- **Socio-Economic Parameters**

Demographics: Household surveys and census data provided information on population structure, gender distribution, household size, and income levels.

Livelihoods: Surveys and interviews assessed local employment patterns, income sources, and natural resource dependence.

Community Infrastructure: Existing infrastructure such as schools, health facilities, roads, and water supply systems were documented.

Cultural Heritage: Cultural heritage sites, traditional knowledge, and indigenous practices were identified and documented.

These parameters provide a comprehensive overview of the current environmental and socio-economic conditions, crucial for evaluating the potential impacts of the SAPZ – AIH Project at Lau.

ES 4.3 QA/QC for Sampling

In the Environmental and Social Impact Assessment (ESIA) for the Proposed Special Agro-Processing Zone (SAPZ) – Agro-Industrial Hub (AIH) Project at Lau, rigorous quality assurance and control (QA/QC) measures are essential to ensure the accuracy, reliability, and validity of collected data. The following measures will be implemented throughout the baseline sampling process:

Standardized Protocols:

- **Data Collection:** Adherence to standardized procedures for sampling and data collection to minimize errors and biases.
- **Sample Handling:** Proper handling and storage protocols to maintain sample integrity.
- **Analysis:** Consistent and precise analysis methods to generate reliable data.

Validation of Results:

- **Peer Review:** Subject matter experts will review findings to ensure scientific accuracy.
- **Stakeholder Consultation:** Engaging stakeholders to incorporate their insights and validate data.
- **Cross-Checking:** Comparing findings with existing literature and datasets to confirm results.

These QA/QC measures ensure that the data accurately represents the environmental and social conditions within and around the project area, fostering trust and credibility among stakeholders.

This commitment to high standards and methodological rigor facilitates informed decision-making and responsible project implementation, ultimately contributing to sustainable development and effective management of potential impacts.

ES 4.4 Test Laboratories

Selection of Test Laboratories for Environmental and Social Impact Assessment (ESIA) for the Proposed Special Agro-Processing Zone (SAPZ) – Agro-Industrial Hub (AIH) Project at Lau was done based on:

1. Water Quality Testing

- **Criteria:** Accreditation, proficiency in key water quality parameters, experience with similar projects.

2. Air Quality Monitoring

- **Criteria:** Accreditation, proficiency in particulate matter and gases, experience with industrial projects.

3. Soil Testing

- **Criteria:** Accreditation, proficiency in soil quality parameters, experience with agricultural and industrial projects.

4. Biodiversity Assessment

- **Criteria:** Expertise in species identification and ecological impact, experience with large-scale projects.

ES 4.5 Description of Test Parameters

Description of Test Parameters for Environmental and Social Impact Assessment (ESIA) for the Proposed Agro-Industrial Hub (AIH) Project at Lau included:

Water Quality: Regular monitoring of various parameters such as pH level, dissolved oxygen, and heavy metals in surface water and groundwater sources will be conducted before, during, and after project implementation using standard testing methods.

Air Quality: Continuous monitoring of air pollutants like particulate matter and volatile organic compounds will be carried out at the project site and surrounding areas to ensure compliance with regulatory standards.

Noise Quality: Assessment of noise levels, including intensity, frequency, and sources, will be performed throughout the project phases, with proposed mitigation measures to minimize noise pollution.

Soil Quality: Evaluation of soil parameters such as pH, nutrient levels, and heavy metal concentrations will be conducted periodically to monitor any changes caused by project activities. Biodiversity: Baseline assessments and ongoing monitoring will track species diversity, habitat quality, and the presence of endangered species, ensuring the preservation of local biodiversity.

Social Impact: Assessments will examine various factors such as livelihood impacts, community health, and access to resources through stakeholder consultations and participatory methods.

ES 4.6 Field Instrumentation and Survey Activities

The field instrumentation and survey activities for the Environmental and Social Impact Assessment (ESIA) of the proposed Agro-Industrial Hub (AIH) Project at Lau were meticulously planned and executed to ensure accuracy, safety, and compliance with regulatory standards.

Pre-Mobilization Checks: Before the wet season field data gathering, activities such as health, safety, and security planning, along with equipment readiness assessments, were conducted to mitigate risks associated with fieldwork.

Equipment and Materials Checklist: A comprehensive list of equipment and materials was prepared, including personal protective gear, soil testing kits, water quality testing equipment, weather monitoring tools, GIS and remote sensing technology, agricultural machinery, and laboratory equipment.

Field Sampling: Various methods were employed for environmental component sampling, including soil and land use assessment, surface and groundwater sampling, air quality and noise measurement, vegetation and wildlife observation, and socio-economic assessments.

Mobilization: Checks were carried out to ensure the readiness of equipment and materials, including inspection for damage, battery condition checks, appropriate storage, review of alternative routes, and security updates.

Samples Handling: Stringent protocols were followed for sample collection, handling, and preservation, adhering to FMEnv Guidelines and Standards. This included maintaining equipment in excellent condition, using properly sterilized sampling containers, and labeling samples accurately.

Sample Storage and Preservations: Samples were carefully packaged, labeled, and stored to prevent disturbance during transportation to the laboratory. Spare samples were taken for each analysis to compensate for potential damage or loss during transit.

ES 4.7 Environmental Quality Analysis

The environmental quality analysis conducted by Mozuk Scientific & Analytics Laboratories Ltd. at Gudu, Abuja, adhered to international standards such as ASTM, APHA, and FMEnv protocols. The analyses were comprehensive, covering various environmental components like noise levels, air quality, groundwater quality, soil characteristics, and vegetation. Summary of the findings include:

- **Soil Quality**

Soil Color: Soil color varied across sampling stations, indicating differences in composition and environmental conditions. Although not regulated, soil color provides insights into organic matter content and mineral composition.

pH: Most pH values were slightly below the optimal range for agricultural soils (6.0 to 8.5), suggesting slightly acidic conditions. Lime treatment might be necessary for optimal agricultural productivity.

Redox Potential: Values suggested varying degrees of soil aeration, influencing nutrient availability and microbial processes, although there are no specific standards for redox potential.

Electrical Conductivity (EC): All EC values were within acceptable limits set by regulatory bodies, indicating low salinity levels favorable for plant growth and suitable for agricultural purposes.

Soil Texture and Grain Size: Soil texture varied significantly across sampling stations, influencing water retention, drainage, and nutrient availability. All samples had grain sizes ≤ 2.00 mm, indicating fine-textured soils, suitable for agricultural purposes.

Moisture Content: Adequate moisture content was observed across all samples, essential for supporting agricultural activities.

Total Organic Matter and Total Organic Carbon: Higher organic matter and organic carbon levels were generally observed, indicating good soil fertility, essential for plant growth and microbial activity.

Total Nitrogen and Total Phosphorus: Levels were adequate for supporting plant growth and essential for root development and energy transfer in plants.

Ammonium, Oil and Grease, Total Hydrocarbon Content: Levels were generally minimal, within acceptable limits for agricultural soils, indicating minimal presence of contaminants.

Exchangeable Cations: Levels varied across sampling stations but indicated balanced soil fertility, crucial for plant growth and development.

Metals/Heavy Metals: Analysis of metals and heavy metals revealed concentrations within acceptable limits, indicating minimal contamination and conducive conditions for agricultural purposes.

Microbial Parameters: Analysis of microbial parameters indicated levels within acceptable ranges, suggesting minimal microbial contamination and favorable conditions for agricultural activities.

Overall, the soil quality assessment suggests that the soils in the Lau proposed site are generally suitable for agricultural purposes, albeit with some considerations such as pH adjustment and nutrient management. The findings provide valuable information for environmental management and land use planning in the area.

- **Groundwater Quality**

Physicochemical Parameters:

The appearance of groundwater from both the community borehole and the Catholic Church borehole was measured at 5.00 TCU, well within the FMEnv and WHO standard of 15 TCU, indicating clear water suitable for consumption. Both samples were found to be odorless, meeting the FMEnv standard of an odour threshold number of 3.5 and aligning with WHO standards for acceptable drinking water quality. pH levels were slightly below the acceptable range (6.35 and 6.37), indicating mildly acidic water that may require adjustment for optimal drinking water quality. Dissolved oxygen levels were low (1.00 mg/L in GW1 and 1.50 mg/L in GW2), suggesting the presence of high organic matter and potential anaerobic conditions. Total dissolved solids, salinity, and electric conductivity were within acceptable limits, indicating low mineral content and good water quality. Turbidity and total suspended solids were minimal, indicating clear water with minimal particulate matter.

Biochemical Parameters:

Oil and grease, biological oxygen demand, and chemical oxygen demand were all within acceptable limits, indicating no contamination from organic sources. Nitrate, ammonia, phosphate, and sulfate levels were all within acceptable limits, indicating minimal contamination from agricultural or wastewater sources.

Metals/Heavy Metals Parameters:

Potassium, magnesium, calcium, iron, lead, copper, nickel, chromium, aluminum, cadmium, manganese, and zinc levels were all within acceptable limits, indicating no contamination from heavy metals.

Microbial Parameters:

Total coliform count and total bacteria count exceeded FMEnv and WHO standards, indicating potential contamination and the need for disinfection. No fecal coliforms were detected, meeting FMEnv and WHO standards and indicating no fecal contamination.

While groundwater quality in Lau generally complies with FMEnv and WHO standards, pH adjustment and microbial treatment are necessary due to mildly acidic pH levels and microbial contamination. Continuous monitoring and community education are crucial for maintaining safe drinking water quality in the long term.

- **Air and Noise Quality**

- PM2.5 and PM10: Levels are generally below international standards but exceed local NESREA limits.
- Particles per Liter: AQC1 has the highest particle concentration, indicating potential particulate pollution.

- Air Quality Index (AQI): Generally within acceptable ranges, with AQC1 having the highest AQI.
- Formaldehyde (HCHO): Very low levels, indicating minimal pollution.
- Total Volatile Organic Compounds (TVOC): Generally low levels, suggesting minimal pollution.
- Temperature and Humidity: Within typical comfort ranges.
- Noise Levels: Some locations exceed the NESREA limit of 90 dBA, indicating potential health risks from noise pollution.

➢ **Climate and Meteorology**

- Climate Zone: Lau LGA falls within the Tropical Savannah Climatic Zone (Aw), characterized by distinct wet and dry seasons.
- Rainfall: Wet season lasts for 7-8 months, with peak rainfall in August. Dry season lasts for 4 months, with January being the driest month.
- Temperature: Ranges from 16°C to 38°C, with hot and cool seasons.
- Climate Change: Evidences of climate change include delayed onset of rains, increased dry days, and higher maximum temperatures.

➢ **Vegetation and Wildlife**

- Soil Fertility: Moderately to highly fertile soils capable of supporting cereal and legume crops.
- Vegetation: Falls within the Sudan Savannah zone, characterized by a combination of grasses, shrubs, and scattered trees.
- Common Plant Species: Includes various grasses, shrubs, and trees, both indigenous and exotic, providing food, medicinal, and economic benefits.

Overall, the discussion provides insights into the environmental factors relevant to the Lau area, including air and noise pollution, climate conditions, and vegetation characteristics. These factors play crucial roles in understanding and mitigating potential environmental impacts associated with the proposed project.

ES 4.8 Socio-Economic Environment

The socio-economic environment analysis provided in this study offers a comprehensive understanding of the project area, encompassing demographics, livelihoods, and existing social structures.

- **Data Collection Methods:** The study employed a combination of qualitative and quantitative methods, including focus group discussions, interviews, surveys, and site visits. This multi-faceted approach ensured a comprehensive understanding of the socio-economic landscape.

- **Sample Selection:** The purposive sampling technique was utilized to ensure that communities and respondents adequately represented the diversity of the study area. Equal representation of males and females in the sampled population enhanced the inclusivity and reliability of the data.

- **Demographic Profile:** The population of the study area comprises six settlements within Lau Local Government Area, with a total population of 19,000. The demographic profile includes gender distribution, age groups, duration of stay in the community, and languages spoken, highlighting the multi-ethnic nature of the communities.

- **Occupation and Education:** Farming emerged as the primary occupation, followed by business and civil service employment. Educational qualifications varied, with a significant portion having attained NCE/ND certificates, indicating a mix of formal and informal education levels.

- **Income Status:** The majority of the population are low-income earners, with about 60% earning between five to thirty thousand naira per month. This underscores the potential socio-economic impact of the Agro-Industrial Zone project in enhancing income and improving living standards.

- **Social Organizations and Amenities:** Existing social structures such as youth, women, and farmers' associations play a vital role in community cohesion and support. However, there is a need for improved social amenities, including healthcare centers and educational facilities, to address the current scarcity in the area.

- **Agricultural Activities:** Agriculture is the backbone of the local economy, with various crops cultivated for subsistence purposes. The study identified common crops and economic trees grown in the area, highlighting their potential contribution to the Agro-Industrial Zone project as raw materials.

- **Other Economic Activities:** In addition to agriculture, residents engage in supplementary economic activities such as manual stone quarrying and firewood selling, underscoring the need for diversified income sources.

- **Awareness of the Project:** A significant portion of the community members lack awareness of the Agro-Industrial Zone project. This indicates a need for increased communication and awareness campaigns to ensure that the community is well-informed about the project's purpose, benefits, and potential impacts.

- **Need for Workshops:** The majority of respondents expressed interest in workshops to create awareness about the project. Workshops could serve as a platform to educate the community about the project's objectives, potential benefits, and how they can participate in decision-making processes.

- **Community as Stakeholders:** Most respondents recognized the communities as stakeholders in the project. Acknowledging and involving communities as stakeholders is essential for fostering a sense of ownership, commitment, and active participation in the project.

- **Involvement in Decision Making:** The majority of respondents emphasized the importance of involving communities in decision-making processes related to project implementation. This highlights the need for participatory approaches that consider community perspectives and preferences in project planning and execution.

- **Attitude Towards the Project:** While the majority expressed acceptance, happiness, and support for the project, some individuals expressed concerns about its feasibility and sustainability. Addressing these concerns through transparent communication, community engagement, and adherence to equitable employment practices can help build trust and support for the project.

- **Benefits of the Project:** Respondents identified various benefits of the project, including employment opportunities, economic diversification, infrastructure development, and improved well-being. Leveraging these perceived benefits can help garner community support and enhance project outcomes.

- **Social Organizations and Benefiting Communities:** Farmers' associations were identified as the primary beneficiaries of the project, followed by youth and women associations.

Understanding the specific needs and priorities of these groups can inform targeted interventions to maximize the project's positive impacts.

- **Challenges and Mitigation Measures:** Respondents highlighted potential challenges such as changes in socio-cultural lifestyles, increased cost of living, and pressure on housing. Mitigation measures such as providing adequate social amenities, constituting impact monitoring committees, and promoting food sustainability can help address these challenges and minimize negative impacts on the communities.

ES 5.0 Potential and Associated Impacts

The introduction sets the stage for a comprehensive evaluation of the potential impacts associated with the proposed SAPZ - AIH project in the LAU Local Government Area (LGA) of Taraba State. It outlines the scope of the assessment, which includes biophysical, health, and socioeconomic implications across all project phases.

Key points highlighted in the introduction include:

1. **Scope of Assessment:** The assessment covers all project phases, including pre-construction, construction, operation, and decommissioning. It considers both normal operational impacts and potential effects arising from abnormal occurrences.
2. **Environmental Concerns:** Various environmental concerns, such as air and water pollution, impacts on employment, and land use change, are identified as potential impacts of the project. These concerns are thoroughly examined to determine their potential effects on environmental receptors.
3. **Assessment Methodology:** The assessment approach involves screening potential impacts using a Risk Assessment Matrix and conducting detailed evaluations of impact-producing factors within each project phase. The significance of potential impacts is quantified using consistent criteria.
4. **Alignment with Environmental Components:** The project's activities are aligned with existing environmental components, and potential changes in the environment resulting from these interactions are identified and evaluated.
5. **Mitigation Measures:** Mitigation measures are proposed to address identified changes in the environment. The Risk Assessment Matrix (RAM) is utilized to determine risks posed by potential impacts and to propose appropriate mitigation measures.

6. **Evaluation Criteria:** Impacts are evaluated based on specific criteria such as legal/regulatory requirements, magnitude of impact, risk posed, public perception, and importance of affected environmental components.
7. **Methodology Utilized:** Various references, including EIA Procedural Guidelines, ISO 14001 approach, and Hazard and Effect Management Process (HEMP), are utilized in the identification and evaluation processes.

ES 5.1 Impact Methodology Description

The impact methodology description provides an overview of the steps taken to identify, assess, and evaluate the potential and associated impacts of the proposed project. It includes the following sections:

1. **Environmental and Social Indicators:** This section outlines the specific indicators used to monitor the impacts of the project on the environment and local communities. It covers various aspects such as noise and vibrations, ecological impacts, hydrology and water quality, soil, socio-economic and health impacts, waste streams and sanitation, land use, access to electricity and infrastructure, and climate change factors.

2. **Impact Identification and Characterization Technique:** This part explains the process of identifying and categorizing impacts into positive and negative, direct and indirect, reversible and irreversible, and short-term and long-term. It also defines residual impacts and provides a table describing the nature of impacts.

3. **Determination of Impact Significance:** This section outlines the criteria used to determine the significance of impacts based on consequence level and impact likelihood. It includes tables detailing the significance criteria for consequence level and impact likelihood, as well as a matrix for impact evaluation.

4. **Impact Prediction and Assessment:** Various tools and models, including Geographic Information Systems (GIS) and environmental modeling, are used to predict the magnitude, extent, and significance of identified impacts. Stakeholder consultations help in forecasting potential impacts under different scenarios. Impacts are assessed based on predetermined criteria such as severity, duration, reversibility, and spatial extent. Both qualitative and

quantitative methods are employed to evaluate positive and negative impacts on the affected environment and communities.

5. **Risk Assessment:** Risks associated with project activities, including natural hazards, operational risks, and socio-economic factors, are identified and analyzed. The likelihood and potential consequences of adverse events are assessed to inform risk management strategies.

6. **Mitigation and Management Measures:** Based on identified impacts and risks, appropriate mitigation and management measures are developed to avoid, minimize, or compensate for adverse effects. These measures aim to enhance project sustainability and promote environmental and social responsibility.

7. **Monitoring and Evaluation:** A monitoring and evaluation plan is established to track the implementation of mitigation measures and assess the effectiveness of impact management strategies. Regular monitoring ensures compliance with regulatory requirements and enables adaptive management based on real-time data and feedback.

The methodology described ensures a comprehensive assessment of potential impacts and helps in making informed decisions regarding the project's design, implementation, and mitigation measures. It aligns with best practices in environmental impact assessment and ensures responsible project management.

ES 5.2 Impact Severity and Profiling

A detailed summary of key impacts and receptors throughout all stages/phases of project execution are outlined including the sources of impacts/risk, affected resources, intensity, scope, duration, consequence level and score, likelihood level and scope, as well as significance and residual impacts. These parameters facilitate the assessment of impact severity and the profiling of project activities.

- **Pre-Construction Phase**
  1. **Land-take and acquisition:**
     - Identified Impact: Alteration of population characteristics due to land loss.
     - Scope: Localized.
     - Impact Significance: Moderate.
     - Affected Resource/Outcome: Livelihood loss, conflict.

2. **Site clearing and preparation:**
    - Identified Impact: Degradation of air and water quality, soil erosion, loss of vegetation and wildlife, health impacts, waste generation, conflicts.
    - Scope: Dispersed.
    - Impact Significance: High.
    - Affected Resource/Outcome: Air quality, surface and groundwater, soil, vegetation and wildlife, human resources, waste generation, health, conflict.

- **Construction Phase**

1. **Mobilization of materials, equipment, and men to site:**
    - Identified Impact: Degradation of air and water quality, soil compaction, loss of vegetation and wildlife, health impacts, conflicts.
    - Scope: Dispersed.
    - Impact Significance: High.
    - Affected Resource/Outcome: Surface and groundwater, soil, vegetation and wildlife, air quality and noise, human resources, conflict.

2. **Civil/Structural works and facility installations:**
    - Identified Impact: Degradation of air and water quality, soil contamination, loss of vegetation and wildlife, health impacts, conflicts.
    - Scope: Dispersed.
    - Impact Significance: High.
    - Affected Resource/Outcome: Air quality, surface and groundwater, soil, vegetation and wildlife, health, conflict.

- **Operation and Maintenance Phase**

1. **Operation of the LAU, SAPZ – AIH:**
    - Identified Impact: Boom town effects, changes in population structure, transportation and noise impacts, waste generation, conflicts.
    - Scope: Dispersed.
    - Impact Significance: High.
    - Affected Resource/Outcome: Livelihood, human resources, transport and noise quality, waste generation, conflict.

2. **Routine maintenance of utility, plants, mills, and facilities:**
    - Identified Impact: Degradation of air and water quality, soil contamination, noise and air pollution, health impacts.
    - Scope: Dispersed.
    - Impact Significance: High.
    - Affected Resource/Outcome: Surface and groundwater, soil, air and noise quality, human resources.
    -

- Decommissioning and Closure Phase
1. **Dismantling of facilities, buildings, utility, and ancillary facilities:**
    - Identified Impact: Livelihood loss, changes in surface and groundwater quality, air and noise pollution, waste generation, transportation impacts, changes in population structure.
    - Scope: Dispersed/Localized.
    - Impact Significance: High.
    - Affected Resource/Outcome: Livelihood, surface and groundwater, air and noise quality, vegetation and wildlife, waste generation, transportation, human resources.

The identified impacts cover a wide range of environmental, social, and economic aspects, highlighting the importance of thorough impact assessment and mitigation measures throughout the project lifecycle.

ES 5.3 Project Phases, Associated Activities and Potential Impacts

The detailed breakdown of potential impacts across different phases of the project is quite comprehensive and summarized below.

- **Pre-Construction Phase:**
    - **Environmental Impacts:** Loss of biodiversity and vegetation, air quality pollution, increased noise levels, and generation of solid waste.
    - **Occupational Health Impacts:** Increased traffic risks, accidents, trips, falls, dust inhalation, and injuries.
    - **Socio-Economic Impacts:** Positive impacts include stakeholder consultation, job opportunities, and increased demand for goods and services. Negative impacts include conflicts over employment, population impacts, and pressure on existing infrastructure.

- **Construction Phase:**
  - **Environmental Impacts:** Air pollution, introduction of invasive species, soil and groundwater contamination, alteration of existing habitat.
  - **Occupational Health Impacts:** Increased dust, heat stress, accidents, injuries, and spread **of communicable diseases.**
  - **Socio-Economic Impacts:** Recruitment of labor, improved livelihood, but also noise pollution and potential conflicts.

- **Operation and Maintenance Phase:**
  - **Environmental Impacts:** Air and noise pollution, water and soil contamination, waste generation.
  - **Occupational Health Impacts:** Workplace accidents, fire outbreaks.
  - **Socio-Economic Impacts:** Employment opportunities, skill transfer, increased public revenue, but also pressure on existing infrastructure and increased traffic.

- **Decommissioning and Abandonment Phase:**
  - **Environmental Impacts:** Groundwater contamination, soil disturbance, pollution from waste management.
  - **Socio-Economic Impacts:** Loss of employment, social vices, and increased traffic.

The positive impacts range from employment opportunities to capacity building, skill transfer, and infrastructure development. However, these must be balanced against the negative impacts such as air and water pollution, habitat alteration, and potential conflicts. Mitigation measures will play a crucial role in minimizing these negative impacts and maximizing the positive ones.

ES 5.4 Risk Assessment

The risk assessment provides a thorough analysis of various environmental and socio-economic risks associated with the SAPZ – AIH, Lau project, and the summary of the key elements are:

Risk Description: Each risk is briefly described to identify its nature and potential impact on the project.

Likelihood (L): This assesses the probability of the risk occurring, categorized as Low, Medium, or High.

Frequency (F): It indicates how often the risk is likely to occur, categorized as Low, Medium, or High.

Impact (I): This evaluates the potential severity of the risk's impact, categorized as Low, Medium, or High.

Impact Significance: It provides a qualitative assessment of the impact's significance, considering both the duration and reversibility, such as Moderate, Short Term; Irreversible, Long Term.

Risk Rating (R): An overall assessment of the risk, combining likelihood, frequency, and impact, categorized as Low, Medium, or High.

Mitigation Plan (P): Recommended strategies and actions to mitigate or manage the identified risk effectively.

The risks range from environmental concerns like air pollution, water contamination, soil degradation, and deforestation to socio-economic impacts such as employment opportunities, local economic growth, community health risks, and cultural displacement. Each risk is evaluated based on its likelihood, frequency, and impact, and appropriate mitigation plans are proposed to manage these risks effectively.

Mitigation strategies include installing emission control systems, implementing water treatment facilities, adopting sustainable farming practices, reforestation efforts, prioritizing local hires, providing health awareness programs, engaging with local leaders, and implementing resource-efficient technologies, among others.

By identifying and addressing these risks proactively, the project aims to minimize negative impacts on the environment and local communities while maximizing the positive outcomes, ensuring sustainable and responsible project implementation.

ES 5.5 Residue Impact Description

The Residual Impact Description provides a thorough evaluation of the ongoing environmental and social impacts that persist despite the implementation of mitigation measures outlined in the Environmental and Social Management Plan (ESMP) for the SAPZ Agro-Industrial Hub (AIH) in Lau.

Environmental Residual Impacts:

1. **Water Resources:** Despite water conservation measures, increased demand for water from irrigation and industrial processing may still impact local water resources. Continuous monitoring and resource management strategies will be essential to mitigate these residual impacts.
2. **Air Quality:** Operational activities may contribute to residual air quality impacts despite emission control systems. Adhering to strict emission standards and best practices for air quality management will help mitigate these impacts.
3. **Biodiversity:** Construction and operational phases may disturb local habitats, leading to residual impacts on biodiversity. Continuous monitoring and additional conservation efforts will be necessary to mitigate these effects.
4. **Soil Quality:** Intensive agricultural activities may lead to residual impacts on soil quality despite adopting sustainable practices. Regular soil health assessments and the use of organic fertilizers will help mitigate these impacts.

Social Residual Impacts:

1. **Livelihoods:** Changes in land use and economic activities may impact local livelihoods despite mitigation efforts. Continuous skills training and support for income-generating activities will be crucial in mitigating these impacts.
2. **Cultural Heritage:** Despite mitigation measures, there may be residual impacts on cultural sites and practices. Engaging with local communities and implementing preservation initiatives will help mitigate these impacts.
3. **Health and Safety:** Operational activities pose health and safety risks despite protocols. Ongoing monitoring, capacity building, and emergency response planning will address these impacts.
4. **Community Relations:** Despite stakeholder engagement efforts, residual impacts on community relations may occur. Establishing grievance mechanisms and maintaining open communication will be crucial.

Cumulative Impacts:

The combined effects of multiple projects in the region may create additional environmental and social pressures. Conducting comprehensive cumulative impact assessments and collaborating with stakeholders will be essential in managing these impacts.

Overall, proactive mitigation measures and ongoing monitoring will help minimize residual impacts, ensuring the long-term sustainability of the SAPZ – AIH project. Continuous stakeholder engagement and adaptive management strategies will be crucial in addressing any unforeseen impacts and promoting sustainable development.

ES 6.1 Mitigation Measures – Objectives and Hierarchy

The mitigation measures outlined for the SAPZ – AIH project at LAU are comprehensive and aim to prevent, reduce, control, remedy, or compensate for adverse impacts while enhancing positive benefits. Here's a breakdown of the mitigation measures:

Mitigation Objectives and Hierarchy: The primary objectives of mitigation measures include avoidance, minimization, control, and compensation of impacts. The mitigation hierarchy guides the selection of appropriate measures, ranging from avoiding impacts at the source to repairing or remedying unavoidable damage.

Environmental, Health, and Safety Management: The Environmental Management System (EMS) will be implemented to manage the impacts of organizational activities on the environment and increase operating efficiency. It includes policies, procedures, and standards for all operations, promoting consistent control and continuous improvement of environmental performance.

Elements of an EMS: The EMS encourages continuous improvement of environmental performance through elements such as establishing an environmental policy, setting objectives and targets, monitoring progress, ensuring employee competence, and taking corrective actions as necessary.

Response Plan for Environmental and Social Impact Assessment (ESIA): The response plan for ESIA includes various components:

- **Implementation of Mitigation Measures:** Adherence to the Environmental and Social Management Plan (ESMP), dedicated team for implementation and monitoring, regular training sessions, and integration of environmental and social criteria into procurement processes.
- **Stakeholder Engagement and Communication:** Development of a comprehensive stakeholder engagement plan, regular meetings and consultations, and establishment of effective communication channels and grievance mechanisms.
- **Monitoring and Evaluation:** Implementation of a robust monitoring and evaluation system, regular impact assessments, and review and update of the ESMP based on results and stakeholder feedback.
- **Adaptive Management:** Adoption of an adaptive management approach, establishment of early warning systems, and fostering a culture of learning and innovation within the project team.

- **Capacity Building and Knowledge Sharing:** Provision of training and capacity-building programs, facilitation of knowledge sharing and collaboration, and leveraging lessons learned and best practices.
- **Compliance and Reporting:** Ensure full compliance with applicable laws and regulations, preparation of regular performance reports, and facilitation of independent third-party audits.

By implementing this comprehensive response plan, the SAPZ – AIH project at LAU can effectively manage environmental and social risks, minimize negative impacts, and enhance positive outcomes for both the project and the surrounding communities.

ES 6.2 Proffered Mitigation Measures

A summary of mitigation measures and adjustments for the project's identified potential and associated impacts across different development phases are provided as follows;

➢ **Pre-Construction Phase**

Project Activity: Land-take and Acquisition

- Associated and Potential Impacts:
  - Alteration of population characteristics due to relocation.
  - Loss of livelihood from agriculture.
  - Conflicts over compensation.

- Impact Category Before Mitigation:
  - Medium to High.

- Mitigation Measures:
  - Ensure adequate compensation for land and crops to minimize relocation.
  - Compensation for loss of income, aligning with IFC Performance Standards, Equator Principles, and AfDB Operational Safeguards.
  - Provide compensation per mutually agreed guidelines.

- Impact Category After Mitigation:
  - Low.

Project Activity: Site Clearing and Preparation

- Associated and Potential Impacts:

- Increased suspended particulates and air quality degradation.
- Surface water contamination from runoff.
- Soil denudation and erosion.
- Loss of vegetation and wildlife migration.
- Influx of job seekers altering population characteristics.
- Soil and water contamination from waste.
- Health impacts from emissions and dust.
- Conflicts due to inadequate consultations.

- Impact Category Before Mitigation:
    - High to Moderate.

- Mitigation Measures:
    - Regular maintenance of vehicles and machinery.
    - Sprinkling open soil surfaces with water and conducting activities during the rainy season.
    - Erosion control measures and re-vegetation of cleared areas.
    - Confine activities to necessary areas and implement noise attenuation.
    - Promote local recruitment.
    - Proper waste handling and disposal.
    - Ensure proper PPE usage and maintain emission standards.
    - Conduct adequate consultations with host communities.

- Impact Category After Mitigation:
    - Low to Negligible.

➢ **Construction Phase**

Project Activity: Mobilization of Materials, Equipment, and Personnel

- Associated and Potential Impacts:
    - Waste contamination of surface water.
    - Soil compaction and contamination.
    - Vegetation loss and wildlife disturbance.
    - Air quality degradation and noise pollution.
    - Influx of job seekers and pressure on infrastructure.
    - Traffic congestion.
    - Health impacts from emissions.

- Potential conflicts.

- Impact Category Before Mitigation:
  - High to Medium.

- Mitigation Measures:
  - Contain and segregate waste, engage certified waste handlers.
  - Use existing roads and dispose of camp wastes properly.
  - Limit camps to designated areas, implement noise attenuation.
  - Maintain vehicles and machinery to meet emission standards.
  - Favor local recruitment.
  - Plan transportation to minimize interactions with local traffic.
  - Conduct consultations to prevent conflicts.

- Impact Category After Mitigation:
  - Low to Negligible.

Project Activity: Civil/Structural Works and Facility Installations

- Associated and Potential Impacts:
  - Air quality degradation and noise pollution.
  - Groundwater contamination.
  - Soil infiltration and contamination.
  - Impacts on plant productivity and wildlife.
  - Health impacts and potential injuries.
  - Potential conflicts.

- Impact Category Before Mitigation:
  - High to Medium.

- Mitigation Measures:
  - Regular maintenance and emission compliance.
  - Conduct piling and foundation activities with care, additional hydrogeological studies.
  - Implement erosion control and re-vegetate disturbed areas.
  - Adhere to emission standards, provide PPE, and conduct activities in the rainy season.
  - Conduct consultations with host communities.

- Impact Category After Mitigation:

- Low to Negligible.

- **Operation and Maintenance Phase**

Project Activity: Operation of the LAU, SAPZ – AIH

- Associated and Potential Impacts:
    - Boom town effects and inflation.
    - Population influx and pressure on infrastructure.
    - Traffic congestion.
    - Soil and water contamination from waste.
    - Potential conflicts.

- Impact Category Before Mitigation:
    - High to Medium.

- Mitigation Measures:
    - Limited control over boom town effects.
    - Promote local recruitment.
    - Strategic transportation planning.
    - Engage certified waste management contractors.
    - Conduct consultations to minimize conflicts.

- Impact Category After Mitigation:
    - Low to Negligible.

Project Activity: Routine Maintenance of Utility, Plants, Mills, and Facilities

- Associated and Potential Impacts:
    - Hazardous waste generation and potential surface water and groundwater contamination.
    - Soil contamination.
    - Emissions and noise from maintenance equipment.

- Impact Category Before Mitigation:
    - High to Medium.

- Mitigation Measures:
    - Adhere to international best practices for maintenance.

- Pave maintenance areas with concrete to prevent contamination.
- Engage certified waste management contractors.
- Maintain vehicles and machinery to meet emission standards.

- Impact Category After Mitigation:
  - Low to Negligible.

➢ **Decommissioning and Closure Phase**

Project Activity: Dismantling of Facilities, Buildings, Utility, and Ancillary Facilities

- Associated and Potential Impacts:
  - Job loss and impact on livelihood.
  - Surface and groundwater quality changes.
  - Emissions and noise pollution.
  - Soil and water contamination from dismantling waste.
  - Traffic congestion.
  - Influx of job seekers.

- Impact Category Before Mitigation:
  - High to Medium.

- Mitigation Measures:
  - Ensure adequate pension plans and skills training for workers.
  - Conduct dismantling meticulously following best practices.
  - Regular maintenance of vehicles and machinery.
  - Implement noise attenuation measures.
  - Engage certified waste management contractors.
  - Plan transportation to minimize local traffic impact.

- Impact Category After Mitigation:
  - Low to Negligible.

These mitigation measures ensure that environmental, social, and health impacts are minimized across all phases of the LAU, SAPZ – AIH project. By implementing these strategies, the project can effectively manage potential negative impacts while enhancing positive outcomes for the local communities and the environment.

ES 7.1 Environmental and Social Management Plan

The Environmental and Social Management Plan (ESMP) is a vital tool for monitoring the effectiveness of mitigation measures and project commitments outlined in the Environmental and Social Impact Assessment (ESIA). Integrated into the project implementation process, it aims to minimize adverse impacts and ensure compliance with environmental regulations and corporate HSE policies. The ESMP details mitigation commitments, stakeholder responsibilities, and monitors biophysical and social environmental attributes throughout the project's lifecycle to address any new impacts arising from project implementation.

Scope and Objectives of ESMP

The ESMP aligns with ISO 14001: Environmental Management System (EMS) guidelines and covers the entire project lifecycle from pre-construction to decommissioning. It is reviewed and updated before activities commence. The primary objective is to integrate environmental and social considerations into daily decision-making, managing risks throughout the project lifecycle. The ESMP is a working document for tracking, evaluating, and communicating environmental and social performance.

Key Objectives

1. **Identify and Manage Impacts**: Assess potential environmental and social impacts of the AIH Project and develop response mechanisms.
2. **Ensure Compliance**: Meet regulatory requirements and international standards for environmental and social management.
3. **Promote Stakeholder Engagement**: Foster transparency and address stakeholder concerns.
4. **Integrate into Project Design**: Incorporate environmental and social management into project operations.

Additional Goals

- Define roles and responsibilities for contractors.
- Outline monitoring and supervision by the National Investment Commission.
- Ensure high environmental protection and working standards.
- Assist in implementing mitigation measures.
- Ensure compliance with HSE policies and national legislation.
- Identify and reduce risks associated with work processes.

The ESMP aims to ensure the AIH Project is conducted responsibly, emphasizing environmental sustainability and social well-being while maintaining transparency and stakeholder trust throughout the project lifecycle.

ES 7.2 Stakeholders Engagement Plan

The Stakeholders Engagement Plan, aligned with the African Development Bank Group guidelines, aims to foster productive interactions with affected parties and interested stakeholders throughout the project cycle. It ensures meaningful engagement by gathering views, concerns, comments, and inputs on project implementation.

Objectives of Stakeholder Consultation

1. Information Sharing: Distribute project-related information to stakeholders.
2. Solicit Feedback: Gather input to inform project design and execution.
3. Enhance Acceptance: Clarify project objectives early to manage expectations.
4. Impact Assessment: Assess and mitigate environmental and social risks.
5. Enhance Benefits: Maximize project benefits.
6. Grievance Addressal: Address project-related grievances.

Consultation Process

Stakeholders from various levels, including national and local governments, and affected communities, will be consulted through interviews, group discussions, and public meetings. Key stakeholders include:

1. Federal and state environmental and agricultural ministries
2. Local government authorities
3. Project Affected Persons (PAPs) and communities
4. Community-Based Organizations

Consultations will begin early, providing essential project information and addressing stakeholder concerns.

Grievance Redress Mechanism (GRM)

The GRM ensures a transparent, fair, and accessible process for stakeholders to raise grievances. Key elements include:

- Purpose: Address concerns promptly and effectively.
- Procedure: Establish multiple complaint channels with clear response timelines.
- Responsibility: Assign grievance officers to manage and monitor complaints.
- Documentation: Maintain a log to track complaints and resolutions.

Security Management Plan

The Security Management Plan protects project assets, personnel, and the community. Key elements include:

- Risk Assessment: Identify security threats and vulnerabilities.
- Security Measures: Implement physical security measures like fencing and surveillance.
- Protocols: Establish procedures for theft, vandalism, and emergencies.
- Community Relations: Collaborate with local law enforcement and leaders.

Resettlement Action Plan (RAP) and Livelihood Restoration Plan (LRP)

The RAP and LRP mitigate the impacts of land acquisition and restore or improve affected livelihoods. Key elements include:

- Resettlement: Provide detailed plans for relocation, compensation, and assistance.
- Livelihood Restoration: Implement programs for skills training, employment, and business support.
- Consultation: Engage with affected communities to address their needs.
- Monitoring and Evaluation: Regularly assess and adjust resettlement and livelihood efforts.

ES 7.3 Environmental Health and Safety Plan

A comprehensive Health and Safety Plan will be developed for the construction, operation, and decommissioning phases of the project to ensure compliance with Ministry of Health and IFC guidelines. This plan aims to safeguard employees' health and safety and includes the following key elements:

- Safety Devices: Use of equipment to prevent injuries or hazardous conditions.
- Drinking Water: Provision of safe drinking water.
- Immunizations: Providing necessary vaccinations.
- Clean Eating Areas: Maintenance of hygienic dining spaces.
- First Aid: Availability of first aid facilities.
- Sanitary Conditions: Maintenance of cleanliness and proper waste management, including bathrooms.
- Waste Management: Proper disposal procedures.
- Signage: Installation of appropriate warning signs.
- Fire Prevention: Installation of fire prevention equipment and conducting training and awareness programs.
- Personal Protective Equipment (PPE): Provision and use of PPE.

A safety specialist will develop, implement, and maintain the safety program, regularly evaluating its effectiveness. This specialist will have written instructions on handling and disposing of hazardous waste, and contingency plans for accidents, spills, and fires. Responsibilities include conducting safety training, inspections, and drills, and investigating accidents. A safety committee will hold regular safety meetings.

Health, Safety, and Environment (HSE) Training Plan

The HSE Training Plan ensures that all project personnel are adequately trained for safe and responsible work. Key components include:

- Training Programs: Development of modules on workplace safety, emergency response, environmental protection, and first aid.
- Target Audience: Tailored training programs for management, workers, and contractors.
- Training Frequency: Regular sessions with refresher courses at specified intervals.
- Evaluation: Assessing training effectiveness through feedback, quizzes, and practical drills.

ES 7.4 Emergency Response Plan

An Emergency Preparedness and Response Plan (EPRP) shall be developed to guide project staff in managing emergencies related to project hazards. The EPRP will align with guidelines from the Federal Ministry of Environment, Nigeria's EIA Procedural Guidelines, ISO 14001 standards, the Hazard and Effect Management Process (HEMP), and International Labour Organization (ILO) guidelines. Key elements of the EPRP include:

- Roles and Responsibilities: Clearly defined roles and responsibilities for emergency personnel.
- Emergency Contacts and Communication: Established communication systems and protocols, including procedures for interacting with local and regional emergency authorities.
- Emergency Procedures: Specific response procedures for different types of emergencies.
- Alarm System: Implementation of an audible emergency alarm system covering the entire site and sub-stations.
- Evacuation Plan: Detailed evacuation procedures, including emergency escape routes, procedures for accounting for all personnel post-evacuation, and specific roles during evacuations. This plan will be practiced regularly.
- Emergency Supplies and Resources: Identification and maintenance of necessary emergency equipment, facilities, and designated areas.
- Training and Drills: A comprehensive training plan with scheduled drills for personnel responsible for rescue, medical duties, spill response, and fire response.

In the event of an emergency:

- Immediate notification of all on-site personnel and coordination with surrounding areas to mitigate impacts.

- Immediate notification of relevant authorities, including the National Emergency Management Agency (NEMA), Taraba State regional/local contacts, local police, and other necessary authorities.
- For imminent emergencies, prompt evacuation advisories and notifications will be issued.
- For slowly developing emergencies, ongoing communication with NEMA and other authorities to determine necessary preventive actions.

Evacuation Procedures

The evacuation procedures include:

1. Alert the Emergency Response Team to assist with evacuation.
2. Use appropriate communication tools (alarms, loudspeakers) based on the incident.
3. Communicate clearly and succinctly: "We have a [type of emergency]. Evacuate to [assembly point]."
4. Turn off equipment, if feasible.
5. Take emergency supplies and staff rosters, if possible.
6. Account for all personnel at the assembly point.
7. Wait for further instructions at the assembly point.

Fire and Explosion Response

The EPRP will also contain specific procedures for responding to fires and explosions, providing detailed guidelines for these types of emergencies.

ES 7.5 Waste Management Plan

The Waste Management Plan for the LAU, SAPZ – AIH project will ensure proper management of all waste generated, including agricultural and agro-allied industrial waste, in accordance with applicable laws, regulations, and international standards. The plan will focus on:

- Types of Waste: Identifying waste types such as crop residues, processing by-products, packaging materials, and chemical waste.
- Waste Minimization: Implementing strategies to reduce, recycle, recover, and reuse waste.
- Waste Management Methods: Addressing specific management practices for agricultural and agro-allied industrial waste, including composting, recycling, and reuse.
- Good Housekeeping: Maintaining clean and organized waste management practices, including tracking and documenting waste.

Key Components of the Waste Management Plan

1. Waste Characterization and Quantification:
    - Conducting a study to identify waste types, quantities, and sources.
    - Classifying waste based on composition, toxicity, and environmental impact.
2. Waste Reduction and Minimization:
    - Reducing waste generation through process optimization and resource efficiency.
    - Promoting eco-friendly materials and technologies.
    - Adopting circular economy principles.
3. Waste Segregation and Collection:
    - Establishing a program to separate waste at the source.
    - Providing adequate collection infrastructure.
    - Training staff on waste segregation protocols.
4. Recycling and Resource Recovery:
    - Partnering with local recycling facilities and waste management companies.
    - Establishing on-site composting and biomass conversion facilities.
    - Exploring value-added uses for waste materials.
5. Hazardous Waste Management:
    - Identifying hazardous waste types, such as agrochemicals and chemical solvents.
    - Implementing safe handling, storage, transportation, and disposal procedures.
    - Providing training and PPE to personnel handling hazardous waste.
6. Monitoring and Reporting:
    - Establishing protocols to track waste generation, segregation, collection, recycling rates, and disposal.
    - Regularly monitoring and evaluating waste management effectiveness.
    - Preparing periodic reports on waste management performance and compliance.

Infrastructure Development

1. Sewerage Collection and Treatment System:
    - An underground sewerage network to collect sewage and convey it to a sewage treatment plant (STP).
    - Treated sewage will be used for irrigation, supported by a pipe network.
2. Effluent Collection and Treatment System:
    - Managing effluents from yam and cassava processing plants through anaerobic and aerobic treatment.
    - Treated effluent will meet standards for reuse in washing and agriculture.

This Waste Management Plan aims to ensure environmental sustainability and regulatory compliance throughout the project lifecycle by adopting comprehensive waste management practices.

ES 7.6 Climate Management Plan

A comprehensive Climate Management Plan was developed using the Climate and Disaster Risk Screening Tool to address short- and long-term climate and disaster risks. This plan aims to integrate resilience-building measures against climate and geophysical hazards, ensuring the project's sustainability and success.

Key Elements of the Climate Management Plan:

1. Climate-smart Agriculture (CSA) Practices:
    - Enhanced management of farms, crops, livestock, aquaculture, and fisheries to optimize resource use, increase productivity, and build resilience.
    - Ecosystem and landscape management strategies to conserve critical ecosystem services.
    - Support services for farmers to adopt climate-smart practices.

2. **Greenhouse Gas (GHG) Emissions Mitigation:**
    - Conduct a comprehensive GHG emissions assessment.
    - Implement energy-efficient technologies and renewable energy sources.
    - Promote sustainable agricultural practices, including conservation agriculture and agroforestry.
    - Use low-emission transportation methods, such as electric or biofuel-powered vehicles.

3. **Climate Risk Assessment and Adaptation:**
    - Conduct a climate risk assessment to identify potential hazards (e.g., flooding, drought, extreme temperatures).
    - Design resilient infrastructure and facilities with flood-resistant construction, water management systems, and heat-resistant materials.
    - Develop early warning systems and emergency response plans.
    - Engage local communities to integrate indigenous knowledge and traditional practices for climate adaptation.

4. **Monitoring, Reporting, and Evaluation:**
    - Establish mechanisms to monitor and evaluate climate management measures.
    - Regularly report on climate performance indicators.
    - Conduct periodic reviews and assessments to update strategies and ensure continuous improvement.

Climate Risk Management Measures Objective Focus

Optimize crops and land management practices - Tailoring cropping practices to suit specific crops and anticipated rainfall patterns.

- Advocating for investments in sustainable land use practices.
- Broadening agricultural production to reduce reliance on rainfed crops.
- Advocating for land tenure and property rights reforms to enhance local natural resource management.
- Equipping farmers with drought- and heat-tolerant crop varieties.
- Creating new insurance mechanisms to mitigate climate-related risks.
- Assisting smallholders in crop diversification to enhance resilience against changing climate conditions.
- Implementing measures to curtail detrimental agricultural practices that contribute to erosion and soil degradation.

Improve livestock practices - Enhance national animal health services.

- Advocate for the adoption of livestock breeds suited to the local climate.
- Promote integrated crop-livestock systems and improved water, feed, and animal management practices to enhance livestock productivity.

Improved Irrigation and Drainage - Prioritize irrigation for drought-sensitive farming and ecosystems.

- Enhance capacity to incorporate climate change scenarios into water resources policy planning.
- Implement technical measures to enhance water use efficiency in rainfed and irrigated agriculture.
- Adopt high-efficiency irrigation methods, such as drip and trickle irrigation.
- Explore techniques for water reuse, rainwater harvesting, and sustainable drainage.
- Utilize farm ponds, farm drainage, and expand micro irrigation systems.

- Evaluate investments in small and medium reservoirs and water supply projects for irrigation purposes.
- Enhance water supplies for agricultural use.

Protect/Harden - Revise design standards to incorporate anticipated storm surge levels.

- Deploy wind protection strategies to mitigate potential damage.
- Restore vegetation on unstable slopes to stabilize soil and prevent erosion.
- Enhance drainage infrastructure to manage increased rainfall and mitigate flooding.

Retreat/Relocate - Assess the feasibility of raising critical facilities to mitigate overflow and inundation risks.

- Develop relocation plans for affected communities to safer areas.
- Consider relocating crops to alternative land plots to avoid flood-prone areas.
- Explore options for moving infrastructure to more inland locations to reduce vulnerability to coastal hazards.

Build training and information systems - Enhance institutional capacity to comprehend and manage the impacts of climate change on both institutions and rural communities.

- Expand accessibility to climate information, including long-term weather forecasts and improved seasonal predictions for informed decision-making in agricultural activities
- Establish early warning systems offering daily weather updates and seasonal forecasts to aid in crop selection and timing
- Enhance training and educational programs focused on sustainable agriculture practices and the adoption of efficient irrigation techniques Strengthen policies, planning and systems - Incorporate climate information into system planning processes.
- Enhance coordination of policies and programs among agriculture ministries and other government agencies to address climate change challenges.
- Bolster the capabilities of disaster risk management and meteorological departments to enhance the quality of decision-making information.

ES 7.7 Environmental Management Plan

The primary objective of environmental monitoring is to ensure that mitigation measures are implemented and potential negative impacts are reduced to acceptable levels. The Special Agro-Industrial Processing Zone Monitoring Plan aims to assess changes in environmental conditions, evaluate mitigation measures' effectiveness, ensure regulatory compliance, and promptly address potential gaps.

The project monitoring scope encompasses two main phases

1. Impact Detection Monitoring: This involves periodic sampling to assess project operations' impact on the environment and human health, conducted by the project Environmental Officer and sustainable staff.
2. Compliance Monitoring: Ensures full compliance with Environmental Protection Agency regulations and standards, typically overseen by a Third-Party Evaluator accredited by the Federal Ministry of Environment.

Monitoring Parameters

Receptors required for monitoring include air quality, water resources, soil quality, waste generation and management, occupational health and safety, odor, noise quality, landscape and visual aspects, and biodiversity.

EHS Management Plan

Several elements will be developed for the project:

- Environmental Health and Safety Plan: Ensures compliance with Ministry of Health Guidelines for Occupational Health and Safety and IFC guidelines.
- Project Specific Emergency Response Plan: Prepared to effectively respond to emergencies, complying with IFC Occupational Safety guidelines and performance standards.
- Spill Contingency Management Plan: Identifies procedures to prevent, contain, clean up, and report spills and releases of hazardous materials.
- Development of a "Bridging" process: Evaluates contractors' EHS procedures.

Development of an Environmental Health and Safety Plan

This plan will cover construction, operation, and decommissioning phases, addressing safety devices, clean facilities, waste management, fire prevention, and Personal Protective Equipment (PPE). A safety specialist will oversee the program's implementation, including training, inspections, and accident investigations.

Development of an Emergency Response Plan

An Emergency Preparedness and Response Plan (EPRP) will outline roles, contacts, procedures, evacuation plans, and training schedules. It will also specify procedures for fire safety, explosion response, and spill response.

Development of a Waste Management Plan

This plan ensures proper waste management in compliance with laws and international standards. It describes waste types, minimization strategies, management methods, and good housekeeping practices.

Spill Contingency Management Plan

This plan aims to prevent, contain, clean up, and report spills of hazardous materials. Measures include proper storage, spill kits, containment structures, and oil/water separators.

Contractor Management

Contractors will be expected to follow EHS guidelines and programs issued by SAPZ, ensuring compliance with occupational health and safety and environmental management standards.

Mitigation Measures

Various mitigation measures will address air quality, water quality, soil contamination, erosion, and noise management. These include proper maintenance, traffic management, spill prevention, erosion control, and noise reduction techniques.

Impact Detection and Compliance Monitoring

These monitoring phases aim to identify sources, verify mitigation measures' implementation, review environmental management plans' effectiveness, and ensure regulatory compliance through periodic assessments and third-party evaluations.

Environmental and Social Management and Monitoring Plan Summary

Preconstruction Phase

- **Site Survey and Geotechnical Investigations:**
    - Impacts: Dust generation.
    - Mitigation: Use water spraying to control dust.
    - Responsibility: Contractor.
    - Parameters: Dust levels.
    - Measurement: Visual inspection, dust meters.
    - Indicator: Acceptable dust levels.
    - Monitoring Responsibility: Environmental Officer.

- **Land Acquisition and Compensation:**
    - Impacts: Disruption of local water sources.

- Mitigation: Conduct hydrological assessments and ensure alternative water supplies.
- Responsibility: Project Proponent.
- Parameters: Water quality parameters.
- Measurement: Water sampling and laboratory analysis.
- Indicator: Water quality meets regulatory standards.
- Monitoring Responsibility: Environmental Officer.

- **Community Consultations and Stakeholder Engagement:**
  - Impacts: Loss of vegetation.
  - Mitigation: Minimize vegetation clearing and promote reforestation efforts.
  - Responsibility: Contractor.
  - Parameters: Area of vegetation cleared.
  - Measurement: Site surveys and vegetation mapping.
  - Indicator: Minimal vegetation clearance.
  - Monitoring Responsibility: Environmental Officer.

Construction Phase

- **Site Clearing and Excavation:**
  - Impacts: Increased dust and emissions.
  - Mitigation: Use dust suppression techniques and maintain equipment.
  - Responsibility: Contractor.
  - Parameters: Dust and emission levels.
  - Measurement: Dust and emission monitoring equipment.
  - Indicator: Acceptable levels of dust and emissions.
  - Monitoring Responsibility: Environmental Officer.

- **Construction of Infrastructure:**
  - Impacts: Potential contamination of water sources.
  - Mitigation: Implement water management plans to prevent contamination.
  - Responsibility: Contractor.
  - Parameters: Water quality parameters.
  - Measurement: Water sampling and laboratory analysis.
  - Indicator: Water quality meets regulatory standards.
  - Monitoring Responsibility: Environmental Officer.

- **Installation of Utilities:**

- Impacts: Habitat destruction.
- Mitigation: Create buffer zones, relocate fauna where necessary.
- Responsibility: Contractor.
- Parameters: Presence of buffer zones, relocated fauna.
- Measurement: Site inspections, wildlife surveys.
- Indicator: Established buffer zones, successful relocation.
- Monitoring Responsibility: Environmental Officer.

- **General Construction Activities:**
    - Impacts: Generation of construction waste.
    - Mitigation: Implement waste management plans, recycle where possible.
    - Responsibility: Contractor.
    - Parameters: Volume of waste generated, recycled waste.
    - Measurement: Waste tracking records.
    - Indicator: High recycling rate, proper waste disposal.
    - Monitoring Responsibility: Environmental Officer.

- **Use of Machinery and Equipment:**
    - Impacts: Noise from construction activities.
    - Mitigation: Restrict construction to daylight hours, use noise dampening equipment.
    - Responsibility: Contractor.
    - Parameters: Noise levels.
    - Measurement: Noise monitoring equipment.
    - Indicator: Noise levels within acceptable limits.
    - Monitoring Responsibility: Environmental Officer.

Operational & Maintenance Phases

- **Operation of Facilities and Equipment:**
    - Impacts: Emissions from operational activities.
    - Mitigation: Use clean technologies and regularly maintain equipment.
    - Responsibility: Facility Operator.
    - Parameters: Emission levels.
    - Measurement: Emission monitoring equipment.
    - Indicator: Emissions within regulatory limits.
    - Monitoring Responsibility: Environmental Officer.

- **Routine Maintenance and Repairs:**
    - Impacts: Water use and potential contamination.
    - Mitigation: Implement water conservation measures and monitor water quality.
    - Responsibility: Facility Operator.
    - Parameters: Water usage, water quality parameters.
    - Measurement: Water meters, water sampling and analysis.
    - Indicator: Efficient water use, water quality standards.
    - Monitoring Responsibility: Environmental Officer.

- **Waste Management and Disposal:**
  - Impacts: Generation of operational waste.
  - Mitigation: Implement comprehensive recycling and waste reduction programs.
  - Responsibility: Facility Operator.
  - Parameters: Volume of waste generated, recycled waste.
  - Measurement: Waste tracking records.
  - Indicator: High recycling rate, proper waste disposal.
  - Monitoring Responsibility: Environmental Officer.

- **Use of Operational Machinery:**
  - Impacts: Noise from operational machinery.
  - Mitigation: Use noise reduction strategies and maintain equipment to minimize noise.
  - Responsibility: Facility Operator.
  - Parameters: Noise levels.
  - Measurement: Noise monitoring equipment.
  - Indicator: Noise levels within acceptable limits.
  - Monitoring Responsibility: Environmental Officer.

Decommissioning Phase

- Dismantling and Removal of Structures:
  - Impacts: Dust and emissions from dismantling activities.
  - Mitigation: Use dust suppression and emission control measures.
  - Responsibility: Contractor.
  - Parameters: Dust and emission levels.
  - Measurement: Dust and emission monitoring equipment.
  - Indicator: Acceptable levels of dust and emissions.
  - Monitoring Responsibility: Environmental Officer.

- **Site Cleanup and Remediation:**
  - Impacts: Potential contamination from dismantling waste.
  - Mitigation: Implement water protection measures and ensure proper waste disposal.
  - Responsibility: Contractor.
  - Parameters: Water quality parameters.
  - Measurement: Water sampling and laboratory analysis.
  - Indicator: Water quality meets regulatory standards.

- Monitoring Responsibility: Environmental Officer.

- **Post-Decommissioning Land Use Planning:**
  - Impacts: Habitat disruption and biodiversity loss.
  - Mitigation: Restore habitats and promote biodiversity in site restoration plans.
  - Responsibility: Contractor.
  - Parameters: Area restored, biodiversity indices.
  - Measurement: Site surveys, biodiversity assessments.
  - Indicator: Successful habitat restoration.
  - Monitoring Responsibility: Environmental Officer.

- **Disposal of Dismantling Waste:**
  - Impacts: Generation of dismantling waste including hazardous substances.
  - Mitigation: Develop a waste management plan for safe disposal of all materials.
  - Responsibility: Contractor.
  - Parameters: Volume and type of waste generated, hazardous waste.
  - Measurement: Waste tracking records, hazardous waste manifests.
  - Indicator: Proper waste disposal, minimal hazardous waste.
  - Monitoring Responsibility: Environmental Officer.

- **Use of Dismantling Machinery:**
  - Impacts: Noise from dismantling activities.
  - Mitigation: Schedule dismantling during less sensitive times, use noise barriers.
  - Responsibility: Contractor.
  - Parameters: Noise levels.
  - Measurement: Noise monitoring equipment.
  - Indicator: Noise levels within acceptable limits.
  - Monitoring Responsibility: Environmental Officer.

- **Cultural Heritage Assessments:**
  - Impacts: Impact on cultural heritage during site clearance.
  - Mitigation: Monitor for cultural

ES 7.8 ESMP Costing and Schedule

In ensuring the successful execution of the environmental and social management measures outlined in the ESMP, the Taraba State Government, through the Ministry of Agriculture, commits to allocating the necessary budgetary resources for the project components. The tentative budget for each project encompasses environmental management expenses that go beyond standard engineering practices, encompassing costs related to environmental and resettlement monitoring. Administrative expenses pertinent to ESMP costing, budget for implementation and the implementation schedule are detailed in the full report.

The breakdown of ESMP costing reveals the various monitoring activities, parameters, locations, phases, frequencies, costs, and responsibilities associated with the project. These activities ensure adherence to environmental regulations and standards throughout the project lifecycle. For instance, under Air Quality monitoring, routine visual assessments are conducted, alongside responses to grievances, aiming to control dust levels in construction areas. Soil Quality monitoring involves sampling for various contaminants before and after construction phases, overseen by the Environmental Manager. Water Resources monitoring entails assessing surface and groundwater quality, with lab analysis and periodic checks spearheaded by the Environmental Manager. Health and Safety surveys, Solid Waste management, Landscape and Visual Amenity monitoring, and Noise measurements are also outlined, each with specific parameters, locations, and implementation responsibilities. These comprehensive measures aim to mitigate environmental impact and ensure compliance throughout project development and operation.

ES 8.0 Conclusion and Recommendation

The proposed establishment of Special Agro-Industrial Processing Zones (SAPZ) in Lau and Wukari Local Government Areas of Taraba State, Nigeria, is projected to have minimal negative impacts on the environment, society, health, and safety. The study highlights the project's significant environmental, health, and socio-economic benefits, outweighing potential adverse effects. While some negative impacts may arise, SMART (Specific, Measurable, Achievable, Relevant, Time-bound) measures have been devised to mitigate them effectively. Robust mitigation measures and management plans, coupled with an institutional framework for implementation, will ensure the project's success. Proposed monitoring programs will be promptly activated.

Key Findings and Recommendations:

1. Assessment and Mitigation: Thorough assessment and identification of potential risks and impacts have been conducted, recommending measures to mitigate, reduce, or offset them to acceptable levels.

2. Stakeholder Engagement: Acknowledging both support and concerns from stakeholders is crucial for project acceptance and sustainability. Comprehensive stakeholder engagement plans must be developed and implemented to address all parties' concerns transparently.
3. Environmental Management: Baseline evaluations of surface and groundwater, along with socio-economic surveys, have been performed to gauge pre-project conditions accurately. Adequate environmental management systems will be deployed to address impacts during the construction and operation phases.
4. Mitigation Measures: The proposed measures effectively address various impacts, including direct, indirect, short-term, temporary, and controllable impacts during construction.
5. Resettlement Assessment: A detailed assessment is recommended to determine the level and extent of resettlement required, ensuring compliance with relevant standards and regulations.

It is affirmed that all environmental and social impacts associated with the SAPZ project have been identified, with mitigation measures outlined to address them. Ensuring the project's acceptance and successful implementation involves diligent stakeholder engagement and adherence to recommended mitigation measures. Transparent communication throughout the project's lifecycle is vital, facilitated by a comprehensive stakeholder engagement plan.

ACKNOWLEDGEMENT

Taraba State Government through the Taraba State Ministry of Agriculture and Food Security wishes to acknowledge the Government of the Federal Republic of Nigeria, African Development Bank (AfDB), the Federal Ministry of Environment (FMEnv.), Taraba State Ministry of Environment and Climate Change, and all other relevant stakeholders and the host communities for their support during this Environmental and Social Impact Assessment (ESIA) study for the "proposed Special Agro-Industrial processing Zone II (SAPZ II) Agricultural Industrial Hub (AIH) at Lau LGA, Taraba State".

The Contributions of the Environmental Consultant, Bolben Energy and Environmental Services Limited commissioned to execute this ESIA study is also well acknowledged and commended.

CHAPTER ONE
INTRODUCTION

1.1 Project Background

The Special Agro-industrial Processing Zones (SAPZ) is a major investment program of the Federal Government of Nigeria (FGN), driven by the Federal Ministry of Agriculture and Food Security (FMAFS) in collaboration with the state governments, Development partners, relevant Federal Ministries, Departments and Agencies (MDAs) and private investors to develop agro-processing clusters in areas of high agricultural production across the country. The SAPZ program enables agricultural producers, processors, aggressors, and distributors to operate in one vicinity reducing transaction costs and sharing business development services for increased productivity and competitiveness. Taraba state is one of the States which has taken proactive action for participation in the program, and AfDB has provided in-principal approval.

The SAPZ Program are designed to concentrate agro-processing activities within areas of high agricultural potential. It will also contribute to rural infrastructure development, improved access to agricultural markets, increased farm productivity, the adoption of agricultural technology, climate smart agricultural production and processing practices, increased value addition and agro-processing, increased skills acquisition, and job creation, for all actors along the value chain, including the small holder farmers, women and youth, people with special needs and vulnerable groups.

The Government of the Federal Republic of Nigeria through the Federal Ministry of Agriculture and Food Security with assistance from the African Development Bank (AfDB), Islamic Development Bank (IsDB) as well as International Funds for Agricultural Development (IFAD) seeks to increase value addition to some staple agricultural products in Nigeria through the introduction of Special Agro-Industrial Processing Zones (SAPZ) Programme. The SAPZ II will be made up of two building blocks, which are the Agricultural Transformation Centers (ATCs) and the Agro-Industrial Hubs (AIHs) across all the participating states.

The first phase of Special Agro-Industrial Processing Zone (SAPZ I) Program was implemented in seven (7) states, namely: Cross River, Imo, Kaduna, Kano, Kwara, Ogun, and Oyo, and the Federal Capital Territory (FCT).

The second phase of the SAPZ program (SAPZ II) has been receiving relevant attention at appropriate quarters. Expression of Interests (EOIs) from about twenty-seven (27) states to participate in the second phase have been submitted to Federal Ministry of Agriculture and Food Security. Taraba State is one of the states that has shown interest and commitment to participate in this phase of the programme.

- SAPZ is made up of two components which are Agricultural Industrial Hub (AIH), and Agricultural Transformation Centers (ATCs)/Aggregation Centres across all participating states. For the ATCs to perform the functions for which they are intended, networks of Aggregation Centers (ACs) are required to aggregate the different commodities.

The proposed SAPZ II intervention program covers the following infrastructure.

- An Agro-Industrial Hub (AIH) at Geri-mallam Community in Lau LGA (Jalingo) which will have the manufacturing and related service units covering training, farm inputs, procurement, and value addition of the identified agriculture products as a forward or backward integration to each other.
- An Agriculture Transformation Centres/Aggregation Centre (ATC/AC) at Hyuku II and Banyo communities Wukari LGA for primary processing activities and to house a modern market for agricultural produce both for wholesale and retail.
- An Agriculture Transformation Centres/Aggregation Centre (ATC/AC) at Babban Bandawa Community, Karim-lamido LGA the intervention is mainly providing support for farm level interventions, improved post-harvest handling and storage

However, this report focuses on the establishment of an Agriculture Industrial Hub (AIH) and its associated facilities at Geri-mallam community in Lau Local Government Area, Taraba State.

1.2 The Proponent

The proponent of this project is the Taraba State Government through the State Ministry of Agriculture and Food Security. In compliance with the provisions of the Nigeria Environmental Impact Assessment (EIA) Act No 86 of 1992 (now codified as the EIA Act CAP E12 Law of the Federation of Nigeria, 2004), as well as international environmental best practices, Taraba State Government has Commissioned **Messr. Bolben Energy and Environmental Services Limited** to conduct the Environmental and Social Impact Assessment (ESIA) Study of the Proposed Agro-Industrial Hub (AIH) at Geri-mallam community in Lau LGA, Taraba State.

1.3 Project Location

Taraba state is located in the north-eastern part of Nigeria, named after the Taraba River, which traverses the Southern part of the state, it is bounded to the west by Nasarawa State and Benue State, northwest by Plateau State, north by Bauchi State and Gombe State, northeast by Adamawa State and south by Northwest Region of Cameroon.

The proposed Agro Industrial Hub (AIH) project would be sited on 500 hectares of land at Geri-mallam in Lau LGA about 47km from Jalingo (the state capital). The proposed project site falls within the following geographical coordinates: latitudes 090530N and 090700E of the Equator and between longitudes 111830E and 112000E of the Prime Meridian.

Figure 1.1 is the map of Nigeria showing Taraba State, Figure 1.2 is the map of Taraba State showing Lau Local Government Area (host LGA) while Figure 1.3 and 1.4 shows the LGA and the specific location of the project area, respectively.

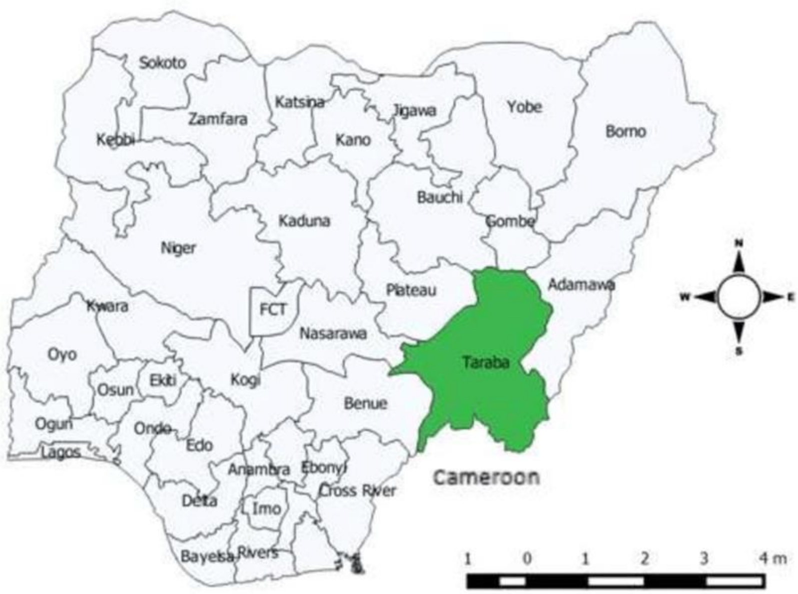


Figure 1.1: Map of Nigeria Showing Taraba State.

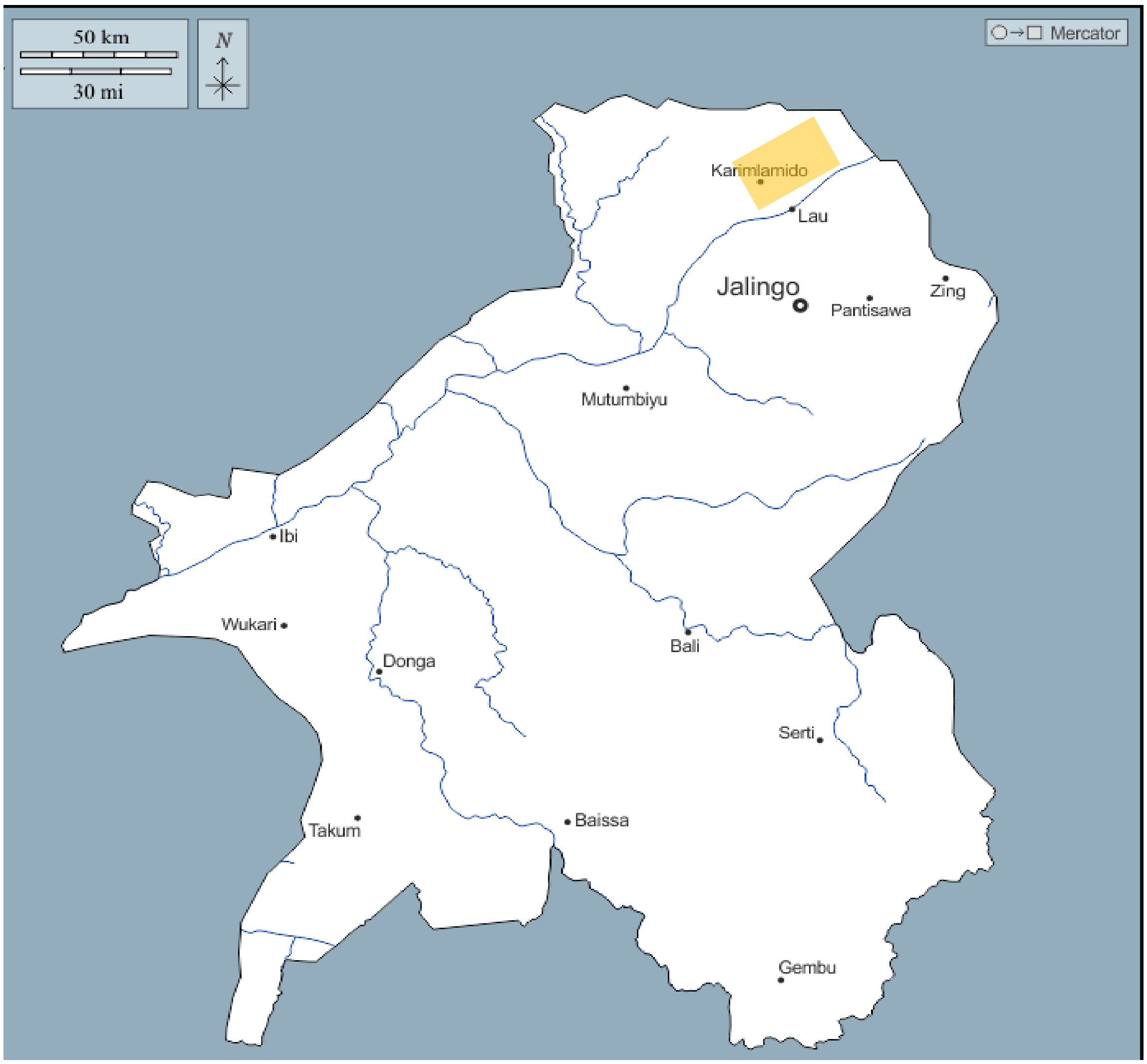


Figure 1.2: Map of Taraba State showing Lau LGA.

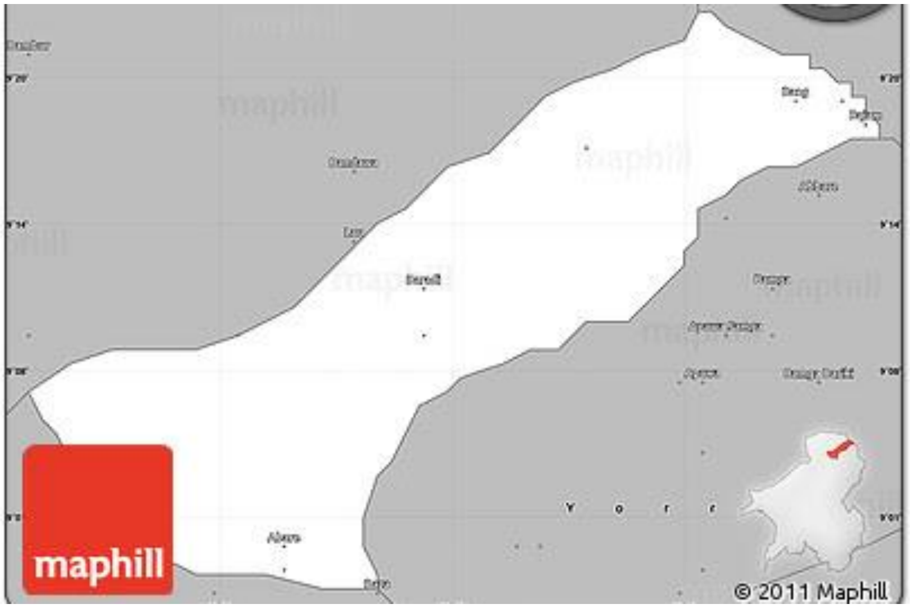


Figure 1.3: Map of Lau LGA.

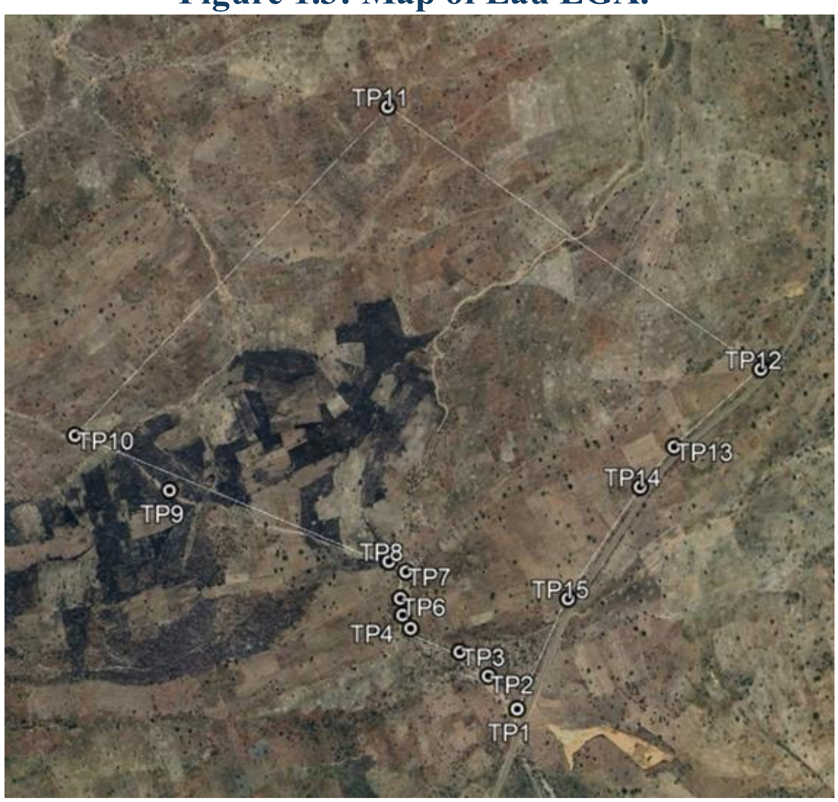


Figure 1.4: Satellite Imagery of the Proposed Project Location

1.4 Project Objectives

The development objective is The SAPZ Program interventions are as follows;

- support economic and social development programs of the Federal Government of Nigeria (FGN) and the State;
- contribute to rural infrastructure development;
- improve access to agricultural markets;
- increase agricultural production and productivity;
- stimulate the adoption of agricultural technology;
- facilitate climate smart agricultural production and processing practices;
- increase value addition and agro-processing; and
- increase skills acquisition and job creation for all actors along the value chain, including the smallholder farmers, women and youth.
- support inclusive and sustainable agro-industrial development.
- seek to enhance the competitiveness of selected value chains. This will be achieved through increased productivity, aggregation and reliable supply of quality raw materials, value addition, market access and private sector investment

The project also hopes to increase production of staple crops, contribute to industrialization, youth empowerment and food security. The project is expected to contribute to the Government's industrialization agenda, support skills development and entrepreneurship for women and youth and build resilient food system in the tropical ecological zones of Nigeria.

1.5.1 ESIA OBJECTIVES AND TERMS OF REFERENCE (ToR)

1.5.1 Objectives of the ESIA study

The main objectives of the ESIA for the proposed SAPZ-II Agro Industrial Hub (AIH) project are:

- Ensure compliance with Nigeria National Environmental Regulations and Policies, African Development Bank and IFAD Standard Industry best practices;
- Provide all necessary environmental baseline data that will form the basis for determining the state of the environment in the project area and identify all environmental aspects of the project that may positively or negatively impact on the environment;

- To identify the associated and potential physical, biological, health, socio-economic and or cultural impacts of the proposed project within the project area;
- To suggest cost effective impact mitigation/remedial measures to ensure successful implementation and sustainability of the project;
- Incorporate the findings from the ESIA study into a detailed and final project design and decisions;
- Develop plans and procedures for effective environmental management of the project throughout its life cycle;
- To produce an ESIA report in consonance with the FMEnv laid down procedural and sectoral guidelines and procedures for environmental impact assessment reports.

1.5.2 Terms of Reference (ToR)

The Terms of Reference for the ESIA study is as approved and in accordance with the FMEnv ESIA Process guideline. The highlights are as follows, to:

- Establish the baseline environmental data for ecological and socio-economic condition of the project area;
- Identify, evaluate and predict the project's impacts on the environment;
- Develop control strategies with a view to mitigate and ameliorate significant impacts of the project; and
- Recommend an environmental management plan for the entire life cycle of the project.

1.5.3 EIA Methodology

The scope of the ESIA study includes, among others, the following:

- Project definition and preparation of terms of reference;

- Field sampling of environmental components of the project area;
- Qualification of potential impacts, prediction and evaluation of their significance using appropriate assessment models;
- Identification of effective mitigation measures for the project's activities;
- Development of comprehensive environmental management plan including monitoring, decommissioning and remediation plans after closure of the project site; and
- Writing of report that conforms to standards and guidelines set by the regulations and international best practices.

The samples taken and analyzed for pollutants include, but not limited to:

1. Soil samples
2. Surface water samples, and
3. Groundwater samples

The following were also established:

- Measurement of existing noise levels under representative conditions at the community closest to the site boundary for baseline data purposes.
- Acquisition of available climatic data to analyze the prevailing meteorological conditions of the project area.
- Determination of the location, approximate magnitude and quality of runoff discharge to existing water body.
- Recommendation of a continuing program of air, water and noise monitoring during operation of the project, including method of measurement, location and frequency.
- Conduct of a Public Review n accordance with FMEnv regulatory guidelines.
- Presence at public hearing (if any) on the ESIA and response to any issues raised by the regulatory agencies and stakeholders during the panel review meeting.
- Capture and incorporate all the comments generated through the ESIA Panel Review into the Final Environmental and Social Impact Assessment (ESIA) report.

1.6 ADMINISTRATIVE/LEGAL FRAMEWORK

The ESIA study was carried out within the framework of national and international laws, guidelines, and regulations. The international guidelines include those of the African Development Bank (AfDB),

Islamic Development Bank (IsDB) as well as International Treaties and Conventions to which Nigeria is a signatory, while the regulations, guidelines and standards, include those of the Federal Ministry of Environment (FMEnv), Federal Ministry Agriculture and Natural Resources,Taraba State Ministry of Environment, Taraba State Environmental Protection Agency (TEPA), Taraba State Ministry of Agriculture and Food Security and Lau Local Government Area. The overall legal and administrative framework within which the EIA was conducted is presented as follows:

1.6.1 National Regulations and Frameworks

National laws, regulatory requirements, guidelines, and standards are applied at the national level through regulatory bodies for the purpose of environmental protection and management in Nigeria. Several Acts, Policies and National Regulations, and International Conventions guide preparation of environmental and social impact assessment activities in Nigeria. Some of these laws, regulations and international conventions are discussed as follows:

A. <u>Federal Ministry of Environment</u>

The Federal Government of Nigeria established Federal Ministry of Environment (FMEnv) in 1999 by a Presidential Directive with an overall mandate to protect, restore and preserve the entire ecosystem of the Nigerian environment. Twenty-one guidelines for pollution abatement in all categories of industries were drafted. Part of the guidelines make it a mandatory requirement for environmental auditing of all existing industries and Environmental and Social Impact Assessment (EIA) of new industries and major development projects.

The Federal Ministry of Environment (FMEnv) since inception has been empowered with the overall responsibility of environmental matters in Nigeria. It has developed instruments of intervention to halt environmental degradation in form of policies, standards, guidelines, and regulations. With the initiation of these instruments, enforcement by FMEnv has become the most effective tool to bring

industries and regulated community into compliance through compliance promotions. These policies are as follows:

- **Revised National Policy on Environment (2016):** The revised National Policy on Environment of 2016 sets out the following goals, objectives, and guiding principles:

  Goals, Objectives, and Guiding Principles

  Policy Goal: The goal of the National Policy on the environment is to *'ensure environmental* protection *and* the *conservation of natural resources for sustainable development'.*

  Strategic Objectives: The strategic objective of the National Policy on the Environment is to coordinate environmental protection and natural resources conservation for sustainable development.

  This goal will be achieved through the following strategic objectives:

  - Securing a quality of environment adequate for good health and well-being;
  - Promoting sustainable use of natural resources and the restoration and maintenance of the biological diversity of ecosystems;
  - Promoting an understanding of the essential linkages between the environment, social and economic development issues;
  - Encouraging individual and community participation in environmental improvement initiatives;

- Raising public awareness and engendering a national culture of environmental preservation; and
- Building partnership among all stakeholders, including government at all levels, international institutions and governments, non-governmental agencies, and communities on environmental matters.

Guiding Principles: The following principles are central to the attainment of the strategic objectives of this Policy:

- ***The Public Trust Doctrine,*** which recognizes that the State is a trustee of all-natural resources, the enjoyment of which is subject to a measure of control necessary to protect the legitimate interest of all sections and stakeholders in the larger framework of strategic national interests;
- ***Environmental Right,*** which ensures that every Nigerian has a right to a clean and healthy environment and a duty to safeguard and enhance the environment;
- ***Environmental Offsetting,*** which requires that where for exceptional reasons of overriding public interest, the general obligation to protect threatened or endangered species and natural systems that are of special importance to sustaining life, providing livelihoods, or general well-being cannot be provided, such cost-effective offsetting measures must be undertaken by the proponents of an activity to restore as nearly as may be feasible the lost environmental services to the community;
- ***The Polluter Pays Principle,*** which prescribes that the polluter should bear the cost of preventing, and remediating pollution;
- ***The User Pays Principle,*** in which the cost of a resource to a user must include all the environmental costs associated with its extraction, transformation and use (including the costs of alternative or future uses forgone);

- ***The Precautionary Principle,*** which holds that where there are threats of serious or irreversible damage, the lack of full scientific knowledge shall not be used as a reason for postponing cost-effective means to prevent environmental degradation;

- ***The Subsidiarity Principle,*** which reflects the preference for making decisions at the lowest level of government or social organization where the issue can be effectively managed – decisions made at the local level are often viewed as more likely to take account of local environmental conditions and the opinions of the local people who often bear the highest environmental costs of development;

- ***Pollution Prevention Pays Principle***, which encourages Industry to invest positively to prevent pollution;

- ***The Principle of Inter-generational Equity***, which requires that the needs of the present generation are met without compromising the ability of future generations to meet their own needs;

- ***The Principle of Intra-generational Equity***, which requires that different groups of people within the country and within the present generation have the right to benefit equally from the exploitation of resources and that they have equal right to a clean and healthy environment;

- ***The Principle of Participation***, which requires that decisions should, as much as possible, be made by the people or on their behalf by representatives chosen by them;

- ***International Cooperation*** in which the country will domesticate multilateral environmental agreements (MEAs) and regional instruments and implement them cooperatively for better environmental management of shared resources. In this regard, the country will take cognizance of all relevant international agreement on the environment and mainstream them in the protection of Nigeria's environment;

- ***Good Environmental Governance*** in which rule of law, effective institutions, transparency and accountability, respect for human rights and the meaningful participation of citizens will be integrated in environmental management;

- ***Integrated Ecosystem Approach*** in which conserving environmental resources is adopted and enhanced to ensure that all the country's ecosystems are managed to the benefits of the people.

- **Environmental Impact Assessment (EIA) Act CAP E12, LFN 2004**

The EIA Act, Cap E 12, LFN, 2004, makes EIA mandatory for any major development project likely to have adverse impacts on the environment. It provides guidelines for activities for which an EIA is compulsory and prescribes the procedure for conducting and reporting EIA. Some of these activities include agriculture, construction of airport, drainage and irrigation, land reclamation, industry, infrastructure development, major building projects, coastal reclamation, ports, mining, petroleum, power generation etc. The required process involves the preparation of the mandatory EIA report and an assessment by a review panel.

The Act sets out to:

- Consider the likely impacts and the extent of these impacts on the environment before embarking on any project or activity;
- Promote the implementation of appropriate policy in all federal laws consistent with all laws and decision-making processes through which goal of the Act may be realized;
- Encourage the development of procedures for information exchange, notification and consultation between organizations and persons when the proposed activities are likely to have significant environmental effects on boundaries or inter-state or on the environment of bordering towns and villages.

An Environmental Impact Assessment (EIA) is an assessment of the potential impacts whether positive or negative, of a proposed project on the natural environment, dealing with the considerations of environmental impact in respect of public and private projects. This regulatory framework for EIA implementation in Nigeria confers the mandate on the FMEnv to ensure proponents of all new major development activities carry out EIA on their proposed projects. There is also a provision for penalties in case of violation and non-compliance.

Some sections relevant to environmental emergency prevention under the EIA include:

(a) **Part 1 Section 2 (1)** requires an assessment of public or private projects likely to have a significant (negative) impact on the environment.

(b) **Part 1 Section 2 (4):** *"All agencies, institutions (whether public or private) except exempted pursuant to this Decree, shall before embarking on the proposed project apply in writing to the Agency (now FMEnv.), so that subject activities can be quickly, and surely identified and environmental assessment applied as the activities being planned.''* This section establishes cases where an EIA is required.

(c) **Part 1 Section 1(c)**: *"To encourage the development of appropriate procedures for information exchange, notification and consultation between organs and persons when proposed activities are likely to have significant environmental effects on boundary and trans-state or on the environment of bordering towns and villages."* This provision forms part of the objectives of the EIA process. It provides that information exchange, notification and consultation would not only extend to communities but also persons affected in their individual capacity.

(d) **Part I Section 4(h)**: The least minimum matters to be addressed by the EIA to include *"A brief and non-technical summary of the information provided under paragraph (a) to (g) of this section,"* which ought to be widely circulated. Thus, communities ought to have ready access to EIA reports.

(e) **Part I Section 7:** Requiring the giving of *"opportunity to government agencies, members of the public, experts in any relevant discipline and interested groups to make comment on environmental impact assessment of the activity."*

(f) **Part I Section 9 (2, 3 & 4):** *"The report of the Agency shall be made available to interested person or group. If no interested person or group requested for the report, it shall be the duty of the Agency to publish its decision in a manner by which members of the public or persons interested in the activity shall be notified. The Council may determine an appropriate method in which the decision of the Agency shall be published so as to reach interested persons or groups, in particular the originators or persons interested in the activity subject of the decision".* This section requires an application in writing to the Agency before embarking on projects for their environmental impact assessment to determine approval.

(g) **Part 1 Section 13:** *"(1)When a project is described on the Mandatory Study List specified in the Schedule to this Decree or is referred to mediation or a review panel, no Federal, State or Local Government or any of their authority or agency shall exercise any power or perform any duty or functions that would permit the project to be carried out in whole or in part until the Agency EIAs taken a cause of action conductive to its power under the Act establishing it or EIAs taken a decision or issue an order that the project could be carried out with or without conditions''.*

(h) **Part II Section 16 & 17:** Participation in *"every screening or mandatory* study," which requires *"comments concerning those effects received from the public..."*

(i) **Part II Section 22 (3):** *Before taking a course of action in relation to a project pursuant to subsection (1) of this section, the agency shall give the public an opportunity to examine and comment on the screening report and any record that EIAs been filed in the public registry established in respect of the project..."*

(j) **Part II Section 25 (1 & 2):** *"After receiving a mandatory study report in respect of a project, the Agency shall, in any manner it considers appropriate, publish in a notice setting out the following information:*

- *The date on which the mandatory study report shall be available to the public*
- *The place at which copies of the report may be obtained; and*
- *The deadline and address for filing comments on the conclusions and recommendations of the report. "Prior to the deadline set out in the notice by the Agency, any person may file comments with the agency relating to the conclusions and recommendations of the mandatory study report."*

(k) **Part II Section 31***: "Where a project is to [be] referred to mediation or a review panel under the Decree, the Council shall, within a prescribed period, refer the Council project to mediation if the Council is satisfied that:*

- *The parties who are directly affected by or have direct interest in the project Have been identified and are willing to participate in the mediation through representatives, and*
- *The mediation is likely to produce a result that is satisfactory to all of the parties."*

(l) **Part II Section 34 (1 & 2):** *"A mediator shall not proceed with a mediation unless the mediator is satisfied that all of the information required for a mediation is available to all of the participants.* "*Mediation shall, in accordance with the provisions of the Decree, and the terms of reference of the mediation help the participants to reach a consensus on:*

- *The environmental effects that are likely to result from the project*

- *Any measures that would mitigate any significant adverse environmental effects, and*
- *An appropriate follow-up programme"*

(m)**Part II Section 37*:*** *"A review panel shall, in accordance with the provisions of the Decree and its terms of reference:*

- *ensure that the information required for an assessment by a review panel is obtained and made available to the public*
- *hold hearing in a manner that offers the public an opportunity to participate in the assessment..."*

(n) **Part II Section 39:** *"On receiving a report submitted by a mediator or review panel, the Agency shall make the report available to the public in any manner the Council considers appropriate and shall advise the public that the report is available."*

(o) **Part II Section 41 (2) (b):** *"The agency shall advise the public of*

- *its course of action in relation to the project*
- *any mitigation measure to be implemented with respect to the adverse environmental effects of the project*
- *the extent which the recommendations set out in any report submitted by a mediator, or a review panel have been adopted..."*

(p) **Part II Section 47:** *"The Council shall not approve a substitution pursuant to subsection 46 (1) of the Decree unless the Council is satisfied that (b) the public EIAs been given an opportunity to participate in the assessment..., and (d) the report EIAs been published."*

(q) **Part II Section 57*:*** *"For the purpose of facilitating public access to records relating to environmental assessment, a public registry shall be established and operated in accordance with the provisions of the Decree in respect of every project for which an environmental assessment is conducted..."*

(r) **Part III Section 62:** *"Any person who fails to comply with the provisions of this Decree shall be guilty of an offence under this Decree and on conviction in the case of an individual to ₦100,000 fine or to five years imprisonment and in the case of a firm or corporation to a fine of not less than ₦50,000 and not more than ₦1,000,000''.* This section creates a legal liability for contravention of any provision. Consequently, the environmental management activities at each phase of the project should be guided by environmental standards including those imposed by legislations and those established by self-regulating industrial codes of practice, industry standards and company policy.

- **Food And Agriculture Organisation (FAO) Guideline and Regulations on National Environmental (Hazardous Chemicals and Pesticides) Regulations (2014). S.I. No. 65/2014.**

These Regulations are made under the National Environmental Standards and Regulations Enforcement Agency Act, with the aim of: promoting a safe use of hazardous chemicals and pesticides; controlling their import, export and sale; ensuring their environmentally sound management, in order to protect human health and the environment; implementing the Rotterdam Convention on the Prior Informed Consent procedure for hazardous chemicals and pesticides. These Regulations shall apply to: storage, usage and marketing of hazardous chemicals and pesticides; banned chemicals listed in the attached schedules; import and export of substances listed in the attached schedules.

Matters covered by these Regulations include: definition of hazardous chemicals; limitation on their importation, exportation, distribution and storage; labelling of containers; issuance of special transportation permits; classification of hazardous waste and its handling and treatment; Registration of importer and exporter and release of permits; preparation and management of emergency plan and notification of accidents and emergencies; general code of practice for the safe use of pesticides and agrochemicals; offences and penalties; definition of relevant terms, including: agrochemicals; chemicals; environmentally sound management; emergency preparedness; hazardous chemicals and pesticides; restricted chemicals and pesticides.

Attached schedules concern: a list of banned hazardous chemicals and pesticides; a list of restricted chemicals and pesticides; information to be indicated in a chemical safety card; guidelines for hazard and precautionary statements; guidelines for transportation, storage and warehousing of hazardous substances; a list of hazardous waste and hazardous substance waste characteristics; guidelines for labelling and packaging of hazardous wastes.

- **Food And Agriculture Organisation (FAO) Guide Line and Regulations on National Environmental Sanitation and Waste Control Regulation (2009) S.I28**

These Regulations, made under section 34 of the National Environmental Standards and Regulations Enforcement Agency (Establishment) Act, 2007, provide for issues of environmental sanitation and all categories of wastes. The purpose of the Regulations is the adoption of sustainable and environmentally friendly practices in environmental sanitation and waste management to minimize pollution. The Regulations provide general rules on cleanliness and environmental sanitation. It vests obligations on institutions, owners of premises to provide portable water supply, lavatories, ensure regular maintenance of the structure, among others. Specific obligations on environmental sanitation are also vested on persons who generate waste, households and dwelling units, etc. The Regulations provide extensively for wastes control, including solid waste control, effluent discharge, hazardous wastes, health care wastes, etc. The Regulations contain penal provisions with some steep penalties for individuals or corporate bodies who breech any provisions of the Regulations.

- **National Interim Guidelines and Standards for Environmental Pollution Control in Nigeria**

This document was drafted in March 1991 to serve as a basic instrument for monitoring and controlling industrial and urban pollution. These guidelines were initiated sequel to the drafting of the National Environmental Policy in 1989. The guidelines and standards relate to six (6) areas of environmental concern, thus:

- Effluent limitations
- Water quality or industrial water uses at points of intake
- Industrial emission limitations
- Noise exposure limitations.
- Management of solid and hazardous waste
- Pollution abatement in industries.

National Environmental Protection (Effluent Limitations) Regulations, 1991

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

National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulations, 1991

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

National Environmental Protection (Management of Hazardous and Solid Wastes) Regulations, 1991

The management of hazardous and solid waste regulation, S.1.15 of 1991 (No. 102, Vol. 7, August, 1991) defines the requirements for groundwater protection, surface impoundment, land treatment, water piles, landfills, incinerators etc. It also describes the hazardous substances tracking programme with a comprehensive list of acutely hazardous chemical products and dangerous waste constituent. It also states the requirements and procedure for inspection, enforcement, and penalty.

Environmental Impact Assessment Procedures and Charges Regulations, 2021

The objective of these Regulations is to indicate the procedure in the Environmental Impact Assessment (EIA) process from project conception to commissioning and follow-up activities in order to ensure that the project is implemented with maximum consideration for the environment

- **National Environmental Standards and Regulations Enforcement Agency (NESREA) Act, 2007**

  To show its readiness to ensure compliance, the Federal Government has in July 2007 released an official gazette establishing the National Environmental Standards and Regulations Enforcement Agency (Establishment) Act, 2007. The agency is charged with the enforcement of environmental standards, regulations, rules, laws, policies, and guidelines. Above all, the agency was saddled 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.

The NESREA Regulations relevant to the proposed development include the following:

- National Environmental (Ozone Layer Protection) Regulations, 2009. S. I. No. 32. These provisions seek to prohibit the import, manufacture, sale, and the use of ozone-depleting substances.
- National Environmental (Noise Standards and Control) Regulations, 2009. S. I. No. 35. The main objective of the provisions of this Regulation is to ensure the tranquility of the human environment or surroundings and their psychological well-being by regulating noise levels.
- National Environmental (Soil Erosion and Flood Control) Regulations, 2010. S. I. No. 12. The overall objective of these Regulations is to check all earth-disturbing activities, practices, or developments for non-agricultural, commercial, industrial, and residential purposes.
- National Environmental (Control of Vehicular Emissions from Petrol and Diesel Engines) Regulations, 2010. S. I. No. 20. The purpose of these regulations is to restore, preserve, and improve the quality of air. The standards contained herein provide for the protection of the air from pollutants from vehicular emission.
- National Environmental (Watershed, Mountainous, Hilly, and Catchments Areas) Regulations, 2009. S. I. No. 27: This makes provisions for the protection of water catchment areas.

- National Environmental (Desertification Control and Drought Mitigation) Regulations, 2010. S. I. No. 13: This Regulation seeks to provide an effective and pragmatic regulatory framework for the sustainable use of all areas already affected by desertification and the protection of vulnerable lands

- National Environmental (Protection of Endangered Species in International Trade) Regulations, 2010. S. I. No. 16: The major objective of this Regulation is to protect species of endangered wildlife from extinction through the prohibition of trade, importation, etc.

- National Environmental (Surface and Groundwater Quality Control) Regulations, 2010. S. I. No. 22: The purpose of this Regulation is to restore, enhance, and preserve the physical, chemical, and biological integrity of the nation's surface waters, and to maintain existing water uses.

- **Climate Change Act 2021**

  The Climate Change Act was signed by Mr. President in November 2021 in order to provide Nigeria with a legal framework to achieve its climate goals, achieve long-term social and economic sustainability, and resilience. The law sets a target for net zero GHG emissions for year 2050 - 2070. The Act mandates the government to set a National Climate Change Action Plan and a five-year carbon budget (with quantified annual objectives) accordingly. Both of these are to be validated by the Federal Executive Council.

- **National Policy on Solid Waste Management (NPSWM), 2020**

  National Policy on Solid Waste Management (NPSWM) was approved by the Federal Executive Council of the Nigerian Government on 15th of July 2020 as a shared national vision of how solid waste should be managed more sustainably with relative and loose uniformity across states of the Federation. Developed in close consultation with stakeholders, the policy is expected to increasingly garner the active participation of numerous players in the management of solid waste including governments at all levels, the private sector, NGOs, CBOs, FBOs, and partnerships resulting in projects and programmes implementation. In essence, until recently, an integrated system that will provide a holistic framework for the scale-up of SWM value-chain to create a country-wide impact was lacking. It is necessary for Nigeria to tackle the issue of solid waste expeditiously firm and to align with international best practices and adopt solid waste management trends that will:

- Result in substantial reduction in volume of waste generated;
- Increase re-use, recovery and recycling activities while targeting the elimination of non-sanitary dumpsites and landfills;
- Encourage private sector participation in SWM;
- Create enabling environment for improved investments in the sector;
- Promote job creation and improved economic activities by establishing waste to wealth schemes;
- Comply with international best practices in environmental health and safety standards for the sector;
- Embed modern technologies in all SWM activities (recovery, transport, disposal, etc) in country; and,
- Comply with international treaties and protocols on waste management.

The policy aims to promote a decentralized and integrated SWM system which allows for the participation of multi-sectoral stakeholders including the public sector (Federal, State and Local governments), the private sector (investors, service providers, waste generators such as markets, schools, hospitals, etc.) including CBOs, FBOs and NGOs, religious and community leaders, youth and women organizations, informal waste workers and recyclers, waste related SMEs, etc. The policy recognizes the Federal Ministry of Environment (FMEnv) as the apex body with the responsibility of articulating and championing the NPSWM 2020.

B. Federal Ministry of Agriculture and Food Security (FMAFS)

The Federal Ministry of Agriculture and Food Security (FMAFS) is responsible for the development of Nigeria‘s agriculture sector. Current programmes in this regard focus on improving agriculture value chains to transform small scale subsistence agriculture into a growing business sector that will create jobs, wealth and ensure food security. FMAFS is responsible for implementing the Staple Crop Processing Zone (SCPZ) programme, Special Agro-Industrial Processing Zones (SAPZ) which were initiated to attract private sector investment in agriculture processing and encourage rural farmers thereby providing them with all the necessary infrastructures and technology for processing their agricultural produce.

- **Agriculture and Rural Development**

  The National EIA Guidelines for Agriculture and Rural Development were published by FEPA in 1995 and provide a detailed set of guidelines for the evaluation and mitigation of environmental impacts from a wide range of agricultural activities. Of particular relevance to the present Project, are:

  - Agricultural land management (bush clearing, land preparation and consolidation);
  - Large-scale farming;
  - Agro-industrial projects;
  - Dams and reservoirs;
  - Irrigation and drainage programmes; and
  - Use of agro-chemicals and fertilizers.

- **The Nigerian Agricultural Policy**

  The agricultural policy document was launched in year 2001, with the following objectives:

  - The achievement of self-sufficiency in basic food supply and the attainment of food security;
  - Increased production of agricultural raw materials for industries;
  - Increased production and processing of export crops, using improved production and processing technologies;
  - Generating gainful employment;

- Rational utilization of agricultural resources, improved protection of agricultural land resources from drought, desert encroachment, soil erosion and flood, and the general preservation of the environment for the sustainability of agricultural production;

- Promotion of the increased application of modern technology to agricultural production; and, Improvement in the quality of life of rural dwellers.

- **Food And Agriculture Organisation (FAO) Guideline and Regulations on The International Code of Conduct for The Sustainable Use and Management of Fertilizers (2019)**

  - The International Code of Conduct for the Sustainable Use and Management of Fertilizers is an important tool for implementing the Voluntary Guidelines, with special regard to nutrient imbalances and soil pollution. The Code promotes practices including nutrient recycling, and agronomic and land management to improve soil health; and recommends regulation related to the sale, distribution and labelling of fertilizer products wherever appropriate. It also promotes capacity development and education programs for all stakeholders involved in the fertilizer value chain, and encourages developed countries to assist others in developing infrastructures and capacity to manage fertilizers throughout their life cycle. It is hoped that
  - It is hoped that governments, industry, farmers, traders and civil society in general will make use of the framework provided in the Fertilizer Code and of the guidelines pertaining to their respective fields as they assign roles, responsibilities and actions to ensure that fertilizers are used sustainably, efficiently and with minimal negative effects on the environment.
  - The International Code of Conduct for the Sustainable Use and Management of Fertilizers was developed in response to the Committee on Agriculture's (COAG) request to increase food safety and the safe use of fertilizers. It is also a response to the third United Nations Environment Assembly (UNEA3) declaration on soil pollution, while ensuring enhanced support to the implementation of the Voluntary Guidelines for Sustainable Soil Management (VGSSM). The Fertilizer Code aims to address issues of global importance, thereby contributing to the implementation of the Sustainable Development Goals (SDGs).
  - The International Code of Conduct for the Sustainable Use and Management of Fertilizers provides a locally adaptable framework and voluntary set of practices

with which governments, the fertilizer industry, agricultural extension and advisory services (AEAS), supporting academic and research institutions, actors in the nutrient recycling industry, civil society and end-users can contribute to sustainable agriculture and food security from a nutrient management perspective by following or adhering to the guidelines and recommendations provided.

- As needed, develop policies that facilitate affordable access to safe and documented fertilizers by farmers and which are linked with appropriate and relevant fertilizer use policy, guidelines and rural AEAS programmes;
- Familiarize themselves and comply with locally applicable regulations and limits and follow guidelines relevant to fertilizer use;
- Set appropriate guidelines and regulations for the use of, and limits on contaminants in, reused and recycled nutrients sources that pose an unacceptable risk to human, animal and soil health and the environment;
- Conduct appropriate testing of recycled nutrient sources and products intended for use in plant production to ensure they meet appropriate guidelines for nutritive content and quality, as well as safety in terms of limits on contaminants such as heavy metals, harmful microbes, and other dangerous or toxic materials;
- Educate stakeholders and fertilizer users on the use of information pertaining to the safety and efficiency, composition, quality, and purity of fertilizers offered for sale, and on means to remain compliant with relevant regulations and guidelines.
- Provide governments with all requested information to allow the setting of standards, regulations and guidelines on the composition and testing of fertilizer products;

- **Agriculture Transformation Agenda (2012)**

The Agriculture Transformation Agenda is the flagship policy of the FMAFS. The Strategy aims to drive growth in the agriculture sector and in particular aims to:

- Generate employment;
- Accelerate the achievement of food and nutritional security;
- Transform Nigeria into a leading player in global food markets; and
- Generate wealth for millions of farmers.

To achieve this vision, the FMAFS acknowledges that the traditional approach in the agriculture sector needs to change. There is recognition of the need for fertilizer procurement and distribution to farmers, marketing institutions, financial value chains and the restructuring of the agriculture investment framework. These objectives have been incorporated into specific policies under the Strategy. The Strategy also aims to move subsistence farmers to a more commercialized system of farming through a market-oriented approach facilitated by a Nigerian Incentive-based Risk Sharing for Agricultural Lending (NIRSAL), encouraging trade and competitiveness. Improvements in commodity value chains have been considered through the varying Nigeria geo-political zones. Taraba State is part of the North-East geo-political zone where priority crops have been identified as Rice, Sugarcane, Livestock and Fisheries.

C. Federal Ministry of Trade and Investment

The Federal Ministry of Industry, Trade and Investment was created to play a decisive role in diversification of 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 growth of the economy for self-reliance. The Federal Ministry of Industry, Trade and Investment was restructured in 2011 to drive the growth of the Nigerian economy, using the model being implemented in both developed and emerging economies like the United Kingdom, Malaysia, and Singapore. This transformation expanded its portfolio to include investment that hitherto was not part of its original mandate as the Federal Ministry of Commerce and Industry.

Vision

To promote economic growth, create jobs and generate wealth.

Mission

To formulate and implement policies and programs to attract investment, boost industrialization, increase trade and exports and develop enterprises.

Mandate

- To create enabling environment to stimulate domestic investment and attract foreign direct investment in all sectors of the economy and make Nigeria the most preferred investment destination.
- To facilitate trade in goods and services and maximize the benefits of international trade through functional bilateral and multilateral trade relations with other countries.
- To accelerate the growth of the industrial sector and enhance productivity.
- To boost the development of Micro, Small and Medium Enterprises (MSME) as the engine of economic growth.

The execution of the mandate of the Ministry are facilitated through its various programmes such as the Nigerian Industrial Revolution Plan (NIRP), National Enterprise Development Programme (NEDEP), Trade Policy, enabling environment for the promotion of investment, industrialization of the country; etc.

The Federal Ministry of Trade and Investment is the Notification Authority on World Trade Organization (WTO) rules in Nigeria and therefore ESIAs role to play in both local and international trade in Aquaculture.

- **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. Section **13** allows an inspector to take emergency measures or request that emergency measures are taken by a person qualified to do so in case of pollution or any nuisance.

- **Forestry Act, Cap F 36, LFN, 2004**

  This Act of 1958 provides for the preservation of forests and the setting up of forest reserves. It is an offense, punishable with up to 6 months imprisonment, to cut down trees over 2ft in girth or to set fire to the forest except under special circumstances.

- **Land Use Act, Cap L 5, LFN, 2004**

  The Land Use Act of 1978 provides that the rights of all Nigerians to use and enjoy land in Nigeria and the natural fruits thereof in sufficient quantity to enable them to provide for the sustenance of themselves and their families be assured, protected, and preserved.

- **Harmful Waste (Special Criminal Provisions, etc.) Act, Cap H1, LFN, 2004**

  The Harmful Waste Act prohibits, without lawful authority, the carrying, dumping or depositing of Harmful waste in the air, land or waters of Nigeria. The following sections are notable:

  - **Section 6** provides for a punishment of life imprisonment for offenders as well as the forfeiture of land or anything used to commit the offence.
  - **Section 7** makes provision for the punishment accordingly, of any conniving, consenting or negligent officer where the offence is committed by a company.
  - **Section 12** defines the civil liability of any offender. He would be liable to persons who have suffered injury as a result of his offending act.

- **Business Facilitation (Miscellaneous Provisions) Act, 2023 ("the Omnibus Act")**

  The Act is part of the Federal Government's initiatives to foster an enabling environment for micro, small and medium-sized enterprises (MSMEs) in Nigeria. The Omnibus Act is a legislative intervention by the Presidential Enabling Business Environment Council (PEBEC) to amend 21 business-related laws and remove bureaucratic barriers to conducting business in Nigeria.

- **Standards Organization of Nigeria (SON) Act, Cap S9, LFN 2004**

  The SON Act, Cap S9, Laws of the Federation of Nigeria 2004 is the enabling Act that empowers the Standards Council to designate, establish and approve standards in respect of metrology, materials, commodities, structures, and processes for the certification of products in commerce and industry throughout Nigeria and to carry out any other functions imposed on it under this Act or any other written law; power to make rules. Section 4 details out the functions of the Council, etc. while section 12 provide for procedure for establishment of industrial standards. Section 14 makes provision for certification marks while section 15 provides for offences in relation to standards.

- **National Agency for Food and Drug Administration and Control (NAFDAC) Act, Cap N1, LFN 2004**

NAFDAC was established by Decree 15 of 1993 as amended by Decree 19 of 1999 and now Cap N1 Laws of the Federation of Nigeria (LFN) 2004, to regulate and control the manufacture, importation, exportation, distribution, advertisement, sale and use of food, drugs, cosmetics, chemicals, medical devices and packaged water (known as regulated products).

In accordance with the enabling laws, NAFDAC is authorized to:

- Regulate and control the importation, exportation, manufacture, advertisement, distribution, sale and use of regulated product;
- Conduct appropriate tests and ensure compliance with standards and specifications;
- Undertake appropriate investigation of the production premises and raw materials of regulated products;
- Compile standards and specifications, regulations and guidelines for the production, importation, exportation, sale and distribution of regulated products;
- Control the exportation and issue quality certification of regulated products intended for export;
- Establish and maintain relevant laboratories for the performance of its functions;

- Undertake the registration of food, drug, medical devices, bottled water and chemicals;
- Undertake inspection of important regulated products; and
- Pronounce on the quality and safety of regulated products after appropriate analysis.

- **Consumer Protection Council Decree 66 of 1992**

The goal of the Consumer Protection Council Decree is to protect consumers' right in Nigeria, and in particular to:

- Provide speedy redress to consumers complaints through negotiations, mediation and reconciliations;
- Seek ways and means of removing or eliminating from the market hazardous products and causing offenders to replace such products with safer and more appropriate alternatives;
- Publish from time to time, list of products whose consumption and sale have been banned, withdrawn, severally restricted or not approved by the Federal Government or foreign governments;
- Cause an offending company, firm, trade, association or individual to protect, compensate, provide relief and safeguards to injured consumers or communities from adverse effects of technologies that are inherently harmful, injurious, violent or highly hazardous;
- Organize and undertake campaigns and other forms of activities as will lead to increased public consumer awareness.

- **The National Biosafety Management Agency Act 2015**

  This Act establishes the National Biosafety Management Agency as a body corporate. The Agency shall be the national authority on biosafety in Nigeria charged with the responsibility for providing regulatory framework institutional and administrative mechanism for safety measures in the application of modern biotechnology in Nigeria with the view to preventing any adverse effect on human health, animals, plants, and environment. The Agency shall also provide measures for the case-by-case assessment.

- **National Policy on Occupational Safety and Health, 2016**

  The policy is aimed at ensuring that all workers are safe at their workplaces across the country. This policy was derived from provisions of the Nigerian Constitution and the International Labour Organization 's (ILO) Convention.

- **Natural Resources Conservation Act CAP 349 LFN 1990**

  The Act was established to take steps that are necessary for the effective management of the physical environment of Nigeria so as to ensure the conservation, protection and proper use of its natural resources. Also, to promote public awareness of the ecological systems of Nigeria and their importance to the social and economic life of the nation and to manage such national parks, marine parks, protected areas, and public recreational facilities as may be prescribed.

- **Local Content Act**

  Nigerian Content is the quantum of composite value added or created in the Nigerian economy through the utilization of Nigerian human and material resources for the provision of goods and services

- **Employee Compensation Act, 2010**

The Act provides compensation to employees who suffer from occupational diseases or sustain injuries arising from accidents at the workplace or in the course of employment. Payment of compensation (to the worker or his dependents in case of death) by the employer is as enshrined 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 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.

- **Nigerian Gender-Related Policies**

Consideration of Gender-related policies is important to this project as Women are going to be parts of this proposed project during the subproject implementation. The project shall consider women improvement activities.

- **The Gender Policy Framework in Nigeria**

The 1999 Constitution the Federal Republic of Nigeria prohibits discrimination based on places of origin, sex, religion, status, ethnic or linguistic association. Successive governments have always demonstrated commitment to upholding this and to promote gender equality and women's empowerment in varying degrees. To facilitate gender equality and women's empowerment, the FGN created favourable national legal and policy frameworks and put in place institutional mechanisms in this regard. Moreover, Nigeria, as a member of the United Nations, signed and ratified the various relevant international instruments, treaties, and conventions without reservation. These instruments have always emphasized that member nations put in place the necessary mechanisms needed to eliminate gender discriminations, ensure equality and human dignity to all men and women. The government of Nigeria in 2000 adopted a National Policy on Women; it was reviewed and upgraded in 2006 to become the National Gender Policy.

- **National Gender Policy, 2006**

  The overall goal of the National Gender Policy of Nigeria is to promote the welfare and rights of Nigerian women and children in all aspects of life: political, social, and economic. The policy seeks to plan, coordinate, implement, monitor, and evaluate the development of women in the country.

- **Penal Code Act CAP 53 LFN 2008**

  The Penal Code makes it an offence punishable with up to 6 months imprisonment for any person who:

  - *Violates the atmosphere in any place so as to make it noxious to the health of persons in general dwelling or carry-on business in the neighborhood, or passing along a public way: or*
  - *Does any act which is, and which he knows or has reason to believe to be likely to spread the infection of any disease dangerous to life, whether human or animals.*

1.6.2 State Legislations

A. <u>Taraba State Ministry of Environment and Climate Change</u>

Taraba State Ministry of Environment was created in the year 2000 with the aim of formulating and implementing government policies on environment. The function of the Ministry includes:

- Control and management of wildlife.
- Environmental Protection.
- Monitoring of Hazardous and Radioactive Materials in the Environment.
- Control of mining and its illegal activities in the State.
- Establishment and maintenance of forest plantations.
- Raising of seedlings, planting, and weeding.

- Solid minerals exploration and exploitation.
- Management of air, water and soil quality against pollution and degradation.

B. <u>Taraba State Ministry of Agriculture and Food Security</u>

The Ministry of Agriculture and Natural Resources (now Agriculture & Food Security), Taraba State, was established on the 27th of August 1991. The Ministry was created primarily for the following functions:

- Advise Government on Agricultural matters.
- Implement Agricultural Development Projects/Programs on behalf of the Government.
- Provision of Farm Inputs.
- Agricultural Extension Work and Farmer Education.
- Preservation, Storage, Quality Control and Marketing of Agricultural Produce.
- Quality Control of Farm Produce to meet International Grades and Standards.
- Implementation of State Buffer Stock Programme.
- Pest Control Services.
- Agricultural Credit Administration.
- Agro Data Collection, Collation and Dissemination.
- Agricultural Mechanization.
- Agricultural Land Protection and Management.
- Promote Cultivation and Varietal Improvement of Crop.
- Promote Livestock Development and Veterinary Services.
- Manpower Development and Capacity Building.

1.6.3 Lau Local Government Area By-Laws

The Local Government By-Law is derived from the Fourth Schedule of 1999 Constitution of the Federal Republic of Nigeria (as amended). The Schedule is reproduced below:

The Constitution of the Federal Republic of Nigeria, 1999 provides in the Fourth Schedule the main functions of Local Governments in Nigeria as follows:

- the consideration and the making of recommendations to a State Commission on Economic Planning or any similar body on:

- the economic development of the State, particularly in so far as the areas of authority of the Council and of the State are affected, and

- proposals made by the said Commission or body;
- collection of rates, radio and television licenses;
- establishment and maintenance of cemeteries, burial grounds and homes for the destitute or infirm;
- licensing of bicycles, trucks (other than mechanically propelled trucks), canoes, wheel barrows and carts;
- establishment, maintenance and regulation of slaughter houses, slaughter slabs, markets, motor parks and public conveniences;
- construction and maintenance of roads, streets, street lightings, drains and other public highways, parks, gardens, open spaces, or such public facilities as maybe prescribed from time to time by the House of Assembly of a State;
- naming of roads and streets, and numbering of houses;
- provision and maintenance of public conveniences and refuse disposal;
- registration of all births, deaths and marriages;
- assessment of privately-owned houses or tenements for the purpose of levying such rates as may be prescribed by the House of assembly of a State; and
- control and regulation of out-door advertising and hoarding;
- movement and keeping of pets of all descriptions;
- shops and kiosks;
- restaurants, bakeries and other places for sale of food to the public;
- laundries, and
- licensing, regulation, and control of the sale of liquor.

Apart from these exclusive functions, Local Governments shall include participation of such Councils in the government of a state with respect to the following matters:

- the provision and maintenance of primary, adult and vocational education;
- the development of agriculture and natural resources other than the exploitation of minerals;
- the provision and maintenance of health services; and
- such other functions as may be conferred on a Local Government Council by the House of Assembly of the State.

As provided for in the 1999 Constitution of the Federal Republic of Nigeria (as amended), Local Governments (LGs) have functions and responsibilities assigned. Some of these functions are performed exclusively by the Local Government (LG) like the maintenance of cemeteries, markets, and motor parks. On the other hand, some other functions and responsibilities are performed concurrently with the State Government. Among these concurrent functions are primary education, agriculture, health, and any other functions that may be conferred on Local Government by the House of Assembly of the State. As can be seen, these various functions and responsibilities of Local Governments are quite enormous and demanding. The tragedy of the situation is that LGs have very limited and circumscribed sources of revenue to enable them to execute meaningfully and effectively the functions and responsibilities assigned to them.

1.6.4 International Convention and Agreements, Best Practice Standards and Guidelines

Nigeria is signatory to a number of international conventions and agreements relating to industry, development and environmental management. In certain cases, conventions and agreement have influenced policy, guidelines and regulations and must be compiled with during the planning, construction, and operation of the project. Among several of such conventions, treaties and agreements are:

- **The United Nations (UN) published guiding Principles on the Human Environment in 1972.**

  Ten of these Guiding Principles were defined as formal declarations that express the basis on which an environmental policy can be built, and which provide a foundation for action. Some of the principles relevant to this project are:

- **Principle Two**

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

- **Principle Six**

  The discharge of toxic substances or of other substances and the release of harmful substances, in such quantities or concentrations as to exceed the capacity of the environment to render them harmless, must be halted to ensure that serious or irreversible damage is not inflicted upon the ecosystems. The just struggle of the people of all countries against pollution should be supported.

- **Principles Seven**

  States shall take all possible steps to prevent pollution of the seas by substances that are liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea.

- **Principle Seventeen**

  This principle specifically states that *"Environmental Impact Assessment, as a National Instrument shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a component National Authority"*.

- **United Nations Conference on Environment and Development (1992) (Popularly referred to as Agenda 21)**

  The United Nations Conference on the Environment and Development (UNCED) in 1992 led to the adoption of agenda 21, which recommended a set of 21 measures for waste management. Some of the recommendations include the following:

  - Prevent and minimize waste production
  - Reuse or recycle the waste to the extent possible.
  - Treat waste by safe and environmentally sound methods.
  - Dispose of the final residues by landfill in confined and carefully designated sites.
  - Integrate environment into development planning at all levels of Government and the private sector;
  - Commence a transition to sustainable development.
  - Address sectorial priorities, plan policies and strategies for the major sectors of the economy; and
  - Simultaneously foster regional and global partnership.

- **Convention on Biological Diversity (1992)**

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

- **Basel Convention on the control of Trans-boundary Movements of Hazardous Wastes and Their Disposal (1987)**

  The convention focuses attention on the hazards of the generation and disposal of Hazardous wastes. The convention defines the wastes to be regulated and control their trans-boundary movement to protect human and environmental health against their adverse effects.

- **Convention on the Conservation of Nature and Natural Resources, 1986**

  This convention came into force in Nigeria on May 7th,1974. The objectives of the convention to encourage individual and joint action for the conservation, utilization and development of soil, water flora and fauna for the present and future welfare of mankind, from an economic, nutritional, scientific, educational, cultural, and aesthetic point of view.

- **Montreal Protocol on Substances that Deplete the Ozone Layer, 1987 (as Amended)**

  The objective of the convention is to protect the ozone layer by-taking precautionary measure to control global emissions of substances that deplete it. This convention is aimed at protecting workers against occupational Hazards in the working environment.

- **Convention on the Protection of workers against occupational Hazards on the working environment due to Air Pollution, Noise and Vibration**

  The objective of the convention is to prevent accidents and injury to health by minimizing the causes of hazards inherent in the working environment.

- **Convention on Occupational Safety and Health and the Working Environment**

  The convention EIAs the objective of enhancement of the existing legal framework for occupational safety regulating the management of chemicals in the workplace with the broad purpose of protecting the environment and the public, and with the specific objective of protecting workers from harmful effects of chemicals.

- **United Nations Convention on Climate Change**

  The Convention on the Climate Change was signed in 1992 during the Rio Earth Summit but was put into force in 1994. The Convention called on developed countries and economies in transition to limit their emissions of the greenhouse gases which cause global warming, although it does not impose mandatory emissions on developing countries.

- **UNFCCC, Paris agreement of 2016 [The agreement was signed on 22 September 2016 and ratified by Nigeria on 16th May 2017]**

  The world is in a race to limit climate change and find workable, practical, and cost-efficient solutions (Renewable Energy, Circular Economy, and Natural Capital) to this emergency that is redefining global partnerships in a way not seen before. This is a race we, as humanity, can win. But for this to happen, unprecedented leadership, sacrifices, concessions from all nations big and small are needed. Nigeria has ratified the 2915 Paris Agreement. This is commendable considering it is one of the top six greenhouse gas emitters in Africa. The Paris Agreement builds upon the Convention and for the first time brings all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects, with enhanced support to assist developing countries to do so. As such, it charts a new course in the global climate effort The Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. Additionally, the agreement aims to strengthen the ability of countries to deal with the impacts of climate change. To reach these ambitious goals, appropriate financial flows, a new technology framework, and an enhanced capacity-building framework will be put in place, thus supporting action by developing countries and the most vulnerable countries, in line with their national objectives. The Agreement also provides for enhanced transparency of action and support through a more robust transparency framework.

- **Nationally Determined Contributions (NDCs)**

  Nationally Determined Contributions (NDCs) made under the Paris Agreement embodies the country's efforts to reduce national emissions and to adapt to the effects of climate change. If fully implemented, these efforts will pave way for a low carbon economy and result in about a 50 percent reduction in emissions. At the same time, the economy will grow at an average annual rate of five percent by 2030. This represents an important milestone in tackling the challenges of climate change.

- **Polluters Pays Principle (Adopted by Nigeria in 1999)**

  In environmental law, the polluter pays principle is enacted to make the party responsible for producing pollution responsible for paying for the damage done to the natural environment. It is regarded as a regional custom because of the strong support it has received in most Organization for Economic Co-operation and Development (OECD) and European Community (EC) countries. The polluter pays principle underpins environmental policy such as an ecotax, which, if enacted by the government, deters and essentially reduces greenhouse gas emissions. Some eco-taxes underpinned by the polluter pays principle include: the Gas Guzzler Tax, in the US, Corporate Average Fuel Economy (CAFE) - a "polluter pays" fine. The U.S. Superfund law requires polluters to pay for clean-up of hazardous waste sites when the polluters can be identified. Polluter pays is also known as extended producer responsibility (EPR). This is a concept that was probably first described by Thomas Lindqvist for the Swedish government in 1990. EPR seeks to shift the responsibility for dealing with waste from governments (and thus, taxpayers and society at large) to the entities producing it. In effect, it internalized the cost of waste disposal into the cost of the product, theoretically meaning that the producers will improve the waste profile of their products, thus decreasing waste and increasing possibilities for reuse and recycling.

- **Stockholm Convention Against Persistent Organic Pollutants of 2004**

Stockholm Convention on Persistent Organic Pollutants is an international environmental treaty, signed in 2001 and effective from May 2004, that aims to eliminate or restrict the production and use of persistent organic pollutants (POPs). In 1995, the Governing Council of the United Nations Environment Programme (UNEP) called for global action to be taken on POPs, which is defined as "chemical substances that persist in the environment, bio-accumulate through the food web, and pose a risk of causing adverse effects to human health and the environment‖. Following this, the Intergovernmental Forum on Chemical Safety (IFCS) and the International Programme on Chemical Safety (IPCS) prepared an assessment of the 12 worst offenders, known as the dirty dozen. The INC met five times between June 1998 and December 2000 to elaborate the convention, and delegates adopted the Stockholm Convention on POPs at the Conference of the Plenipotentiaries convened from 22–23 May 2001 in Stockholm, Sweden. The negotiations for the Convention were completed on 23 May 2001 in Stockholm. The convention entered into force on 17 May 2004 with ratification by an initial 128 parties and 151 signatories. Co-signatories agree to outlaw nine of the dirty dozen chemicals, limit the use of DDT to malaria control, and curtail inadvertent production of dioxins and furans. Parties to the convention have agreed to a process by which persistent toxic compounds can be reviewed and added to the convention if they meet certain criteria for persistence and transboundary threat. The first set of new chemicals to be added to the Convention was agreed upon at a conference in Geneva on 8 May 2009. As of June 2018, there are 182 parties to the Convention, (181 states and the European Union). Notable non-ratifying states include the United States, Israel, Malaysia, and Italy. The Stockholm Convention was adopted to EU legislation in REGULATION (EC) No 850/2004.

- **Cartagena Protocol on Biosafety of 2003**

The Cartagena Protocol on Biosafety to the Convention on Biological Diversity is an international agreement on biosafety as a supplement to the Convention on Biological Diversity effective since 2003. The Biosafety Protocol seeks to protect biological diversity from the potential risks posed by genetically modified organisms resulting from modern biotechnology The Biosafety Protocol makes clear that products from new technologies must be based on the precautionary principle and allow developing nations to balance public health against economic benefits. It will for example let countries ban imports of genetically modified organisms if they feel there is not enough scientific evidence that the product is safe and requires exporters to label shipments containing genetically altered commodities such as corn or cotton.

- **Vienna Convention for the Protection of the Ozone Layer**

  This Convention was instituted in 1985 and places general obligation on the countries to make appropriate measures to protect human health and the environment against adverse effects resulting from human activities which tend to deplete the ozone layer.

- **Convention on access to Information, Public Participation in Decision making and access to Justice in Environment Matters (Aarhus 1998)**

  Article 1 (Objective) notes that "in order to contribute to the protection of the right of every person of present and future generations to live in an environment adequate to his or her health and well-being, each Party shall guarantee the rights of access to information, public participation in decision-making, and access to justice in environmental matters in accordance with the provisions of this Convention.''

1.6.5 International Best Practices

Other considerations of the ESIA include other international best practices. International institutions provide guidance on best practices for the ESIA process and place emphasis on achieving sustainable environmental, social, and health outcomes. They also provide environmental standards and limits for emissions and discharges. Some key project impact mitigation measures such as resettlement are also specified. The overall project design and this ESIA will align with international best practices such as guidelines published by the International Finance Corporation (IFC) and the World Bank. The following is a summary of the specific international requirements and standards that will be applied to this ESIA. It should be noted that, given the private-sector nature of the development, the IFC Performance Standards described below will be most directly applicable to the project in this case.

A. World Bank Guidelines on Environmental Assessment

The World Bank requires an Environmental Impact Assessment (EIA) of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable to improve decision making. Additionally, the policy specifies that the Bank undertakes environmental screening of each proposed project to determine the appropriate extent and type of EIA. The Bank classifies projects into one of four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. Details of World Bank EIA procedures and guidelines are published in the bank's EA Source Books Vols. II–III of 1991.

World Bank Operational and Safeguard Policies

The World Bank is committed to several operational and safeguards policies that aim to prevent and mitigate undue harm to people and their environment in any development initiative involving the bank. These policies provide guidelines for bank and borrower staff in the identification, preparation, and implementation of programs and projects. There are ten World Bank Environmental/Safeguard Policies. Not all these policies are triggered by the Special Agro-industrial Processing Zone (SAPZ) Hub development. The World Bank policies that have been triggered by the proposed Special Agro-industrial Processing Zones (SAPZ) Hub are:

- **Operational Policy (OP)/Bank Procedure (BP) 4.01:** Environmental Assessment (last updated February 2011). This is the umbrella policy for the Bank's environmental 'safeguard policies' which among others include:
  - **Operational Policy/Bank Procedure 4.04 (**Natural Habitat) - seeks to ensure that World Bank-supported infrastructure and other development projects take into account the conservation of biodiversity, as well as the numerous environmental services and products which natural habitats provide to human society.

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

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

- **Operational Policy /Bank Procedure 4.11** - Physical Cultural Resources seeks to avoid, or mitigate, adverse impacts on cultural resources from development projects that the World Bank finances.

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

and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation. The Bank favours preventive measures over mitigatory or compensatory measures, whenever feasible. EA looks at the interaction of the project with the natural environment (air, water, and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples, and physical cultural resources); and where applicable, transboundary, and global environmental aspects.

B. The IFC Performance Standards

The IFC applies Performance Standards to manage social and environmental risks and impacts and to enhance development opportunities in the private sector. The IFC Performance Standards encompass eight topics:

- **Environmental and Social Assessment and Management System**: Commercial clients/investees are required to manage the environmental and social performance of their business activity, which should also involve communication between the client/investee, its workers, and the local communities directly affected by the business activity. This requires the development of a good management system, appropriate to the size and nature of the business activity, to promote sound and sustainable environmental and social performance as well as lead to improved financial outcomes.
- **Labour and Working Conditions:** For any business, its workforce is a valuable asset and a sound worker-management relationship is a key component of the overall success of the enterprise. By protecting the basic rights of workers, treating workers fairly, and providing them with safe and healthy working conditions, commercial clients/investees can enhance the efficiency and productivity of their operations and strengthen worker commitment and retention.
- **Pollution Prevention and Abatement:** Increased industrial activity and urbanization often generate increased levels of pollution to air, water, and land that may threaten people and the environment at the local, regional, and global level. Commercial clients/investees are required to integrate pollution prevention and control technologies and practices (as technically and financially feasible as well as cost-effective) into their business activities.
- **Community Health, Safety, and Security:** Business activities can increase the potential for community exposure to risks and impacts arising from equipment accidents, structural failures, and releases of hazardous materials as well as impacts on a community's natural resources, exposure to diseases, and the use of security personnel. Commercial clients/investees are responsible for avoiding or minimizing the risks and impacts on community health, safety, and security that may arise from their business activities.
- **Land Acquisition and Involuntary Resettlement:** Land acquisition due to the business activities of a commercial client/investees may result in the physical displacement (relocation or loss of shelter) and economic displacement (loss of access to resources necessary for income

generation or as means of livelihood) of individuals or communities. Involuntary resettlement occurs when affected individuals or communities do not have the right to refuse land acquisition and are displaced, which may result in long-term hardship and impoverishment as well as environmental damage and social stress. Commercial clients/investees are required to avoid physical or economic displacement or minimize impacts on displaced individuals or communities through appropriate measures such as fair compensation and improving livelihoods and living conditions.

- **Biodiversity Conservation and Sustainable Natural Resource Management:** Protecting and conserving biodiversity (including genetic, species, and ecosystem diversity) and its ability to change and evolve, is fundamental to sustainable development. Commercial clients/investees are required to avoid or mitigate threats to biodiversity arising from their business activities and to promote the use of renewable natural resources in their operations.
- **Indigenous Peoples:** Indigenous Peoples are recognized as social groups with identities that are distinct from other groups in national societies and are often among the marginalized and vulnerable. Their economic, social, and legal status may limit their capacity to defend their interests and rights to lands and natural and cultural resources. Commercial clients/investees are required to ensure that their business activities respect the identity, culture, and natural resource-based livelihoods of Indigenous Peoples and reduce exposure to impoverishment and disease.
- **Cultural Heritage:** Cultural heritage encompasses properties and sites of archaeological, historical, cultural, artistic, and religious significance as well as unique environmental features and cultural knowledge, innovations, and practices of communities embodying traditional lifestyles, which are protected for current and future generations. Commercial clients/investees are required to avoid significant damage to cultural heritage due to their business activities.

C. Environmental and Social Safeguards Policies (African Development Bank)

The African Development Bank issued its Environmental Assessment Guidelines (EAG) in 1992, but since then, many changes have occurred in the Bank's structure and operations. The revised Environmental and Social Assessment Procedures (ESAP 2015) have therefore been updated to reflect the more integrated approach addressing all cross-cutting themes as well as the new organizational structure. The main purpose of the Environmental and Social Assessment Procedures (ESAP) is to improve decision-making and project results in order to ensure that Bank-financed projects, plans, and programs are environmentally and socially sustainable as well as in line with Bank's policies and guidelines. The ESAP applies to the Bank's public-sector operations. Similar procedures were developed and approved for the Bank‘s private sector operations: AfDB Environmental Review Procedures for Private Sector Operations (2000). Other relevant AfDB policies are AfDB Policy on the Environment (2004), AfDB Environmental Review Procedures for Private Sector Operations (2000), AfDB Gender Policy (2001), AfDB Policy on Poverty Reduction (2004), and AfDB Policy on Involuntary Resettlement (2003). In the development of the ESIA, the AfDB ESAP guideline was used to address the following areas:

- Aims
- Brief project description and key components
- Major environmental and social impacts and climate change risk
- Enhancement/mitigation measures and complementary initiatives
- Environmental and social monitoring program
- Public consultations and disclosure requirements
- Institutional arrangements and capacity building requirements
- Estimated costs
- Implementation schedule and reporting
- Conclusion
- References and contacts

D. The African Development Bank (AfDB) Integrated Safeguards System (ISS)

The E&S safeguards of the AfDB are a cornerstone of the Bank's support for inclusive economic growth and environmental sustainability in Africa. AfDB will apply the Integrated Safeguards System for the proposed Agro-industrial processing facilities considered under the AAU project. The Bank ISS is designed to promote the sustainability of project outcomes by protecting the environment and people from the potentially adverse impacts of projects. This requires that all the activities under the project will comply with the safeguard requirements of the ISS during projects preparation and implementation. The safeguards aim to:

- Avoid adverse impacts of projects on the environment and affected people, while maximizing potential development benefits to the extent possible.
- Minimize, mitigate, and/ or compensate for adverse impacts on the environment and affected people when avoidance is not possible.
- Help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage E&S risks.

The ISS consists of four interrelated components as summarized in Figure 1.5

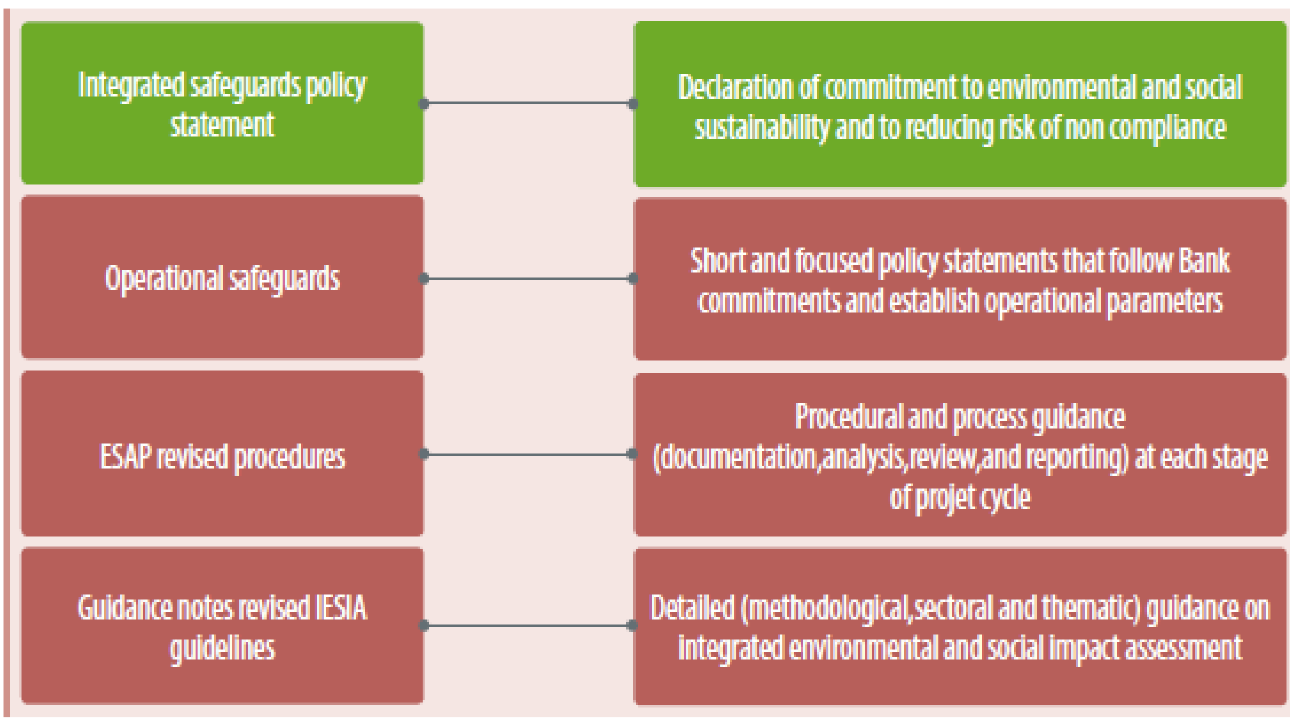


Figure 0.5: Structure of the AfDB ISS

The Integrated Safeguards Policy Statement

This describes common objectives of the Bank's safeguards and lays out policy principles. It is designed to be applied to current and future lending modalities, and it considers the various capacities and needs of regional member countries in both the public and private sectors. The

Integrated Safeguards comprises of Policy Statement that sets out the basic tenets that guide and underpin the Bank's approach to environmental safeguards. The Bank's Integrated Safeguards Policy Statement sets out the Bank's own commitments to and responsibilities for delivering the ISS: to

- ensure the systematic assessment of E&S impacts and risks.
- apply the OSs to the entire portfolio of Bank operations.
- support clients and countries with technical guidance and practical support in meeting the requirements.
- implement an adaptive and proportionate approach to E&S management measures to be agreed with clients as a condition of project financing.
- ensure that clients engage in meaningful consultations with affected groups; respect and promote the protection of vulnerable groups, in a manner appropriate to the African context.

Operational Safeguards (OSs)

These are a set of five safeguard requirements that Bank clients are expected to meet when addressing social and environmental impacts and risks. Bank staff use due diligence, review, and supervision to ensure that, clients comply with these requirements during project preparation and implementation. Over time the Bank may adopt additional safeguard requirements or update existing requirements to enhance effectiveness, respond to changing needs, and reflect evolving best practices. The five OSs presented in table 1.1 were designed to:

- Better integrate considerations of E&S impacts into Bank operations to promote sustainability and long-term development in Africa.
- Prevent projects from adversely affecting the environment and local communities or, where prevention is not possible, minimize, mitigate and/or compensate for adverse effects and maximize development benefits.
- Systematically consider the impact of climate change on the sustainability of investment projects and the contribution of projects to global greenhouse gas emissions.
- Delineate the roles and responsibilities of the Bank and its borrowers or clients in implementing projects, achieving sustainable outcomes, and promoting local participation.

– Assist regional member countries and borrowers/clients in strengthening their own safeguards systems and their capacity to manage E&S risks.

Table 0.1: AfDB Operational Safeguards OS1-5.

Operational Safeguard	Description	Triggered (Yes/No)
OS 1: *Environmental and social assessment*	This overarching safeguard governs the process of determining a project's environmental and social category and the resulting environmental and social assessment requirements	**This OS is triggered.** The construction and operation of the AIH will have environmental interactions with potential negative impacts to the people and the environment.
OS 2: *Involuntary Resettlement: Land Acquisition, Population Displacement and Compensation*	This safeguard consolidates the policy commitments and requirements set out in the Bank's policy on involuntary resettlement and incorporates a few refinements designed to improve the operational effectiveness of those requirements	**This OS is triggered.** The AIH shall be constructed on lands that are previously being use for farming activities by those within the nearby community.
OS 3: *Biodiversity and Ecosystem Services*	This safeguard aims to conserve biological diversity and promote the sustainable use of natural resources. It also translates the commitments in the Bank's policy on integrated water resources management into operational requirements.	**This OS is not triggered.** The project is on a piece of land being used for farming activities with limited sensitive ecological receptors. Areas of ecological importance particularly the stream on the site will be conserved/enhanced as part of project landscaping activities to ensure the preservation of the natural habitat for aquatic organisms.

Operational Safeguard	Description	Triggered (Yes/No)
OS 4: *Pollution Prevention and Control, Greenhouse Gases, Hazardous Materials and Resource Efficiency*	This safeguard covers the range of key impacts of pollution, waste, and hazardous materials for which there are agreed international conventions, as well as comprehensive industry-specific and regional standards, including greenhouse gas accounting, that other multilateral development banks follow.	**This OS is triggered.** The construction and operation activities will generate waste including hazardous waste which will require proper management to prevent environmental pollution.
OS 5: *Labour Conditions, Health, and Safety*	This safeguard establishes the Bank's requirements for its borrowers or clients concerning workers' conditions, rights and protection from abuse or exploitation. It also ensures greater harmonization with most other multilateral development banks.	**This OS is triggered.** Many workers are envisaged to be engaged during the construction and operation of the Hub. These workers would need to comply with HSE policies and requirements and be kept safe.

E. Islamic Development Bank (IsDB) Environmental and Social Safeguards

Islamic Development Bank (IsDB)'s ESSP is considered as an important tool for enhanced development effectiveness, with an overarching goal to facilitate achievement of the environmental and social soundness and sustainability of IsDB-financed projects. The ESSP demonstrates institutional values and commitment to:

- Address environmental and social risks and impacts in a structured operational framework across the project cycle;
- Ensure environmental and social soundness and sustainability of investments;
- Support integration of environmental and social aspects into the decision-making process; and
- Public consultation and disclosure of information.

F. International Funds for Agricultural Development (IFAD)'s Social, Environmental and Climate Sustainability

Social, environmental and climate sustainability is critical for achieving IFAD's mandate. Projects and programmes that foster social, environmental and climate sustainability rank among the Fund's highest operational priorities. In order to meet these objectives, IFAD has updated its 2017 Social, Environmental and Climate Assessment Procedures (SECAP). This updated edition of SECAP lays out an improved framework and process for managing risks and impact and integrating mainstreaming priorities into new IFAD-supported investments. IFAD actively embraces the principles of sustainable development by:

- Adopting good international practices, including on climate change and environment;
- Working towards greater harmonization of safeguard practices among United Nations agencies, multilateral financial institutions, and other development partners; and
- Improving its own internal processes and capacity.

SECAP will:

- Help IFAD to identify social, environmental and climate risks and impacts, and their significance, and determine the level of risk management required to address the risks and impacts associated with IFAD-supported investments and global and regional grant-funded programmes;
- Help to identify opportunities to mainstream climate resilience, environmental sustainability, nutrition, gender equality and the empowerment of women, youth and other vulnerable groups into IFAD strategies and programming;
- Support borrowers/recipients/partners and IFAD in improving decision-making and promoting the sustainability of project and programme outcomes through ongoing stakeholder engagement;
- Assist borrowers/recipients/partners in fulfilling their own international and national social, environmental and climate commitments;
- Ensure that IFAD's practices are aligned with its own policies and the procedures of other multilateral financial institutions; and
- Enable IFAD to continue accessing environmental and climate financing.

1.7 The ESIA Methodology

This ESIA study was carried out in accordance with the Federal Ministry of Environment (FMEnv) Procedural and Sectoral Guidelines 1995 and Taraba State Ministry of the Environment and Climate Change Guidelines. It involved a blend of a multidisciplinary team and standard methods from pure science, engineering, social and health sciences in order to obtain basic data for impact identification and establishment of mitigation and amelioration measures. It generally involved desktop studies, field research, consultation, impact assessment and proffering of mitigation measures and development of an ESIA Report as discussed below.

1.7.1 Desktop Studies

Desktop studies were undertaken to acquire information on climate and atmospheric condition, geology, soil, socio-economics, and other environmental components of the plant facility Catchment Area. It involved the review of existing literature particularly, from reports of previous ESIA studies in the area and other relevant studies. Materials reviewed include internet sources, textbooks, reports, survey maps, aerial photographs, articles and other international journals. These serve as secondary data for environmental database for the ESIA studies.

1.7.2 Reconnaissance Survey

A reconnaissance survey of the proposed project site was undertaken to familiarize the ESIA team with the project area. This assisted in the concept design of field research execution.

1.7.3 Fieldwork Activities/Laboratory Analysis

Field research was used to verify and harmonize information gathered from desktop studies and also fill data gaps identified. The fieldwork was carried out in line with the FMEnv Procedural Guidelines (1995) and Taraba State Ministry of Environment and Climate Change Guidelines on ESIA. It covered all the relevant aspects of the ecological, socio--economic and health environment and was conducted for various aspect of the environment including, soil quality, land use pattern, terrestrial and socio-economic and ethnographic issues

1.7.4 Validation

The systematic incorporation of expert opinion was used to identify potential environmental impacts and to predict their magnitudes and significance (empirical worst-case scenario) using the data gathered from the field investigation. Experts in the relevant fields (as listed in the list of report preparers) were consulted for their opinions on issues relating to the potential ecological impacts of the plant facility.

1.7.5 Consultation with Stakeholders

Stakeholder consultation is a very important aspect of ESIA study, this was carried out in and around the proposed project area of influence and stakeholders (especially the neighbouring communities) were consulted and interacted with. Some of these were consulted through questionnaire administration. This was done to ensure that the views and opinions of all the identified stakeholders regarding the proposed project and their associated potential impacts, are integrated into the ESIA.

1.7.6 Impact Assessment Methodologies

This involved impact identification, prediction and evaluation. Impact evaluation was carried out using the Leopold Matrix methodology and ISO 14001 while the overall assessment was carried out through the use of the 'Strength of Relationship Matrix Approach' method. This method defines, numerically, the degree of interdependence of the various environmental parameters that were considered. The 1 - 5 ratings were assigned to characterize the interrelationship by panel of experts. The impact evaluation results obtained form the basis for development of the Environmental and Social Impact Assessment (ESIA) report for the proposed project.

1.7.7 Reporting and Review

The findings of the ESIA study of the proposed project were subsequently documented as contained in this draft report. The final version of this report shall be issued at the end of the review of the draft report by the Federal Ministry of Environment. This shall incorporate all pertinent issues and comments arising from the review meetings as shall be directed by the FMEnv.

1.7.8 Impact Mitigation and Compliance Monitoring (IMM)

Upon the grant of final ESIA approval, the Ministry shall during the implementation of the project, monitor the progress of the project from site preparation to commissioning in order to ensure compliance with all stipulated mitigation measures and project specifications.

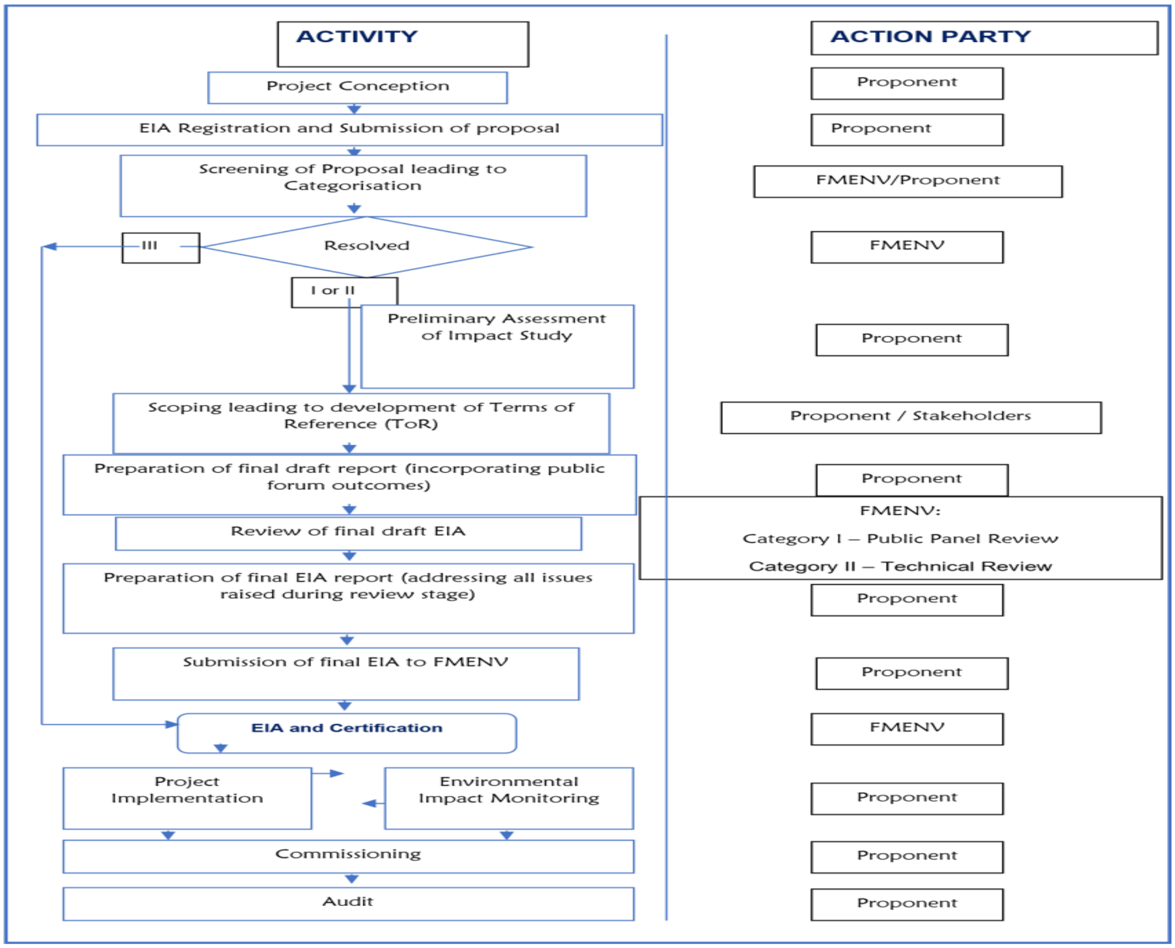


Figure 1.6: FMEnv EIA Process Flow Chart

1.8 The Structure of the ESIA Report

This ESIA report is presented in nine (9) chapters following standard report format as specified by the FMEnv.

- Chapter one contains the introduction with background on the project and the project's proponent's terms of reference, brief description and location of the project, review of the legal and administrative framework for ESIA, ESIA objectives, methodology and the structure of the prepared ESIA report.

- Chapter two discusses the justification, the need of the project, the value of the project, the project alternatives, and the envisaged sustainability of the proposed project.
- Chapter three gives a detailed description of the entire proposed project, the raw materials, input and outputs, technological layout, waste management strategy.
- Chapter four contains the description of existing environmental factors of climate (Rainfall, Wind Speed and direction, Temperature, and relative Humidity), Geography of the location, land use and landscape patterns, Hydrogeology (ground water, surface water, soil), air quality, noise level, biodiversity, socio-economic conditions, and built-up areas.
- Chapter five contains the details of the identification, quantification, and evaluation of the predicted Associated and Potential Environmental Impacts that may affect the project implementation.
- Chapter six presents cost-effective mitigation measures to minimize or completely eliminate identified negative impacts of the proposed project.
- Chapter seven presents a robust comprehensive Environmental Management Plan (EMP) for the proposed project and the decommissioning schedule.
- Chapter eight highlights the remediation plan after de-commissioning/closure and de-commissioning schedule.
- Chapter nine ends with the recommendations and conclusion.

These nine chapters are preceded by a Cover Page, Tables of Content, and List of Abbreviations/Acronyms. List of Tables, List of Figures, List of Plates, List of ESIA Preparers, Acknowledgement and Executive Summary and are then followed by references and Annexure such as Survey Plan and Methodology for field sampling and Analytical Methods and others.

CHAPTER TWO
PROJECT JUSTIFICATION

2.1 Introduction

Agriculture is the principal source of livelihood in Nigeria, and the sector employs nearly three-quarters of the nation's workforce. Nigeria is endowed with vast arable land, a conducive climate, and different agro-ecological zones. Food crop production have not kept pace with population growth, resulting in rising food imports and declining levels of national food self-sufficiency. Some of the reasons for the failures of the agricultural sector in the country are poor implementation of Government Policies; excessive postharvest losses due to poor postharvest handling; poor market access and value chain development; herders/farmers clash; lack of adequate farming equipment; lack of social amenities; illiteracy; lack of access to agricultural financing; environmental degradation and other natural disasters; and poor access to quality inputs such as fertilizers and improved seedlings.

In recent years however, the Nigerian agricultural sector has been on a recovery curve, recording improvements, particularly in farm production volumes due to favourable Government intervention. A rapid increase in current agro-processing capacities, crops and livestock productivity enhancement and rural infrastructure provision are requirements to drive optimal agricultural production. It is against this backdrop that the Federal Republic of Nigeria, engaged in a radical transformation of the sector through new funding arrangement, institutional realignment, administrative framework strengthening, and market reforms to reposition the sector.

2.2 Need for The Project

Supposing agricultural production continues to expand as expected, and fiscal policies are not in place to manage the growth of the downstream processing and trading industries, the result will be reduced prices at the farm and in the primary market at the expense of the primary producers (farmers). Given that situation, the initial growth will not be sustainable, and the confidence of farmers will be lost. Therefore, agricultural growth and expansion must be balanced across the value chain, and managed to comply with prevailing industrial opportunities, which requires

thoughtful planning by governments. The establishment of the Taraba State Special Agro-Industrial Processing Zone is one of such governmental agricultural intervention and contingency planning by the State.

African Development Bank (AfDB), as part of the implementation of its Feed Africa Programme, will be providing financial and technical support to the Federal Government of Nigeria through the development of Special Agro-industrial Processing Zones "SAPZs" to concentrate agro-processing activities within areas of high agricultural potential, to boost productivity and integrate production, processing, and marketing of priority commodities.

SAPZ is defined as a demarcated area of land (or a corridor), developed with desirable infrastructure and dedicated to attracting and supporting investments in agro-processing and related activities (otherwise called the Processing Hub or Agro-Industrial Hub (AIH))

The Agro Industrial Hub (AIH) is mainly a secondary value addition and supply center (at industrial scale) which serves as channel for distribution and retail to consumers and export of value-added farm agricultural produce. The hubs shall be equipped with industrial agro-processing facilities where value addition processes shall take place. It shall also house associated non processing infrastructure and common infrastructure facilities, including an administration office, R&D, QA & QC lab, Knowledge centre and ICT, procurement centre, community vocational centre, health centre, residential/duty post-recreational/playground, electricity, water, power, fire station, solid waste management centre, public toilets, internal/access roads, solar streetlights, and truck parking required for Agro-Industrial activities. The AIH shall also include the development of processing support infrastructure facilities like cold stores, veterinary clinics, livestock/poultry quarantine zones, livestock /poultry breeding center etc. These shared facilities will enable agricultural producers, processors, aggregators, and distributors to operate in the same vicinity to reduce transaction cost.

Each hub covers typically an area of 20 – 250 hectare and includes centrally managed tracts of land developed, subdivided, and dedicated to supporting firms and other stakeholders engaged in agro-processing and related activities, located throughout the production area surrounding the hub. The design of the Hub offers a variety of prepared land plots complete with infrastructure for anchor investors to build their agro-processing factories. The prepared land sites complete with infrastructure facilities shall include industrial sheds, small, medium, and large-scale industrial lands.

The SAPZs aim to develop competitive processing capacity by promoting private sector investment, enabled by investment in public goods, policy interventions and the provision of desirable support services and skills development. The Federal Government and host State Governments will facilitate the backbone infrastructure leading to the SAPZ. Simultaneously, the operator of the SAPZ will provide and manage infrastructure within the zone to attract a wide range of private sector investors' investments in agricultural production, processing, and the entire ecosystem from farm inputs to ancillary industries.

2.3 Benefit of The Project

The proposed project will offer several benefits which include:

- Boost farm incomes, reduce poverty, create clusters of economic growth, and increase tax revenue through value additions.
- Encourage longer-term private sector investment, thereby assuring the sustainability of industrial development, through Government's intervention in creating and maintaining enabling environments.
- Create wealth for rural farming communities.
- Stimulate private-public partnership.
- Increase food and nutritional security, create new/green jobs, and thereby reduce rural-urban migration through enhancement of productivity at the farm level.
- Promote private sector investment in climate-smart and green technologies, enabled by investment in public goods, policy interventions and the provision of pertinent support services and skills development.
- Reduce the levels of post-harvest loss/deterioration of agricultural produce and increase net profits to farmers.

- Guarantee availability of feedstock for sustainable input supply to agro-processing plants.

- General improvement of the standard of living for the populace.
- Facilitate national economic diversification.
- Create new sustainable jobs, especially for the youth and, reduce unemployment and crime.
- Boost rural livelihoods and reduce rural-urban drift.

2.4 Value of The Project

The proposed project cost is estimated at Two Billion Naira (₦2Billion) only to be funded through equity contribution by the project proponent, interested private investor and bank loan. It is envisaged that a large percentage of the total cost will be injected into the local economy for procurement of project designs, approvals/permits, construction materials, services, etc.

2.5 Envisaged Sustainability

The proposed project's sustainability is viewed from the lens of ensuring that the benefits realized are maintained and continue to influence positively into the foreseeable future. The project's sustainability is addressed under four key areas. They include the economic, technical, social, and environmental sustainability potentials.

Economic Sustainability of the Project

Taraba State Government shall ensure standard business ethics and transparency; preventing corruption, encourage public advocacy and lobbying, transparency in payment of taxes, encouraging human rights and security. Proceeds accruing from the agro-processing activities will continually contribute additional revenue to the State and the Federal Government of Nigeria. More jobs will be created and this in turn shall meet the State Government financial, socioeconomic, and material obligations to the host communities. The favourable enabling environment ensures that the Agro-processing Zone shall continue to exist for decades as a business venture and as an industry.

Technical Sustainability of the Project

The proposed Special Agro-industrial Processing Zone (SAPZ) Project shall adopt the principle of Best Available Techniques (BAT) for design, construction, and operation. To ensure technical sustainability, the following principles shall be enshrined in the project:

- Local content will be generously utilized in the design, construction, and operation.
- Skills transfer will be encouraged between expatriates' engineers and local engineers to close the gap in knowledge throughout the project life.
- The State Government shall ensure the training and retraining of its local Engineers.

Social Sustainability of the Project

To ensure the social sustainability of the project, the State Government shall ensure:

- ***Robust and sustained stakeholder engagement***: The State Government shall ensure sustained and effective Stakeholder Engagement in a structured and culturally appropriate manner with affected communities. The consultation process will be tailored to the risks and impacts of the Project; the Project's phase of development; the language preferences of the affected community; their decision-making processes; and the needs of disadvantaged and vulnerable groups.
- ***Establish a grievance redress mechanism:*** This shall be designed to receive and facilitate the resolution of concerns and grievances about the project's environmental and social performance as part of its Environmental and Social Management System (ESMS). Potential sources of grievances and acts of sabotage could include community youth groups, tribal conflicts, etc.
- ***Security Surveillance of the Facility:*** Encroachment and breach of Agro-processing facility security by a third party that can typically cause safety and environment incidents shall be monitored.

Environmental Sustainability of the Project

The proposed Special Agro-industrial Processing Zone (SAPZ) Hub Project shall be environmentally sustainable because agro-processing activities shall continually be guided by applicable environmental regulations such as Environmental and Social Safeguards Policies (African Development Bank), FMEnv policies and World Bank Guidelines on Environmental Assessment. Also, incorporating the findings and recommendations of this ESIA and subsequent implementation of the Environmental & Social Management Plan (ESMP) for the project activities will ensure the desired environmental sustainability.

In addition, At the early stages of conceptualization of this development, several visits to the study area were conducted to obtain first-hand information of the project area thereby understanding potential environmental receptors of the construction on its immediate environment. Innovative technologies that are economically viable and having minimal environmental, social and health impacts shall be utilized in the execution of the proposed project.

2.6 Project Options and Alternatives

Established ESIA processes including the requirements of Nigerian regulations call for an analysis of reasonable alternatives to various elements of the proposed project. To align with the Federal Ministry of Environment‘s (FMEnv) *National Environmental Protection (Effluent Limitations) Regulation of 1991* which mandates early selection of best engineering and operational options for new point sources, a range of alternatives and options were evaluated to facilitate identification of the most appropriate means of meeting the project‘s environmental objective. Project alternatives analysis in environmental assessment is designed to bring environmental and social considerations into project selection as well as the early stages of project planning, and the later stages of site selection, design, and implementation. The benefits of evaluating alternatives are for the selection of the best project design, selection of the best project location, and most efficient use of resources which will aid avoidance of adverse impacts and achievement of sustainable development goals. Therefore, the following options and alternatives were appraised:

- Project options: No project options; Delayed project options; and Go-ahead option
- Project alternatives: Alternative location/site, alternative design/technology.

Project Options

Option One: No Project Option

This option assumes that the project will not take place which means that no further development will take place in Lau LGA, because of the non-viability of the feasibility studies. The No Project option will harm the local and national economies. The significant socio-economic and industrial development benefits associated with the proposed development such as increased business opportunities, increased revenue to the government, increased foreign exchange earnings, employment opportunities, etc. will be forfeited. As a result, the 'No Project option' was not considered to be a viable or acceptable option for the proposed project.

Option Two: Delayed Project Option

Due to some unfavorable conditions such as civil unrest or hostilities within the stakeholder communities, malicious public opinion, unfavorable government policies, prevailing bad economic conditions, or any force majeure, implementation of a proposed project may be delayed. Considering this option implies that

the development's activities would be stalled until conditions become conducive. Interestingly, none of the above mentioned or any related delaying factors currently exist against the proposed development, therefore the delayed project option was not considered a preferred option and thus was not selected.

Option Three: Go-Ahead Option

This Project option admits and emphasizes the vital need for the planned development. Considering its many benefits, this option was significantly weighed positive. This option will contribute to improved and increased production which will enhance the revenue base of Nigeria.

It will also enhance job creation and many more direct and indirect socio-economic benefits. This Go-Ahead option was deemed viable and therefore considered. The proposed project should therefore be executed as planned.

Project Alternatives

The identification and investigation of alternatives is a key aspect of the ESIA process. Therefore, all reasonable and feasible alternatives were identified and assessed during the scoping phase to determine the most suitable alternatives to consider and assess during the ESIA phase. The preferred project alternatives are highlighted and presented here. Alternatives can typically be identified according to:

- Site/ Project Location alternatives
- Technology alternatives

For any alternative to be considered feasible such an alternative must meet the need and purpose of the development proposal without presenting significantly high associated impacts. The alternatives are described, and the advantages and disadvantages are presented. It is further indicated which alternatives are considered feasible from a technical as well as environmental perspective. Incremental alternatives typically arise during the ESIA process and are usually suggested as a means of addressing identified impacts. These alternatives are closely linked to the identification of mitigation measures and are not specifically identified as distinct alternatives. This section provides information on the development of footprint alternatives, as well as the type of activity, activity layout, technological and operational aspects of the activity.

Alternative 1: Site/ Project Location Alternatives

Selection of the preferred location (Geri-mallam community) for the proposed Agro Industrial Hub (AIH) was based on the fact that the axis is enriched with various commodities such as rice, yam, sorghum, cassava among others. It also possesses proximal advantage to the State Capital (Jalingo) and vast lands that are suitable for such construction activities. Lau LGA is strategically positioned at a central point in the Northern part of Taraba State, and this comparative advantage shall drive socio-economic development in other proximal LGAs and Farming Communities that surround it. Some of the major challenges faced by Famers around the Lau axis are post-harvest losses, inadequate storage facilities, high transportation cost, low production capacity, and a lack

of access to structured markets. Setting the AIH in Lau LGA shall address these challenges and drive the much-needed socio-economic development in Lau, its environment, Taraba State and Nigeria as a whole. These considerations make the proposed project site most suitable location the Agro Industrial Hub.

Alternative 2: Technology Alternatives

Conventional Technology

This technology is not environmentally friendly and has led to an increase in Greenhouse Gases (GHGs) in the atmosphere causing climate change.

Green Agro-Processing Technology

The proposed Special Agro-industrial Processing Zone (SAPZ) shall strictly adhere to international and national terminal engineering design, construction standards, and codes of practices of the green Agro-Processing Hub which shall include rainwater harvesting, recycling wastewater, installing solar panels which will tremendously help to erase carbon footprints. Going with Green Agro-Processing Hub technology shall help mitigate climate change and bring substantial benefits which shall include reduced operational costs, reduced capital asset life cycle costs, greater utilization of assets, improved benefits to the community, optimization of new and better technologies, as well as reduced environmental, health and safety risks. In view of these advantages, the '**Green Agro-Processing Technology'** is the chosen alternative.

Summary

Having considered several of the project's options in terms of their social, economic, technical, and environmental implications/benefits both in the short and long run, the project option which gives credence to the execution of the proposed project was selected. To select the Best Available

Technique (BAT) in line with the National Environmental Protection (Effluents Limitation) Regulations 1991, many alternatives were also considered which favours the selection of execution of the proposed project on the selected site based on its viability. Therefore, the proposed project should be executed as planned.

CHAPTER THREE
PROJECT DESCRIPTION

3.1 Introduction

This chapter provides a detailed overview of the proposed Agro-Industrial Hub (AIH) to be situated in Lau Local Government Area of Taraba State, including its location, scope, components, and operational characteristics. The chapter aims to provide a clear understanding of the project's design and objectives.

3.2 Project Background and Overview

The Taraba State Government through the phase 2 of the African Development Bank's Special Agro-Industrial Processing Zones (SAPZ-II) Program is in the process of setting up an Agro Industrial Hub (AIH) in the State. This AIH, once completed is expected to catalyze private investment in agriculture, drive the development of regional economy, create linkages, and stimulate growth across the agricultural value chains.

The AIH shall be strategically located in proximity to primary production areas and shall serve as a major off taker to proximal farmer communities from whom it shall source raw materials supply, for secondary value addition, and distribution to consumer and export markets.

The hub shall house both agro processing and non-processing facilities, for value addition, administrative and other support services. This one-stop-shop approach of concentrating developmental centers and processing facilities across the various agricultural value chain segments in on place will enable agricultural producers, processors, aggregators, and distributors to operate in the same vicinity to reduce transaction cost. The hub is typically expected to include centrally managed tracts of land developed, subdivided, and dedicated to supporting firms and other stakeholders engaged in agro-processing and related activities, located throughout the production area surrounding the hub. The design of the Hub shall offer a variety of prepared land plots complete with infrastructure for anchor investors to build their agro-processing factories. The prepared land sites complete with infrastructure facilitates will include industrial sheds, small, medium, and large-scale industrial lands.

3.2.1 Project Location Description and Land Take

The selected location for the setup of the Agro Industrial Hub in Taraba State is Lau Local Government Area which is approximately 47km away from the Taraba State Capital - Jalingo. The Agro-Industrial Hub (AIH) at Lau will have the manufacturing and related service units covering training, farm inputs, procurement, and value addition of the focal agricultural products as a forward or backward integration to each other. The site is situated in the Northern part of Taraba State in a community called *Garin Malam* in Lau LGA. Lau LGA is bounded to the North by the River Benue and Karim Lamido LGA and to the South by Ardo Kola, Jalingo and Yorro LGAs (Figure 1).

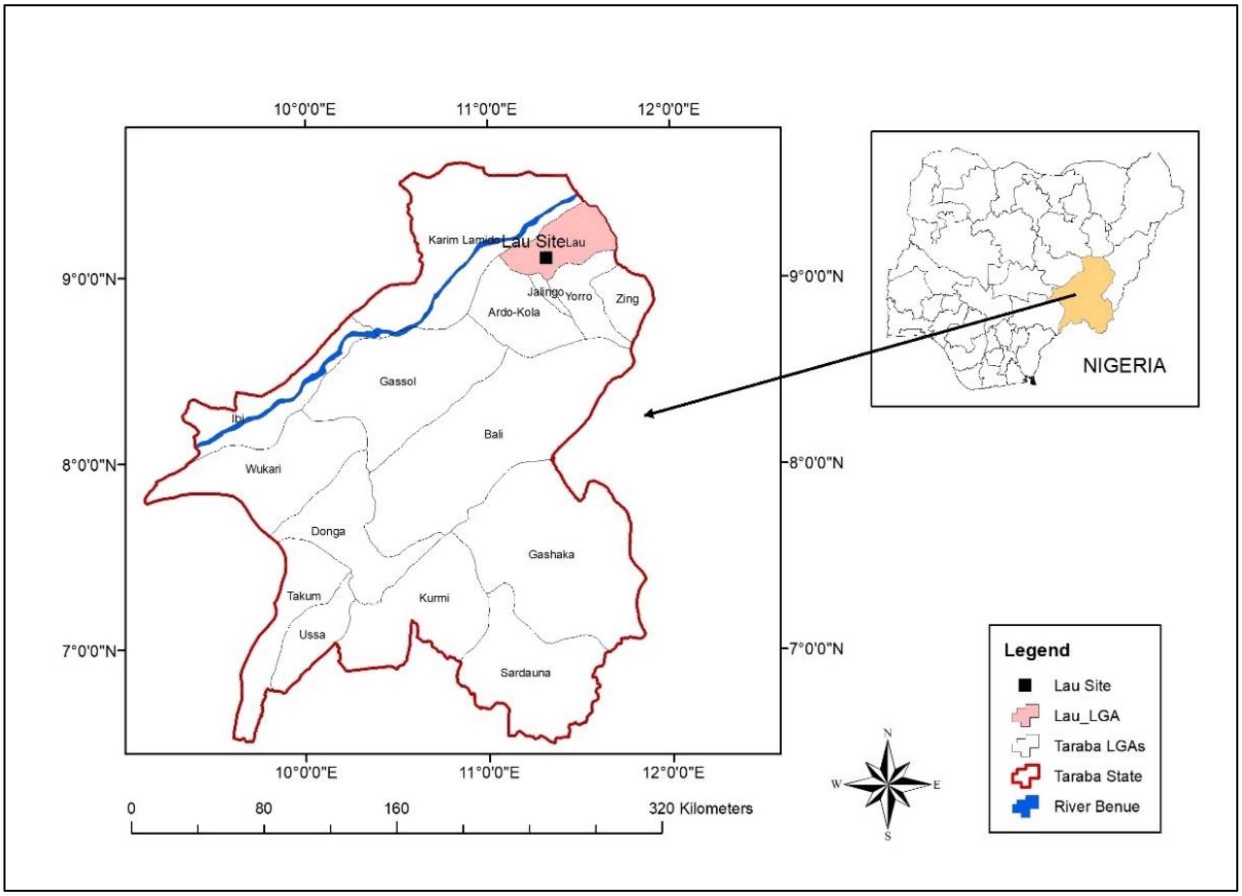


Figure 3.1: Proposed Project Site

The Lau proposed site is located between longitudes 11°18′30″E and 11°20′30″E of the Prime Meridian and between Latitudes 09°05′30″N and 09°07′00″N of the Equator. It covers an Area of 339.00 Hectares (Ha) and a Perimeter of 7.90 Kilometers (Figure 2) with an elevation of 189m above sea level.

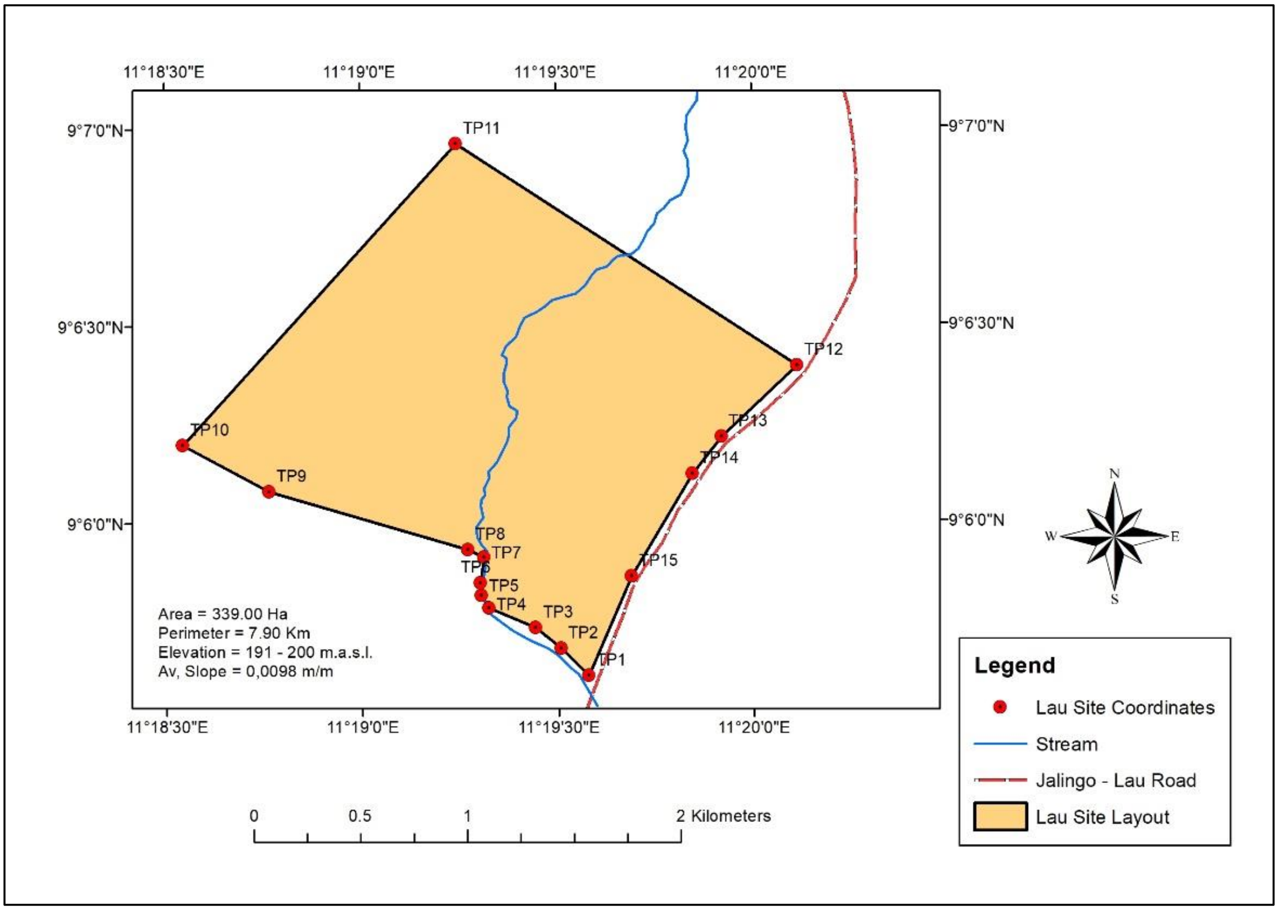


Figure 3.2: Proposed Site Layout

Of the total land allocated for the Lau AIH project (500 hectares), a total area of 152 hectares (ha) have been earmarked for the setup of physical infrastructure, processing, and allied facilities. The remaining expanse of land shall be utilized for commercial farming to produce additional raw materials that shall be fed into the Hub.

Geospatial coordinates of the site boundary based on field survey are presented in Table 3.1. The coordinates were obtained using the Garmin Global Positioning System (GPSMAP 79S) with an accuracy level of 3.00 meters.

S/N	LATITUDE	LONGITUDE	POINTS
1	9.093460°	11.326267°	TP1
2	9.094669°	11.325120°	TP2
3	9.095543°	11.324006°	TP3
4	9.096381°	11.322101°	TP4
5	9.096872°	11.321782°	TP5
6	9.097500°	11.321676°	TP6
7	9.098511°	11.321859°	TP7
8	9.098878°	11.321196°	TP8
9	9.101337°	11.312712°	TP9
10	9.103318°	11.309045°	TP10
11	9.116062°	11.320680°	TP11
12	9.106519°	11.335240°	TP12
13	9.103506°	11.331998°	TP13
14	9.101953°	11.330737°	TP14
15	9.097662°	11.328089°	TP15

Table 3.1: Geospatial Coordinates of the Proposed

(Source: Bolben Field Survey (2024)

The delineated maps of the proposed project site are represented in Plates 3.1 and 3.2:

Plate 3.1: Delineated Map 1 of the Proposed Site

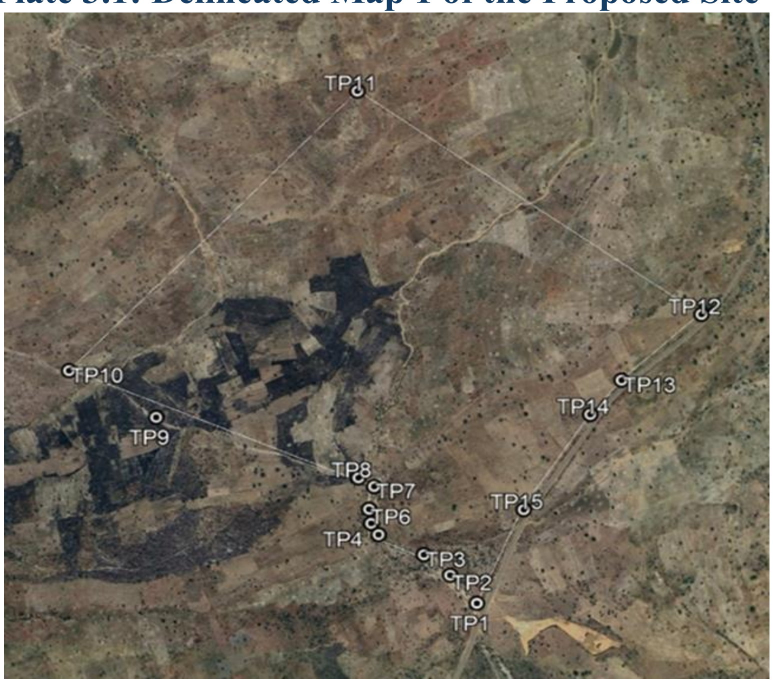


Plate 3.2: Delineated Map 2 of the Proposed Site

Pictorial Evidence of The Proposed Sites:

Plate 3.3: Illustration of The Distance of The Proposed Project Site From Minda Geri-Mallamin Road

Plate 3.4: Members of the SPIU, ESIA and Technical Feasibility Team on the proposed project Site during the reconnaissance survey

3.3 Project Components/Outputs

The AIH to be situated in Lau LGA shall be an environment friendly facility comprising of physical and common infrastructure components interwoven with green spaces. The Hub has been planned to accommodate the requirement of the industries for focus commodities to be processed (these commodities include Rice, Maize, Cassava, and Dairy). The following proposed facilities shall make up the components of the Lau AIH Project:

- Industrial Units
  - Rice Mills
  - Casava Value addition
  - Cattle Feed Unit
  - Seed processing unit
  - Standard design factories for value addition
- Physical Infrastructure
  - Road network
  - Storm Water Drainage System
  - Water Supply System
  - Sewerage and Effluent System
  - Street Lighting System
  - Electrical Distribution System
- Environmental Infrastructure
  - Sewage Treatment Plant
  - Common Effluent Treatment Plant
- Common Facilities
  - Administration office
  - Residential Training Center
  - Staff Accommodation
  - Cold Storage
  - Farm Input Store

- Warehousing facilities with Weigh Bridge
- Parking facilities
- Testing labs
- Custom hiring centre
- Farm input sale depot
- Guest house and recreation facilities

Figure 3 is a representation of the masterplan design for the proposed AIH in Lau LGA of Taraba State.

Figure 3.3: Masterplan design of the proposed AIH in Lau LGA

The land use distribution for the various components of the AIH to be setup in Lau LGA are presented in Table 3.2

S/N	Plot No	Area (Acre)	Percentage Allocation
1	Industrial Plots	100.0	65.0
2	Road & Parking	19.0	12.5
3	Physical Infrastructure	9.0	6.0
4	Common Facilities	24.0	16.5
Total		**152.0**	**100**

Table 2: AIH Land Use Distribution

The following sections provides a description of each of the components that shall make up the AIH Project.

i. **Rice Mills:** The AIH is proposed to develop 5 units of 4T / hour capacity rice mills in the SAPZ. Each unit is planned to be developed in a 5 acre plot. Each mill will have a silo to store 3000MT of paddy. The project shall commence with the full development of one mill for a start.

ii. **Casava Processing Plant**: A casava value addition unit of 40 MT / day is proposed in a 5 acre plot as part of this project, mainly for starch and flour extraction.

iii. **Cattle Feed Plant**: A cattle feed plant with a capacity of 40 MT/Day is proposed as part of this AIH. It shall use the waste bran from the rice mill as well as maize grown in the region for its raw material requirement.

iv. **Seed Processing Unit**: The AIH shall also include a seed processing plant for the SAPZ.

v. **Ready Built sheds**: 10 sheds of 2,000fts each will be constructed for small industries involved in the value-added food products.

vi. **Site Development**: Site grading will include cutting, filling, and compacting the filled-up earth so as to integrate the micro drainage pattern of the site to the proposed storm water drainage system. The site will be protected by boundary fencing and an aesthetically designed entrance plaza is proposed.

vii. **Road Network**: The proposed road network is bituminous road in the AIH and would comprise 30m and 24m ROW for better circulation of large trucks and will be pedestrian friendly.

viii. **Storm Water Drainage**: The entire storm water drainage system for the AIH has been planned to utilize the natural slopes wherever possible and an economically graded slope in other locations, to design an economical and sustainable surface drainage system with integration of rainwater harvesting.

ix. **Water Supply Network:** The AIH comprises of agro processing factories apart from common facilities. The water requirement is calculated based on the requirement for the processing and domestic usage. The total water demand is estimated at 1.2 million litres per day. The source of water will be ground water through a set of industrial borewells.

x. **Sewerage Collection and Treatment System**: An underground sewerage network has been designed to collect sewage from each plot and convey it to a sewage treatment plant (STP). At the STP, the sewage would be treated to acceptable standards and the treated sewage will be used for irrigation purpose for which pipe network is considered.

xi. **Effluent Collection and Treatment System**: The major effluent generated will be from the parboiling section of the rice mills and from the casava processing plant generated through washing and from the centrifuge. The effluent treatment will be through a series of anaerobic and aerobic treatment. The treated effluent will meet the standard to be supplied back to the rice mills for boiler feed and for washing in other units.

xii. **Electrical Generation and Distribution:** The aggregate power demand of the Hub is estimated to be the order of 7MW for both industrial and domestic use. Since the grid power do not cover this region, it is proposed to install a gas based captive power plant of 7MW capacity and distributed to the entire AIH. Solar street lighting is proposed for the outdoor illumination.

xiii. **Office and Training Centre:** A full-fledged office and training center is proposed in the AIH which shall be located at its entrance. The center is designed for a capacity of 50 trainees and will have training halls, accommodation for staff, trainees, guests etc. A food court, bank, testing lab is proposed in this zone. Demo Plots for farm training is also proposed as part of the training center.

xiv. **Common Warehouse**: A common warehouse with a capacity of 20,000MT is proposed with support facilities such as weigh bridge, truck parking and driver amenities.

xv. **Custom Hiring Center and Workshop:** This center will provide farm machinery on hire for the farmers and will also house a full-fledged workshop for general maintenance of farm equipment. The centre will also provide training for the maintenance and operations of farm machinery and equipment.

xvi. **Farm Input Sale Counter:** This center is proposed to cater for the supply of quality farm inputs such as seeds, fertilizers etc. for the farmers.

3.4 Project Developmental Phases and Activities

Setting up the Agro Industrial Hub in Lau LGA shall comprise of a wide range of activities to be implemented through series of developmental phases, aimed at ensuring that the developmental process maintains proper accountability, transparency, and compliance with relevant regulations and standards. The AIH project is being implemented through a Public Private Partnership (PPP) arrangement between the Taraba State Government and the Project Management Agency (PMA). It shall take the form of a Build, Operate, Maintain and Transfer (BOM and T) model. Generally, the developmental works shall be centered around administrative, engineering, and managerial functions.

The various phases that shall make up the project developmental lifecycle of this AIH Project includes the:

- Pre-Construction Phase
- Construction Phase
- Operation, Maintenance, and Commissioning Phase
- Decommissioning Phase

The sections below describe each of the five (5) developmental phases of the AIH Project and their associated activities.

3.4.1 Phase 1: Pre-Construction Phase

The purpose of this phase is to lay the foundation for a successful execution of the AIH setup Project. It is characterized by activities aimed at qualifying the State for the AfDB Loan, accessing the loan, and preparing the various plans and designs that shall be used during the construction phase. Key activities that are carried out in this phase includes:

- State expression of interest to participate in the SAPZ-II program
- Site selection and ratification
- Procurement of works and consulting services
- Technical feasibility studies
- Environmental and social impact assessment
- Reporting and approval of the AfDB, FMEnv, Federal Ministry of Finance and national Planning and other relevant regulatory institutions
- Engineering and architectural designing
- Development of business plans
- Completion of legal loan access requirements (e.g signing of Memorandum of Understanding)
- Funds disbursement and resource procurement
- Relocation and compensation (if required)
- Resource mobilization and deployment to site

Key Environmental and Social Impact Considerations in Phase 1

From an environmental and social impact perspective, key considerations in this phase includes:

- Suitability of the selected site for the AIH Project
- Likely impacts of the AIH project on the environment and host community and mitigation planning
- Stakeholders' engagement, grievance redressal, and securing buy-in
- Inclusivity in project design and planning
- Baseline environmental and socio-economic reporting
- Environmental and social management planning
- Compensation of project affected persons

3.4.2 Phase 2: Construction Phase

This is the implementation phase, where the project plan is put into motion and the work of the project is performed practically on site. In this phase, the engaged Project Management Agency (PMA) shall coordinate all technical and managerial functions, including the engineering and construction components, procurements, project management and reporting. Foreign expatriates with the technical know-how for executing specialist works shall be engaged in this phase (where it is ascertained that these skills cannot be sourced locally), while local labour shall be used to execute less specialized works.

This phase shall include all associated activities during construction. Including:

- Site and vegetation clearing
- Excavating and burrowing
- Land filing and compacting
- Culverts and drains constructing
- Bituminous road construction
- Fencing, pavements and surfacing works
- Construction of agro processing facilities, associated non processing infrastructure and common facilities

- Ancillary works like installing signposts, guideposts, KM posts, grassing and beautification of embankments
- Clean up and waste management
- QA/QC inspections and tests

Key Environmental and Social Impact Considerations in Phase 2

From an environmental and social impact perspective, key considerations in this phase shall include:

- Compliance with ESMP
- Involvement of the locals in construction works for knowledge transfer and project learning
- Proper waste management

3.4.3 Phase 4: Operation, Maintenance, and Commissioning Phase

Upon commissioning of the AIH, this phase shall focus on the operationalization of the Hub to enable the achievement of the envisaged project benefits. This shall be the longest phase of the project, and it shall be more of operations than a project. It consists of the daily business routines that shall trigger revenue generation and value creation for an initial period, not less than twenty-five (25) years. The key activities that shall be carried out in this phase shall include:

- Business model planning
- Workforce recruitments
- Production and other related functions
- Operations management and facility maintenance

Key Environmental and Social Impact Considerations in Phase 4

From an environmental and social impact perspective, key considerations in this phase shall include:

- Compliance with ESMP
- Periodic ESIA audits
- Proper waste management
- Maintenance of environmental and ecosystem balance
- CSR and engagements with local communities

Commissioning is the officially launch the completed Agro Industrial Hub, to enable the commencement of business operations. It shall serve as a corridor between the construction phase and operationalization of the Hub. This commissioning phase shall be witnessed by all stakeholders, including the AfDB, the Taraba State Government, related Regulatory Institutions, Traditional Rulers, the locals from the host and neighboring communities as well as the Project Management Agency (PMA). The key activities to be carried out in this phase shall include:

- Launching of the Agro Industrial Hub
- Testing and acceptance of the Hub and its associated facilities

Key Environmental and Social Impact Considerations in Phase 3

From an environmental and social impact perspective, key considerations in this phase shall include:

- Compliance with ESMP
- Participation of stakeholders in the launch event

3.4.4 Phase 5: Decommissioning Phase

This is the past phase of the AIH project, and it is predicated majorly on the forceful closure of the project. This project is envisaged to be a continuous venture upon operationalization. However, in the event of an unavoidable closure, then the decommissioning phase shall be triggered. The focus is this stage is on the restoration of the environment to its original state before exit. The key activities that are expected in this phase shall include:

- Dismantling of the AIH facility
- Rehabilitation and restoration of the environment to its original state
- Compensation of staff

These are further detailed in the Environmental and Social Management Plan (ESMP)

Key Environmental and Social Impact Considerations in Phase 5

From an environmental and social impact perspective, key considerations in this phase shall include:

- Proper waste management and evacuation
- Compensation of the local community and Staff members
- Restoration of the environment
- Proper evacuation of the facility construction materials from the site

3.5 Other Relevant Considerations for The Project

In addition to the considerations captured above, other relevant factors worthy of note that are instrumental to the success of this project are detailed below:

3.5.1 Water Needs and Sources

Water is a vital input needed for the successful completion of the construction phase of this project as well as the smooth running of its operations. An estimated 1.2 million litres of water shall be needed daily. The project shall source for water for its construction and operations phases from ground water sources, through a set of industrial borewells.

Additionally, recycled water from the facilities, and harvested rainwater shall be used to compliment the industrial bore wells and augment the facility's daily water needs.

3.5.2 Waste Management

On this project, it is envisaged that different types of wastes shall be generated across the various stages of the project lifecycle. Some of these are detailed below:

- Organic wastes like stems, leaves, husks, straws, peels, seeds, and roots shall be generated in the operational life of this project. Though non-hazardous, these wastes shall be converted to other by-products like animal feeds and sold in the hub.

- Liquid wastes like effluent produced from cleaning, washing, and processing operations, containing organic matter, nutrients, pesticides, and other contaminants shall be generated in the operational phase of this project. To address this, effluent treatment will be done through a series of anaerobic and aerobic treatment processes in line with the National Effluent Limitation Regulation, S.1.8 of 1991 (No. 42, Vol. 78, August,1991). The treated effluent will meet the standard to be supplied back to the rice mills for boiler feed and for washing in other units.

Furthermore, a sewage collection and treatments system consisting of an underground sewerage network shall be constructed to collect sewage from each plot and convey it to a sewage treatment plant (STP). There it will be treated to acceptable standards and recycled for irrigation purposes.

3.5.3 Sources of Inputs

The inputs required for the various phases of this project can be classified into manpower, materials, and machinery. In all cases, inputs for the implementation of this project shall first be sourced locally in line with the Nigerian Local Content Act 2010. Where these inputs cannot be sourced from the community, the state, or the Nation (Nigeria) then they shall be sourced for internationally.

Agricultural inputs that shall serve as raw materials for the AIH (including rice paddy, maize and yam) shall be sourced from neighboring farming communities and clusters like the Karim Lamido Rice and Maize Cluster.

3.5.4 Sources of Power

On this project, it is estimated that the aggregate power demand of the Hub shall be about 7MW for both industrial and domestic use. Considering that the proposed location for the AIH does not fall within the coverage of the National Power Grid, the Hub shall install a gas based captive power plant of capable of generating 7MW of electricity or more and shall distribute it to the entire AIH and its environs. Also, solar street lighting shall be used for outdoor illumination to augment the electricity needs.

3.6 Project Implementation Schedule

The AfDB SAPZ-II intervention has a completion period of six (6) years and within this period, the Agro-Industrial Hubs is expected to be completed between the third quarter of 2022 and the first quarter of 2025. The Gantt Chart below represents the project implementation schedule for the SAPZ-II Program.

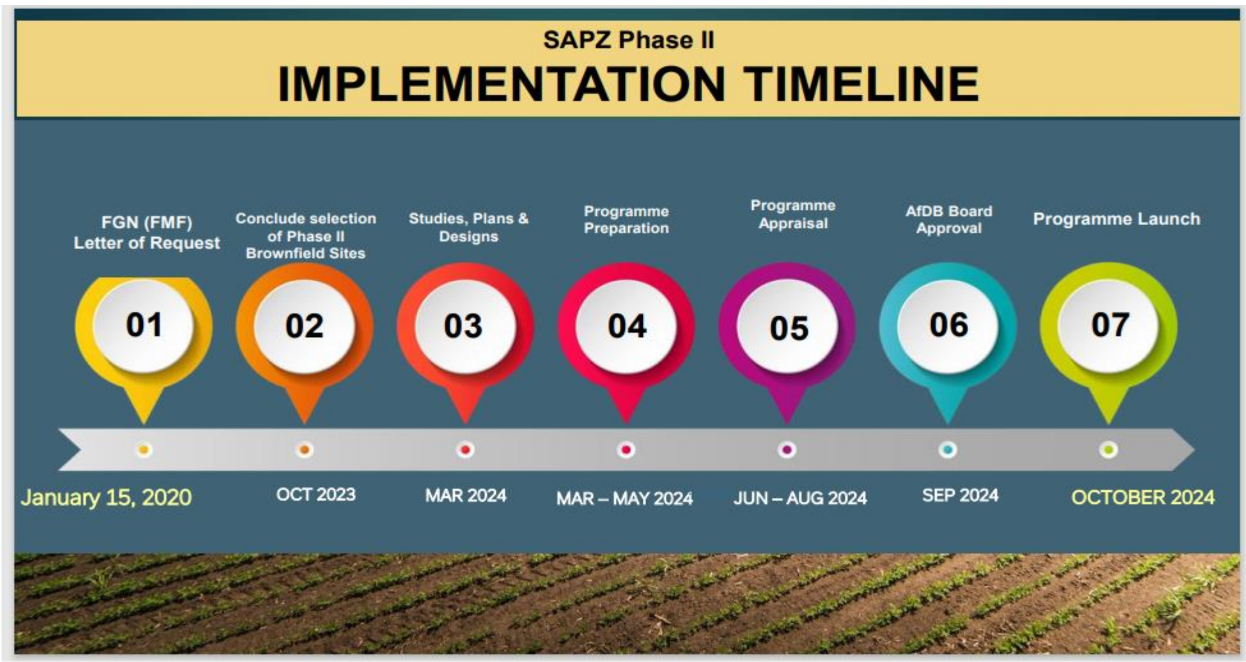


Figure 3.4: SAPZ Program Implementation Schedule

CHAPTER FOUR
DESCRIPTION OF EXISTING ENVIRONMENT

4.0 Introduction

This chapter offers an overview of the existing environmental and socio-economic conditions within the Project area, serving as a benchmark against which the potential impacts of the proposed Project are evaluated. Establishing a comprehensive environmental baseline condition is integral to the Environmental and Social Impact Assessment (ESIA) process, providing essential information on the characteristics and features of the project environment.

Furthermore, it serves as the scientific foundation for predicting, evaluating, and mitigating the impacts of project activities on the environment, monitoring environmental changes, and supporting decision-making processes throughout the project lifecycle, including management and decommissioning.

The components covered include:

A. **Physical environment:** encompassing meteorology, geology, soil type and distribution, and surface/groundwater characteristics.

B. **Biological environment:** detailing the location and distribution of flora and fauna characteristics.

C. **Socio-economic and health conditions:** describing the demographic structure, cultural aspects, social and health status of affected communities, as well as outcomes of consultations and stakeholder engagement.

Any project-induced changes will have both positive and negative impacts on residents, particularly the biophysical surroundings. Therefore, the environmental characterization presented in this ESIA is based on information gathered from site visits to the project area, supplemented by relevant literature. The project's Area of Influence (AoI) for the proposed Special Agro-Processing Zone (SAPZ) – Agro-Industrial Hub (AIH) Project at Lau was defined as the region surrounding the project where significant environmental and social effects resulting from project activities would be observed. The AoI encompassed the entire 339HA of the project area, as well as sections of the surrounding environment within a radius of approximately 5 kilometers. This AoI intersected with other small and rural communities, including Garin Dogo, Garin Mallam, Kaudat, Minda, and Riggi.

4.1 Baseline Sampling Methodology Framework

The methods utilized for collecting and documenting the environmental baseline condition of the project area are outlined as follows. The baseline condition of the proposed location was established through literature research and field data gathering, followed by laboratory analyses of field samples. These tasks were conducted by a multidisciplinary team comprising environmental scientists and engineers. The procedures followed adhered to both FMEnv and international standards and best practices, incorporating the following elements:

- Development of an Environmental Impact Assessment (EIA) Terms of Reference (ToR).
- Site Verification.
- Designing a field sampling strategy and rationale to meet regulatory requirements.
- Pre-mobilization activities, including calibration checks and job hazard analysis.
- Collection, handling, and storage of field samples in the field.
- Onsite supervision and oversight by regulators.
- Demobilization and transfer of samples to FMEnv accredited laboratories for analysis.

4.1.1 Study Area Definition

The site is situated in the Northern part of Taraba State at Garin Malam in Lau LGA. Lau LGA is bounded to the North by the River Benue and Karim Lamido LGA and to the South by Ardo Kola, Jalingo and Yorro LGAs (Figure 4.1).

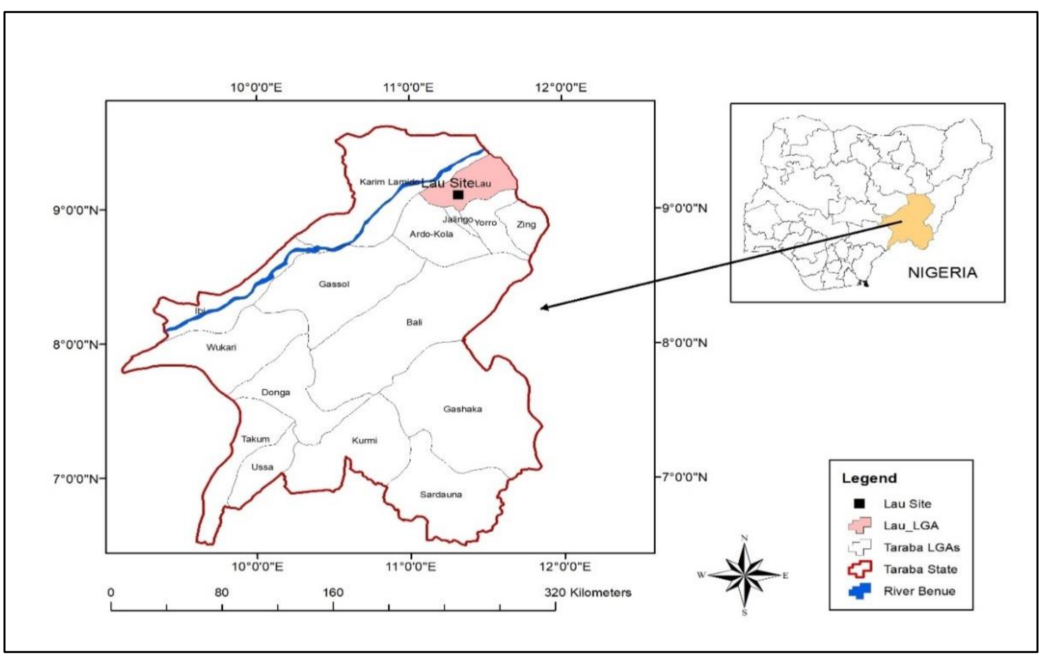


Figure 4.1: Lau LGA and the proposed site

The Lau proposed site is located between longitudes 11°18′30″E and 11°20′30″E of the Prime Meridian and between Latitudes 09°05′30″N and 09°07′00″N of the Equator. It covers an Area of 339.00 Hectares (Ha) and a Perimeter of 7.90 Kilometers (Figures 4.2).

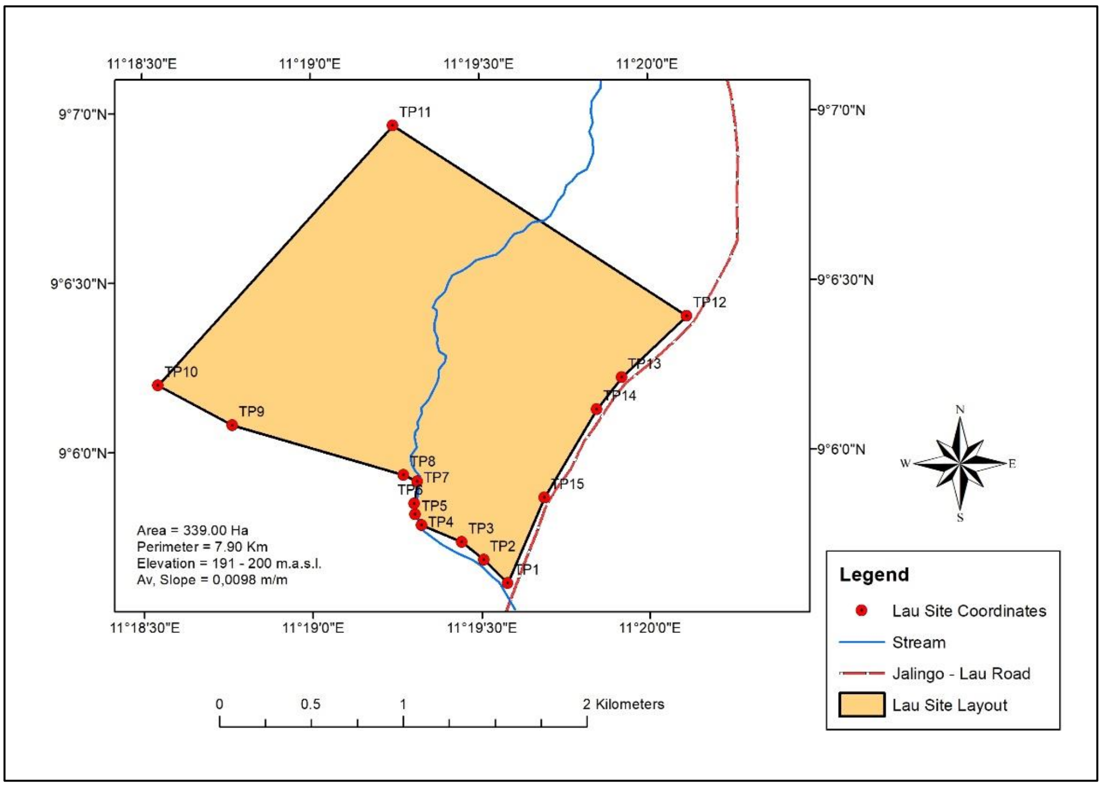


Figure 4.2: Layout of the Lau proposed site

The Geospatial coordinates of the site boundary based on field survey are presented on Table 1. The coordinates were obtained using the Garmin Global Positioning System (GPSMAP 79S) with an accuracy level of 3.00 meters.

S/NO.	LONGITUDE	LATITUDE	POINTS
1	11° 19′ 34.47″E	09° 05′ 37.01″N	TP1
2	11° 19′ 30.03″E	09° 05′ 41.32″N	TP2
3	11° 19′ 25.88″E	09° 05′ 44.03″N	TP3
4	11° 19′ 19.07″E	09° 05′ 46.93″N	TP4
5	11° 19′ 17.65″E	09° 05′ 49.26″N	TP5
6	11° 19′ 17.48″E	09° 05′ 51.23″N	TP6
7	11° 19′ 18.41″E	09° 05′ 55.15″N	TP7
8	11° 19′ 16.07″E	09° 05′ 56.06″N	TP8
9	11° 18′ 45.57″E	09° 06′ 05.19″N	TP9
10	11° 18′ 32.14″E	09° 06′ 12.42″N	TP10
11	11° 19′ 14.32″E	09° 06′ 58.43″N	TP11
12	11° 20′ 06.59″E	09° 06′ 24.33″N	TP12
13	11° 19′ 54.84″E	09° 06′ 13.33″N	TP13
14	11° 19′ 50.31″E	09° 06′ 07.82″N	TP14
15	11° 19′ 41.04″E	09° 05′ 52.33″N	TP15

Table 4.1: Geospatial coordinates of the Lau proposed site.

Source: ***Bolben*** *Field Survey (2024)*

4.1.2 Baseline Data Collection

a. Environmental Baseline Sampling:

- Field surveys to assess the current status of environmental components such as air quality, water quality, soil characteristics, flora and fauna, and natural resources were conducted.
- Sampling techniques to collect representative data, including water and soil samples for laboratory analysis were utilized.
- Remote sensing and Geographic Information Systems (GIS) technology to map land cover/use, vegetation types, and ecological habitats was employed.

b. Socio-economic Baseline Sampling:

- Engagement with local communities through participatory methods, including interviews, focus group discussions, and community meetings, to understand socio-economic dynamics, cultural practices, and livelihood patterns.
- Conducted household surveys to gather demographic information, socio-economic indicators, and community perceptions regarding the proposed project.
- Identified and documented key social assets, including community infrastructure, cultural heritage sites, and customary land use practices.

4.1.3 Stakeholder Engagement

- Established communication channels with relevant stakeholders, including local communities, government agencies, non-governmental organizations (NGOs), and other interested parties.
- Conducted stakeholder consultations to solicit feedback, address concerns, and incorporate local knowledge into the baseline data collection process.

The SAPZ Project Stakeholder to be consulted will include:

- Federal Ministry of Environment (FMENV)
- Taraba State Urban and Regional Planning Board
- Taraba State Ministry of Environment
- Taraba State Ministry of Agriculture
- Lau Local Government Area (LGA)
- Federal Ministry of Agriculture and Rural Development (FMARD)
- Project Affected Persons (PAPs) and affected communities
- Community Based Organizations

4.1.4 Data Analysis and Interpretation

- Analyzed collected data to establish baseline conditions and trends across environmental and social parameters.
- Interpreted findings to identify potential environmental and social sensitivities, vulnerabilities, and areas of concern.
- Utilized statistical analysis and spatial modeling techniques to quantify and visualize baseline data.

4.1.5 Quality Assurance and Control

- Ensured the accuracy, reliability, and validity of collected data through rigorous quality assurance and control measures.

- Implemented standardized protocols for data collection, sample handling, and analysis to minimize errors and biases.
- Validated results through peer review, expert consultation, and cross-checking with existing literature and datasets.

4.1.6 Previous Literature Review and Environmental Reports

A comprehensive review of international standards, particularly those set by organizations like the Environmental Protection Agency (EPA), European Bank and the International Finance Corporation (IFC), along with national environmental regulations, was conducted to understand the applicable environmental safeguards.

Additionally, various relevant publications related to similar projects and environmental contexts were consulted. These publications were available in the public domain and via request, including information gathered from previous environmental and socioeconomic studies conducted by the Taraba State Ministry of Environment and Urban Development (TSMEUD) on the Environmental Impact Assessment (EIA) of Taraba State.

A. Desktop Research and Secondary Public Data

The systematic acquisition of data concerning the regional environmental and meteorological characteristics, geology, ecological profile, and socio-economic elements of the project area, as well as similar environments, involved consulting relevant textbooks, engaging in informed stakeholder discussions, reviewing research materials, articles, scientific magazines, and journals.

❖ **Secondary Public Data**

Baseline data, particularly pertaining to the social and health conditions of the project area, were obtained from secondary public databases. The sources consulted for this study include, but are not limited to:

- National Population Census, 2006.
- Nigeria Demographic and Health Survey, 2018.
- National Bureau of Statistics, 2020.
- Nigerian Meteorological Agency (NIMET), 1991 – 2020.

❖ **Field Sampling Design**

This section of the report provides a brief overview of the data gathering processes conducted, including air quality and noise measurement, soil sampling, surface and groundwater sampling, and socio-economic assessments.

❖ **Study Team**

The scientific team involved in the study comprised BOLBEN Energy and Environmental Services Ltd. multidisciplinary team, representatives from FMEnv, and QAQC personnel. (TSMEnv&UD)

B. Reporting

- Compiled baseline data, analysis results, and methodological details into a comprehensive Baseline Sampling Report.
- Presented findings in a clear, accessible format, incorporating maps, tables, and graphs to facilitate understanding and decision-making.
- Documented any limitations, uncertainties, or gaps in the baseline data and propose recommendations for further study or data collection.

The Baseline Sampling Methodology provided a structured framework for systematically collecting and analyzing baseline data essential for the ESIA process of the Proposed Special Agro-Processing Zone (SAPZ) – Agro-Industrial Hub (AIH) Project at Lau. By establishing a robust baseline understanding of environmental and social conditions, this methodology supports informed decision-making and proactive management of potential impacts throughout the project lifecycle (Fischer, 2010).

4.2 Number of Samples or Parameter

The number of samples and parameters were based on standard approach which involves selecting a representative number of samples across various environmental and social parameters to ensure comprehensive coverage and accurate assessment. The general description of the parameters is:

4.2.1 Environmental Parameters

Air Quality: Samples may include measurements of pollutants such as particulate matter (PM_{10} and $PM_{2.5}$), nitrogen oxides (NO_x), sulfur dioxide (SO_2), and volatile organic compounds (VOCs) taken at strategic locations within and around the project area.

Noise Quality: Noise quality will be monitored to assess the impact of project activities on the ambient noise levels. Monitoring will be conducted at strategic locations within and around the project site. Sound level meters will be used to record noise levels in decibels (dB).

Water Quality: Samples from surface water bodies, groundwater wells, and potentially impacted water sources were collected and analyzed for parameters such as pH, dissolved oxygen, turbidity, nutrients (nitrogen and phosphorus), heavy metals, and organic pollutants.

Soil Characteristics: Soil samples were taken at various depths and locations to assess parameters such as texture, organic matter content, nutrient levels (nitrogen, phosphorus, potassium), pH, and presence of contaminants such as heavy metals and pesticides.

Biodiversity: Sampling methodologies involved ecological surveys, including vegetation assessments, wildlife inventories, and habitat assessments to document species diversity, abundance, and distribution patterns.

4.2.2 Socio-Economic Parameters

Demographics: Household surveys and census data collection provide information on population demographics, including age structure, gender distribution, household size, and income levels.

Livelihoods: Surveys and interviews are conducted to assess local livelihood strategies, employment patterns, sources of income, and dependence on natural resources for livelihoods.

Community Infrastructure: Documentation of existing infrastructure such as schools, health facilities, roads, and water supply systems are essential to understand community needs and potential impacts on infrastructure.

Cultural Heritage: Identification and documentation of cultural heritage sites, traditional knowledge, and indigenous practices help assess potential impacts on cultural resources and heritage preservation.

4.4 QA/QC for Sampling

In the Environmental and Social Impact Assessment (ESIA) for the Proposed Special Agro-Processing Zone (SAPZ) – Agro-Industrial Hub (AIH) Project at Lau, ensuring the accuracy, reliability, and validity of collected data and sampling is paramount. To achieve this, rigorous quality assurance and control measures will be implemented throughout the baseline sampling process. Standardized protocols for data collection, sample handling, and analysis will be established and adhered to meticulously, minimizing errors and biases. By following these protocols, we aim to generate data that accurately represents the environmental and social conditions within and surrounding the project area.

Moreover, validation of results will be a critical component of the ESIA process. Findings from baseline sampling will undergo thorough scrutiny through various validation mechanisms. Peer review by subject matter experts, consultation with stakeholders, and cross-checking with existing literature and datasets will be conducted to ensure the robustness and credibility of the collected data and analysis outcomes. This validation process not only enhances the reliability of the ESIA findings but also instills confidence in stakeholders regarding the accuracy and integrity of the assessment.

By prioritizing accuracy, reliability, and validity in data collection and sampling, and implementing stringent quality assurance and control measures, the ESIA for the SAPZ – AIH Project at Lau will uphold the highest standards of scientific rigor and transparency. This commitment to methodological excellence not only facilitates informed decision-making but also fosters trust and credibility among stakeholders. Ultimately, a well-founded ESIA ensures that the potential environmental and social impacts of the project are thoroughly assessed and managed, contributing to sustainable development and responsible project implementation.

4.5 Test Laboratories

Selection of Test Laboratories for Environmental and Social Impact Assessment (ESIA) for the Proposed Special Agro-Processing Zone (SAPZ) – Agro-Industrial Hub (AIH) Project at Lau:

4.5.1 Water Quality Testing Laboratory

The selection criteria for laboratories conducting water quality testing for the Project included accreditation by relevant regulatory authorities and proficiency in testing parameters such as pH, dissolved oxygen, BOD, COD, TSS, nutrients, and heavy metals. Additionally, the laboratories should demonstrate experience in conducting water quality assessments for similar industrial and agricultural projects. To ensure high-quality analysis, collaboration with renowned environmental testing laboratories with expertise in water quality analysis is recommended.

4.5.2 Air Quality Monitoring Laboratory

For air quality monitoring, laboratories were accredited by regulatory agencies and proficient in monitoring parameters including particulate matter, nitrogen oxides, sulfur dioxide, carbon monoxide, and volatile organic compounds. It was essential for the selected laboratories to have a track record of conducting air quality monitoring for industrial projects in various environmental settings. To ensure reliable results, partnering with established air quality monitoring firms equipped with state-of-the-art monitoring equipment and expertise was involved.

4.5.3 Soil Testing Laboratory

For soil testing, it is imperative to select an accredited laboratory proficient in soil pH, organic matter content, nutrient analysis, heavy metal testing, and soil compaction assessment. The chosen laboratory should have extensive experience in soil testing for both agricultural and industrial projects, encompassing soil fertility assessment and contamination analysis. To ensure accurate and reliable results, collaboration with reputable soil testing laboratories with a proven track record in assessing soil quality in agricultural zones is recommended.

4.5.4 Biodiversity Assessment Laboratory

For biodiversity assessment, a specialized laboratory with expertise in species identification, habitat assessment, and ecological impact analysis was essential. It is crucial that the selected laboratory demonstrates a proven track record in conducting biodiversity assessments for large-scale development projects across diverse ecosystems. To ensure thorough and accurate assessments, engagement with reputable biodiversity research institutions or environmental consulting firms possessing expertise in ecological surveys and impact assessments is recommended.

4.6 Description of Test Parameters

Description of Test Parameters for Environmental and Social Impact Assessment (ESIA) for the Proposed Agro-Industrial Hub (AIH) Project at Lau included:

4.6.1 Water Quality

- **Test Parameters**: pH level, dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), nutrients (nitrogen and phosphorus), heavy metals (if applicable).
- **Testing Frequency**: Regular sampling and testing of surface water and groundwater sources before, during, and after project implementation.
- **Methodology**: Standard water quality testing methods recommended by relevant regulatory authorities or international standards.

4.6.2 Air Quality

- **Test Parameters**: Concentrations of particulate matter (PM10 and PM2.5), nitrogen oxides (NOx), sulfur dioxide (SO2), carbon monoxide (CO), volatile organic compounds (VOCs), ozone (O3).
- **Testing Frequency**: Continuous monitoring of air quality at project site and surrounding areas using fixed or mobile monitoring stations.
- **Methodology:** Utilization of approved air quality monitoring equipment and methodologies in accordance with regulatory standards.

4.6.3 Soil Quality

- **Test Parameters**: Soil pH, organic matter content, nutrient levels (nitrogen, phosphorus, potassium), soil texture, heavy metal concentrations, soil compaction.
- **Testing Frequency**: Soil sampling and testing before project commencement and periodically during and after project activities.
- **Methodology**: Standard soil sampling and testing techniques recommended by soil science associations or regulatory agencies.

4.6.4 Biodiversity

- **Test Parameters**: Species diversity, abundance, and distribution (flora and fauna), habitat quality assessment, presence of endangered or threatened species.
- **Testing Frequency**: Baseline biodiversity assessments conducted before project initiation, with periodic monitoring during project implementation and post-project assessments.
- **Methodology**: Utilization of recognized biodiversity assessment methods such as habitat surveys, transect sampling, and species inventories.

4.6.5 Social Impact

- **Test Parameters**: Livelihood impacts, community health and safety, social cohesion, cultural heritage preservation, access to services and resources, gender and equity considerations.
- **Testing Frequency**: Ongoing social impact assessments conducted through stakeholder consultations, surveys, and participatory methods.
- **Methodology**: Utilization of social impact assessment tools and frameworks, including community perception surveys, focus group discussions, and participatory rural appraisal techniques.

4.7 Field Instrumentation and Survey Activities

Activities conducted before and after the field exercise are outlined below.

A. Pre-Mobilization Checks

Before the wet season field data gathering, the following activities were pre-planned:

B. Health, Safety, and Security Plan and Field Activities Plan

BOLBEN prepared a detailed Health, Safety, and Security Plan along with a Field Activities Plan prior to field mobilization. These plans addressed potential risks associated with the fieldwork and outlined preventive measures to be followed during various activities conducted during the field data gathering exercise.

C. Equipment Used and Materials Checklist

The equipment and materials utilized for data collection included Personal Protective Equipment (PPE), sampling tools, containers, handheld devices, hand auger, preservatives, first aid box, etc. These items were assessed for adequacy, maintenance, calibration status, and field readiness.

Soil Testing Kits: Including pH meters, soil moisture meters, and nutrient testing kits to evaluate soil quality and fertility.

Water Quality Testing Equipment: Such as water quality meters, turbidity meters, and dissolved oxygen meters to assess the suitability of water sources for processing and irrigation.

Weather Monitoring Tools: Including weather stations and data loggers to collect meteorological data like temperature, humidity, and rainfall patterns.

GIS and Remote Sensing Tools: Geographic Information Systems (GIS) software and remote sensing technology to map land use, vegetation cover, and natural resources within the SAPZ area.

Energy Assessment Equipment: Energy meters and power analyzers to measure energy consumption and identify opportunities for energy efficiency improvements.

Agricultural Machinery: Tractors, plows, and tillage equipment for field preparation and crop cultivation assessments.

Water Management Equipment: Irrigation equipment such as drip irrigation systems or sprinklers to assess water distribution efficiency and irrigation needs.

Laboratory Equipment: Including spectrophotometers, chromatographs, and incubators for analyzing agricultural products, soil samples, and water quality parameters.

Surveying Instruments: Total stations, GPS receivers, and drones for land surveying and mapping to establish property boundaries and topographical features.

Communication and Data Collection Tools: Mobile devices, tablets, and data loggers for collecting field data, conducting surveys, and recording observations.

Safety Gear: Personal protective equipment (PPE) including gloves, goggles, and helmets to ensure the safety of field workers during data collection activities.

Analytical Software: Statistical analysis software and modeling tools for processing and interpreting collected data to generate baseline reports and recommendations.

Table 4.2: Environmental Field Sampling Materials, Equipments, and Methods.

Field Sampling Equipment			
S/N	**Item**	**Objective**	**Qty**
1	Hand Auger	For soil sampling	1
2	Camera	For pictorial documentation	1
3	In-situ meter	Water salinity measurement	1
4	Multiparameter analyzer	Air quality, temperature, total dissolved solids, conductivity and pH	1
5	Bailers / Water Sampler	Surface and groundwater	1
6	Markers / disposable gloves	Labels	2
7	GPS	Sampling locations and sample coordinates	2
Field Sampling Materials			
S/N	**Item**	**Objective**	**Qty**
1	0.5 litre plasticwater bottles	Groundwater Heavy Metals	2
2	1 litre plasticwater bottles	Groundwater Physicochemical	2
3	250ml amberbottles	Groundwater Microbial	2
4	Ziploc bag	Soils	6
5	Paper masking tape	Labels	2
6	Markers / disposable gloves	Labels	3
7	Plaid bags	Samples and materials	1
8	Coolers and icepacks	Samples presentation and transport	1

9	Safety boots	Foot wear PPE	2
10	Field notes / work sheets	Daily work achieved and targets	2
11	Chain of custody forms	Samples logging and tracking	5
12	Attendance sheet	Records	3

Environmental Component	**Method of collection**
Soil / Land use	Dutch stainless-steel hand auger, core samplers, interviews, and direct observation.
Surface and Groundwater	Grab sampling, streams, wells and boreholes, interviews, and direct observation.
Air Quality and Noise	Multiparameter analyzer, observations and publications.
Vegetation	Transects, key informant interviews, direct observation, and sample collection.
Wildlife	Direct observation, key informant interviews, and indirect count method.
Socio-economics / Health	Interviews, questionnaires, focus group discussions, and publications.

D. Mobilization

Prior to set-out, certain checks were carried out to confirm that the equipment and materials were suitable for intended purpose. These checks comprised of the following:

- Inspecting instrument for physical damage;
- Checking the battery condition of the GPS, camera, air and noise meters, etc.;
- Appropriate storage of equipment to avoid exposure to extreme temperature and moisture conditions;
- Review alternative movement routes; and
- Appraise security updates.

E. Samples Handling

The following sample collection and handling were carried out in accordance with FMEnv Guidelines and Standards.

- All sampling equipment was maintained in excellent condition, calibrated against international standards and adequate steps were taken to ensure that they function normally.
- Only new and thoroughly washed, rinsed and sterilized sampling containers were used.
- For heavy metal determination, sampling bottles were used and were rinsed with a solution of one-part nitric acid to four parts water, followed by copious amounts of distilled water.
- Water samples for BOD determination were collected in amber oxygen bottles and kept away from light source.
- Soil and ground water samples were preserved as soon as they were collected.
- Heavy metal samples were acidified to a pH of about 2 with concentrated H_2SO_4 respectively.
- All samples were adequately labeled to preserve their identity. Label included project title, sample code number, source, sampling date, etc.
- All samples were safely packed and transported to the laboratory for analysis.

F. Sample Storage

All samples were packaged, clearly labelled and stored carefully to avoid any disturbance during transport to the laboratory. To compensate potential damage and loss of samples during the transportation, spare samples were taken for each analysis.

G. Sample Preservations

Following sampling, each sample was properly labelled, arranged, and preserved in accordance with BOLBEN sample QAQC procedures.

4.8 Environmental Quality Analysis

Laboratory analyses for the environmental samples collected were analyzed and processed by Mozuk Scientific & Analytics Laboratories Ltd., at Gudu, Abuja. Analyses were generally in line with international American Society for Testing and Material (ASTM) and American Public Health Association (APHA) as well as FMEnv Standard protocols. Other QA/QC measures adopted are:

- Use of trained personnel at all phases of the study;
- Written analytical standard operating procedures were followed during analyses; and
- Outline auditing and checking of analyses results, including control solutions and mid-point standards, were introduced into every batch or ten samples as applicable, and analyses for which deviation of these quality control/mid–point standards are outside 90 to 110% of expected value were repeated.

The samples collection, analyses and reporting for the existing environment baseline were subject to recommended quality assurance standards in accordance with the stipulated regulatory bodies in Nigeria.

4.8.1 Sampling Program

The field studies involved both quantitative sampling and observations of various environmental components within the project's Area of Influence (AoI). Primary data for representation was collected during the dry season and harmonized with the wet season secondary data, in Lau, Taraba State. These components included noise levels, air quality, groundwater quality, soil characteristics, and vegetation. All sampling locations were accurately geo-referenced using a handheld Global Positioning System (GPS) device.

The objective of the sampling program is to obtain comprehensive baseline system within limited time and budget constraints. The sampling locations were selected based on higher ecological and environmental sensitivity and current and previous usage of certain areas. Positioning at each sampling station during the fieldwork activities was achieved with the aid of a hand-held Garmin Global Positioning System (GPS) V, (model CZ 99052-20). At each sampling station, coordinates at which sampling actually took place were documented (Table 4.3).

Figure 4.3a and b: Selected Soil Sampling Activity

Table 4.3: Geographical Coordinates of the Sampled Stations

S/N	Code/Location Description	Latitude (N)	Longitude (E)
Lau Community			
Groundwater Sample			
1.	GW_1	9.109956	11.337830
2.	GW_2	9.119124	11.337261
Soil Sample			
1.	SS_1	9.093637	11.326147
2.	SS_2	9.096712	11.326475
3.	SS_3	9.100166	11.327602
4.	SS_4	9.100600	11.326910
5.	SS_5	9.102276	11.328310
6.	SS_6	9.101546	11.327869
7.	SS_7	9.100782	11.328310
8.	SS_8	9.106185	11.334183
9.	SS_9	9.107249	11.333077
10.	SS_{10}	9.107298	11.334640
11.	SS Control 1	9.097420	11.324912
12.	SS_{12}	9.099030	11.327020
13.	SS_{13}	9.097958	11.329267
14.	SS_{14} Control 2	9.117359	11.337225

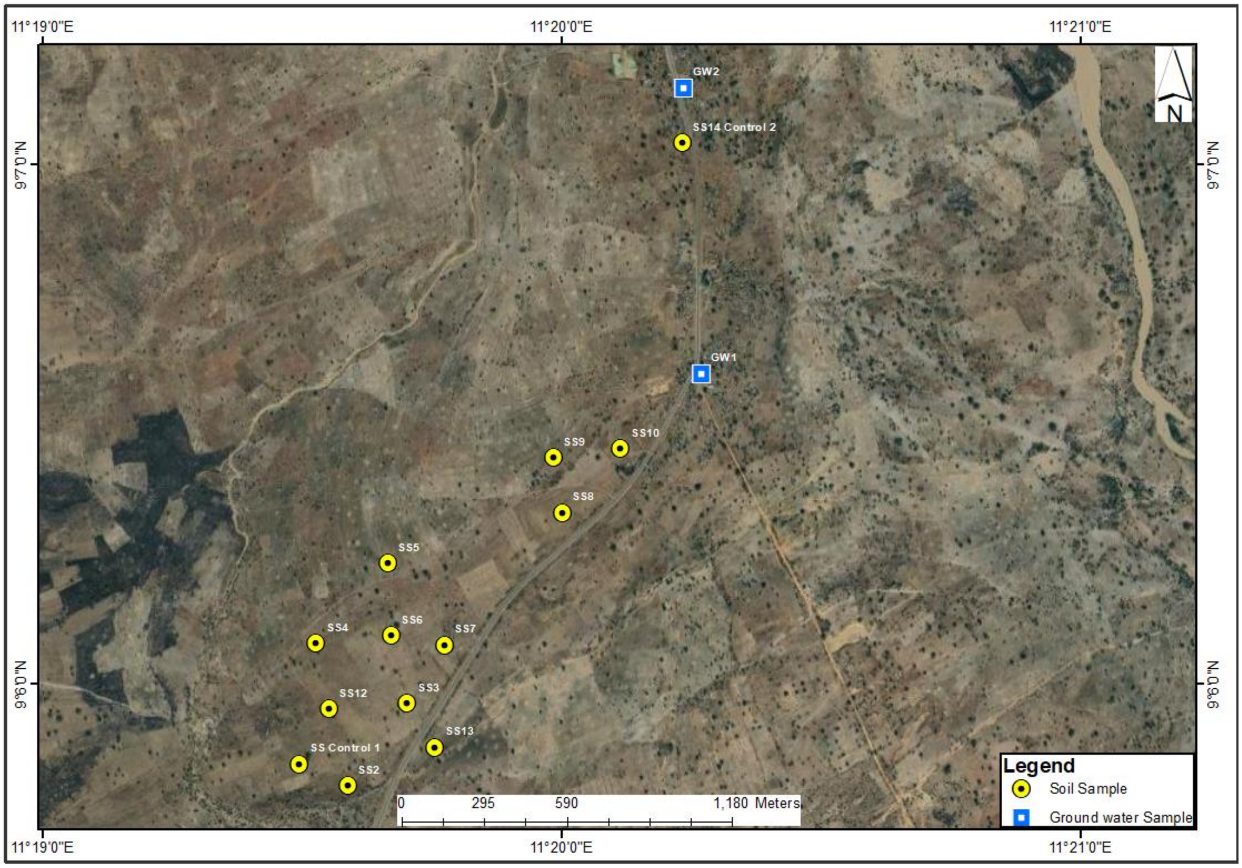


Figure 4.3: Sampling Points for Soils and Groundwater

4.8.2 Soil Quality

The soils at the Lau proposed site originate from metasediments of the Undifferentiated Basement Complex and older granite gneiss rock (saprolite) (Federal Department of Agricultural Land Resources – FDALR, 1990). They vary from Grossarenic typic kandiustalfs to Typic haplustepts (Osujieke et al., 2020), generally being deep, well-drained loam sand with sandy loam and clay loam sub-surfaces (FDALR, 1990). These soils have low organic carbon, total nitrogen, and available phosphorus, indicating moderate to low fertility, which necessitates fertilizer use for crops like yam and cassava (Osujieke et al., 2020). Despite this, the hard-indurated lateritic layers in the subsoil provide a solid base for building foundations.

Table 4.4a; Table 4.4b; and Table 4.4c presents the soil physicochemical and microbial characteristics for sampling stations SS1, SS2, and SS3; SS4, SS5, and SS6; and SS7, SS8, SS9 and SS10 Control respectively at various depths (Top and Sub). These results have been compared with the standards set by the Federal Ministry of Environment (FMEnv), Nigeria, and the World Health Organization (WHO) to determine soil environmental and agricultural quality.

Soil Color: The soil color varies from grey (6/1) in SS1 and SS2 to light reddish brown (6/4) in SS3 (Table 4.4a). SS4 has light brown (6/3) at the top and light reddish brown (7/4) in the subsoil. SS5 shows reddish yellow (7/6) at the top and reddish brown (5/4) in the subsoil. SS6 has consistent light reddish brown (7/4) in both top and subsoil layers (Table 4.4b). The soil color remains consistent across most stations, with SS7, SS8, and SS10 Control showing light brown (6/3) in both top and subsoil layers. SS9 has a pinkish grey (6/2) hue in both layers (Table 4.4c). While soil color is not regulated, it provides insights into organic matter content and mineral composition. The soil color varies across the stations, reflecting different compositions and environmental conditions. While soil color is not specifically regulated by FMEnv or WHO, the variation in color indicates differences in soil composition and conditions. This variation does not directly affect soil quality based on regulatory standards but provides insights into the soil's physical characteristics.

pH: The pH values range from 5.78 to 6.43 for SS1, SS2 and SS3, indicating slightly acidic to neutral conditions (Table 4.4a). From Table 4.4b, pH levels range from 5.65 to 6.99. SS4 shows slightly acidic topsoil (5.65) with neutral subsoil (6.98). SS5 and SS6 have near-neutral pH values (6.92 to 6.99). From Table 4.4c, pH values range from 5.31 to 6.34. SS7 to SS9 have slightly acidic pH levels (5.31 to 5.91), whereas SS10 Control has a near-neutral pH (6.23 to 6.34). According to FMEnv and WHO standards, the optimal pH range for agricultural soils is 6.0 to 8.5. Most of the observed pH values are slightly below this range, suggesting slightly acidic conditions. This may necessitate lime treatment to neutralize the acidity for optimal agricultural productivity.

Redox Potential: The redox potential values for SS1, SS2, and SS3 ranges between 390.40 mV and 420.00 mV, indicating moderately oxidizing conditions (Table 4.4a). For SS4, SS5, and SS6, the redox potential values range from 368.00 mV to 495.00 mV. SS4 exhibits higher redox potential (495.00 mV), indicating more oxidizing conditions, while SS5 and SS6 have moderate values (368.00 to 399.00 mV) (Table 4.4b). The redox potential values for SS7, SS8, SS9, and SS10 range from 350.00 mV to 431.00 mV. SS7 has a lower redox potential (350.00 to 390.00 mV), while SS8 shows higher values (422.00 to 431.00 mV) (Table 4.4c). These values indicate varying degrees of soil aeration, with higher values suggesting more oxidizing conditions. Although there are no specific standards for redox potential, but these values suggest varying degrees of soil aeration, influencing nutrient availability and microbial processes.

Electrical Conductivity (EC): The electrical conductivity ranges from 183.70 µS/cm to 430.00 µS/cm for SS1, SS2, and SS3 (Table 4.4a), reflecting the soil's ability to conduct electric current. For SS4, SS5, and SS6, electrical conductivity ranges from 300.20 µS/cm to 478.00 µS/cm (Table 4.4b). SS4 has lower values (300.20 to 436.00 µS/cm) compared to SS5 and SS6 (444.20 to 478.00 µS/cm). Electrical conductivity ranges from 375.00 µS/cm to 465.00 µS/cm for SS7, SS8, SS9 and SS10 (Table 4.4c). All of these EC values are well within the acceptable limit of less than 2000 µS/cm set by FMEnv and WHO, indicating low salinity levels favorable for plant growth and suitable for agricultural purposes.

Table 4.4a: Soil Physicochemical and Microbial Characteristics

S/N	PARAMETER		UNIT	*SS1*		*SS2*		*SS3*	
				A (Top)	B (Sub)	A (Top)	B (Sub)	A (Top)	B (Sub)
1.	Color		-	Grey 6/1	Light grey 7/1	Grey 6/1	Grey 6/1	Light reddish brown 6/4	Light reddish brown 6/4
2.	pH		-	6.15	6.43	5.78	5.93	5.90	6.20
3.	Redox Potential		-	395.00	415.00	409.00	420.00	390.40	400.30
4.	Electrical Conductivity		µS/cm	416.00	183.70	342.00	411.00	430.00	378.00
5.	Temperature		ºC	29.50	30.45	31.20	30.56	32.40	35.23
6.	Texture	Sand	%	34.20	24.30	65.20	60.60	55.30	60.90
		Silt		56.80	65.20	24.30	32.00	24.70	21.70
		Clay		9.00	10.50	10.50	7.40	20.00	17.40
7.	Grain Size		Mm	≤ 2.00	≤ 2.00	≤ 2.00	≤ 2.00	≤ 2.00	≤ 2.00
8.	Moisture Content		%	2.15	2.22	2.00	2.56	2.14	2.92
9.	Total Organic Matter		mg/kg	12.016	10.588	15.36	13.33	16.94	17.30
10.	Total Organic Carbon		mg/kg	7.60	7.30	7.20	6.54	6.03	6.67
11.	Total Nitrogen		mg/kg	29.93	26.00	23.40	22.45	23.78	32.00
12.	Total Phosphorus		mg/kg	1.68	1.59	2.78	3.48	1.92	3.43
13.	Ammonium		mg/kg	1.98	2.32	0.78	1.89	2.09	2.22
14.	Oil and Grease		mg/kg	0.01	<0.001	<0.001	<0.001	<0.001	<0.001
15.	THC		mg/kg	2.09	2.60	1.90	1.11	2.00	2.18
Exchangeable Cations									
16.	Calcium (Ca^{2+})		Cmol/Kg	0.50	0.59	0.40	0.62	0.70	0.33
17.	Potassium (K^{+})		Cmol/Kg	0.010	0.01	0.010	0.01	0.010	0.02
18.	Sodium (Na^{+})		Cmol/Kg	0.03	0.01	0.02	0.03	0.10	0.01

19.	Magnesium (Mg^{2+})	Cmol/Kg	0.35	0.25	0.45	0.36	0.55	0.55
Metals/Heavy Metal Parameter								
20.	Barium (Ba)	mg/kg	12.01	12.32	10.45	11.11	15.82	14.50
21	Aluminium (Al)	mg/kg	1.93	1.60	0.98	0.82	1.11	1.09
22.	Mercury (Hg)	mg/kg	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
23.	Lead (Pb)	mg/kg	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
24.	Zinc (Zn)	mg/kg	0.74	0.57	1.20	2.10	2.34	3.50
Microbial Parameter								
25.	HBC	Cfu/g	5.2×10^5	3.2×10^6	5.1×10^6	3.2×10^5	7.8×10^5	5.8×10^5
26.	HFC	Cfu/g	3.2×10^4	2.0×10^4	2.1×10^5	1.5×10^4	4.6×10^6	3.1×10^4
27.	HUBC	Cfu/g	2.0×10^3	1.2×10^3	6.6×10^3	7.9×10^3	2.9×10^3	3.0×10^3
28.	HUFC	Cfu/g	1.0×10^2	3.0×10^2	1.1×10^2	1.0×10^2	4.0×10^2	1.1×10^2

THC: Total Hydrocarbon Content**,** ***CFU***=Colony forming unit, ***HBC*****=** Heterotropic Bacteria Count, ***HFC*****=** Heterotropic Fungi Count, ***HUBC***=Hydrocarbon Utilizing Bacteria Count, ***HUFC***=Hydrocarbon Utilizing Fungi Count, ***FMEnv***: Federal Ministry of Environment ***(Source:*** Mozuk Scientific & Analytics Laboratories; May, 2024).

Temperature: Soil temperature measurements range from 29.50°C to 35.23°C for SS1, SS2, and SS3 (Table 4.4a). For Table 4.4b, soil temperatures range from 29.45°C to 34.50°C. SS4 shows slightly lower temperatures (29.45°C to 32.40°C) compared to SS5 and SS6 (31.10°C to 34.50°C). The soil temperatures for SS7, SS8, and SS9 range from 35.50°C to 39.20°C. SS7 and SS10 Control show slightly lower temperatures compared to SS8 and SS9 (Table 4.4c). While there are no specific regulatory standards for soil temperature by FMEnv or WHO, it is a crucial factor affecting microbial activity and nutrient cycling in the soil. These temperatures are typical for tropical climates and are suitable for microbial activity and plant growth.

Soil Texture: The soil texture components, comprising varying proportions of sand, silt, and clay, differ significantly across the sampling stations. SS1 has higher silt content, SS2 is sandier, and SS3 has a higher clay content in the subsoil (Table 4.4a). For SS4, SS5, and SS6, soil texture varies significantly with SS4**:** Sand (42.90-40.90%), Silt (35.10-39.00%), Clay (20.10-22.00%); SS5: Sand (52.60-57.60%), Silt (32.90-42.50%), Clay (4.90-9.50%), and SS6: Sand (34.40-44.40%), Silt (32.60-45.30%), Clay (20.30-23.00%) (Table 4.4b). Soil texture across the stations SS7, SS8, SS9 and SS10 varied significantly as well with SS10 Control: Sand (57.50-65.00%), Silt (13.35-20.60%), Clay (21.65-21.90%) while SS7 and SS8 have higher sand content, indicating better drainage but lower water retention (Table 4.4c). SS9 and SS10 Control have more balanced textures, providing better water retention and nutrient availability. The texture reflects different soil types, influencing water retention and drainage. SS4 and SS6 have more balanced textures, while SS5 is more sandy, indicating better drainage but lower water retention. While there are no specific texture requirements, soil texture is critical for soil health and structure, influencing water retention, drainage, and root penetration.

Grain Size: All soil samples from the 9 stations including the control have grain sizes less than or equal to 2.00 mm, indicating fine-textured soils. This fine grain size is not specifically regulated by FMEnv or WHO but is suitable for agricultural purposes, ensuring good soil structure and nutrient availability.

Moisture Content: The moisture content ranges from 2.00% to 2.92% for SS1, SS2, and SS3 (Table 4.4a), reflecting varying water retention capacities. For SS4, SS5, and SS6 moisture content ranges from 2.30% to 2.91% (Table 4.4b), while for SS7, SS8, SS9, and SS10 the values ranges from 1.98% to 2.94%, with slight variations among stations and depths (Table 4.4c). Although not specifically regulated, moisture content is important for soil health, as it indicates the soil's ability to retain water, which is essential for plant growth and microbial activity. The observed moisture content is adequate for supporting agricultural activities.

Total Organic Matter: For Table 4.4a, total organic matter is highest in SS3 (16.94 to 17.30 mg/kg) and lowest in SS1 (10.588 to 12.016 mg/kg). From Table 4.4b total organic matter ranges from 9.99 mg/kg to 27.35 mg/kg, with SS6 having the highest levels. Total organic matter ranges from 3.40 mg/kg to 8.24 mg/kg for SS7 to SS10 (Table 4.4c). SS9 shows higher organic matter content, indicating better soil fertility. While there are no specific limits set by FMEnv or WHO, higher organic matter generally indicates better soil fertility. The observed healthy levels of organic matter indicate good soil fertility, supporting plant growth and microbial activity.

Total Organic Carbon: The total organic carbon content ranges from 6.03 to 7.60 mg/kg for SS1, SS2, and SS3 (Table 4.4). Total organic carbon ranges from 12.30 mg/kg to 62.60 mg/kg, with SS6 showing the highest levels (Table 4.4b). The ranges for SS7,SS8, SS9 and Control SS10 are from 5.48 mg/kg to 13.54 mg/kg (Table 4.4c), with SS9 having the highest levels. These values are indicative of soil health. Adequate levels of organic carbon are crucial for sustaining soil microbial activity and fertility, contributing to nutrient cycling and soil structure.

Table 4.4b: Soil Physicochemical and Microbial Characteristics

S/N	PARAMETER		UNIT	SS4		SS5		SS6	
				A(Top)	B(Sub)	A(Top)	B(Sub)	A(Top)	B(Sub)
1.	Color		-	Light brown 6/3	Light reddish brown 7/4	Reddish yellow 7/6	Reddish brown 5/4	Light reddish brown 7/4	Light reddish brown 7/4
2.	pH		-	5.65	6.98	6.92	6.98	6.83	6.99
3.	Redox Potential		-	495.00	368.00	387.00	390.00	368.20	399.00
4.	Electrical Conductivity		uS/cm	436.00	300.20	444.20	478.00	469.00	470.00
5.	Temperature		ºC	29.45	32.40	33.30	31.10	33.50	34.50
6.	Texture	Sand	%	42.90	40.90	57.60	52.60	34.40	44.40
		Silt		35.10	39.00	32.90	42.50	45.30	32.60
		Clay		22.00	20.10	9.50	4.90	20.30	23.00
7.	Grain Size		Mm	≤ 2.00	≤ 2.00	≤ 2.00	≤ 2.00	≤ 2.00	≤ 2.00
8.	Moisture Content		%	2.59	2.45	2.30	2.78	2.91	2.82
9.	Total Organic Matter		mg/kg	10.03	9.99	12.06	10.30	14.00	27.35
10.	Total Organic Carbon		mg/kg	12.30	45.30	12.70	23.50	62.39	62.60
11.	Total Nitrogen		mg/kg	16.70	15.00	25.30	24.40	20.18	19.80
12.	Total Phosphorus		mg/kg	1.72	2.23	2.45	2.40	1.90	2.89
13.	Ammonium		mg/kg	10.90	12.30	9.73	11.35	12.45	9.56
14.	Oil and Grease		mg/kg	0.01	<0.001	0.09	0.04	0.01	0.03
15.	THC		mg/kg	0.12	2.35	0.09	1.10	0.80	1.01
Exchangeable Cations									
16.	Calcium (Ca^{2+})		Cmol/Kg	0.20	0.23	0.78	0.65	0.94	0.87
17.	Potassium (K^{+})		Cmol/Kg	0.90	0.10	0.06	0.08	0.010	0.09
18.	Sodium (Na^{+})		Cmol/Kg	0.07	0.09	0.01	0.04	0.10	0.09
19.	Magnesium (Mg^{2+})		Cmol/Kg	0.27	0.32	1.34	0.56	0.55	0.50
Metals/Heavy Metal Parameter									
20.	Barium (Ba)		mg/kg	2.81	1.77	21.00	15.20	5.00	3.20
21	Aluminium (Al)		mg/kg	<0.001	<0.001	<0.001	<0.001	3.00	1.22
22.	Mercury (Hg)		mg/kg	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
23.	Lead (Pb)		mg/kg	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
24.	Zinc (Zn)		mg/kg	3.70	2.33	2.78	0.92	0.11	2.78
Microbial Parameter									

25.	HBC	Cfu/g	$7.0 X 10^5$	$5.5 X 10^5$	$2.9 X 10^6$	$1.1 X 10^5$	$9.0 X 10^5$	$3.2 X 10^5$
26.	HFC	Cfu/g	$2.0 X 10^2$	$3.6 X 10^3$	$5.9 X 10^4$	$1.0 X 10^4$	$3.5 X 10^4$	$1.0 X 10^4$
27.	HUBC	Cfu/g	$1.0 X 10^4$	$4.7 X 10^3$	$4.4 X 10^2$	$3.0 X 10^2$	$7.5 X 10^3$	$9.7 X 10^2$
28.	HUFC	Cfu/g	$6.0 X 10^2$	$1.0 X 10^2$	$5.9 X 10^1$	$9.0 X 10^1$	$2.0 X 10^2$	$3.8 X 10^1$

THC: Total Hydrocarbon Content***,*** ***CFU***=Colony forming unit, ***HBC=*** Heterotropic Bacteria Count, ***HFC=*** Heterotropic Fungi Count, ***HUBC***=Hydrocarbon Utilizing Bacteria Count, ***HUFC***=Hydrocarbon Utilizing Fungi Count, ***FMEnv***: Federal Ministry of Environment ***(Source:*** Mozuk Scientific & Analytics Laboratories; May, 2024).

Total Nitrogen: Total nitrogen content varies from 22.45 to 32.00 mg/kg for SS1, SS2, and SS3 (Table 4.4a). These content varies from 15.00 mg/kg to 25.30 mg/kg for SS4, SS5, and SS6 (Table 4.4b) with SS5 having the highest nitrogen content, indicating good nutrient availability for plant growth. SS7, SS8, SS9, and SS 10 content varies from 20.40 mg/kg to 27.50 mg/kg (Table 4.4c). SS8 and SS9 show the highest nitrogen content, indicating good nutrient availability for plant growth. The observed nitrogen levels indicate good nutrient availability for crop growth, essential for plant development and suitable for agricultural purposes.

Total Phosphorus: Phosphorus content ranges from 1.59 to 3.48 mg/kg, with higher values in the subsoil of SS2 (Table 4.4a). Phosphorus levels range from 1.72 mg/kg to 2.89 mg/kg for SS4, SS5, and SS6 (Table 4.4b) with SS6 subsoil showing the highest phosphorus content. The levels range from 2.10 mg/kg to 15.00 mg/kg for SS7, SS8, SS9, and SS10 (Table 4.4c) with SS9 having the highest phosphorus content, essential for root development and energy transfer in plants. These levels are adequate for supporting plant growth.

Ammonium: Ammonium levels are relatively low for SS1, SS2, and SS3, ranging from 0.78 to 2.32 mg/kg (Table 4.4a). Ammonium content ranges from 9.56 mg/kg to 12.45 mg/kg for SS4, SS5, and SS6 (table 4.4b). The values range from 4.09 mg/kg to 9.70 mg/kg for SS7, SS8, SS9, and SS10 (Table 4.4c). The observed values indicate a good supply of ammonium for plant uptake, contributing to nitrogen availability.

Oil and Grease: The levels of oil and grease are below detectable limits in most samples for SS1, SS2, and SS3, ranging from <0.001 to 0.01 mg/kg (Table 4.4a). Oil and grease levels range from <0.001 mg/kg to 0.09 mg/kg for SS4, SS5, and SS6 (Table 4.4b), while the levels are below detectable limits (<0.001 mg/kg) across all stations in Table 4.4c, except for a minor presence in

SS10 Control topsoil (0.01 mg/kg). FMEnv and WHO standards suggest that oil and grease should be minimal in agricultural soils. The observed levels are within acceptable limits, indicating minimal presence.

Total Hydrocarbon Content (THC): THC values range from 1.11 to 2.60 mg/kg for SS1, SS2, and SS3 (Table 4.4a), the values range from 0.09 mg/kg to 2.35 mg/kg for SS4, SS5, and SS6 (Table 4.4b) while they range from <0.001 mg/kg to 0.09 mg/kg for SS7, SS8, SS9, and SS10 Control soils. Both FMEnv and WHO standards suggest that THC should be minimal in agricultural soils. The observed low THC levels indicate minimal hydrocarbon presence, which is favorable for soil health and promoting healthy soil conditions.

Exchangeable Cations: The levels of exchangeable cations vary across the sampling stations with Calcium (Ca^{2+}) at 0.33 to 0.70 Cmol/Kg, Potassium (K^+) from 0.010 to 0.02 Cmol/Kg, Sodium (Na^+) 0.01 to 0.10 Cmol/Kg, and Magnesium (Mg^{2+}) with 0.25 to 0.55 Cmol/Kg (Table 4.4a). For SS4, SS5, and SS6, the values are Calcium (Ca^{2+}): 0.20 to 0.94 Cmol/Kg, Potassium (K^+): 0.01 to 0.90 Cmol/Kg, Sodium (Na^+): 0.01 to 0.10 Cmol/Kg, Magnesium (Mg^{2+}): 0.27 to 1.34 Cmol/Kg (Table 4.4b). Samples SS7, SS8, SS9, and SS10 levels of exchangeable cations are Calcium (Ca^{2+}): 0.80 to 5.23 Cmol/Kg, Potassium (K^+): 0.07 to 1.18 Cmol/Kg, Sodium (Na^+): 0.01 to 0.93 Cmol/Kg, and Magnesium (Mg^{2+}): 0.50 to 2.30 Cmol/Kg (Table 4.4c). These cation levels are critical for soil fertility, indicating balanced nutrient availability essential for plant growth. The observed levels in the soils indicate balanced soil fertility, which is crucial for plant growth and development.

Table 4.4c: Soil Physicochemical and Microbial Characteristics

S/N	PARAMETER		UNIT	*SS7*		*SS8*		*SS9*		*SS10 Control*	
				A(Top)	B(Sub)	A(Top)	B(Sub)	A(Top)	B(Sub)	A(Top)	B(Sub)
1.	Color		-	Light brown 6/3	Light brown 6/3	Light brown 6/3	Light brown 6/3	Pinkish grey 6/2	Pinkish grey 6/2	Light brown 6/3	Light brown 6/3
2.	pH		-	5.60	5.55	5.70	5.62	5.31	5.91	6.34	6.23
3.	Redox Potential		-	390.00	350.00	422.00	431.00	409.20	398.00	378.29	370.20
4.	Electrical Conductivity		uS/cm	420.00	380.00	460.40	400.50	388.20	375.00	423.20	465.00
5.	Temperature		ºC	35.50	37.80	38.00	39.20	37.60	38.50	36.40	37.30
6.	Texture	Sand	%	56.20	49.30	54.30	55.90	55.90	50.60	65.00	57.50
		Silt		25.00	37.90	36.70	40.60	25.00	27.20	13.35	20.60
		Clay		18.80	12.80	9.30	3.50	19.10	22.20	21.65	21.90
7.	Grain Size		Mm	≤ 2.00	≤ 2.00	≤ 2.00	≤ 2.00	≤ 2.00	≤ 2.00	≤ 2.00	≤ 2.00

8.	Moisture Content	%	2.00	2.02	2.30	2.94	2.00	2.67	1.98	2.30
9.	Total Organic Matter	mg/kg	5.14	3.40	8.24	4.40	7.56	4.22	6.30	4.30
10.	Total Organic Carbon	mg/kg	9.70	7.80	8.90	9.00	13.54	5.60	7.89	5.48
11.	Total Nitrogen	mg/kg	25.30	22.63	26.30	27.50	25.30	22.60	23.20	20.40
12.	Total Phosphorus	mg/kg	3.50	3.30	5.40	7.80	13.70	15.00	2.34	2.10
13.	Ammonium	mg/kg	6.00	4.09	9.70	9.67	5.55	5.00	6.70	6.45
14.	Oil and Grease	mg/kg	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.01
15.	THC	mg/kg	0.04	0.01	0.01	0.01	0.07	0.09	<0.001	<0.001
Exchangeable Cations										
16.	Calcium (Ca^{2+})	Cmol/Kg	5.23	4.44	2.70	0.99	1.00	0.80	3.20	2.49
17.	Potassium (K^{+})	Cmol/Kg	1.00	0.18	1.11	0.07	0.08	0.23	1.09	1.18
18.	Sodium (Na^{+})	Cmol/Kg	0.60	0.89	0.91	0.01	0.19	0.05	0.65	0.93
19.	Magnesium (Mg^{2+})	Cmol/Kg	0.60	0.72	2.30	0.50	2.00	1.50	0.89	1.70
Metals/Heavy Metal Parameter										
20.	Barium (Ba)	mg/kg	14.44	9.60	13.90	19.00	22.90	23.70	17.20	18.90
21	Aluminium (Al)	mg/kg	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1.45	<0.001
22.	Mercury (Hg)	mg/kg	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
23.	Lead (Pb)	mg/kg	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
24.	Zinc (Zn)	mg/kg	1.20	1.59	<0.001	<0.001	0.10	0.09	<0.001	<0.001
Microbial Parameter										
25.	HBC	Cfu/g	8.2×10^6	3.0×10^6	1.8×10^5	1.0×10^5	6.0×10^5	6.2×10^5	6.0×10^5	5.9×10^5
26.	HFC	Cfu/g	5.0×10^3	3.0×10^4	1.1×10^4	1.4×10^3	3.5×10^4	3.2×10^4	5.5×10^3	4.1×10^3
27.	HUBC	Cfu/g	2.0×10^3	2.2×10^3	1.1×10^2	1.0×10^2	2.1×10^2	2.5×10^2	7.5×10^3	1.3×10^2
28.	HUFC	Cfu/g	7.0×10^1	5.0×10^1	1.0×10^1	2.0×10^1	2.0×10^2	1.8×10^2	9.0×10^2	1.6×10^2

THC: Total Hydrocarbon Content**,** ***CFU***=Colony forming unit, ***HBC***= Heterotropic Bacteria Count, ***HFC***= Heterotropic Fungi Count, ***HUBC***=Hydrocarbon Utilizing Bacteria Count, ***HUFC***=Hydrocarbon Utilizing Fungi Count, ***FMEnv***: Federal Ministry of Environment ***(Source:*** Mozuk Scientific & Analytics Laboratories; May, 2024).

Metals/Heavy Metals: SS1, SS2, and SS3 shows levels of metals and heavy metals vary with Barium (Ba) having 10.45 to 15.82 mg/kg, Aluminum (Al), 0.82 to 1.93 mg/kg, Mercury (Hg) and Lead (Pb) are below detectable limits (<0.001 mg/kg), while Zinc (Zn) has values 0.57 to 3.50 mg/kg (Table 4.4a). For SS4, SS5, and SS6, the values are Barium (Ba): 1.77 mg/kg to 21.00 mg/kg, Aluminium (Al): <0.001 mg/kg to 3.00 mg/kg, Mercury (Hg): <0.001 mg/kg, Lead (Pb): <0.001 mg/kg, and Zinc (Zn): 0.11 mg/kg to 3.70 mg/kg (Table 4.4b). Tables 4.4c registers values of Barium (Ba): 9.60 mg/kg to 23.70 mg/kg, Aluminum (Al): <0.001 mg/kg, Mercury (Hg): <0.001 mg/kg, Lead (Pb): <0.001 mg/kg, and Zinc (Zn): <0.001 mg/kg to 1.59 mg/kg representing SS7, SS8, SS9, and SS10. FMEnv and WHO standards set limits for mercury (0.2 mg/kg), lead (85 mg/kg), and zinc (300 mg/kg). The observed levels of mercury and lead are below detection limits, and zinc levels are within safe limits, indicating minimal heavy metal contamination.

Microbial Parameters: The microbial parameters assessed include Heterotrophic Bacteria Count (HBC), Heterotrophic Fungi Count (HFC), Hydrocarbon Utilizing Bacteria Count (HUBC), and Hydrocarbon Utilizing Fungi Count (HUFC). These values suggest active microbial life supporting soil health. While there are no specific limits for these microbial parameters, they are indicative of biological activity and potential contamination.

The soil quality at sampling stations SS1, SS2, and SS3 in the Agro-Industrial Hub (AIH) at Lau LGA, Taraba State, is largely compliant with FMEnv and WHO standards. Key observations include slightly acidic pH values, which may require lime treatment for optimal agricultural use, and low levels of heavy metals and hydrocarbons, indicating minimal contamination. The presence of healthy organic matter and balanced nutrient levels supports the planned agro-industrial operations. Similarly, the soil quality at sampling stations SS4, SS5, and SS6 shows compliance with FMEnv and WHO standards. Notable findings include slightly acidic pH values in SS4 topsoil, adequate organic matter, and balanced nutrient levels, with low levels of heavy metals and hydrocarbons, indicating minimal contamination. The soil quality at sampling stations SS7, SS8, SS9, and SS10 (Control) also aligns with FMEnv and WHO standards. Observations include slightly acidic pH values, adequate organic matter, and balanced nutrient levels, with low levels of heavy metals and hydrocarbons, indicating minimal contamination. Overall, the soil quality across all sampling stations is suitable for agricultural activities. The slightly acidic pH values can be amended for optimal use, and the low levels of heavy metals and hydrocarbons indicate minimal contamination. The presence of healthy organic matter and balanced nutrient levels supports the planned agro-industrial operations.

4.8.3 Groundwater Quality

The groundwater samples (Table 4.5) are compared with both FMEnv and WHO standards for drinking water. This detailed analysis addresses each parameter, evaluating the results in relation to the established standards.

- **Physicochemical Parameters**

Appearance (TCU): The appearance of groundwater from both the community borehole and the Catholic Church borehole in Lau was measured at 5.00 TCU. This is well within the FMEnv and WHO standard of 15 TCU, indicating that the water is clear and suitable for consumption in terms of visual quality.

Odour (TN): Both samples from Lau were found to be odourless. This meets the FMEnv standard of an odour threshold number of 3.5 and aligns with the WHO standard that drinking water should be acceptable to consumers and free from any abnormal odour, ensuring it is pleasant to drink.

Table 4.5: Groundwater Physicochemical and Microbial Characteristics

S/N	PARAMETER	UNIT	RESULT		FMEnv
			GW1	*GW2*	Limit for Drinking Water
			Lau (Community Borehole)	Lau (Borehole at Catholic Church)	
1.	Appearance	TCU	5.00	5.00	15(Colourless)
2.	Odour	TN	Odourless	Odourless	3.5(Odourless)
3.	pH		6.35	6.37	6.50- 8.50
4.	Dissolved Oxygen	mg/L	1.00	1.50	NS
5.	Total Dissolved Solids	mg/L	103.00	105.00	500.00
6.	Salinity	mg/L	0.07	0.04	NS
7.	Electric Conductivity	µS	207.00	210.00	NS
8.	Turbidity	mg/L	0.15	0.24	1.0
9.	Total Suspended Solid	mg/L	0.02	0.04	10.00
Chemical Parameter					
10.	Oil and Grease	mg/L	<0.001	<0.001	0.05
11.	BOD	mg/L	0.00	0.00	0.00
12.	COD	mg/L	22.70	26.30	NS
13.	Nitrate (NO_3^-)	mg/L	0.93	0.52	10.00

14.	Ammonia (NH_3	mg/L	0.02	0.03	5.00
15.	Phosphate (PO_4^{3-})	mg/L	3.33	4.21	NS
16.	Sulphate (SO_4^{2-})	mg/L	1.60	1.26	500
17.	Total Hardness	mg/L	18.00	15.00	200
18.	Total Alkalinity	mg/L	10.00	11.00	NS
19.	Total Acidity	mg/L	15.0	15.0	NS
Metals/Heavy Metal Parameter					
20.	Potassium (K)	mg/L	5.05	7.04	NS
21.	Magnesium (Mg^{2+})	mg/L	4.30	3.59	NS
22.	Calcium (Ca^{2+})	mg/L	0.37	0.20	NS
23.	Iron (Fe^{2+}/ Fe^{3+})	mg/L	0.03	0.05	1.00
24.	Lead (Pb)	mg/L	<0.001	<0.001	0.05
25.	Copper (Cu)	mg/L	<0.001	0.01	0.10
26.	Nickel (Ni)	mg/L	<0.001	0.02	0.05
27.	Chromium (Cr)	mg/L	<0.001	<0.001	0.05
28.	Aluminum (Al)	mg/L	0.02	0.04	1.00
29.	Cadmium (Cd)	mg/L	<0.001	<0.001	0.01
30.	Manganese (Mn)	mg/L	<0.001	<0.001	0.05
31.	Zinc (Zn)	mg/L	0.10	0.23	5.00
Microbial Parameter					
32.	Total Coliform Count	Cfu/ml	10.00	10.00	NS
33.	Total Bacteria Count	Cfu/ml	10.00	10.00	0
34.	Fecal Coliform	Cfu/ml	0.00	0.00	0

CFU=Colony forming unit***, BOD***: Biological Oxygen Demand, ***COD:*** Chemical Oxygen Demand, ***TN:*** Threshold Number, ***TCU***: True Colour Unit, **NS**: Not Stated, ***FMEnv***: Federal Ministry of Environment, ***Limit Source****:* Federal Ministry of Environment National Guidelines and Standards for Water Quality in Nigeria, 2007
(***Source:*** Mozuk Scientific and Analytics Laboratories; May, 2024).

pH: The pH levels for the groundwater samples were 6.35 and 6.37, slightly below the FMEnv and WHO acceptable range of 6.50 to 8.50. This indicates mildly acidic water, which could potentially affect the corrosion of pipes and the solubility of metals in the water supply system.

Dissolved Oxygen (mg/L): Dissolved oxygen levels were 1.00 mg/L in GW1 and 1.50 mg/L in GW2. Although there are no specific FMEnv or WHO standards for dissolved oxygen in drinking water, these low levels could suggest the presence of high organic matter and potential anaerobic conditions.

Total Dissolved Solids (mg/L): The total dissolved solids (TDS) were 103.00 mg/L and 105.00 mg/L for the two samples, well within the FMEnv limit of 500 mg/L and WHO limit of 1000 mg/L. This indicates the water has a low mineral content, which is generally associated with good taste and suitability for drinking.

Salinity (mg/L): Salinity measurements were very low, at 0.07 mg/L and 0.04 mg/L. There are no specific FMEnv or WHO standards for salinity in drinking water, but these values indicate fresh water with minimal salt content.

Electric Conductivity (µS): Electric conductivity values were 207.00 µS and 210.00 µS. Although not specifically regulated by FMEnv or WHO, these low values suggest a low ion concentration, which typically indicates good water quality.

Turbidity (mg/L): Turbidity levels were measured at 0.15 mg/L and 0.24 mg/L, both well below the FMEnv standard of 1.0 mg/L and the WHO limit of 5 NTU. Low turbidity indicates clear water without significant particulate matter, which is essential for safe drinking water.

Total Suspended Solids (mg/L): The total suspended solids (TSS) in the water samples were 0.02 mg/L and 0.04 mg/L, significantly lower than the FMEnv standard of 10 mg/L. This shows that the water contains minimal suspended particles, ensuring it is clean and free from visible contaminants.

- **Biochemical Parameters**

Oil and Grease (mg/L): Oil and grease were undetectable (<0.001 mg/L) in both groundwater samples. This is well within the FMEnv standard of 0.05 mg/L, indicating no contamination from hydrocarbon sources.

Biological Oxygen Demand (BOD) (mg/L): The biological oxygen demand was 0.00 mg/L for both samples, meeting the FMEnv standard of 0.00 mg/L. This indicates there is no biodegradable organic matter present in the water, which is favorable for drinking water quality.

Chemical Oxygen Demand (COD) (mg/L): COD values were 22.70 mg/L and 26.30 mg/L. While not specifically regulated by FMEnv or WHO, these values suggest some presence of oxidizable organic compounds. This parameter requires monitoring to ensure the water remains safe for consumption.

Nitrate ($NO3^-$) (mg/L): Nitrate levels were 0.93 mg/L and 0.52 mg/L, well within the FMEnv limit of 10 mg/L and the WHO limit of 50 mg/L. These low nitrate levels indicate no significant agricultural or wastewater contamination.

Ammonia (NH_3) (mg/L): Ammonia concentrations were 0.02 mg/L and 0.03 mg/L, far below the FMEnv limit of 5 mg/L and the WHO limit of 1.5 mg/L. This indicates no recent organic pollution in the groundwater.

Phosphate ($PO43^-$) (mg/L): Phosphate levels were 3.33 mg/L and 4.21 mg/L. While there are no specific FMEnv or WHO standards, these values are typical for groundwater and do not indicate significant pollution.

Sulphate ($SO42^-$) (mg/L): Sulphate concentrations were 1.60 mg/L and 1.26 mg/L, well below the FMEnv standard of 500 mg/L and the WHO standard of 250 mg/L. This indicates no contamination from sulphate compounds.

Total Hardness (mg/L): Total hardness values were 18.00 mg/L and 15.00 mg/L, much lower than the FMEnv limit of 200 mg/L and the WHO limit of 500 mg/L (as $CaCO_3$). This shows that the water is soft, which is beneficial for household use and reduces the need for water softeners.

Total Alkalinity (mg/L): Total alkalinity was 10.00 mg/L and 11.00 mg/L. While not specifically regulated, these low values indicate a limited buffering capacity against pH changes, which could impact the water's stability.

Total Acidity (mg/L): Total acidity was 15.0 mg/L in both samples. There are no specific FMEnv or WHO standards for total acidity, but moderate acidity could contribute to the slightly low pH observed in the samples.

- **Metals/Heavy Metals Parameters**

Potassium (K) (mg/L): Potassium levels were 5.05 mg/L and 7.04 mg/L. Although there are no specific FMEnv or WHO standards for potassium in drinking water, these values are typical for groundwater and do not indicate any contamination.

Magnesium ($Mg2^+$) (mg/L): Magnesium levels were 4.30 mg/L and 3.59 mg/L. These low levels, while not specifically regulated by FMEnv or WHO, are typical for groundwater and do not suggest any contamination.

Calcium (Ca^{2+}) (mg/L): Calcium concentrations were 0.37 mg/L and 0.20 mg/L. The very low levels contribute to the water's softness and are well below any concerning limits.

Iron (Fe^{2+}/ Fe^{3+}) (mg/L): Iron levels were 0.03 mg/L and 0.05 mg/L, well within the FMEnv standard of 1.00 mg/L and the WHO standard of 0.3 mg/L. This indicates no iron contamination, ensuring the water is not discolored and has no metallic taste.

Lead (Pb) (mg/L): Lead was undetectable (<0.001 mg/L) in both samples, meeting both the FMEnv standard of 0.05 mg/L and the WHO standard of 0.01 mg/L. This indicates no lead contamination, which is crucial for health safety.

Copper (Cu) (mg/L): Copper levels were <0.001 mg/L and 0.01 mg/L, well within the FMEnv standard of 0.10 mg/L and the WHO standard of 2.0 mg/L. This indicates no copper contamination.

Nickel (Ni) (mg/L): Nickel concentrations were <0.001 mg/L and 0.02 mg/L, well below the FMEnv standard of 0.05 mg/L and the WHO standard of 0.07 mg/L. This indicates no nickel contamination.

Chromium (Cr) (mg/L): Chromium was undetectable (<0.001 mg/L) in both samples, meeting both the FMEnv and WHO standards of 0.05 mg/L. This indicates no chromium contamination.

Aluminum (Al) (mg/L): Aluminum levels were 0.02 mg/L and 0.04 mg/L, well below the FMEnv standard of 1.00 mg/L and the WHO standard of 0.1 mg/L. This indicates no aluminum contamination.

Cadmium (Cd) (mg/L): Cadmium was undetectable (<0.001 mg/L) in both samples, meeting both the FMEnv standard of 0.01 mg/L and the WHO standard of 0.003 mg/L. This indicates no cadmium contamination.

Manganese (Mn) (mg/L): Manganese was undetectable (<0.001 mg/L) in both samples, meeting the FMEnv standard of 0.05 mg/L and the WHO standard of 0.4 mg/L. This indicates no manganese contamination.

Zinc (Zn) (mg/L): Zinc levels were 0.10 mg/L and 0.23 mg/L, well within the FMEnv standard of 5.00 mg/L and the WHO standard of 3.0 mg/L. This indicates no zinc contamination.

- **Microbial Parameters**

Total Coliform Count (CFU/ml): Total coliform counts were 10.00 CFU/ml in both samples. While FMEnv has no specific limit, the WHO standard is 0 CFU/ml. The presence of coliforms indicates potential contamination and suggests the need for disinfection.

Total Bacteria Count (CFU/ml): Total bacteria counts were also 10.00 CFU/ml in both samples, exceeding the FMEnv and WHO standards of 0 CFU/ml. This indicates contamination and necessitates immediate treatment to ensure the water is safe to drink.

Fecal Coliform (CFU/ml): No fecal coliforms were detected in either sample, meeting both FMEnv and WHO standards of 0 CFU/ml. This indicates no fecal contamination, which is positive for health safety.

The groundwater quality in Lau generally complies with FMEnv and WHO standards, with the exceptions of pH levels and microbial contamination. pH Adjustment are required due to the mildly acidic nature of the groundwater should be corrected by adding a suitable base to raise the pH within the acceptable range of 6.50 to 8.50. Microbial Treatment due to the presence of total coliforms and total bacteria, disinfection through chlorination or UV treatment is recommended to eliminate potential pathogens. Continuous monitoring of the groundwater quality should be conducted to ensure compliance with FMEnv and WHO standards and to detect any potential changes in water quality. Educating the community about maintaining water quality and preventing contamination is crucial for ensuring the long-term safety of the water supply. By addressing these issues through appropriate treatment and regular monitoring, the community can ensure their drinking water remains safe and healthy.

4.8.4 Air and Noise Quality

The main air pollution sources associated to the project are transport vehicles and diesel generators that would be used during the construction phase while during operation the major sources will be industrial/processing plants.

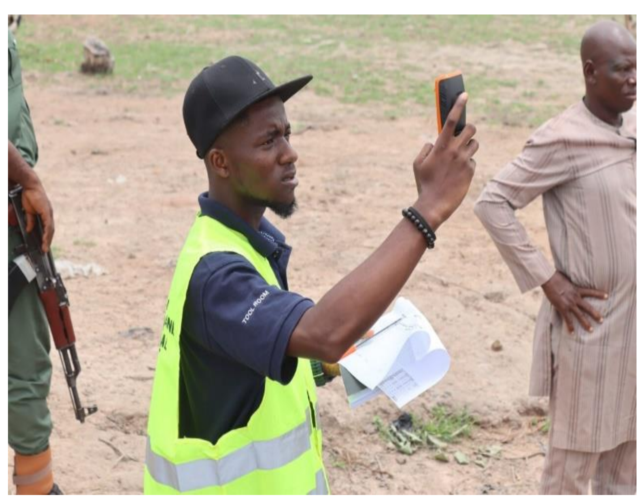


Figure 4.3a and b: Selected Air Quality and Noise Levels Measurements.

These impacts are temporary and will be mitigated according. Ambient noise levels at the proposed site were conducted, however due to the low anthropogenic and industrial activities and influences at the area, the result revealed are relatively low. During construction operations, this situation is expected to increase significantly. The air quality sampling points are presented in Figure 4.4, while the baseline ambient air quality and noise level around the proposed project area are represented in Table 4.6.

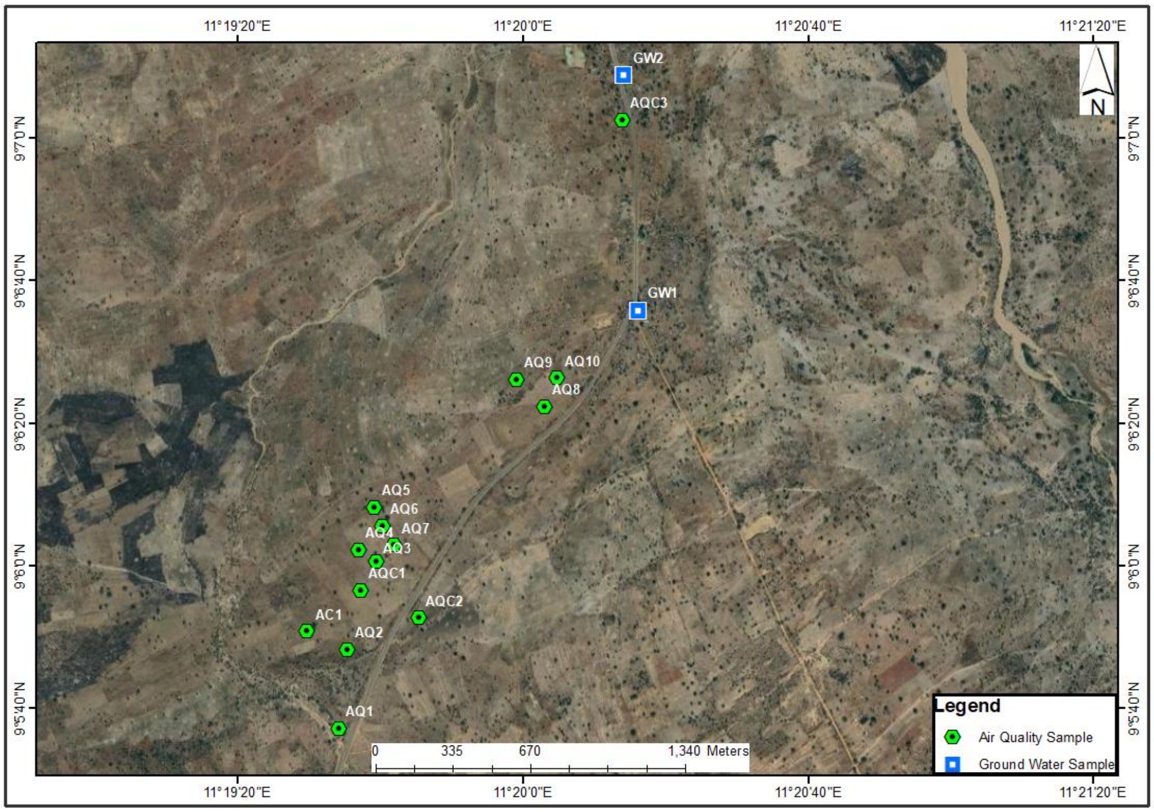


Figure 4.4: Air Quality Sampling Points

PM2.5 (Particulate Matter <2.5 microns): All measured values for PM2.5 are well below the FMEnv, WHO, and USEPA standard of 250 µg/m³, indicating good air quality with respect to fine particulate matter. However, they exceed the NESREA limit of 40 µg/m³. Although the levels are within the safe range for international standards, local regulations suggest a need for closer monitoring, particularly at AQC1, where the highest value is recorded.

PM10 (Particulate Matter <10 microns): The PM10 levels are well within the FMEnv, WHO, and USEPA standard of 250 µg/m³, as well as the NESREA limit of 150 µg/m³. This indicates

Point Code	Latitude	Longitude	P2.5 ($\mu g/m^3$)	PM10 ($\mu g/m^3$)	Particles (per/L)	AQI	HCHO mg/m^3	TVOC mg/m^3	TEMP ^oF	HUM %RH	Noise dBA	
											Min	Max
AQ1	9.093637	11.326147	9.2	15.6	1375	43	0.06	0.27	32.7	48.6	46.7	84.5
AQ2	9.096712	11.326475	9.9	18.4	1657	41	0.05	0.17	37.2	41.8	39.9	69.3
AQ3	9.100166	11.327602	12.6	22.2	1890	52	0.04	0.19	36.8	41.9	52.9	68.1
AQ4	9.100600	11.326910	8.8	13.9	1309	36	0.01	0.04	34.7	40.3	44.3	77.8
AQ5	9.102276	11.327546	9.9	17.8	1557	41	0.04	0.19	37.2	41.8	59.1	84.8
AQ6	9.101546	11.327869	13.5	24.9	2033	56	0.02	0.01	97.5	51.9	50.5	81.0
AQ7	9.100782	11.328310	10.7	18.4	1636	44	0.01	0.03	103	35.7	51.6	95.1
AQ8	9.106185	11.334183	21.6	37.9	3304	70	0.01	0.03	104	34.7	49.8	80.3
AQ9	9.107249	11.333077	18.2	32.0	2815	61	0.01	0.03	103	35.1	45.4	76.4
AQ10	9.107298	11.334640	10.3	16.7	1585	42	0.01	0.03	101	44.4	47.9	75.7
Additional Samples Collected for Lau LGA Site												
AC1	9.097420	11.324912	17.2	28.9	2631	61	0.01	0.08	90.7	62.1	41.8	65.8
AQC1	9.099030	11.327020	14.5	22.9	2126	53	0.01	0.08	91.8	60.9	35.1	64.4
AQC2	9.097958	11.329267	10.5	18.4	1646	43	0.01	0.03	93.3	59.3	37.9	65.9
AQC3	9.117359	11.337225	17.7	30.3	2729	65	0.01	0.03	98.7	52.5	41.5	65.4
GW1	9.109956	11.337830	17.2	28.0	2497	58	0.01	0.03	94.4	60.5	41.1	66.4
GW2	9.119124	11.337261	17.9	30.7	2776	66	0.01	0.03	99.9	51.8	49.1	74.4
FMEnv /WHO/ USEPA Standard*			250	250	-	-	-	-	-	-	90	
NESREA Limit			40	150	-	-	-	-	-	-		

Table 4.6: Ambient Air and Noise Levels.

Particles (per Liter): There are no specific FMEnv or WHO standards for the number of particles per liter in air. However, AQC1, with 3144 particles/L, has the highest particle concentration, followed by SW1 and AQ6. This suggests higher particulate pollution in these areas, necessitating further investigation.

Air Quality Index (AQI): All AQI values are within acceptable ranges, with AQC1 having the highest AQI of 68, indicating moderate air quality. Most sites show good air quality, but the slightly higher values at SW1 and AQ6 suggest some areas of concern.

Formaldehyde (HCHO) (mg/m³): Formaldehyde levels are very low, with all sites measuring below 0.04 mg/m³. While there are no specific limits provided in the table, these low levels indicate minimal formaldehyde pollution.

Total Volatile Organic Compounds (TVOC) (mg/m³): TVOC levels are generally low, with the highest being 0.18 mg/m³ at SW1. These values suggest minimal pollution from volatile organic compounds.

Temperature (°F): Temperature readings vary, with AQ1 and AQ4 showing the highest temperatures of 105°F. There are no specific standards for temperature in the context of air quality, but these values can impact comfort and health, especially for vulnerable populations.

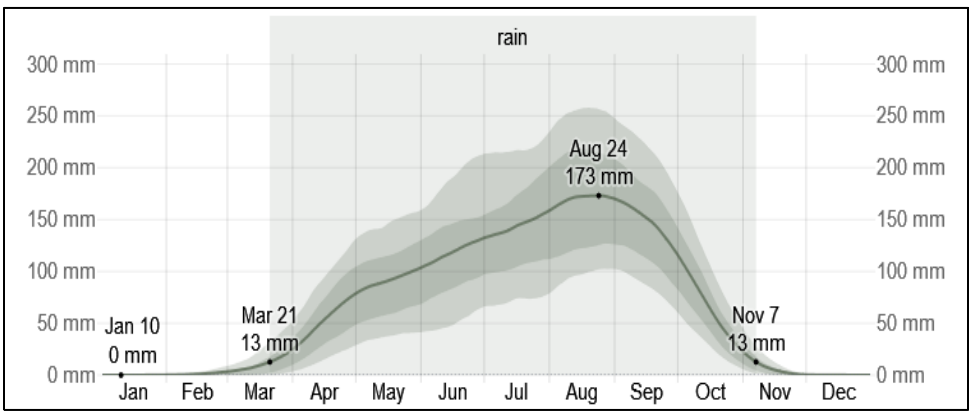
Humidity (%RH): Humidity levels range from 34.0% to 51.9%. While no specific standards are provided, these values are within typical comfort ranges. Lower humidity can exacerbate respiratory conditions, whereas higher levels can promote mold growth.

Noise (dBA): Noise levels at AQ1 and AQ4 exceed the NESREA limit of 90 dBA, with values of 89.9 dBA and 86.0 dBA, respectively. These high noise levels can contribute to hearing loss and stress-related health issues over prolonged exposure.

The air quality in the surveyed locations generally meets international standards for particulate matter, formaldehyde, and TVOCs. However, there are localized concerns, particularly with PM2.5 and PM10 levels exceeding local NESREA limits, and elevated noise levels at certain points. Addressing these issues through targeted interventions will help ensure a healthier environment for the community.

4.8.5 Climate and Meteorology

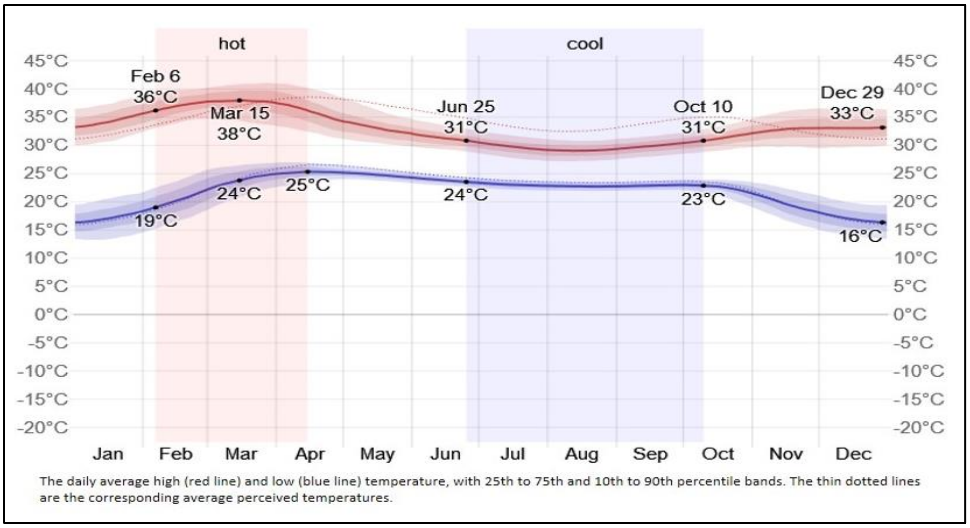
Lau LGA falls within the Tropical Savannah Climatic Zone (Aw) as presented by the Koppen-Geiger (1928) world climates classification system. This climatic area is also referred to as the Tropical wet and dry climatic zone due to its distinct wet and dry season characteristics. The wet or rainy season lasts for seven (7) to eight (8) months (March to November), with a sliding 31-day rainfall of at least 13 millimeters (Weather Spark, 2024). Peak rains are received in August, with an average rainfall of 172 millimeters (Figure 4.5). The dry season lasts for four (4) months (November to March) with driest month being January characterized by an, average rainfall of 0 millimeters. Generally, mean annual rainfall around Lau and Karim Lamido areas is less than 1000mm (Adebayo, 2002). The dry season commences in November and terminates in March with peaks occurring in the moths of January and February.



Source: Weather Spark (2024)

Figure 4.5: Average monthly rainfall characteristics of Lau.

Temperatures typically vary from *16°C* to *38°C* and is rarely below *13°C* or above *41°C* (Weather Spark, 2024). The hot season lasts for about two (2) months (February to April), with an average daily high temperature above 36°C. The hottest month of the year in Lau is March, with an average high temperature of 38°C and an average low of 24°C. The cool season lasts for three (3) to four (4) months (June to October), with an average daily high temperature below 31°C. The coldest month of the year in Lau is December, with an average low temperature of 17°C and an average high of 33°C (Figure 4.6). The climatic regime of the Lau area provides a conducive atmosphere for both rain-fed irrigation agriculture and livestock farming.



Source: Weather Spark (2024)

Figure 4.6: Average monthly temperature characteristics of Lau

However, studies have acknowledged eminent occurrence of climate change conditions in Tabarab State as a whole (Adebayo, 2012; Adebayo and Oruonye, 2012a; 2012b; Adebayo and Oruonye, 2013; Oruonye, 2014).The evidences of climate change as observed by these scholars among others include delayed onset date of rains, increase in number of dry days during the raining season and increase in maximum temperature (Adebayo, 2012; Adebayo and Oruonye, 2012a; 2012b; Adebayo and Oruonye, 2013). Besides, awareness of climate change and variability among rural farmers in Taraba State have also been acknowledged (Oruonye 2014). Farmers in the state are fully aware of the menace of climate change in the state in terms of changes in trends of total annual rainfalls; onset, cessation and length of rainy seasons and changes in temperature.

The relief map of Taraba State showing the proposed projects sites is presented in Figure 4.7. The general relief of Lau area ranges between 160 and 300 meters above sea level (m.a.s.l.). However, the proposed site is characterized by a nearly level to gentle undulating plain with elevations ranging from 191 to 200 m.a.s.l. This makes the land a near to flat surface with an average slope of 0.0098 mm^{-1}. The site is also dissected almost into two equal halves by an ephemeral stream which runs from the southeast and northwards into the Benue River. Areas around the stream are subjected to episodic flash floods mostly during the periods of peak rains in August and September.

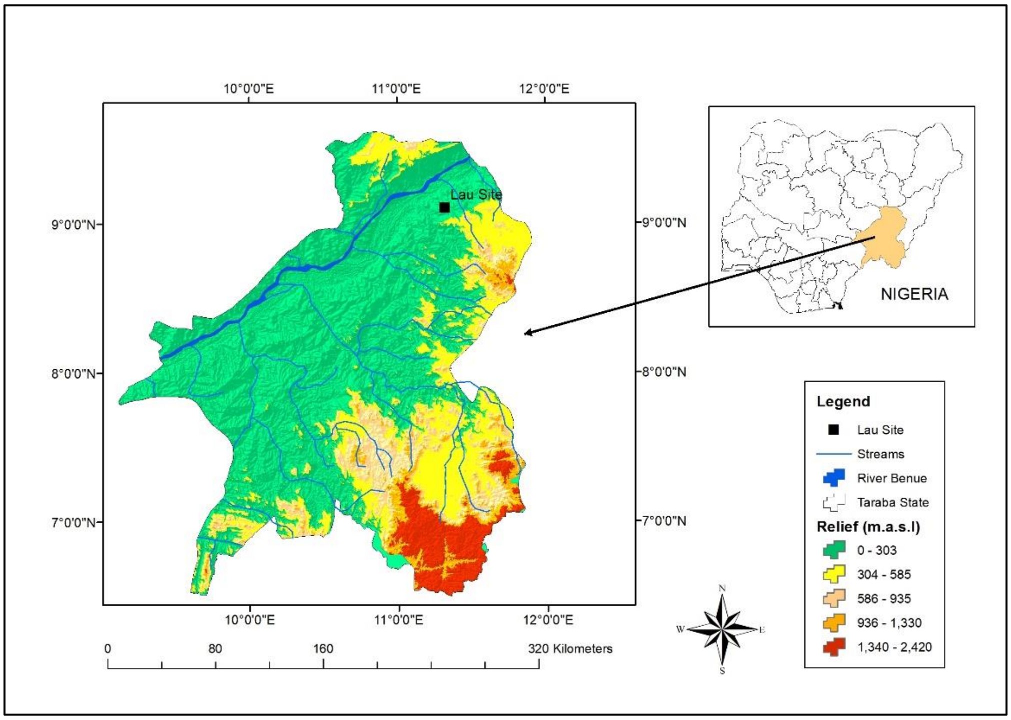


Figure 4.7: Relief and Drainage of the Lau proposed site

4.8.6 Vegetation and Wildlife

Based on field observation and interaction with residents of Garin Malam who cultivate crops on the site, soils of the site were considered to be moderate to high in fertility and capable of supporting cereal (Maize, Rice etc,) and legume (Cowpea and Groundnuts) crops. Although a large proportion of Lau LGA is characterized by expansive clay soils (Vertisols or Smectites), it was observed that the proposed site is situated on a stable land void of the vertisols. This makes the site a favourable ground for the construction of the proposed infrastructural processing facility (Buildings and road network).

Lau LGA falls within the Sudan Savannah zone of the Nigerian vegetation belts. This vegetation belt is originally characterized by a combination of grasses, shrubs and scattered tree plan forms. Owing to this combination it is best referred to as the Woodland Savannah vegetation ecosystem. The most common grass and weed forms include *Amarantus spinosus; Chryssanthellum americanum; Eragrostis tenella; Setaria barbata; Pennisetum polystechion; Schzachyrium; Syndrella nodifera; Tridax procumbens;* and *Ipomoea eriocarpa*. The most common tree and shrub plant forms found in the area include *Bauhinia, Thonningii, Balanites aegyptiaca, Ziziphus spp,* *Crateva adansonii, Celtis integrifolia, Ficus spp, Pakia biglobosa*, *Vitellaria paradoxa* and *Prosopis Africana* among others.

Prominent exotic wooded plant species include *Azadictracta indica, Eucalyptus spp., Khaya senegalensis, Phoenix dactylifera, Anacardium occidentale, Psidium Guajava, Mangifera indica, Citurs sinensi.* The occurrence of the aforementioned vegetation forms in the area is a pointer to the type of food, medicinal and economic plants that could propagated in the area.

4.9 Socio-Economic Environment

The primary information used in this study was gathered through Focus Group Discussion, Key Informant Interviews, meeting and questionnaire survey. The study area encompasses the project site and all the settlements investigated within the vicinity. The surveys involved quantitative statistics related to demographics and socio-economic livelihoods. Secondary data were sourced from government documents, articles, and books. Other information sources such as experts were used to secure reliable knowledge and understanding. In the process of quantitative data analysis, secondary data were reviewed to secure information on demographics, employment, and economy in general of the study area.

In order to generate information for this study, site visit was carried out to the facility site at Garin Mallam on 25th January 2024. The visit involved Taraba state representatives, African Development Bank representatives and SEIA team (Figure 4.8). Primary data for the work was collected by two consultants and seven field assistants between 25 and 28 February 2024. Apart from the interviews, focus group discussion and meeting held, purposive sample survey was conducted in the six settlements within the project vicinity. The purposive sampling was adopted to enable selection of the best suited communities and respondents that would adequately give required answers to the research questions. Another reason for choosing purposive sampling was to minimize errors which is often experienced with large sample size. It was also to enable us meetup with the challenges of time.

Figure 4.8: SEIA Visitation Team at Garin Mallam Facility Site.

Equal number of males and females were sampled in each of the six settlements for questionnaire administration as presented in Table 4.7. Five males and females were purposely sampled from the communities with less than one thousand populations, while ten males and females were selected from the rest of the communities with over one thousand people. Figure 4.9 illustrates the filling of survey questionnaire by the participants in the various communities. During the survey, site observation was undertaken to have a deeper understanding of current baseline conditions in the study area. Data was also generated on the socio-economic living conditions of the affected settlements. Moreover, information was sourced on community perception on socio-economic impact of the project. The analysis was done using SPSS software and the results presented in tables and figures.

Figure 4.9: Respondents Filling the Survey Questionnaire in the Communities.

Table 4.7: Total Number of Sampled Respondents

S/No	Settlement	Number of Sample
1	Garin Dogo	20
2	Garin Mallam	20
3	Kaudat	10
4	Lau	20
5	Minda	20
6	Riggi	10
	Total	100

4.9.1 Socio-Economic and Demographic Profile

This is essential to ascertain and outline the socio-economic impacts of the Agro-Industrial Zone project as described in the following sub-sections. The information here is kept concise providing adequate facts to understand the impacts and to enlighten management plan. The section gives update and analyze the governance, demographic and socio-economic characteristics of only the affected communities.

Administrative Structure

The Nigerian country is divided into States, Local Government Areas (LGAs), Districts and Villages. Lau is an LGA headquarters and one of the – LGAs in Taraba State. The project site and the six studied settlements are situated in the same district within the Lau LGA. The LGA is governed by an elected chairman known as the Chief Executive Officer of the local government. In Taraba State, the most senior traditional leaders are called differently in the regions. For instance, in Jalingo, the most senior traditional leader is called the Emir, while in Wukari, the most senior traditional leader is known as the Aku. In this hierarchy, the District Head (Hakimi) is responsible for overseeing the affairs related to culture and values in a group of communities. The village head supervises a village community, the ward head (Mai Unguwa) provides leadership over a unit of community or village. The family heads are Household Heads who oversee the affairs of individual families. Figure 4.10 gives a proper illustration of the leadership hierarchy.

Figure 4.10: Traditional Administration Hierarchy (Adopted from Richflood, 2020)

Population

This report reflects 6 settlements within Lau Local Government Area of Taraba State. The population figures for the studied settlement are provided in Table 4.8. The total population for the study area is 19,000. The largest settlement is Lau, with the population of 10,000 people, and is the local government headquarters. It is followed by Garin Dogo (3,000) and is nearest settlement to Garin Mallam, the facility site and Lau, the LGA headquarters. Minda (2,600) is next largest settlement and closest to the project site. The smallest settlement around the area from population perspective is Riggi with 7,00 people.

In terms of distance, Lau is the furthest settlement from the project site, with a distance of 4 Km from the project site. Garin Mallam where the project site is located is the nearest with a distance of 5,00 metres. Lau town is the oldest settlement in the area, which has been in existence for more than 120 years. Garin Mallam, Garin Dogo and Minda were established between 1900 and 1910. Kaudat and Riggi are the newest villages, established in about 80 years ago.

The local population density was not determined. But the household surveys show that the average size comprises between five and seven members. Such large households are associated with the people's culture of polygamy, where a man have more than one wife. Most of the households are nuclear households, that is, closely related family members mostly consisting of parents and children.

Table 4.8: Population and Distance of the Project Affected Settlements

S/No	Settlement	Population	Distance from Facility Site
1	Garin Mallam	1,500	500 Metres
2	Garin Dogo	3,000	3½ Km
3	Kaudat	1,200	3 Km
4	Lau	10,000	4 Km
5	Minda	2,600	2½ Km
6	Riggi	7,00	3 Km
7	Total	19,000	

Gender Profile

The result of gender in Figure 4.11 shows that equal percentages (50%) of male and female were sorted for questionnaire survey in this study. Such balanced gender perspective, expresses equality, freedom from discrimination, and helps to enhance the scientific quality and relevance of research.

This is because gender defines the power, privilege and possibilities that some people have and some do not have in the society or a given area.

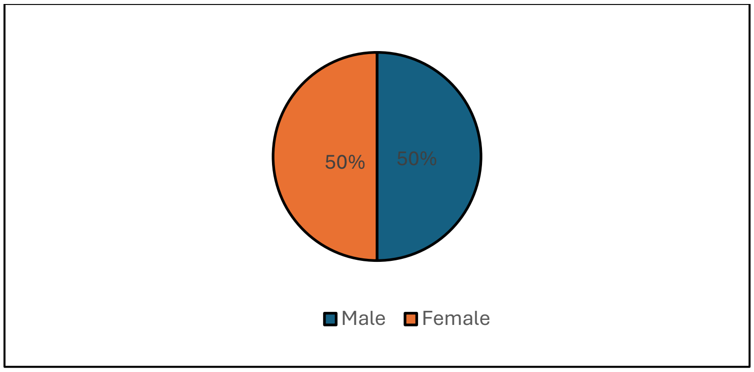


Figure 4.11: Gender of the Respondents

Age Status

Figure 4.12 provides the different age categories in the study area. A sizeable percentage (88%) of the people is within the working-age population of between 18 and 54 years of age. Few (12%) people are 55 years or older. This data has not been related with 2006 NPC data, which is considered to be obsolete. Notwithstanding, the 2006 census did not indicate an identical percentage of people in Taraba within the working-age population.

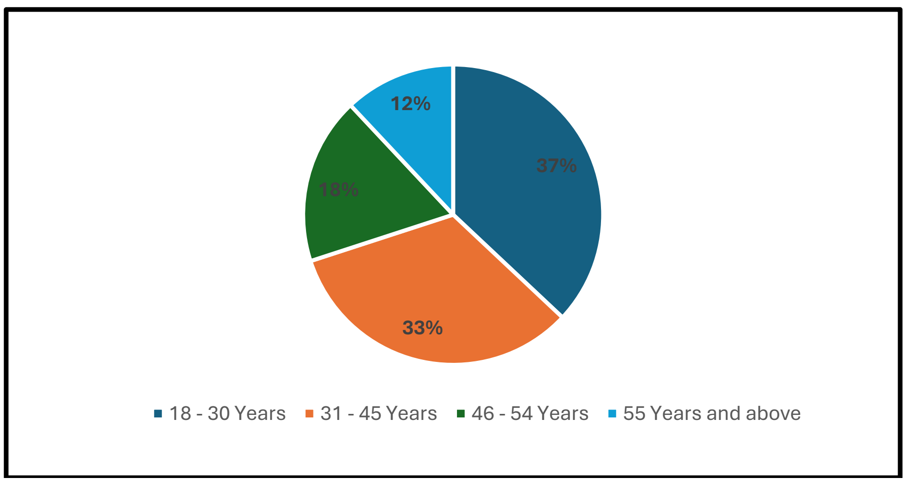


Figure 4.12: Age Group of the Respondents

Occupation Status

Figure 4.13 illustrate the occupational distribution of the study area inhabitants. The result reveals that the major occupation of the people was farming as indicated by 66% of the respondents. About 22% of the respondents were business men and women. Therefore, business is second major career of the people. Only 12% were civil servants and 4% indicated other professions like community leadership and security agent.

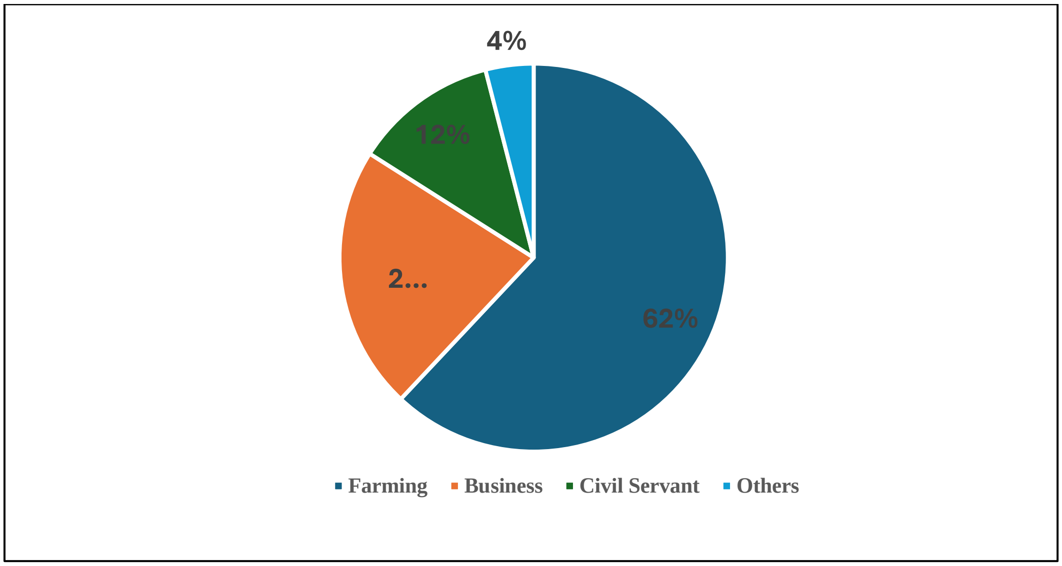


Figure 4.13: Occupation of the Respondents

Educational Qualification

The various educational qualification obtainable in the study area is illustrated in Figure 4.14. The result indicates that most (45%) of the people have NCE/ND certificates. The second majority (27%) of the people have secondary school certificates. About 13% of the people in the study area have attained primary school education. Only 8% of the population have obtained HND/BSc qualification. Just few (7%) of the people attended informal education.

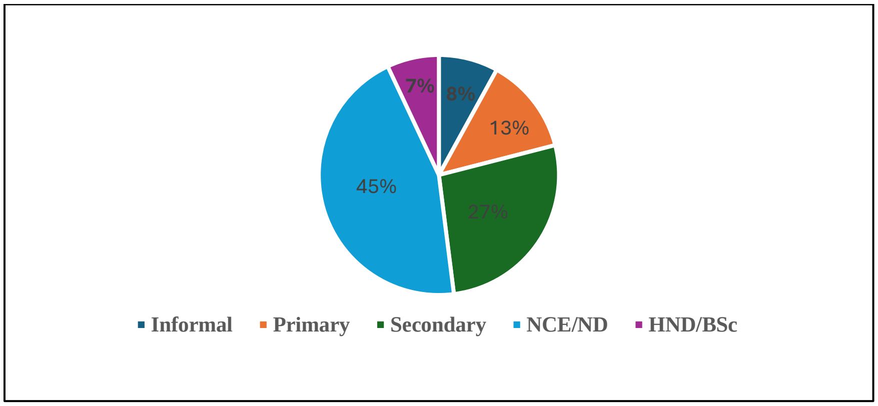


Figure 4.14: Educational Qualification of the Respondents

Monthly Income Status

The monthly income of the people is provided in Figure 4.15. The result reveals that majority (33%) of the respondents earn between even to thirty thousand naira per monthly. About 27% of the population earn between five to ten thousand naira monthly. Thirty percent (30%) of the people earn about thirty-one thousand naira (#31, 000) and above per month. This result implies that about 60% of the people living in the study area are low income earners. Hence establishing the Agro-Industrial Zone project in the area is timely and will go a long way in diversifying the economy and thereby enhancing people's income and improving their standard of living.

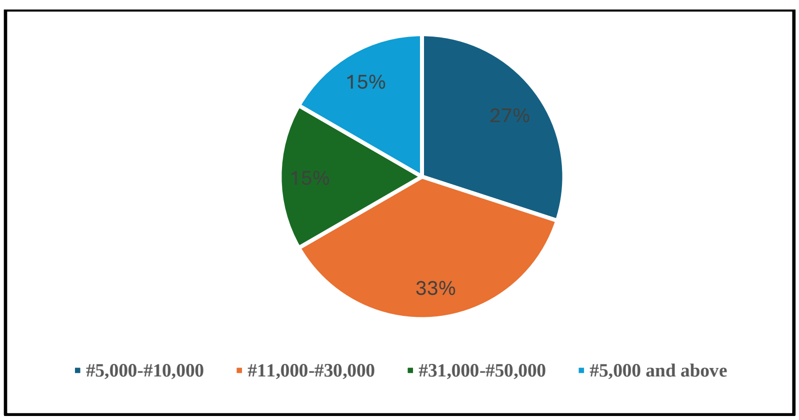


Figure 4.15: Monthly Income of the Respondent

Duration in the Community

The information on duration of stay in the community is illustrated in Figure 4.16. The result discloses that a greater percentage (66%) of the respondents have stayed in their respective communities for a period of twenty years and above. About 15% stayed for a period of eleven to nineteen years. Eleven percent (11%) stayed for six to ten years, while only eight percent stayed for the period of less than five years in their respective communities. Since most of the people have stayed for a longer period of time in the study area. This gives them adequate experience and knowledge that is required about the socio-economic conditions and dynamics in cultural, economic and social life style in the area.

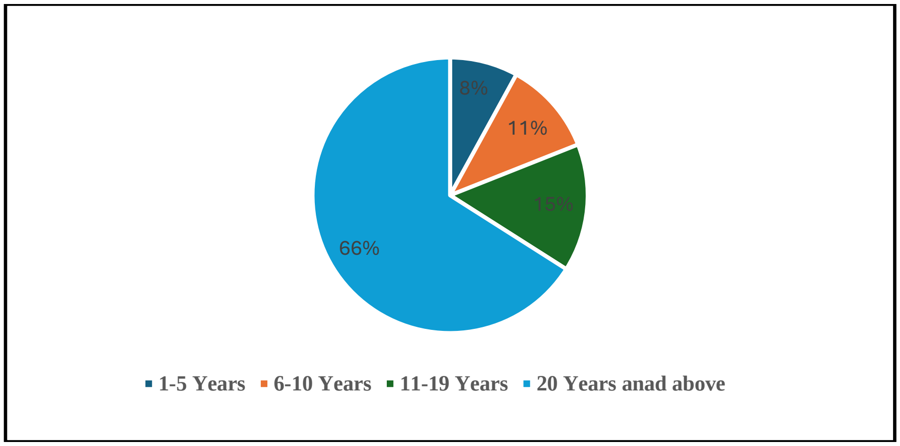


Figure 4.16: Duration of Stay in the Community

Languages Spoken in the Project Affected Communities

Several languages were found to be spoken in the communities of the study area. The result in Table 4.9 reveals that about ten different dialects are spoken in the area. Most (57%) of the respondents indicated Mumunye as one of the languages spoken in the area. About 30% of the respondents indicated hausa and Minda, while 24% specified Fulani and Lamnjawa. Only 1% point out that Chamba and Gomo are spoken in the study area. This outcome signifies that the communities are multi-ethnic in nature.

Table 4.9: Languages Spoken in the Project Affected Communities

S/NO	Language	Response	Frequency	Percent
1	Mumunye	Yes	57	57.0
		Missing	43	43.0
		Total	100	100
2	Fulani	Yes	24	24.0
		Missing	76	76.0
		Total	100	100.0
3	Lamnjawa	Yes	24	24.0
		Missing	76	76.0
		Total	100	100.0
4	Hausa	Yes	30	30.0
		Missing	70	70.0
		Total	100	100.0
5	Minda	Yes	30	30.0
		Missing	70	70.0
		Total	100	100.0
6	Jenjo	Yes	14	14.0
		Missing	86	86.0
		Total	100	100.0
7	Wurukun	Yes	19	19.0
		Missing	81	81.0
		Total	100	100.0
8	Yanda	Yes	9	9.0
		Missing	91	91.0
		Total	100	100.0
9	Kuna	Yes	8	8.0
		Missing	92	92.0
		Total	100	100.0
10	Luguda	Yes	2	2.0
		Missing	88	88.0
		Total	100	100.0
11	Chamba	Yes	1	1.0
		Missing	99	99.0
		Total	100	100.0
12	Gomo	Yes	1	1.0
		Missing	99	99.0
		Total	100	100.0

4.9.2 Existing Socio-Economic Activities and Amenities

This section provides information on the socio-economic activities prevailing the study area. It captures facts on agricultural production, that is, types of crop cultivated, major economic trees, and the types of social organization found in the area.

Crop Cultivation

This sub-section describes the agricultural activities which forms basic part of village livelihoods and the backbone of rural economy. Agricultural production in the study area is mainly for subsistence purpose, which means it is closely associated to food security. Therefore, crops are cultivated to feed the family and to obtain little income to carter for the needs of the family members.

The type of trees raised and maintained in the study area were investigated. The result presented in Table 4.10 discloses that about eleven different type of crops are cultivated by the people. Most (73%) of the respondents specified cassava as a common crop in the area. The other crops mostly cultivated by the people includes maize (60%), beans (56%), yam (55%), ground nuts (54%), rice (52%), and millet (50%). However, beniseed, melon, Bambara nuts, soya beans, and coco yam were identified by less than fifty percent of the respondents. The yield per hectare and price Kilogramme of crops is not captured in the study due to time constraint. This finding signifies that several types of crops are produced by the local communities. Such crops would serve as supplement raw material that can boost production of the Agro-Industrial Zone Project. The people need to be encouraged by supporting their farming activities to ensure adequate production and sustainability of the project.

Table 4.10: Type of Crops Cultivated in the Study Area

S/NO	Crop	Response	Frequency	Percent
1	Yam	Yes	55	55.0
		Missing	45	45.0
		Total	100	100
2	Rice	Yes	52	52.0
		Missing	48	48.0
		Total	100	100.0
3	Ground Nuts	Yes	54	54.0
		Missing	46	46.0
		Total	100	100.0
4	Guinea Corn	Yes	50	50.0
		Missing	50	50.0
		Total	100	100.0
5	Maize	Yes	60	60.0
		Missing	40	40.0
		Total	100	100.0
6	Beniseed	Yes	20	20.0
		Missing	80	80.0
		Total	100	100.0
7	Millet	Yes	50	50.0
		Missing	50	50.0
		Total	100	100.0
8	Melon	Yes	40	40.0
		Missing	60	60.0
		Total	100	100.0
9	Bambara Nuts	Yes	47	47.0
		Missing	53	53.0
		Total	100	100.0
10	Beans	Yes	56	56.0
		Missing	44	44.0
		Total	100	100
11	Soya Beans	Yes	30	30.0
		Missing	70	70.0
		Total	100	100.0
12	Cassava	Yes	73	73.0
		Missing	27	27.0
		Total	100	100.0
13	Coco Yam	Yes	46	46.0
		Missing	54	54.0
		Total	100	100.0

Economic Trees

There are trees that have economic values either because of the fruit they bear or for preservation of the environment. Such type of trees is commonly found in the study area. The result presented in Table 4.11 shows that majority (80%) of the respondents indicated orange as one of the economic trees found in the area. About 77% and 76% respectively mentioned mango and banana. Some of the trees specified by most of people includes moringa (68%), baobab tree (56%) and cashew tree (56%). Others stated trees such as Guava (53%), locust beans tree (52%), shear butter (51%), tamarind (50%), and iroko (50%). Figure 13 show typical examples of economic trees found in the study area.

Table 4.11: Type of Economic Trees in the Study Area

S/NO	Economic Tree	Response	Frequency	Percent
1	Shear Butter	Yes	51	51.0
		Missing	49	49.0
		Total	100	100
2	Locust Beans	Yes	52	52.0
		Missing	48	48.0
		Total	100	100.0
3	Baobab Tree	Yes	44	44.4
		Missing	56	56.o
		Total	100	100.0
4	Tamarind	Yes	50	50.0
		Missing	50	50.0
		Total	100	100.0
5	Guava	Yes	53	53.0
		Missing	47	47.0
		Total	100	100.0
6	Moringa	Yes	68	68.0
		Missing	32	32.0
		Total	100	100.0
7	Dead Palm	Yes	45	45.0
		Missing	55	55.0
		Total	100	100
8	Cashew	Yes	56	56.0
		Missing	44	44.0
		Total	100	100.0
9	Iroko	Yes	50	50.0
		Missing	50	50.0

		Total	100	100.0
10	Orange	Yes	80	80.0
		Missing	20	20.0
		Total	100	100.0
11	Banana	Yes	76	76.0
		Missing	24	24.0
		Total	100	100.0
12	Mango	Yes	77	77.0
		Missing	23	23.0
		Total	100	100.0

Figure 4.17a, b, and c: Mango Tree, Locust Bean Tree and Cashew Tree Orchard

Other Economic Activities

During the field survey, it was observed that the inhabitants of the area studied engage in other economic activities such as manual stone quarrying and fire wood fuel selling. They do this in order to supplement their meager earnings from the subsistence farming. However, individual's earning from such activities is not reflected in this study due to time constraint. Figures 14 and 15 illustrate the quarrying and fire wood selling activities in the study area.

Figure 4.18: Manual Stone Quarrying along Jalingo – Lau Highway

Figure 4.19: Firewood Selling Depot along Jalingo - Lau Highway

Existing Social Organizations

The social organizations existing in the communities was studied. The result presented in Table 4.12 shows that greater percentage (87%) of stated that they have youth association in their communities. About 64% specified women association, 62% indicated farmers' association, while 40% of the respondents itemized other organizations such as hunters and vigilante associations. They expressed that these social organizations provide security, support, and sense of purpose, allowing individuals to thrive and work together towards success in their communities.

Table 4.12: Existing Social Organization in the Communities

S/NO	Organization	Response	Frequency	Percent
1	Youth Association	Yes	87	87.0
		Missing	13	13.0
		Total	100	100
2	Women Association	Yes	62	62.0
		Missing	38	38.0
		Total	100	100.0
3	Farmers' Association	Yes	64	64.0
		Missing	36	36.0
		Total	100	100.0
4	Others	Yes	40	40.0
		Missing	60	60.0
		Total	100	100.0

Existing Social Amenities

The current social amenities in the study area was considered. The result in Table 4.13 reveals that most (85%) of the respondents indicated borehole. The second majority (82%) of the people mentioned school, 50% noted healthcare centre, while 40% of the respondents cited other amenities like market, police station and army base. Such social amenities have significant positive impact on the health and well-being of people within a community. They similarly provide opportunities for recreation where people come to relax. The government security out fits such as police station and army base to ensure safety in the communities. However, it was observed that the studied communities generally experience scarcity of social amenities. This calls for immediate action and intervention by the concerned government agencies and NGOs. Table 8 provide the list of social amenities found in the communities. Table 4.14 provides list of social amenities available, while Figures 4.20 and 4.21 illustrate the major types of social amenities found in the study area.

Table 4.13: Existing Social Amenities in the Affected Communities

S/NO	Amenity	Response	Frequency	Percent
1	School	Yes	82	82.0
		Missing	18	18.0
		Total	100	100
2	Healthcare Centre	Yes	50	50.0
		Missing	50	50.0
		Total	100	100.0
3	Borehole	Yes	85	85.0
		Missing	15	15.0
		Total	100	100.0
4	Others	Yes	40	40.0
		Missing	60	60.0
		Total	100	100.0

Table 4.14: List of Social Amenity Existing in the Study Area

S/No	Community	Primary School	Secondary School	Healthcare Centre	Police Station	Borehole	Market
1	Garin Dogo	√	√	√	√	√	√
2	Garin Mallam	√	NA	NA	NA	√	√
3	Kaudat	√	NA	NA	NA	√	√
4	Lau	√	√	√	√	√	√
5	Minda	√	NA	√	√	√	√
6	Riggi	√	NA	NA	NA	√	√

Figure 4.20a and b: Hand Pump Borehole and Primary School Complex


Figure 4.21 a and b: Rural Market Square and Healthcare Centre

4.9.3 Community Perception on Socio-Economic Impact of the Agro-Industrial Zone

Project

This section assesses the perception of people on the socio-economic impact of the Agro-Industrial Zone project in the affected communities. The analysis is critical so as to understand the potential range of impacts of the proposed change to be caused by the new project. It will also provide insight on the responses of those impacted if the change occurs.

Awareness of The Agro-Industrial Zone Project

People's awareness of the proposal to establish the Agro-Industrial Zone project within the study area was investigated. The result in Table 4.15 reveals that most (54%) of the community members indicated lack of awareness of the new developmental project. Less than half (42%) of the respondents acknowledged cognizance of the project. The finding implies is that there is inadequate information about the project among the community members. Hence more awareness needs to be created among the people to make them more informed and empowered. This will make the people secure ownership, commitment and encourage active participation by the citizens who are better equipped to defend the course and address the challenges that might be caused in future by the project.

Table 4.15: Awareness of the Agro-Industrial Zone Project

Response		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	42	42.0	43.8	43.8
	No	54	54.0	56.3	100.0
	Total	96	96.0	100.0	
Missing	System	4	4.0		
Total		100	100.0		

The Need for Workshop to Create Awareness

The perception of community members on the need of workshop was explored. The outcome in Table 4.16 shows that majority (86%) of the people indicated interest in workshop. Just an insignificant percentage (5%) of the respondent did not show interest in workshop. This finding infers that awareness campaign need to be carried out in the project affected communities. Such campaign does not only help public visibility and consciousness of developmental project. But it as well increases community's knowledge of the available programmes and services to be offered.

Table 4.16: The Need for Workshop to Create Awareness

Response		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	86	86.0	94.5	94.5
	No	5	5.0	5.5	100.0
	Total	91	91.0	100.0	
Missing	System	9	9.0		
Total		100	100.0		

Community as Stakeholders of the Project

The perception of people on communities as stakeholder in the project was explored. The result in Table 4.17 discloses that most (74%) of the respondents indicated communities serve as stakeholders in developmental project. Only 16% of the respondents did not consent to the view. Community-level stakeholders are individuals with interest in a project or individuals who will be affected by a project.

Table 4.17: Communities as Stakeholders of the Project

Response		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	74	74.0	82.2	82.2
	No	16	16.0	17.8	100.0
	Total	90	90.0	100.0	
Missing	System	10	10.0		
Total		100	100.0		

Involvement of Communities in Project Decision Making

Perception on involvement of communities in decision-making on project implementation was examined. The outcome in Table 4.18 unveils that greater percentage (88%) of the people proclaimed that the communities need to be involved in decision-making. Just insignificant percentage (7%) of the respondents declined the idea of involving the communities in decision-making. Public participation in decision-making is expedient in project implementation. This is because such individuals or those representing the public might have decision-making capabilities related to the project implementation. Spalang & Vroom (2007) observed that it is wise for project managers to try as much as possible to involve relevant internal and external stakeholders in the decision-making process to tap their ideas that will ensure growth, sustainability and curtail the unforeseen challenges that the project may instigate over a period of time.

Table 4.18: Involvement of Communities in Project Decision Making

Response		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	88	88.0	90.7	90.7
	No	7	7.0	7.2	97.9
	3.00	1	1.0	1.0	99.0
	14.00	1	1.0	1.0	100.0
	Total	97	97.0	100.0	
Missing	System	3	3.0		
Total		100	100.0		

Attitude of Communities Towards the Agro-Industrial Zone Project

The thoughts and feelings of community dwellers towards the agro-industrial zone was inspected. The findings in Table 4.19 avers that the community members have diverse feelings about the project. Majority (70%) of the people expressed acceptance for the new developmental project.

The second majority (63%) indicated happiness, 59% specified courage, 52% showed support for the project. Almost half of the respondents respectively expressed satisfaction and motivation about the project. However, during the face-to-face interview, some individuals expressed fear about feasibility and sustainability of the project. Such people buttressed their view by citing some gigantic projects initiated in the past that have become abandoned in their communities.

Table 4.19: Attitude of Communities Towards the Agro-Industrial Zone Project

S/NO	Attitude	Response	Frequency	Percent
1	Acceptance	Yes	70	70.0
		Missing	30	30.0
		Total	100	100
2	Happiness	Yes	63	63.0
		Missing	37	37.0
		Total	100	100.0
3	Satisfaction	Yes	50	50.0
		Missing	50	50.0
		Total	100	100.0
4	Support	Yes	52	52.0
		Missing	48	48.0
		Total	100	100.0
	Courage	Yes	59	59.0
		Missing	41	41.0
		Total	100	100.0
	Motivation	Yes	50	50.0
		Missing	50	50.0
		Total	100	100.0

4.9.4 Benefits of the Agro-Industrial Zone Project to the Communities

The opinion of people on the benefits of the new project to the affected communities was surveyed. The data in Table 4.20 indicates that most (67%) considered the project a means of employment opportunity. The second majority (60%) of the respondents considered economic diversification as the benefit of the new project. About 57% of the participants stated carrier development, 54% mentioned increase in income, 52% opportunity for infrastructure development, while 51% considered improvement in well-being as the benefit of the Agro-Industrial Zone project. These findings aver that the people in the study area are conversant with the purpose of community developmental project. Through initiating such project, government attempts to create more wealth opportunities for community members.

Table 4.20: Benefits of the Agro-Industrial Zone Project to the Communities

S/NO	Benefit	Response	Frequency	Percent
1	Employment Opportunity	Yes	67	67.0
		Missing	33	33.0
		Total	100	100
2	Increase in Income	Yes	54	54.0
		Missing	46	46.0
		Total	100	100.0
3	Improvement in Well-Being	Yes	51	51.0
		Missing	49	49.0
		Total	100	100.0
4	Economic Diversification	Yes	60	60.0
		Missing	30	30.0
		Total	100	100.0
5	Carrier Development	Yes	57	57.0
		Missing	43	43.0
		Total	100	100.0
6	Infrastructural Development	Yes	52	52.0
		Missing	48	48.0
		Total	100	100.0

Social Organization that will Benefit from the Project

The opinion of people on the type of social organization that will benefit from the Agro-Industrial Zone Project was inquired. The result in Table 4.21 discloses that most (84%) considered farmers' association that will greatly benefit from the project. The second majority (70%) of the participants indicated youth association, women association was specified by 55%, while 30% of the respondent itemized other associations like security agents specifically hunters and vigilante groups.

Table 4.21: Social Organization that will Benefit from the Project

S/NO	Social Organization	Response	Frequency	Percent
1	Youth Association	Yes	70	70.0
		Missing	30	30.0
		Total	100	100
2	Farmers' Association	Yes	84	84.0
		Missing	16	16.0
		Total	100	100.0
3	Women Association	Yes	55	55.0
		Missing	45	45.0
		Total	100	100.0
4	Others (Security)	Yes	30	30.0
		Missing	70	70.0
		Total	100	100.0

The Benefiting Communities from the Agro-Industrial Zone Project

Developmental projects are undertaken in order to make positive and direct impacts on the local communities. Therefore, inquiry was made on the communities that will mostly benefit from the proposed Agro-Industrial Zone project. The result presented in Table 4.22 discloses that most (73) of the respondents indicated Garin Mallam, the closes community to the site will highly benefit from the project. The second majority of the participants considered Garin Dogo as the most benefiting community. About 60% of the respondents considered Minda, while 56% specified Lau as the utmost befitting community. These closest communities might benefit from the project in terms of local job, improved infrastructure, or funding for community groups or projects.

Table 4.22: The Benefiting Communities from the Agro-Industrial Zone Project

S/NO	Community	Response	Frequency	Percent
1	Garin Mallam	Yes	73	73.0
		Missing	27	27.0
		Total	100	100
2	Garin Dogo	Yes	66	66.0
		Missing	44	44.0
		Total	100	100.0
3	Lau	Yes	56	76.0
		Missing	44	24.0
		Total	100	100.0
4	Minda	Yes	60	60.0
		Missing	40	40.0
		Total	100	100.0

4.9.5 Challenges the Project May Cause to the Communities

Developmental projects are often associated with unforeseen challenges. In view of this, the unexpected challenges that might come with the Agro-Industrial Zone project was inquired. The result in Table 4.23 depicts that greatest percentage (67%) of the people said establishment of the project could lead to change in socio-cultural life style of the affected communities. The next majority (60%) of the participants indicated rise in cost of living as one of the challenges that might occur. About 55% of the respondents specified pressure on housing, 54% considered alteration of physical aesthetics, 51% stated breakage of social ties, few (30%) mentioned increased in-and out- migration as the consequence of instituting the project in their vicinity. This implies that management plan should be provided on the strategies for discussing the changes, threats, or opportunities to be noticed with the project. People should be encouraged to open up about any problem spotted, and to come up with solution.

Table 4.23: Challenges the Project May Cause to the Communities

S/No	Challenge	Response	Frequency	Percent
1	Change in Social/Cultural Life Style	Yes	67	67.0
		Missing	33	33.0
		Total	100	100
2	Alteration of Aesthetics	Yes	54	54.0
		Missing	46	46.0
		Total	100	100.0
3	Breakage of Social Ties	Yes	51	51.0
		Missing	49	49.0
		Total	100	100.0
4	Increased In – and Out - Migration	Yes	30	30.0
		Missing	70	70.0
		Total	100	100.0
5	Pressure on Housing	Yes	55	55.0
		Missing	45	45.0
		Total	100	100.0
6	Rise in Cost of Living	Yes	60	60.0
		Missing	40	40.0
		Total	100	100.0

4.9.6 Mitigation Measures for Unforeseen Challenges the Project Might Cause to the Communities

Opinion of the participants was sought on the possible mitigation measures that could be adopted to curtail the unforeseen challenges that might be brought by the project. The findings in Table 4.24 portrays that majority (84%) of the participants indicated provision of adequate social amenities as one of the measures to mitigate challenges of the project. The next majority (80%) of the respondents considered constituting impact monitoring and management committee as an expedient strategy. About 64% specified intervention by NGOs and social organizations, 60% itemized sustainability of food supply in the affected communities, while 50% identified abolishing bribery and corruption as the right measure to the challenges to be instigated by the project.

Table 4.24: Mitigation Measures for Unforeseen Challenges the Project Might Cause to the Communities

S/NO	Measure	Response	Frequency	Percent
1	Constituting impact monitoring and management committee	Yes	80	80.0
		Missing	20	20.0
		Total	100	100
2	Provision of adequate social amenities and infrastructure	Yes	84	84.0
		Missing	16	16.0
		Total	100	100.0
3	Intervention by NGOs and social organizations	Yes	64	64.0
		Missing	36	36.0
		Total	100	100.0
4	Abolishing bribery and corruption	Yes	50	50.0
		Missing	50	50.0
		Total	100	100.0
5	Sustainability of food supply in the affected communities	Yes	60	600
		Missing	40	40.0
		Total	100	100.0

This exercise has analyzed various socio-economic impacts in the studied area. The fundamental outcomes are summarized as follows:

Most of the communities in the area are rural villages that have no building guidelines. Majority of the inhabitants are rural poor who can hardly afford construction of standard houses. Instead they resort to using local building materials in house construction. This make their houses to be ill ventilated, have substandard fence and lack basic housing facilities, which in turn impact negatively on their well-being. There a need for government to put in place awareness campaign to enlighten the rural dwellers on the essentials of having basic housing facilities in their houses. Such will improve their health and well-being.

Finding indicates that the communities cultivate diverse crops which can serve as substitute raw materials to the Agro-Industrial Zone Project. Therefore, it is recommended for government in collaboration with the project management to provide a plan that will encourage and empower people of these communities through supporting their farming activities by giving them loans or farm item assistance. Enhancing people' farming activities will boost production of the project.

Result shows that most members of the concerned communities are not aware of the Agro-Industrial Zone project. In due course, greater percentage of the people wish workshop should be organized to educate them on the potential benefits to be derived from establishment of the project. We therefore recommend that government should organize workshop in the affected areas to enlighten the members of the relevance of the project to the concerned communities. Much awareness will make the people secure ownership, commitment and encourage active participation by the citizens who are better equipped to defend the course and address the challenges that might be caused in future by the project.

Result shows that greater percentage of the people suggest the need for the communities to be involved in decision-making about implementation of the project. Government should consider and speed up action on this opinion. This is because such individuals or those representing the public might have decision-making capabilities related to the project implementation. Therefore, involving stakeholders in decision-making process helps in tapping their ideas that will ensure growth, sustainability and curtail the unforeseen challenges that the project may instigate over a period of time. Discovery reveals that some individuals entertain fear about feasibility and sustainability of the project. Others fear of being sidelined from enjoying dividend in terms of due consideration for employment opportunity as host communities. In order to avoid any crisis that might emanate from such tendencies, federal character system should be observed whenever employment exercise is to be done. This will make peace to reign in the communities and ensure progress of the project.

CHAPTER FIVE
POTENTIAL AND ASSOCIATED AND IMPACTS

5.0 Introduction

This chapter undertakes an evaluation of the biophysical, health, and socioeconomic implications across all project phases, including pre-construction, construction, operation, and decommissioning. It presents the findings from a comprehensive assessment of the potential environmental impacts associated with the proposed SAPZ - AIH project to be situated and operated within the LAU Local Government Area (LGA) of Taraba State. The assessment considers both normal operational impacts and potential effects arising from abnormal occurrences.

The identified impacts are categorized as either threats or opportunities to human and environmental wellbeing. Project activities and their environmental interfaces encompass a wide array of concerns, such as air and water pollution, impacts on employment, and land use change, among others. These concerns have been thoroughly examined to determine the potential impacts of the proposed project on environmental receptors. This section outlines the overall approach to impact assessment and mitigation. The impact evaluation methodology is based on sectoral guidelines provided by FMEnv. It involves:

- Screening of potential impacts associated with each project phase using a Risk Assessment Matrix.
- Detailed evaluation of impact-producing factors within each project phase, with the significance of potential impacts quantified using consistent criteria.

The assessment approach involves aligning the proposed project's activities with the existing environmental components, identifying and evaluating potential changes in the environment resulting from these interactions, and proposing mitigation measures to address such changes. At this stage of the Environmental Impact Assessment (EIA), both negative and positive impacts of the proposed SAPZ – AIH, LAU project on the existing environment have been identified. Various references, including the EIA Procedural Guidelines, the ISO 14001 approach, and the Hazard and Effect Management Process (HEMP), were utilized in the identification process. The Risk Assessment Matrix (RAM) was employed to determine risks posed by identified potential impacts and to propose appropriate mitigation measures. In predicting impacts, a practical 'worst-case scenario' approach was utilized to assess extreme effects, while a 'consensus of opinions' method was employed to determine the importance of affected environmental components. Evaluation of impacts was conducted using specific criteria such as legal/regulatory requirements, magnitude of impact, risk posed, public perception, and importance of affected environmental components. This section of the report presents the outcomes of the identification and evaluation processes.

5.1 Impact Methodology Description

Figure 5.1 below depicts the steps taken in identifying, assessing, and evaluating the potential and associated impacts of the proposed project.

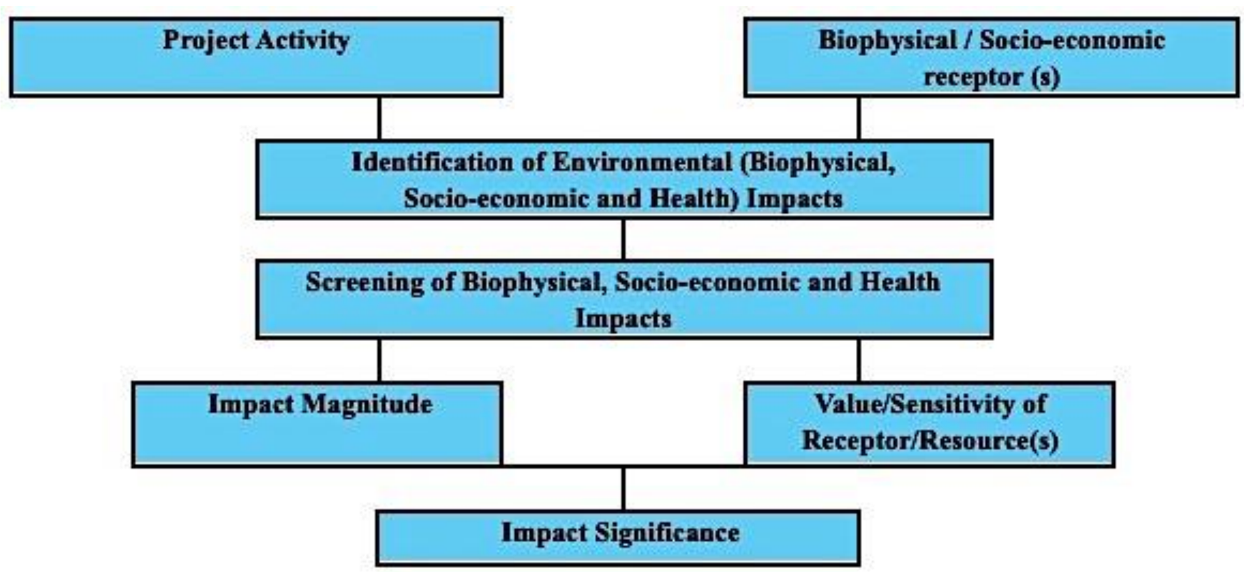


Figure 5.1: Impact Methodology Overview

5.1.1 Environmental and Social Indicators

The activities outlined in section three of this Environmental Impact Assessment (EIA) for the SAPZ – AIH, Lau project will interact with various environmental components, with their impacts monitored through specific indicators. These indicators encompass:

a. Noise and Vibrations

- **Measurement Units:** Decibels (dB).
- **Indicators:**
    - Baseline Noise Levels: Initial measurements to understand the pre-project noise levels.
    - Construction Noise: Monitoring during construction phases to ensure compliance with noise regulations.
    - Operational Noise: Assessment of noise during the operational phase of the project to gauge ongoing impact.

- Vibration Levels: Measurement of ground and structural vibrations, particularly near sensitive receptors like residential areas or wildlife habitats.

b. Ecological Impacts

- **Floral Abundance and Diversity:**
  - Species Inventory: Identification and cataloging of edible plants and weeds in the project area.
  - Vegetation Cover: Measurement of changes in plant cover and health.
  - Invasive Species: Monitoring the presence and spread of non-native plants.

- **Fauna Abundance and Diversity:**
  - Species Inventory: Identification of small reptiles, insects, and other fauna.
  - Population Monitoring: Tracking changes in population sizes and health of species.
  - Habitat Quality: Assessment of habitat conditions and suitability for local wildlife.

c. Hydrology and Water Quality

- Surface Water and Groundwater:
  - Dissolved and Suspended Solids: Measurement to assess water clarity and pollution levels.
  - pH Levels: Monitoring to ensure water remains within safe limits for aquatic life and human use.
  - Biochemical Oxygen Demand (BOD): Evaluation of organic pollution by measuring oxygen consumption.
  - Chemical Oxygen Demand (COD): Measurement of total oxygen required to oxidize both organic and inorganic matter.
  - Turbidity: Assessment of water clarity, indicating the presence of suspended particles.
  - Toxicity: Testing for the presence of harmful substances.
  - Heavy Metals: Analysis for metals like lead, mercury, and cadmium that can have severe health impacts.
  - Microbial Loads: Checking for pathogens and indicator organisms such as coliform bacteria.

d. Soil

- Type and Composition:
  - Soil Type Classification: Identification of soil types based on texture and structure.
  - Physicochemical Properties: Analysis of soil pH, nutrient content, organic matter, and moisture levels.
  - Microbial Composition: Assessment of soil microbial communities and their health.
  - Particle Size Distribution: Measurement of the proportions of sand, silt, and clay to understand soil texture.

e. Socio-Economic and Health Impacts

- Community Needs and Concerns:
  - Stakeholder Engagement: Regular consultations with host communities and third-party stakeholders to address concerns.
  - Impact Assessments: Evaluating the social impact of the project on local communities.

- Population and Ethnicity:
  - Demographic Surveys: Collecting data on community population and ethnic composition.
  - Cultural Sensitivity: Ensuring project activities are respectful of local customs and traditions.

- Community Relations:
  - Conflict Resolution: Mechanisms to address and resolve disputes arising from project activities.
  - Community Involvement: Involving local communities in decision-making processes.

- Livelihood Activities:
  - Employment Opportunities: Monitoring job creation and ensuring fair employment practices.
  - Income Levels: Assessing changes in community income levels as a result of the project.

- Health Facilities and Risks:
  - Healthcare Access: Evaluating the availability and quality of health services.
  - Health Risks: Identifying potential health risks associated with the project and mitigation measures.

- Waste Streams and Sanitation:
  - Waste Management Practices: Assessment of waste handling, treatment, and disposal methods.
  - Sanitation Facilities: Availability and condition of sanitation infrastructure.

- Land Use:
  - Land Use Changes: Monitoring changes in land use patterns and their impacts.
  - Zoning Compliance: Ensuring the project adheres to local land use regulations.

- Access to Electricity and Infrastructure:
  - Infrastructure Development: Assessment of improvements in infrastructure such as roads, transport, and electricity access.
  - Household Utilities: Monitoring access to essential services like water and electricity.

- Climate Change Factors:
  - Carbon Footprint: Measurement of greenhouse gas emissions associated with the project.
  - Climate Resilience: Assessment of the project's ability to withstand climate change impacts.

These indicators are essential for ensuring that the SAPZ – AIH, Lau project is conducted responsibly, with minimal adverse impacts on the environment and local communities. Monitoring these indicators will help in making informed decisions and implementing necessary mitigation measures.

5.1.2 Impact Identification and Characterization Technique

Impact identification is a crucial process that ensures the comprehensive identification and consideration of all potentially significant impacts during project design and implementation. These impacts are categorized into two types: positive and negative. Assessment of these impacts occurs at different stages of the project's life cycle, encompassing mobilization/construction, operation, and decommissioning phases. To assess the overall significance of the impacts, the adopted techniques take into account factors such as the nature, type, and reversibility of the impact, the magnitude of the change, and the current status and sensitivity of the resource/receptor. This process is illustrated in Figure 5.2.

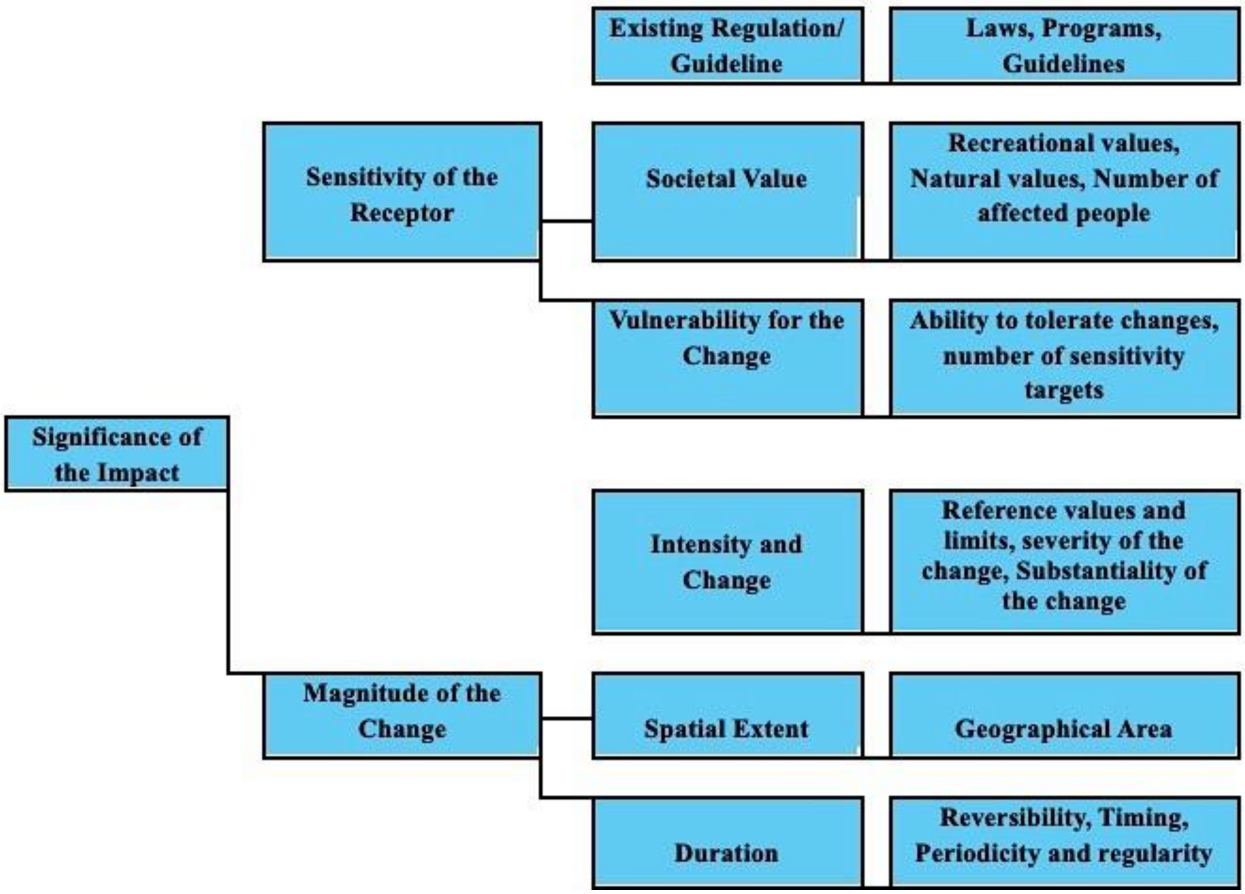


Figure 5.2: Impact Characterization

This involves the identification of the current baseline environmental, social, and project subcomponents that are expected to be affected by the proposed project. The identified impacts are categorized based on their reversibility, directness, temporality (short or long term), permanence, temporariness, and cumulative nature, among other factors.

Table 5.1: Impact Descriptions

NATURE OF IMPACTS	
Positive Impacts	These are significant benefits that result from an improvement to the baseline or the inclusion of new, desirable factor.
Negative Impacts	These are negative consequences caused by an antagonistic change from the baseline or introduction of a new, undesirable factor.
Direct Impacts	These are inevitable consequences that are directly related to the project's proposed activities.

Indirect Impacts	These are the changes that are less obvious or impacts are further away from the impact source.
Cumulative Impacts	Impacts resulting from the interaction of project components or activities with other activities in past, concurrently, or in the future.
Residual Impacts	These are the effects that persist even after mitigation measures have been implemented.
REVERSIBILITY / IRREVERSIBILITY	
Reversible Impacts	These are impacts that do not cause permanent change to the components of the environment.
Irreversible Impacts	These impacts cause permanent impairment to the environmental component of the area.
DURATION OF IMPACTS	
Long Term	Impacts that will continue for the life of the Project, but cease when the project stops operating
Short term	Short term impacts are predicted to last only for a limited period or as a result of mitigation measures and natural recovery
On-site	These are limited to the project site

5.1.3 Determination of Impact Significance

Determination of impact significance is based on two key criteria namely;

- Impact Significance Criteria
- Impact likelihood Criteria

Table 5.2: Impact Significance Criteria

CONSEQUENCE LEVEL	SIGNIFICANCE CRITERIA
Major (3)	**Workers Health and Safety:** one or more fatalities or life-threatening injuries/illness. **Environmental and Social**: widespread modification or extraordinary severity in physical environment or economic resources or social structure lasting more than one year, with an area extent of impact > 1 percent of study area.
Moderate (2)	**Workers Health and Safety:** injury requiring medical attention, or illness requiring long-term medical care or > 2 lost tie instances for same or recurring incident/illness during phase of work. **Environmental and Social:** local modification of measurable severity in physical environment or economic resources, lasting form a few months up to one year before recovery, with an area extent of impact extending from 01 to 1 percent of study area; or more widespread modification of lesser severity.
Minor (1)	**Workers Health and Safety:** 1-2 lost time instances for same or recurring illness/injury. **Environmental and Safety**: localized, relatively isolated change in physical environment or economic resources, lasting only a few days to a few months before recovery, with no observable residual effects; and with an area extending from 0.01 to 0.1 percent of study area; impacts less significant than exerted by nature.
Negligible (0)	**Workers Health and Safety**: Negligible first-aid case (no lost time) or near miss. **Environmental and Social**: Little or no change in physical environment, even temporarily, conditions consistent with background conditions.

Table 5.3: Impact likelihood Criteria

CONSEQUENCE LEVEL	SIGNIFICANCE CRITERIA
Probable (3)	Impact or event can reasonably be expected to result from project, occur routinely for similar operations.
Occasional (2)	The Impact or event has occurred in similar operations in this country or conditions could allow the impact/event to reoccur.
Seldom (1)	The impact or event has occurred once or twice in the company/industry, but conditions in this program are unlikely to allow the impact/event to occur.

Improbable (0)	The impact or event has never before occurred.

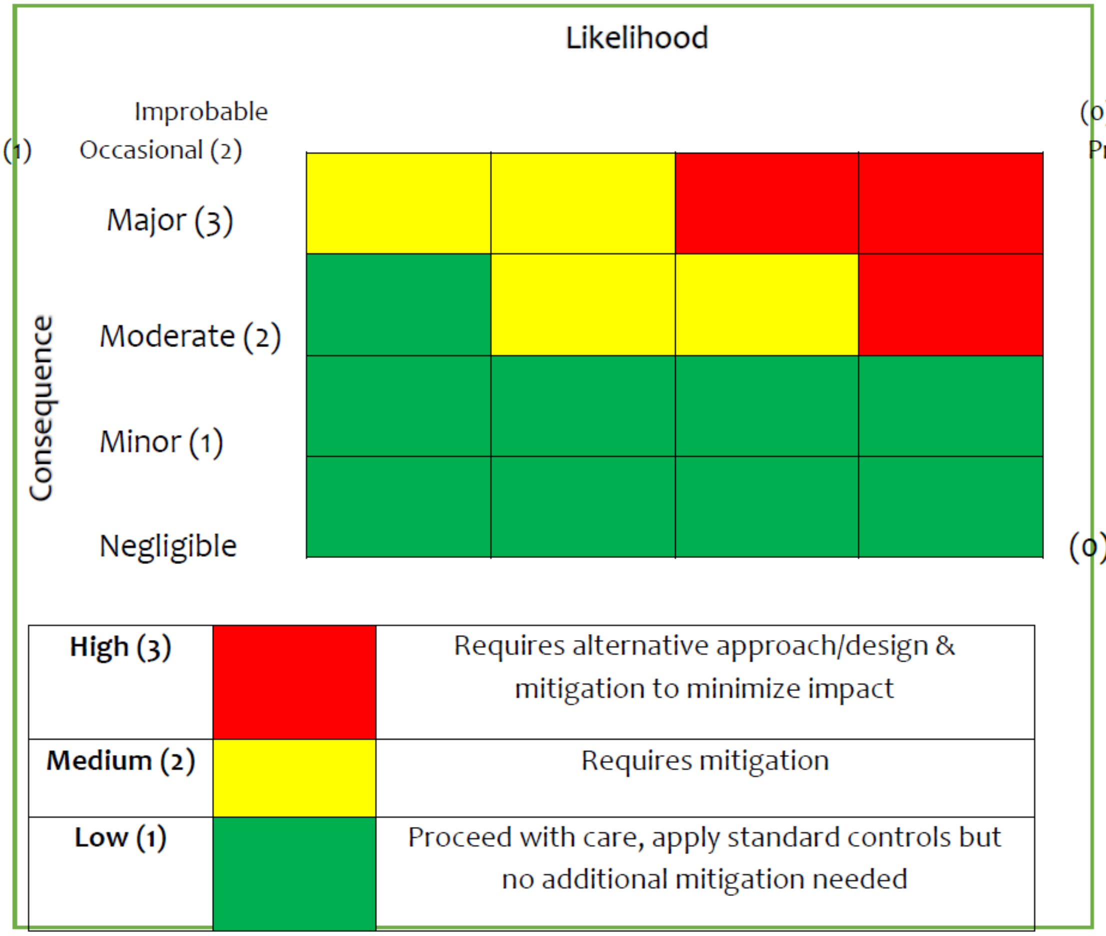


Figure 5.3: Impact Evaluation Matrix

5.2 Impact Methodology Description

The Impact Methodology Description provides a structured framework for assessing and evaluating the potential environmental and social impacts of proposed projects. This document outlines the methodologies, criteria, and tools utilized in conducting the Environmental and Social Impact Assessment (ESIA). The primary goal is to identify, predict, and mitigate adverse impacts while maximizing positive outcomes. The methodology overview includes:

Baseline Data Collection:

The assessment begins with comprehensive data collection to establish baseline conditions of the project area. This includes gathering information on environmental, social, economic, and cultural aspects through field surveys, interviews, and literature reviews.

Impact Identification:
Utilizing the collected baseline data, potential impacts associated with the project are identified. These impacts are categorized into environmental (e.g., air quality, water quality, biodiversity), social (e.g., community displacement, cultural heritage), and economic (e.g., employment opportunities, income generation).

Impact Prediction:
Various tools and models are employed to predict the magnitude, extent, and significance of identified impacts. Techniques such as Geographic Information Systems (GIS), environmental modeling, and stakeholder consultations are utilized to forecast potential impacts under different scenarios.

Impact Assessment:
Impacts are assessed based on predetermined criteria including severity, duration, reversibility, and spatial extent. Qualitative and quantitative methods are employed to evaluate both positive and negative impacts, considering their significance on the affected environment and communities.

Risk Assessment:
Risks associated with project activities are identified and analyzed, considering the likelihood and potential consequences of adverse events. This includes assessing risks related to natural hazards, project operations, and socio-economic factors.

Mitigation and Management Measures:
Based on the identified impacts and risks, appropriate mitigation and management measures will be developed to avoid, minimize, or compensate for adverse effects. These measures aim to enhance the ATC project sustainability and promote environmental and social responsibility.

Monitoring and Evaluation:

A monitoring and evaluation plan will be established to track the implementation of mitigation measures and assess the effectiveness of impact management strategies. Regular monitoring ensures compliance with regulatory requirements and enables adaptive management based on real-time data and feedback.

5.3 Impact Severity and Profiling

Table 5.5 illustrates the potential impacts and receptors throughout all stages/phases of project execution. It outlines the sources of impacts/risk, affected resources, intensity, scope, duration, consequence level and score, likelihood level and scope, as well as significance and residual impacts. These parameters facilitate the assessment of impact severity and the profiling of project activities.

Table 5.4: Summary of Key Impacts and Receptors for all Development Phases.

Pre-Construction Phase				
Project Activity	**Affected Resource / Outcome**	**Identified Impact**	**Scope**	**Impact Significance**
Land-take and acquisition	Land Loss	Alteration of population characteristics if previous owners of acquired lands relocate to get farmlands elsewhere, leading to alteration of population structure.	Localized	Moderate
	Livelihood Loss	Livelihood that would normally result from tilling the land for agriculture would be lost, resulting in lower living standards for affected people.	Localized	High
	Conflict	Conflicts could occur if compensation for acquired land is not properly handled.	Localized	Medium
	Air Quality	Increased suspended particulate in ambient air and degradation of	Localized	High

Site clearing and preparation		ambient air quality by emission from construction machinery.		
	Surface and Groundwater	Due to the project site's close proximity to surface water, surface water impacts may result from site clearing and preparation activities. During site clearing, runoff from cleared areas, especially if conducted during the rainy season, could carry sand and clay/silt particles into the water, increasing turbidity. Additionally, if vegetal materials from clearing are transported into the surface water, it could elevate organic matter levels, leading to increased biochemical oxygen demand (BOD) and heterotrophic microbe populations. Furthermore, waste materials such as domestic and sanitary waste from on-site workers, as well as leaks or spills of lube and fuel from equipment and machinery, could also contaminate/pollute the surface water.	Dispersed	High
	Soil	The key impacts of site clearing and preparation on soil is denudation and subsequent exposure to erosion	Localized	Medium

	Vegetation and Wildlife	Loss of vegetation and migration of wildlife from the area, leading to alteration of species composition and abundance	Dispersed	High
	Human Resources and Influx	Influx of job seekers into the area will lead to an alteration of population characteristics in the project area	Dispersed	Moderate
	Waste Generation	Potential soil and /or water contamination form mishandling of generated solid and liquid wastes, and construction waste.	Dispersed	High
	Health	Negative health effects on health of project workers and host communities by emissions and dust released from site clearing and preparation activities	Localized	High
	Conflict	Conflicts may arise during site clearing and preparation activities due to inadequate consultations and/or perceived inequalities in employment	Localized	Medium
Construction Phase				
	Surface and	Due to the project site's close proximity to surface water, potential impacts may arise from waste generated by workers on-site. This	Dispersed	High

Mobilization of materials, equipment and men to site	Groundwater	waste includes spent lube oils from vehicles and cranes. Additionally, sanitary waste from on-site workers could result in the introduction of heterotrophic microbes into the surface water. Improper disposal of food cans and tins may also lead to heavy metal contamination of the water.		
	Soil	Heavy duty trucks used for mobilization could cause soil compaction, leading to structural changes. Wastes from construction camps could also cause soil contamination	Localized	Medium
	Vegetation and Wildlife Loss	Loss of vegetation during setting up of construction camp as well as scaring wildlife species away with noise from vehicles and equipment used during construction.	Dispersed	Medium
	Air Quality and Noise	Emissions and noise from vehicles, machinery, and equipment used for mobilization and site lighting generators could degrade ambient air quality and elevate noise levels.	Localized	High
	Human Resources and Influx	Influx of job-seekers could alter population characteristics of the area.	Dispersed	Medium

		Pressure on existing infrastructure due to influx.		
	Noise Quality	Project-related traffic could lead to congestion, negatively affecting local people.	Public	Medium
	Health and Air Quality	Gaseous emissions from project equipment and machinery could cause health effects, mostly respiratory. Possible increase in communicable diseases due to influx is a possible impact.	Localized	High
	Conflict	Conflicts could arise between project workers and host communities if adequate consultations are not held	Localized	Medium
	Air Quality	Emissions from vehicles and machinery, as well as dust and suspendable particulates generated from trenching activities and machinery such as concrete mixers and piling machines, could lead to degradation of air quality and elevation of ambient noise levels.	Localized	High
		Piles may be driven down to the upper water table level, potentially causing inadvertent infiltration of groundwater by cement and		

Civil/Structural works and facility installations	Surface and Groundwater	concrete. Abstraction of water from the aquifer could result in the depletion of groundwater resources, ultimately leading to subsidence. Additionally, the erection of transmission line poles in the water may disturb sediment, resulting in increased turbidity. Furthermore, cement and other hazardous materials from civil/structural works could be transported into surface water, causing contamination.	Dispersed	High
	Soil	Potential infiltration and contamination of soil with hazardous materials may occur, potentially altering soil fertility status and inducing nutrient toxicity in plants.	Localized	High
	Vegetation and Wildlife	The productivity of plants may decrease due to a reduction in the photosynthetic area on leaves, blockage of stomatal pores, interference with transpiration and respiration, and mechanical damage to leaf surfaces. This could predispose plants to secondary infections. Additionally, noise generated by machinery may	Dispersed	Medium

		frighten wildlife species away from the site, resulting in their migration and potentially altering the composition and abundance of species in the area.		
	Health	Potential health impacts on workers and host communities due to emissions from equipment and machinery. Injuries (and deaths) of site workers should be included as possible impact.	Localized	High
	Conflict	Conflicts may emerge during site clearing and preparation activities due to insufficient consultations and/or perceived disparities in employment opportunities.	Localized	Medium
Operation and Maintenance Phase				
Operation of	Livelihood	Boom town effects and associated inflation, leading to price hikes without a corresponding increase in earning power of local communities. Impacts of excessive abstraction of underground water and storm water runoffs into surface water can affect water resources quality and availability for the local community.	Dispersed	High

the LAU, SAPZ – AIH	Human Resources and Influx	Possible influx of people who will provide value added services such as schools, banks, hospitals, supermarket/stores, etc. could lead to influx of populations into project area, causing alterations to population structure in the area and pressure on existing facilities.	Dispersed	Medium
	Transport And Nosie Quality	Traffic congestion may lead to physiological effects on individuals and increase the likelihood of accidents due to operational transportation.	Public	Medium
	Waste Generation	Potential soil and /or water contamination form mishandling of generated solid waste, operation waste and sewer created by the project. Potential adverse effect from unsustainable management of effluent and wastewater generated from operations.	Dispersed	High
	Conflict	Conflicts may arise if communities perceive that they are not receiving fair treatment and if promises made by proponents are left unfulfilled.	Localized	Medium
		During routine maintenance, the generation of hazardous materials		

Routine maintenance of utility, plants, mills and facilities	Surface and Groundwater	such as spent lube oils, fuel and oil filters, and spent batteries is possible. If not managed appropriately, these wastes could be washed into nearby surface water by runoff or infiltrate into the soil and groundwater, leading to contamination and pollution. This poses a risk to local communities that rely heavily on surface and groundwater aquifers for their water supply.	Dispersed	High
	Soil	Accidental release of hazardous materials generated from routine maintenance activities could lead to contamination of the soils, thus altering soil quality status	Localized	High
	Air and Noise Quality	The project activities may result in emissions from machinery and an increase in ambient noise levels due to the operation of maintenance equipment.	Public	Medium
Decommissioning and Closure Phase				
	Livelihood	Employees involved in the project may face job loss when decommissioning activities begin,	Localized	High

Dismantling of facilities, buildings, utility and ancillary facilities		impacting their employment and livelihood.		
	Surface and Groundwater	The impact of this activity on surface and groundwater quality will have both positive and negative aspects. On the positive side, the removal of piles and other structures will eliminate perturbations to surface and groundwater, returning conditions to pre-project levels. However, on the negative side, the dismantling of structures may disturb sediment, particularly if transmission line poles fall into surface water. Additionally, materials from dismantling could infiltrate groundwater, leading to contamination.	Dispersed	Low
	Air and Noise Quality	The use of vehicles, machinery, equipment for mobilization, and generators for lighting on site may emit gaseous emissions, particulates, and noise. These emissions and noise levels could contribute to the degradation of ambient air quality and an increase in ambient noise levels.	Localized / Public	High

	Vegetation and Wildlife	Noise generated by machinery may disturb wildlife species, causing them to flee the site and potentially leading to changes in species composition and abundance due to migration from the area.	Dispersed	Low
	Waste Generation	Potential soil and /or water contamination form mishandling of generated solid and liquid wastes, and other decommissioning and closure procedures related waste.	Dispersed	Medium
	Transportation	Traffic congestion could lead to physiological effects on individuals due to associated stress and frustration.	Localized / Public	High
	Human Resources	The influx of job seekers into the area may result in changes to the population characteristics of the project area.	Localized	Medium

The primary objective of the ESIA study was to comprehensively identify and characterize all associated environmental impacts or effects resulting from the Lau, SAPZ Agro-Industrial Hub (AIH). While various approaches exist for predicting and evaluating project environmental impacts, the EIA Procedural Guidelines, the ISO 14001 approach, and the Hazard and Effect Management Process (HEMP), were mainly referenced in the impact identification process chosen for this study. Using this method, impacts ranging from low to severe significance were identified, assessed, and quantified. Notably, among the impacts with high significance ranking are:

a) Injury and personnel entrapment resulting from heavy lifting during construction.
b) Air pollution and potential climate change effects caused by fugitive emissions.
c) Contamination of surface water due to wastewater and effluent discharges.

d) Risk of explosions and fires resulting from routine activities and accidental incidents.
e) Noise pollution generated by process equipment.
f) Pollution of land and water from potential oil spill incidents.
g) Traffic and transportation impacts resulting from the loading of finished products.

5.4 Project Phases, Associated Activities and Potential Impacts

The proposed projects will engage with the environment through different avenues referred to as "development aspects," which may lead to alterations in the existing environmental conditions. These alterations are termed as "impacts." The activities associated with the phases of the SAPZ – AIH, Lau project and the identified environmental aspects of the proposed development that may induce impacts on the environment comprise:

A. Pre-Construction Phase

- Preliminary site surveys and investigation works.
- Land take for the proposed Special Agro-industrial Processing Zone (SAPZ) Hub.
- Mobilization of personnel and equipment for site preparation activities.
- Energy requirements (provision of energy for construction).
- Labor requirements.
- Stakeholders' engagement.
- Site preparation activities including fencing, vegetation removal, excavations, earth works.

B. Construction Phase

- Foundations work and construction.
- Concrete works and pilling.
- Site fabrication (welding) and coating.
- Construction of the Agro-industrial hub building.
- Construction and installation of various equipment, infrastructures and facilities (processing plants, treatment plants, power generation equipment, electric poles, and transformers, etc.).
- Technical finishing and fittings (civil, electrical, and plumbing works, backfilling, etc.).
- Demobilization.
- Commissioning Agro-processing hub

C. Operation Phase

- Operation of the SAPZ – AIH, LAU Facility.
- Use of water for domestic activities and industrial activities.
- Movement of raw materials in and finished products out of the Hub.
- Power generation and servicing (installation of electric pole to obtain electricity from an already existing power plant).
- Routine maintenance of installed facilities.
- Recruitment of workers.
- Waste generation

D. Decommissioning Phase

- Shutdown of activities.
- Removal of electrical cables and wires.
- Demolition and Removal of AIH components for relocation, sale or land retrieval.

- Demobilization of decommissioned equipment.
- Waste generation and management.
- Site Restoration activities – clean-up of site and landscaping

5.4.1 Identified Impacts for Pre-Construction Phase

A. Environmental Impacts

Positive

- Stakeholder consultation and engagement is carried towards informing identified stakeholders about project activities and providing them with an opportunity to contribute to project development.
- Sensitization and training on the ESMP implementation and monitoring.
- Job opportunities from hiring unskilled labor for vegetation clearing, security etc.

Negative

- Loss of biodiversity and vegetation through site clearing.
- Air quality pollution from site excavation and land bulldozing.
- Site workers, products suppliers and goods seller's influx causing pressure on existing social infrastructure.
- Disruption or loss of top soil from heavy-duty vehicle operations including grading, filling, excavation, earthwork.
- Increased noise levels and vibrations from vehicle movement and equipment operations.
- Generation of solid waste (scrap metal, wood, sand, concrete, iron rods, paper)

B. Occupational Health Impacts

Positive

- Conduction of Occupational Health and Safety (OHS) awareness programs for PMU (Project Management Unit) and third-party contractors inducting them on safety guidelines and practices.

Negative

- Increased traffic during mobilization with risk of accidents leading to possible casualties.
- Trips, falls, dust inhalation and injuries from open excavations and working at heights.

C. Socio-Economic Impacts

Positive

- The project will conduct socioeconomic stakeholder consultations to educate the residents of the host communities about the project's social safeguard components.
- Generation of jobs (skilled and unskilled) during site preparation.
- Increased demand for goods and services from retail vendors and canteens as a result of job opportunities made available for host community, locals especially the youths.
- Increased revenue for suppliers as some materials will be sourced locally.

Negative

- Stock piling and dust from materials and vehicular activity may affect the facility's visual aesthetics for personnel and visitors.
- Conflicts over employment issues.
- Population impacts, as there would be a minor increase in the host communities as a result of the preparation efforts.

5.4.2 Identified Impacts for Construction Phase

A. Environmental Impacts

Positive

- Employment opportunities for people within the host communities for both skilled and unskilled workers.
- Installation of Effluent Treatment Plant (ETP) will avoid the disposal of waste water generated to the nearest water body.
- Increased livelihood from employment opportunities among host communities, locals, youth, increasing demand for goods and services from retail vendors.
- Reduce the footprint on drug importation.
- Provision of electricity from the already existing power plant within the facility with a backup generator of 800KVA, which will result in less emission.

Negative

- Emissions generated from vehicle exhaust, dust and machinery engine emissions could potentially pollute air.
- Introduction of invasive species through negligence during equipment importation.
- Site runoff resulting from dust suppression sprays, cement works, oils, grease from machinery and vehicles.
- Soil / groundwater contamination resulting from accidental leakages and spills from heavy duty trucks.

- Construction activities will alter and lead to loss of the existing fauna and flora habitat and diversity around the facility.

B. Occupational Health Impacts

Positive

- Reinduction of all site staff and personnel on OHS awareness, safety guidelines and practices.

Negative

- Increased dust in the ambient air in working zones.
- Heat stress from increased exposure of construction workers to the sun.
- Work site accident and injuries, trips, falls and burns.
- Increased risk of infections and spread of communicable diseases due to influx of people.
- Increased noise and vibration levels.

C. Socio-Economic Impacts

Positive

- Recruitment of skilled, semi-skilled and unskilled labour will be observed.
- Improved livelihood from job opportunities for locals especially the youths.

Negative

- Construction activities may also bring about noise pollution, thus, being a nuisance to neighbours near-by, and others.
- Possibility of conflict between contractor and working personnel.

5.4.3 Identified Impacts for Operations and Maintenance Phase

A. Environmental Impacts

Positive

- Creation of substantial agricultural and agro-allied infrastructure and products within the region.
- Operation of the ETP will avoid the disposal of waste water generated to the nearest water body, the treated waste water will be reused in-house for domestic purpose.

- Increased livelihood from employment opportunities among host communities, locals, youth, increasing demand for goods and services from retail vendors.

Negative

- Air Pollution by volatile and gaseous emission (CO, CHCO2, NOx, etc.) from diesel generators and other pollutant emissions from industrial activities in the AIH.
- The operations of the generators and power plants, and industrial operations will generate noise pollution.
- Water and Soil contamination in the event of an accidental oil spill, or contaminants from serviced generators and vehicles can seep into ground and groundwater, which may contaminate the aquifer.
- Generation and handling of waste materials (paper, domestic wastes, E-waste, etc).

B. Occupational Health Impacts

Negative

- Work place accidents/incidents resulting from slips, trips and fall from height, cuts and bruises during operation and maintenance.
- Accidental fire outbreak with resultant smoke and soot from the facility

C. Socio-Economic Impacts

Positive

- Offers graduates employment opportunities as well as a channel for knowledge transfer to help skill up the workforce.
- Improve tertiary institution educational curriculum as partnerships will be formed with corporates and local/international academic institutions to improvement tertiary institution educational curriculum and, sensitization programs in universities to change perception and promote innovation and technology among potential graduates with the aim of increasing talent supply.
- Promote Research and development for innovation.
- Promotion of employment opportunities and poverty reduction: the project will attract employment during construction and operation. The employment will increase income to local communities as most of the casual laborers and some skilled workforce will be sourced from the project sites.
- Bridge of gender gap. Participation and mainstreaming different groups (women, boys, girls and men's) will have impact in minimizing disparity among vulnerable parts of the community (elders, women, children and youth).

- Presents promising investment opportunities in the agro-industrial sector, ensuring the availability of affordable food, and contributing to address food security concerns.
- Economic boost for Taraba state and generation of revenue for the state and the Nation.
- It will attract foreign investors to the state, there increasing revenue for the state.

Negative

- Influx of people into the host community, thereby putting pressure on the existing infrastructure and available resources.
- Increased traffic and road accidents from increased vehicle transit.

5.4.4 Identified Impacts for Decommissioning and Abandonment Phase

A. Environmental Impact

Positive

- Regrowth of new vegetation and return of species that have migrated away from the area.
- Restoration of the project land to the state close to its original state.

Negative

- Disturbance to soil profile, and potential contamination from surface runoff during abandonment.
- Ground water contamination from Site runoff resulting from dust suppression sprays, oils and grease from machinery and vehicles as well as waste water from dismantling works.
- Pollution resulting from improper management of waste.
- Air quality pollution as a result of dust and heavy equipment dismantling movement.
- Increased noise levels within community during dismantling activities.

B. Socio-Economic Impacts

Negative

- Loss of business/employment/source of income and means of livelihood due to SAPZ – AIH, Lau Project activity closure. Thus, indirectly impeding other small business activities banking on the project activities.
- Social vices like theft and vandalism as a result of job loss by host community youths.
- Increased traffic impact while moving demobilized equipment and personnel.

C. Occupational Health Impacts

Negative

- Air quality pollution resulting in illnesses such as swollen eye, difficulty in breathing, catarrh and bronchitis (respiratory tract infections).
- On-site traffic congestion and risk of accident during dismantling of the AIH facilities.

5.4.5 Summary of Positive Impacts

Employment Opportunities

The project is envisaged to provide direct employment in the AIH and other industrial raw material procurement zones including direct employment in the farming sector outside the SAPZ. The AIH project will also provide indirect employment in primary, secondary and tertiary sectors including banks, logistics, insurance, manufacturing etc. of the Project Area of Influence.

Capacity Building

The project will provide increase capacity building and training in during both construction and operational phases ensuring that the locals, project affected people and their communities are prioritized. During project construction and Implementation, locals and project affected people will be taught, skills enhanced and impacted which will be utilized even after the project life cycle.

Skill Transfer

The project seeks to attract both national and foreign experts and consultants for the development, design, construction and operation of the AIH. During these interactions and processes, the locals will have significant benefit through the transfer of relevant technical skills and tools.

Increase Public Revenue

The project will help restore confidence in foreign investors and promote good doing business climate. The project seeks to attract foreign and national investment that help strengthen and decentralize the economy, increase the national treasury through tax payments, and encourage rural and community development.

Food Security

The project will reduce poverty and hunger by restoring hopes and confidence in farmers. Rural and local farmers will be motivated and inspire to grow and produce surplus cash crops and product with the availability of the Special Agro-Industrial Processing Zone and specific AIH across designated regions of the county. This means farmers and wouldn’t have to worry about the available market for purchasing and storing their products.

Economy

The proposed ATC will promote production and value-added goods and services for the local and foreign markets thus stimulating industrial and commercial growth. It will eventually Increase in revenue and profitability of the sector thereby encouraging mindset change in youth towards the agribusiness sector. Most importantly, the project promised to raises the competitiveness and efficiency of SME opportunities among youth and significantly increase earning potential and improving health and sanitation.

Infrastructure Development

The Project will stimulate the establishment of major infrastructures for both local and foreign needs considering the local government's infrastructure gaps and needs. This infrastructural development will decentralize the area and improve the physical and aesthetic outlook of the local government. The project is envisaged to accelerate the infrastructure development in the Wukari area the second commercial hub in Taraba State and Nigeria.

5.4.6 Summary of Negative Impacts

Impacts on Air Quality

It is important to note that the project takes place in rural areas where air quality is usually good. The current and existing air pollution source along the project area is vehicular traffic (particulates and combustion emissions). Potential air emissions from the project in the form of fugitive dust and emission releases will occur as a result of earth work activities including vegetation clearing, excavation works, and transportation of materials to and from the project sites especially where trucks travel on unpaved portions of tracks and roadways. The local ambient air quality around the project area will be temporarily impacted during construction phase as the result of air emissions generated by construction activities. In addition, pollutant emissions will occur due to the operation of diesel fuel generators, and exhaust emissions form transport vehicles such as material transport trucks and administrative vehicles. Therefore, the potential impacts of the project activities on air quality is associated with dust emissions and an increase the following combustion pollutant concentration (CO, NO_X, SO_2 and PM). This impact is localized and not significant.

Impacts on Water Resources

Increased sediments as a result of increased soil erosion due to earthworks can enter surface waters causing increase turbidity and hence impacting aquatic fauna and flora by altering the aquatic environment. In proper handling of lubricants, hazardous substances and hydrocarbons (fuels, gasoline, etc.) may also cause water pollution of surface and ground water. However, the quantities required for used are small and not expected to affect surface and ground water as long as good management practices are applied.

Surface Water

Surface water could be affected during the construction and operation of the AIH project. Site clearance, removal of trees and shrubs and site preparatory works would cause a subsequent increase in surface runoff which may, in turn, increase the risk of flooding and soil erosion. Surface water quality could be affected by number of factors during both construction and operations of the ATC. Construction activities and operation phase may cause increased soil erosion and sediment loading of nearby streams, while accidental leaks or spills of hydrocarbons (oil, fuel or other substances) can also pollute surface water and impact on ground water. During operations, the major threats to surface water quality is likely to be pollution form pesticides, fertilizers, sewage, effluents from operations and processing plants etc. Gradually seepage of improperly stored materials, chemicals, and products from storage continent may also continue to contaminate surface.

Groundwater

The construction works at the AIH may have significant impacts on ground water hydrology and quality. Potential chemicals and improper handling of lubricating slurry, fertilizers and other toxic substances during construction and operation may cause groundwater pollution thus through gradual seepage.

Impacts on Soil Quality

The project area is located within the coastal plain and is generally flat with some undulating rises. The main impacts on soil will occur due to increases erosion potential as a result of vegetation clearing and earth moving activities. Additionally, the increase in potential of erosion, will be a risk of soil contamination from solid waste generated by site activities, as well as liquid waste such as lubricants, slurry, and accidental spills, and leaks occurring from storage and work areas. Impacts associated with soil contamination may continue long after operations have ceased if mitigation measures are not carefully management.

Impacts from Waste Generation

The Project will produce many types of wastes during both construction phase and operational phase. During mobilization and construction phases, solid materials such as domestic waste, packaging from construction materials, debris, excavation remnants and others will be generated which could contaminate both soil and water resources. Vendors, construction staffers and employees must adhere to strict hygiene practices and correctly dispose waste in adherence the EPA standards. In addition to these wastes generated during construction phase, the operational phase would produce huge volume of waste from key sectors, zones, processing and value-added streams within the Special Economic Zone and the Special Agro-Industrial Processing Zone. Wastes expected to be generated during this period include; raw materials from farmlands, plantations, concessions areas and their cumulative wastes generated as well as effluents and wastewater from the processing and value-added streams.

Generally, the AIH will include; Industrial Units (Yam Processing Plant, Cassava Processing Plant, Modern Market Complex, Maize processing Unit) and the Common Infrastructure (Site Development, Road Network, Storm Water Drainage, Water Supply Network, Sewerage Collection and Treatment System, Effluent Collection and treatment system, Electrical Generation and Distribution, Office and Training Centre, Common Ware House, Custom Hiring Center and Work Shop and Farm Input Sale Counter). All these activities would post environmental, social and economic impacts and thus mitigation measures increase the project performance and acceptability.

Impacts from Noise and Vibration

The main source of noise and vibration will be as the result of drilling and other earthmoving activities. Additionally, noise will be generated from transportation activities during construction period which would be much higher than during the operational period. The increased noise level can impact employee's health and safety and reduce performances. Heavy vehicle operators, nearby communities and resident in close proximity to project area of influence are at higher risk of noise nuisance.

Impacts of Visual

Construction activities at AIH may be include construction of campsites, recruitment and mobilization of equipment and machineries transportation and other operations carried out at both day and night. Lighting at night can result in visual impact on local communities and sensitive fauna species. Unobtrusive lighting disrupts critical behaviour of biodiversity. It can stall the recovery of threatened species and interfere with their ability to undertake long-distance migrations, reduce breeding success and their chances of survival. Lighting should be kept to the minimum requirement for safety at night-time.

Impacts on Fauna and Flora

Construction activities are likely to affect the local vegetation and faunal and flora species directly or indirectly. Site clearing, excavation and initial preparatory works will potentially impact local flora and fauna of the proposed project area. These preparatory site activities will alter the natural habitat of critical species and the ecosystem services they provide. Vegetation clearing and earthwork activities will also result in increased noise and may result in loss in fauna and flora species and by extension affect their reproduction patterns.

Impacts on Health and Safety

Construction works, industrial processes and operations attracts significant numbers of people and professionals from diverse orientations including skilled labourer, unskilled labourer, technical experts, construction works, and operations technicians. Consequently, there is an increased risk of trips, falls, injuries, accidents and spread of diseases amongst these contractors, pedestrians, passengers and staff at the project level as well as the project's community level.

In addition to the risks of accidents, there is an increased risk of accidental exposure to hazardous materials and substances during construction and operations should said materials not stored and handled in the appropriate manner and form. The risks and impacts on health and safety are increased if contractors and employees do not adhere to the administration of the Personal Protection Equipment (PPEs) relative to their respective scope of work and not equipped with relevant trainings in occupational health and safety procedures.

An internationally trained and experienced safety specialist will be responsible for the preparation, implementation and maintenance of a comprehensive safety program, which will periodically be reviewed and evaluated. Access to a nearby first aid facility will be provided and a driver and an ambulance will be made available should there be a need to transport patients to another location.

These risk of accidents, injuries and diseases should be minimized by providing regular training and procedures for workers, equipment usage and regular health safety induction protocols to reduce and offset these impacts.

Socio-Economic Impacts

The project is expected to provide employment and social livelihood opportunities in the short and long term during both construction and operation phases. Employment opportunities will be tailed on both male and female gender basis and preference will be given workers from the local communities. As a norm, there would be high influx of people from other region to the project proposed areas for job opportunities which potentially results into social friction an altered social dynamic, and possibly increasing the risks occurrence of diseases and infections. The Project Implementation Unit will work with the Community Liaison Officer and Contractors to put in place appropriate actions that prevent reduce, minimize or offset such impacts.

Impacts to Cultural Resources

Based on the field survey, no activities under the project are expected to take place near any cultural or archaeological resources. Avoiding cultural resources during planning stages and ensuring equal representation and participation of relevant project affected persons and communities in decision making process helps to mitigate impacts to cultural resources. Damage to cultural resources constitute threat to social cohesion and would lead to resentment of the proposed project. However, should any cultural site or resources be found, the appropriate standard for chance finds will be applied.

5.5 Risk Assessment

Table 5.5 presents a comprehensive risk assessment for the SAPZ – AIH, Lau project, identifying key environmental and socio-economic risks associated with the project activities. Each risk is evaluated based on several criteria: the likelihood of occurrence (L), frequency of occurrence (F), and potential impact (I). The table also assesses the significance of these impacts, providing a risk rating (R) and corresponding mitigation plans (P) to manage and mitigate these risks effectively.

The table covers a wide range of potential risks, from environmental concerns like air pollution and water contamination to socio-economic impacts such as employment opportunities and local economic growth. Each risk is categorized to provide a clear understanding of its potential effects and the steps required to mitigate these impacts, ensuring the project is conducted in a sustainable and responsible manner.

Key Elements of the Risk Assessment:

- Risk Description: Brief description of the identified risk.
- Likelihood (L): The probability of the risk occurring (Low, Medium, High).
- Frequency (F): How often the risk is likely to occur (Low, Medium, High).
- Impact (I): The potential severity of the risk's impact (Low, Medium, High).
- Impact Significance: Qualitative assessment of the impact's significance, considering both the duration and reversibility (e.g., Moderate, Short Term; Irreversible, Long Term).
- Risk Rating (R): Overall assessment of the risk, combining likelihood, frequency, and impact (Low, Medium, High).
- Mitigation Plan (P): Recommended strategies and actions to mitigate or manage the identified risk.

The detailed risk assessment aims to ensure that all significant risks are identified, evaluated, and managed through effective mitigation strategies, thereby minimizing negative impacts on the environment and local communities while maximizing the positive outcomes of the project.

Table 5.5: Risk Assessment

Risk Description	Likelihood (L)	Frequency (F)	Impact (I)	Impact Significance	Risk Rating (R)	Mitigation Plan (P)
Air Pollution	Medium	Medium	High	Moderate, Short Term	High	Install emission control systems, regular monitoring
Water Contamination	Low	Low	High	Irreversible, Long Term	Medium	Implement water treatment facilities, strict waste management
Soil Degradation	Medium	Medium	Medium	Revisable, Long Term	Medium	Adopt sustainable farming practices, soil restoration programs
Deforestation	Low	Low	High	Irreversible, Long Term	Medium	Reforestation efforts, compliance with land use regulations
Loss of Biodiversity	Low	Low	High	Irreversible, Long Term	Medium	Create conservation areas, monitor biodiversity regularly
Noise Pollution	Medium	High	Medium	Short Term, Moderate	Medium	Use sound barriers, limit noisy activities to daytime hours
Employment Opportunities	High	High	High	Long Term, Significant	High	Prioritize local hires, provide training and skill development
Local Economic Growth	High	High	High	Long Term, Significant	High	Support local businesses, invest in community infrastructure

Community Health Risks	Medium	Medium	High	Long Term, Significant	High	Health awareness programs, regular health check-ups for workers
Cultural Displacement	Low	Low	Medium	Long Term, Moderate	Medium	Engage with local leaders, ensure cultural considerations in planning
Resource Depletion	Medium	Medium	High	Long Term, Significant	High	Implement resource-efficient technologies, continuous resource monitoring
Economic Inequality	Medium	Medium	High	Long Term, Significant	High	Inclusive policies, equitable distribution of benefits, support for marginalized groups

5.6 Residual Impact Description

The Residual Impact Description provides a comprehensive evaluation of the ongoing environmental and social impacts that persist despite the implementation of mitigation measures outlined in the Environmental and Social Management Plan (ESMP) for the SAPZ Agro-Industrial Hub (AIH) in Lau. This section is crucial as it identifies and assesses the impacts that cannot be fully eliminated but can be managed to acceptable levels through continuous monitoring and adaptive management strategies.

The implementation and operation of the SAPZ – AIH project will interact with various environmental and social components, resulting in certain residual impacts. These impacts are the remaining effects on the environment and society after all planned mitigation measures have been applied. The goal of this assessment is to ensure that even these residual impacts are managed in a way that minimizes their significance and promotes sustainable development.

5.6.1 Environmental Residual Impacts

Water Resources:

The project's activities, particularly those related to irrigation and industrial processing, will significantly increase the demand for water. Despite implementing water conservation measures such as efficient irrigation systems and water recycling, there will still be residual impacts on local water resources. These impacts will be monitored through regular water quality assessments and resource management strategies to ensure that the water demand does not adversely affect local ecosystems and communities.

Air Quality:

Operational activities, including biomass burning and emissions from vehicles and machinery, are likely to contribute to residual air quality impacts. Although emission control systems and regular monitoring are in place, these activities may still lead to elevated levels of pollutants. Adhering to strict emission standards and implementing best practices for air quality management will be essential in mitigating these residual impacts.

Biodiversity:

Construction and operational phases of the project may disturb local habitats, leading to potential residual impacts on biodiversity. While measures such as creating buffer zones and habitat restoration projects are planned, some impacts on local flora and fauna may still occur. Continuous monitoring of biodiversity and implementation of additional conservation efforts will be necessary to mitigate these effects.

Soil Quality:

Intensive agricultural activities can lead to soil degradation through erosion, nutrient depletion, and compaction. Despite adopting sustainable farming practices and soil conservation techniques, there may be residual impacts on soil quality. Regular soil health assessments and the application of organic fertilizers and soil amendments will help in maintaining soil productivity and mitigating these impacts.

5.6.2 Social Residual Impacts

Livelihoods:

The project aims to minimize displacement and provide alternative livelihood options for affected communities. However, there may still be residual impacts on local livelihoods due to changes in land use and economic activities. Providing continuous skills training and supporting income-generating activities will be crucial in mitigating these impacts and ensuring that the affected communities can adapt to new economic conditions.

Cultural Heritage:
Despite thorough cultural heritage assessments and planned mitigation measures, there may be residual impacts on cultural sites and practices. These impacts could arise from land alterations and the influx of new populations. Engaging with local communities, respecting cultural practices, and implementing cultural preservation initiatives will help mitigate these residual impacts.

Health and Safety:
Operational activities pose certain health and safety risks to both workers and local communities. Despite implementing health and safety protocols, residual impacts such as exposure to pollutants and occupational hazards may still occur. Ongoing health monitoring, capacity building, and emergency response planning will be essential in addressing these impacts.

Community Relations:
Even with extensive stakeholder engagement and community involvement efforts, there may be residual impacts on community relations due to unforeseen circumstances or conflicts of interest. Establishing robust grievance mechanisms and maintaining open lines of communication with all stakeholders will be crucial in addressing and mitigating these impacts.

5.6.3 Cumulative Impacts

The cumulative impacts of the SAPZ – AIH project, in conjunction with other existing and planned projects in the region, may create additional environmental and social pressures. These pressures can result from the combined effects of multiple projects on local resources and communities. Conducting comprehensive cumulative impact assessments and collaborating with other stakeholders to implement joint mitigation efforts will be essential in managing these impacts. By addressing the cumulative effects, the project can contribute to a more sustainable regional development strategy.

Overall, the implementation of the SAPZ – AIH project will inevitably lead to some residual environmental and social impacts. However, the proactive mitigation measures outlined in the ESMP will be continuously monitored and adjusted to minimize these impacts. The project’s commitment to ongoing stakeholder engagement and adaptive management strategies will be crucial in addressing any unforeseen residual impacts and ensuring the long-term sustainability of the project.

CHAPTER SIX
MITIGATION MEASURES

6.0 Introduction

This chapter presents appropriate and cost-effective mitigation measures to prevent, reduce, control, remedy, or compensate for adverse impacts and enhance the positive benefits of the proposed LAU, SAPZ – AIH project. These measures aim to reduce impacts to As Low as Reasonably Practicable (ALARP). Residual impacts that may occur despite these mitigation measures are also acknowledged. Subsequently, Chapter Seven will detail management plans to oversee and monitor these mitigation measures through an effective Environmental and Social Management Plan (ESMP). The acceptability or suitability of a project is contingent on various factors, one of which is the mitigation of negative environmental and social impacts to tolerable levels. Typically, reducing impact significance involves implementing mitigation measures to address identified negative impacts.

6.1 Mitigation Objectives and Hierarchy

The primary objectives of mitigation measures are prevention, reduction, and possible control of impacts. For clarity, the following definitions are provided:

- **Avoidance:** Methods aimed at preventing the occurrence of negative impacts or impeding such occurrences from resulting in harmful environmental or social outcomes.
- **Minimization:** Limiting or reducing the degree, extent, magnitude, or duration of adverse impacts. Reduction can be achieved by scaling down, relocating, or redesigning project elements.
- **Control:** Ensuring that occurring impacts are reduced to a level as low as reasonably practicable.
- **Compensation:** Recompense for residual impacts through offsets.

Table 6.1: Summary of Mitigation Hierarchy.

Avoid at Source; Reduce at Source	Avoiding or reducing at source is essentially ‘designing’ the project so that a feature causing impact is designed out (e.g. pipeline re-route) or altered (e.g. reduced working width). Often called minimization.
Abate on Site	This involves adding something to the basic design to abate the impact-pollution controls fall within this category. Often called end-of-pipe.
Abate at Receptor	If an impact cannot be abated on-site then measures can be implemented off-site. An example of this would be to instruct authorities in affected schools to increase the level of supervision of their pupils during the period of civil works.

Repair or Remedy	Some impacts involve unavoidable damage to a resource, e.g. agricultural land during pipeline construction. Repair essentially involves restoration and reinstatement type measures.

6.1.1 Environmental, Health and Safety Management

The ESIA and various E&S studies have identified key E&S aspects, risk and impacts requiring mitigation and control. Identification and assessment of impacts has been undertaken through a process comprising consultation, modelling, on-site observations, literature review and expert opinion based on experience of other similar projects. The contractor will develop an Environmental Management Plan that represents the policies, procedures and standards for all of its operations. This ESMP will accommodate the role of an Environmental Management System (EMS) in the absence of a fully developed EMS for the SAPZ – AIH, LAU project.

The Environmental Management System (EMS) is a set of processes and practices which enables an organization to manage the impacts of its organizational activities on the environment and also to increase its operating efficiency. It is a framework which helps the organization to achieve its environmental goals through consistent control of its operations. The framework includes organization's environmental programs in a comprehensive, systematic, planned and documented manner and includes the organizational structure, planning and resources for developing, implementing and maintaining organizational policy for the protection of the environment. It provides a structured approach to planning and implementation of the environment protection measures.

6.1.2 Elements of an EMS

The Environmental Management System (EMS) encourages the organization to continuously improve its environmental performance. The basic elements of an EMS are as follows:

- The organization commits initially to an environmental policy.
- It includes review of the present status and future environmental goals of the organization.
- Analysis of the environmental impacts and the legal requirements.
- Keeping environmental policy as the basis, the organization sets the environmental objectives and targets for reducing environmental impacts and for complying with the legal requirements.
- Establishment of plans for improving the environment performance and also for meeting the objectives and targets of the organization.
- Monitoring, measuring and evaluating the progress for achievement of the objectives.
- To ensure environmental awareness and competence of the employees of the organization.

- To take corrective actions if the objectives and targets are not being met.
- To have regular review of the progress of the EMS and to make improvements on continuous basis.

6.1.3 Response Plan for Environmental and Social Impact Assessment (ESIA)

Response Plan for Environmental and Social Impact Assessment (ESIA) for the Proposed Special Agro-Processing Zone (SAPZ) – Agro-Industrial Hub (AIH) project will include the following:

Implementation of Mitigation Measures

- Ensure strict adherence to the Environmental and Social Management Plan (ESMP) throughout all project phases.
- Establish a dedicated team responsible for implementing and monitoring mitigation measures outlined in the ESMP.
- Conduct regular training sessions for project staff and contractors on environmental and social responsibilities and best practices.
- Integrate environmental and social criteria into procurement processes to ensure compliance with standards and regulations.

Stakeholder Engagement and Communication

- Develop a comprehensive stakeholder engagement plan to foster transparency, trust, and collaboration among all stakeholders.
- Organize regular meetings, workshops, and consultations with affected communities, local authorities, NGOs, and other relevant stakeholders to address concerns and gather feedback.
- Establish effective communication channels, such as hotlines and grievance mechanisms, to promptly address community grievances and complaints.

Monitoring and Evaluation

- Implement a robust monitoring and evaluation system to track the effectiveness of mitigation measures and identify any emerging environmental or social issues.
- Conduct regular environmental and social impact assessments to assess project performance and compliance with regulatory requirements.
- Review and update the ESMP based on monitoring results and stakeholder feedback to ensure continuous improvement.

Adaptive Management

- Adopt an adaptive management approach to proactively respond to changing environmental and social conditions and emerging risks.
- Establish early warning systems to identify potential environmental and social impacts and trigger appropriate corrective actions.
- Foster a culture of learning and innovation within the project team to continually improve environmental and social management practices.

Capacity Building and Knowledge Sharing

- Provide training and capacity-building programs for project staff, local communities, and relevant stakeholders on environmental and social issues, sustainable practices, and disaster preparedness.
- Facilitate knowledge sharing and collaboration with other similar projects, government agencies, research institutions, and NGOs to leverage lessons learned and best practices.

Compliance and Reporting

- Ensure full compliance with applicable laws, regulations, and international standards related to environmental and social management within Nigeria and global standards.
- Prepare regular environmental and social performance reports to stakeholders, regulatory authorities, and project funders, highlighting progress, challenges, and achievements.
- Facilitate independent third-party audits to verify compliance and effectiveness of environmental and social management practices.
- By implementing this comprehensive response plan, the SAPZ – AIH project at LAU can effectively manage environmental and social risks, minimize negative impacts, and enhance positive outcomes for both the project and the surrounding communities.

6.2 Proffered Mitigation Measures

Table 6.1 summaries mitigation and adjustment measures for the project's identified potential and associated impacts. It presents the mitigation measures for individual project activities outlined in Chapter 5, Table 5.5.

Table 6.2: Summary of Mitigation Measures for all the Development Phases Project Activities.

Pre-Construction				
Project Activity	**Associated and Potential Impacts**	**Impact Category Before Mitigation**	**Mitigation Measures**	**Impact Category After Mitigation**
Land-take and acquisition	Alteration of population characteristics if previous owners of acquired lands relocate to get farmlands elsewhere, leading to alteration of population structure.	Medium	LAU, SAPZ - AIH shall ensure adequate compensation for all acquired land and crops thereon, aiming to minimize the necessity for relocation.	Low
	Livelihood that would normally result from tilling the land for agriculture would be lost, resulting in lower living standards for affected people.	High	Compensation payments shall encompass arrangements for loss of income, aligning with the provisions of IFC Performance Standards, the Equator Principles, and the AfDB Operational Safeguards	Low
	Conflicts could occur if compensation for acquired land is not properly handled.	Medium	Adequate compensation, as per mutually agreed guidelines between landowners, the project proponent, and the Taraba State government, shall be	Low

			provided for all acquired lands.	
Site clearing and preparation	Increased suspended particulate in ambient air and degradation of ambient air quality by emission from construction machinery.	High	Regular maintenance of project vehicles and machinery shall be conducted to meet international emission standards, minimizing emission levels. Regular sprinkling of open soil surfaces with water during trenching shall be performed. The bulk of construction activities shall be conducted during the rainy season to further reduce suspended particulates in the air.	Low
	Due to the project site's close proximity to surface water, surface water impacts may result from site clearing and preparation activities. During site clearing, runoff from cleared areas, especially if conducted during the rainy season, could carry sand and clay/silt particles into the water, increasing turbidity. Additionally, if vegetal	High	Regular maintenance of project vehicles and machinery shall be conducted to comply with international emission standards. Regular sprinkling of open soil surfaces with water during trenching shall be performed. The bulk of	Low

	materials from clearing are transported into the surface water, it could elevate organic matter levels, leading to increased biochemical oxygen demand (BOD) and heterotrophic microbe populations. Furthermore, waste materials such as domestic and sanitary waste from on-site workers, as well as leaks or spills of lube and fuel from equipment and machinery, could also contaminate/pollute the surface water.		construction activities shall be conducted during the rainy season.	
	The key impacts of site clearing and preparation on soil is denudation and subsequent exposure to erosion	Medium	Adequate erosion control measures shall be implemented to prevent erosion of open soil surfaces, including channelizing runoff. Site clearing and preparation activities shall be confined to necessary areas only. Cleared but unused spaces shall be re-vegetated with fast-growing species.	Low
	Loss of vegetation and migration of wildlife from the area, leading to	High	Site clearing and preparation activities shall be confined to necessary	Low

	alteration of species composition and abundance		areas only. Noise attenuation measures, such as fencing and the use of mufflers, shall be implemented.	
	Influx of job seekers into the area will lead to an alteration of population characteristics in the project area	Moderate	A policy promoting the recruitment of workers from local/host communities shall be implemented. Positions shall be open to job seekers from outside host communities only if they cannot be filled locally.	Low
	Potential soil and /or water contamination form mishandling of generated solid and liquid wastes, and construction waste.	High	Proper waste handling and disposal measures will be implemented to prevent contamination.	Low
	Negative health effects on health of project workers and host communities by emissions and dust released from site clearing and preparation activities	High	Project clearing and grading equipment shall be maintained to meet international emission standards. Proper use of PPE for workers shall be ensured.	Low
	Conflicts may arise during site clearing and preparation activities due to inadequate consultations	Medium	Adequate consultations with host communities, with the active involvement of the Taraba State Government,	Negligible

	and/or perceived inequalities in employment		shall be conducted to minimize conflicts.	
Construction				
Mobilization of materials, equipment and men to site	Due to the project site's close proximity to surface water, potential impacts may arise from waste generated by workers on-site. This waste includes spent lube oils from vehicles and cranes. Additionally, sanitary waste from on-site workers could result in the introduction of heterotrophic microbes into the surface water. Improper disposal of food cans and tins may also lead to heavy metal contamination of the water.	High	All wastes originating from the project area shall be adequately contained to prevent inflow into surface and groundwater, thus averting contamination. These containment measures shall include proper stacking and segregation of wastes at the source, as well as the designation of certified waste handlers.	Low
	Heavy duty trucks used for mobilization could cause soil compaction, leading to structural changes. Wastes from construction camps could also cause soil contamination	Medium	Heavy trucks shall, to the extent possible, utilize existing roads and routes to minimize soil compaction. Wastes generated at construction camps shall be collected properly and disposed of by an accredited waste management agency.	Low
	Loss of vegetation during setting up of construction camp as well as	Medium	Construction camps and stacking areas shall be	Low

	scaring wildlife species away with noise from vehicles and equipment used during construction.		limited to designated project areas to minimize vegetation loss. Noise attenuation measures, such as fencing and the use of mufflers, shall be implemented to mitigate noise effects on wildlife.	
	Emissions and noise from vehicles, machinery, and equipment used for mobilization and site lighting generators could degrade ambient air quality and elevate noise levels.	High	All project vehicles and machinery shall undergo proper maintenance to meet international emission standards, thereby minimizing emission levels. Noise attenuation measures, such as the provision of mufflers, shall be implemented wherever feasible.	Low
	Influx of job-seekers could alter population characteristics of the area. Pressure on existing infrastructure due to influx.	Medium	A policy favoring the recruitment of workers from local/host communities shall be implemented. Positions shall be open to job seekers from outside host communities only when they cannot be filled locally.	Low

	Project-related traffic could lead to congestion, negatively affecting local people.	Medium	Project transportation shall be planned to minimize interactions with local routine transport. Whenever feasible, project transportation shall be scheduled to occur during off-peak periods.	Low
	Gaseous emissions from project equipment and machinery could cause health effects, mostly respiratory. Possible increase in communicable diseases due to influx is a possible impact.	High	All project vehicles and machinery shall undergo proper maintenance to meet international emission standards, thereby minimizing emission levels.	Low
	Conflicts could arise between project workers and host communities if adequate consultations are not held	Medium	Adequate consultations shall be conducted with host communities, with the active involvement of the Taraba State government, to minimize the occurrence of conflicts.	Negligible
	Emissions from vehicles and machinery, as well as dust and suspendable particulates generated from trenching activities and machinery such as concrete mixers and piling machines, could lead to	High	Regular maintenance of project vehicles and machinery shall be conducted to comply with international emission standards. Regular	Low

	degradation of air quality and elevation of ambient noise levels.		sprinkling of open soil surfaces with water during trenching shall be performed. The bulk of construction activities shall be conducted during the rainy season.	
Civil/Structural works and facility installations	Piles may be driven down to the upper water table level, potentially causing inadvertent infiltration of groundwater by cement and concrete. Abstraction of water from the aquifer could result in the depletion of groundwater resources, ultimately leading to subsidence. Additionally, the erection of transmission line poles in the water may disturb sediment, resulting in increased turbidity. Furthermore, cement and other hazardous materials from civil/structural works could be transported into surface water, causing contamination.	High	Piling and foundation activities shall be conducted meticulously, adhering to international best practices. Additional hydrogeological studies shall be conducted to ensure adequate groundwater resources.	Low
	Potential infiltration and contamination of soil with hazardous materials may occur, potentially altering soil fertility	High	Piling and foundation activities shall be conducted with care, adhering to international best practices. All open soil surfaces shall	Low

	status and inducing nutrient toxicity in plants.		be paved to prevent infiltration of pollutants.	
	The productivity of plants may decrease due to a reduction in the photosynthetic area on leaves, blockage of stomatal pores, interference with transpiration and respiration, and mechanical damage to leaf surfaces. This could predispose plants to secondary infections. Additionally, noise generated by machinery may frighten wildlife species away from the site, resulting in their migration and potentially altering the composition and abundance of species in the area.	Medium	Proper machinery maintenance shall be implemented to reduce noise levels. Noise attenuation methods like barriers or mufflers shall be utilized. Erosion control measures shall be implemented to prevent soil disturbance and vegetation damage. Disturbed areas shall be re-vegetated promptly.	Low
	Potential health impacts on workers and host communities due to emissions from equipment and machinery. Injuries (and deaths) of site workers should be included as possible impact.	High	Emission standards for project vehicles and machinery shall be adhered to. Regular maintenance and watering of open soil surfaces during trenching shall be conducted to reduce particulate suspension. Construction activities shall be conducted during the	Low

			rainy season to minimize health risks.	
	Conflicts may emerge during site clearing and preparation activities due to insufficient consultations and/or perceived disparities in employment opportunities.	Medium	Adequate consultations with host communities, actively involving the Kaduna State Government, shall be conducted to minimize conflicts.	Low
Operation and Maintenance Phase				
Operation of the LAU, SAPZ – AIH	Boom town effects and associated inflation, leading to price hikes without a corresponding increase in earning power of local communities. Impacts of excessive abstraction of underground water and storm water runoffs into surface water can affect water resources quality and availability for the local community.	High	LAU, SAPZ – AIH exercises very limited to no control over this impact, and therefore, no mitigation measures are available.	Low
	Possible influx of people who will provide value added services such as schools, banks, hospitals, supermarket/stores, etc. could lead to influx of populations into project area, causing alterations to population structure in the area and pressure on existing facilities.	Medium	AIH will establish a policy promoting the recruitment of workers from local/host communities, with positions open to job seekers from outside the host communities only if local candidates are unavailable. This approach will help	Low

			deter the influx of job seekers to some extent.	
	Traffic congestion may lead to physiological effects on individuals and increase the likelihood of accidents due to operational transportation.	Medium	Project transportation shall be strategically planned to minimize interactions with local routine transport, with efforts to schedule transportation during off-peak periods whenever possible.	Negligible
	Potential soil and /or water contamination form mishandling of generated solid waste, operation waste and sewer created by the project. Potential adverse effect from unsustainable management of effluent and wastewater generated from operations.	High	Certified waste management contractors shall be engaged for proper waste collection and disposal.	Low
	Conflicts may arise if communities perceive that they are not receiving fair treatment and if promises made by proponents are left unfulfilled.	Medium	Sufficient consultations shall be conducted with host communities, with the active participation of the Taraba State Government, to minimize conflicts.	Negligible
	During routine maintenance, the generation of hazardous materials such as spent lube oils, fuel and oil		Routine maintenance activities shall be meticulously conducted,	

Routine maintenance of utility, plants, mills and facilities	filters, and spent batteries is possible. If not managed appropriately, these wastes could be washed into nearby surface water by runoff or infiltrate into the soil and groundwater, leading to contamination and pollution. This poses a risk to local communities that rely heavily on surface and groundwater aquifers for their water supply.	High	adhering to international best practices to prevent contaminants from infiltrating groundwater. This will involve concrete paving of maintenance areas to ensure that hazardous materials cannot seep into groundwater. Certified waste management contractors will be engaged to handle waste collection and disposal on the site.	Low
	Accidental release of hazardous materials generated from routine maintenance activities could lead to contamination of the soils, thus altering soil quality status	High	Rigorous adherence to international best practices shall be implemented. This includes concrete paving of maintenance areas to prevent contaminants from infiltrating soils and altering soil quality status. Additionally, certified waste management contractors will be employed to handle waste collection and disposal on the site, further mitigating the risk of soil contamination.	Low

	The project activities may result in emissions from machinery and an increase in ambient noise levels due to the operation of maintenance equipment.	Medium	Project vehicles and machinery shall undergo regular maintenance and adhere to international emission standards to reduce emissions.	Negligible
Decommissioning and Closure Phase				
Dismantling of facilities, buildings, utility and ancillary facilities	Employees involved in the project may face job loss when decommissioning activities begin, impacting their employment and livelihood.	High	Adequate pension plans for project workers shall be ensured. Skills training shall be offered to provide alternative means of earning a living.	Low
	The impact of this activity on surface and groundwater quality will have both positive and negative aspects. On the positive side, the removal of piles and other structures will eliminate perturbations to surface and groundwater, returning conditions to pre-project levels. However, on the negative side, the dismantling of structures may disturb sediment, particularly if transmission line poles fall into surface water. Additionally, materials from dismantling could	Low	Dismantling activities shall be conducted meticulously, adhering to international best practices. Dismantling areas shall be paved with concrete to prevent contamination.	Negligible

	infiltrate groundwater, leading to contamination.			
	The use of vehicles, machinery, equipment for mobilization, and generators for lighting on site may emit gaseous emissions, particulates, and noise. These emissions and noise levels could contribute to the degradation of ambient air quality and an increase in ambient noise levels.	High	Regular maintenance of project vehicles and machinery shall be conducted to comply with international emission standards. Noise attenuation measures such as barriers or mufflers shall be implemented.	Low
	Noise generated by machinery may disturb wildlife species, causing them to flee the site and potentially leading to changes in species composition and abundance due to migration from the area.	Low	Noise attenuation measures such as barriers or mufflers shall be implemented. Disturbed areas shall be re-vegetated promptly to restore plant productivity and maintain biodiversity.	Negligible
	Potential soil and /or water contamination form mishandling of generated solid and liquid wastes, and other decommissioning and closure procedures related waste.	Medium	International best practices for waste management shall be adhered to. Certified waste management contractors shall be engaged for waste collection and disposal.	Low
	Traffic congestion could lead to physiological effects on individuals	High	Project transportation shall be planned strategically to minimize interactions with	Low

	due to associated stress and frustration.		local routine transport. Transportation shall be scheduled during off-peak periods whenever possible.	
	The influx of job seekers into the area may result in changes to the population characteristics of the project area.	Medium	Comprehensive pension plans for project workers shall be ensured. Skills training shall be offered to provide alternative means of livelihood.	Low

Table 6.3: Summary of Direct Biogeophysical and Socio-Economic Mitigation Measures.

Receptor	Summary of Mitigation Measures
Biogeophysical Environment	
Air Quality	▪ Ensure adequate maintenance and repair equipment and machineries ▪ Adopt a traffic management plan while avoiding congest routes ▪ Ensure that vehicles and machines are switched off when not in use ▪ Water surfaces to control dust emissions ▪ Avoid burning of materials resulting from onsite clearance ▪ Ensure that persons working in areas prone to dust are provided PPEs ▪ Ensure the use of high-quality diesel for generators and vehicles ▪ Maintain minimum traffic speed on-site and on access roads ▪ Ensure that construction materials and hazardous substances are well handled ▪ Cover all vehicles hauling materials likely to give off excessive dust emissions ▪ Regularly water spray surfaces to control dust emissions
	▪ Ensure to install sediment and erosion control measures

Water Resources	▪ Follow guidelines and procedures for immediate cleanup of spillages (oil, fuel, chemicals) ▪ Cover open stockpiles of construction materials on site with tarpaulins during rainstorm events to prevent the washing away of construction materials ▪ Install natural or synthetic liners beneath chemical storage tanks ▪ Compact earthworks as soon as the final surfaces are formed to prevent erosion especially during the wet season ▪ Ensure to grade gravel roads for maintenance of existing drainage patterns ▪ Ensure the protection of riparian areas ▪ Ensure to avoid dumping of construction waste into water bodies ▪ Ensure that proper storage of chemicals and onsite materials
Aquatic Ecology	▪ Schedule construction activity to avoid heavy rainfall ▪ Ensure that hazardous materials are not discharge in aquatic ecosystems ▪ Ensure to construct fence at the perimeter of construction site to avoid cross pollution with aquatic resources ▪ Ensure to prevent dumping of oil, filter cans and other substances into aquatic ecosystem
Terrestrial Ecology	▪ Cautions must be accorded during vegetation clearing to minimize species loss and destruction ▪ Ensure that all species of conservation values are enumerated, conserved and reported to the designated conservation authority
Waste Water	▪ Ensure to obtain required permit for discharge of effluent and chemical wastes ▪ Ensure that all effluent and chemical waste water meets at acceptable levels for discharging ▪ Ensure that the point of discharge of effluent and wastewater is approved prior to any discharge ▪ Ensure to adopt good house keep during construction phase and operation phase ▪ Ensure that washing water from vehicles is drained in a sand/silt

Biodiversity	▪ Ensure that no flora species classified as Vulnerable on the IUCN Red List are removed or cleared ▪ Ensure that no tree greater than 200 mm diameter at breast height is damaged ▪ Promote plantation of trees and green corridors along the project facility ▪ Ensure that no species discovered during excavation are traded for commercial value ▪ Minimize vegetation clearance ▪ Prevent any hunting activities ▪ Ensure to report fauna species of high conservation value ▪ Avoid all direct and indirect impact on areas of high ecological ▪ Ensure that sustainable management of solid and liquid waste emanating from construction and operation activities ▪ Ensure outdoor construction lighting is unobtrusive and turn off when not required
Soil	▪ Landscape the excavated areas in a suitable way to allow native vegetation to regrow naturally ▪ Suspend activities during extreme rainfall events ▪ Ensure to Provide drainage channels and silt traps for all parts of the topsoil storage areas ▪ Ensure to rehabilitate areas with topsoil and revegetate after completion of activities ▪ Install sediment and erosion controls ▪ Use non-toxic and readily biodegradable chemicals on-site where feasible ▪ Install natural or synthetic liners beneath chemicals storage tanks ▪ Grade unpaved roads
Hydrocarbons and Hazardous Materials	▪ Ensure that disposal of obsolete chemicals, fertilizers, and other industrial processing chemicals occurs according to the EPA's standards ▪ Ensure that all chemicals are clearly label and stored in accordance with their respective Material Safety Data Sheet (MSDS)

	▪ Ensure to store hazardous materials separately from non-hazardous materials ▪ Use oil traps ▪ Ensure to hydrocarbons in a separate area that has an impermeable floor, adequate space, ventilation and roof to prevent rainfall from seeping ▪ Carefully fuel/refuel vehicles, and machineries to avoid spillage
Noise	▪ Choose inherently quiet equipment ▪ Keep equipment speed as low as possible ▪ Minimize idling time for pickup trucks and other equipment ▪ Limit site working hours where feasible ▪ Ensure that all workers exposed to noise emanating environment are equipped with hearing protection and relevant PPEs ▪ Schedule noisy activities during the morning hours ▪ Enforce noise monitoring ▪ Inform the locals when noisy activities are planned ▪ Utilize and properly maintain silencers or mufflers that reduce vibration on construction equipment ▪ Operate only well-maintained mechanical equipment on-site

Socio-Economic	▪ Ensure to set up a formal compliant register system which responds to complaints about nuisances in a timely manner ▪ Adopt policies for recruiting locally and hiring local sub-contractors as much as possible ▪ Include local communities in the consultations and participation process throughout the project activities ▪ Ensure high rate of local employment to minimize influx of foreign workers ▪ Ensure equal employment opportunities ▪ Adhere to prohibition of child labor ▪ Prohibit discrimination in any form or manner such as religion, ethnicity, tribe, creed etc. ▪ Adopt a grievance mechanism to enable the communities and employees to relate concerns that arise from the Project or Contractors
Socio-Economic Environment	
Land and Land Use	▪ Conduct assessment to verify if project do not trigger relocation/resettlement ▪ Conduct thorough assessment of project area of influence to understand and address relevant environmental and social risks ▪ Utilize alternative designs to reduce and minimize land use impacts ▪ Adopt Chance Find Procedures for unanticipated discovery of finding of archaeological or historical significance
Waste Generation	▪ Promote recycling and reuse of general refuse ▪ Ensure that disposal of obsolete chemicals, fertilizers, and other industrial processing chemicals occurs according to the EPA's standards ▪ Prohibit the burning of refuse on the construction and operation site ▪ Ensure to obtain required authorization from the EPA for disposal of hazardous waste generated onsite ▪ Segregate chemical wastes and properly store and dispose hazardous waste according to the EPA's standards ▪ Recycle onsite whenever feasible

	▪ Fence construction site to prevent flying materials to deposit in nature ▪ Ensure that vehicles transporting wastes are fully covered ▪ Ensure adequate onsite waste segregation ▪ Adopt good housekeeping practices during all phases of the project ▪ Prohibit all forms of littering on-site
Health and Safety	▪ Provide surveillance and active screening of workers ▪ Provide health care benefits to workers ▪ Ensure that hazardous substances are kept in suitable, safe, adequately marked and locked storing place ▪ Conduct health awareness initiative ▪ Restrict access to the operation sites ▪ Ensure that employee/workers/ contractors are informed about the risks and prevention methods for Corvid 19, Ebola, HIV, STDs and others ▪ Conduct firefighting and leak checks training drills for staff ▪ Ensure that workers are qualified, well trained and instructed in handling their equipment, including PPEs ▪ Install warning signs at the entrance of the site to prohibit public access ▪ Provide appropriate PPE (impermeable latex gloves, working overalls, safety boots, safety helmets, safety goggles, hearing protein devices for workers exposed to noise levels exceeding 90 dBA, and lifesaving vests for sites near water bodies) ▪ Develop and implement an Emergency Preparedness & Response Plan ▪ Ensure containers of hazardous substances are clearly marked and that MSDS's are available ▪ Designate an area where contaminated materials and hazardous can be stored for proper disposal according to the EPA's standards ▪ Provide training to personnel on occupational health and safety and safety procedures prior to beginning work at sites ▪ Ensure that sensitive and dangerous areas with high risks are clearly designated ▪ Ensure that presence of an onsite first aid treatment facility

	▪ Adopt good housekeeping practices for ensuring hygiene on site ▪ Ensure the presence of firefighting equipment such as dry powder extinguisher ▪ Ensure that safety specialist is recruited to manage the preparation, implementation and maintenance of a comprehensive safety program ▪ Ensure to eliminate pools of stagnant water, which could serve as breeding grounds for infectious diseases ▪ Install warning signs at places where dangerous and high risks operations are ongoing ▪ Ensure that protective materials are use at all times
Traffic	▪ Properly plan and develop traffic control plan ▪ Notify the affected communities regarding the operation schedule and consult with them about potential traffic issues ▪ Provide traffic re-rooting plan for the construction phase ▪ Limit the movement of heavy machineries to off-peak hours and provide prior notification to local communities ▪ Repair any road damage caused by increased traffic due to operations ▪ Pave road where heavy use is expected ▪ Speed limitation should be enforced for instance, onsite 10km/h, through towns and villages 35km/h and on the highway 80km/h ▪ Ensure safety of motorists through adequate warning, signing, delineation and channeling at least 500 m down and up-gradient form the construction site ▪ Ensure the prohibition of passenger siting on the back of trucks working for the Contractor/sub-contractor ▪ Ensure that all drivers are licensed and obey traffic rules and regulations
Visual Amenity	▪ Ensure that site cleanliness and sanitation is maintained ▪ Ensure outdoor construction lighting is unobtrusive and turn off when not required
	▪ Ensure that all accidents and incidents are report and investigated

Accident	▪ Ensure that all workers are qualified, ell trained and instructed in handling their equipment, including health protection equipment ▪ Implement speed limits for trucks entering and exiting the construction facility ▪ Ensure that vehicles transporting wastes are fully covered ▪ Ensure adequate onsite waste separation ▪ Adopt good housekeeping practices during all phases of the project ▪ Ensure the presence of an onsite First Aid Provider ▪ Ensure that safety specialist is recruited to manage the preparation, implementation and maintenance of a comprehensive safety program ▪ Adopt good housekeeping practices for ensuring hygiene on site ▪ Ensure the presence of firefighting equipment such as dry powder extinguisher ▪ Ensure that safety specialist is recruited to manage the preparation, implementation and maintenance of a comprehensive safety program ▪ Ensure to eliminate pools of stagnant water, which could serve as breeding grounds for infectious diseases ▪ Install warning signs at places where dangerous and high risks operations are ongoing ▪ Ensure that protective materials are use at all times ▪ Provide surveillance and active screening of workers ▪ Provide health care benefits to workers ▪ Ensure that hazardous substances are kept in suitable, safe, adequately marked and locked storing place ▪ Conduct health awareness initiative ▪ Restrict access to the operation sites ▪ Ensure that employee/workers/ contractors are informed about the risks and prevention methods for COVID-19, Ebola, HIV, STDs and others ▪ Conduct firefighting and leak checks training drills for staff ▪ Ensure that workers are qualified, well trained and instructed in handling their equipment, including PPEs

	▪ Install warning signs at the entrance of the site to prohibit public access ▪ Provide appropriate PPE (impermeable latex gloves, working overalls, safety boots, safety helmets, safety goggles, hearing protein devices for workers exposed to noise levels exceeding 90 dBA, and lifesaving vests for sites near water bodies) ▪ Develop and implement an Emergency Preparedness & Response Plan ▪ Ensure containers of hazardous substances are clearly marked and that MSDS's are available
Cultural Heritage	▪ Ensure to apply the standard Procedures for Chance Finds

CHAPTER SEVEN
ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

7.0 Introduction

The Environmental and Social Management Plan (ESMP) serves as a stand-alone tool utilized to monitor the effectiveness of mitigation measures and project commitments outlined in the Environmental and Social Impact Assessment (ESIA). It is integrated into the project implementation process to minimize or eliminate adverse impacts and ensure compliance with environmental regulatory standards and corporate HSE policies. The ESMP outlines the commitments to implementing mitigation measures incorporated into the project design, as well as additional mitigations recommended in the ESIA. It also delineates the roles and responsibilities of various stakeholders. Furthermore, the ESMP emphasizes all biophysical and social environmental attributes to be monitored throughout the lifecycle of the proposed project, aiming to curtail associated negative, residual, and cumulative impacts, and identify any impacts not addressed in the ESIA report arising from project implementation.

7.1 Scope and Objectives of ESMP

The ESMP is designed to meet required standards and regulations on environmental and social management performance, aligning with ISO 14001: Environmental Management System (EMS) guidelines. It encompasses the entire project lifecycle from pre-construction to decommissioning phases and undergoes reviews and updates before activities commence. The main objective of the ESMP is to integrate environmental and social considerations into daily decision making, ensuring that environmental risks are managed throughout the project lifecycle. It serves as a working document for tracking, evaluating, and communicating environmental and social performance, with objectives including monitoring compliance, ensuring best practices management, and raising awareness of potential impacts.

Detailed objectives of the ESMP include defining contractors' roles and responsibilities, outlining monitoring and supervision by the National Investment Commission, ensuring high environmental protection and working standards, assisting the contractor in implementing mitigation measures and preventing environmental damages, ensuring compliance with HSE policies and national legislations, and identifying and reducing risks associated with work processes.

Objectives:

i. To identify and assess potential environmental and social impacts of the AIH Project.
ii. To establish procedures and mechanisms for responding to and managing identified impacts.
iii. To ensure compliance with regulatory requirements and international standards for environmental and social management.
iv. To promote stakeholder engagement, transparency, and accountability in impact response activities as well as address concerns and issues raised in the EIA's stakeholder engagement process.
v. Incorporate environmental and social management into Project design and operating procedures.

7.2 Stakeholders Engagement Plan

Consistent with the African Development Bank Group Environmental and Social Policies and Guidelines, the stakeholder's engagement plan is designed to establish an effective platform for productive interaction with the potentially affected parties, disadvantaged groups, and others with interest in the implementation outcome of the Project. The stakeholder engagement plan will provide meaningful stakeholder engagement throughout the project cycle. The consultation is aimed to solicit views, concerns, comments and inputs from wide range of stakeholders and project affected parties regarding project implementation.

The primary objectives of the Stakeholder Consultation are summarized below:

- Provide project related information and materials to affected and interested parties.
- Solicit feedback from stakeholders to inform project design, implementation, monitoring, and evaluation.
- Enhance project acceptance by clarifying project objectives and scope at an early stage and manage stakeholders' expectations.
- Assess and mitigate project environmental and social impacts and risks.
- Enhance project benefits.
- Address project grievance.

During the ESIA process, stakeholders from all levels (national, local government and residents in the project affected area) will be consulted and views be sought through interviews, group discussions and a number of public meetings. The SAPZ Project Stakeholder to be consulted will include:

- Federal Ministry of Environment (FMENV)
- Taraba State Urban and Regional Planning Board
- Taraba State Ministry of Environment
- Taraba State Ministry of Agriculture
- Lau Local Government Area (LGA)
- Federal Ministry of Agriculture and Rural Development (FMARD)
- Project Affected Persons (PAPs) and affected communities
- Community Based Organizations

The Public Consultation process will be initiated during the early stage of the project. Relevant stakeholders engaged and consulted regarding the prospects of the project, meetings conducted between the Consultant, and the project Implementation Team, Essential documents about the project to be reviewed and resources persons and experts' views solicited. Other sources of information and regulatory institutions will be consulted and detailed with use of specialized data collection and interpretation tools to facilitate the field assessments and surveys. Stakeholder consultation will be conducted at the local level to solicit inputs, views and comments from the project affected rural people.

The Consultation shall aim to:

- Promptly address issues and concerns raised to avoid conflict;
- Comply with national regulation and international best practices;
- Build consensus on identified potential adverse/beneficial impacts of the proposed project and proffering mitigation measures before the project commencement;
- Address any misconceptions concerning the development that may arise;
- Ensure that any apprehension and fears about the project, nature, scale, and impact of the operation have been addressed.

The proceedings take the form of:

- Introduction of the project to community members and stakeholders.
- Informing them of the locations for the proposed development and the nature of the project.
- Entertaining comments and questions from stakeholders.
- Addressing concerns raised by stakeholders.

7.2.1 Grievance Redress Mechanism (GRM)

The Grievance Redress Mechanism is designed to address concerns and complaints from affected stakeholders promptly and effectively. Key elements include:

Purpose: To provide a transparent, fair, and accessible process for stakeholders to raise grievances related to the project.

Procedure: Establishment of multiple channels for lodging complaints (e.g., hotlines, suggestion boxes, community meetings), clear timelines for response, and a step-by-step process for resolving issues.

Responsibility: Designated grievance officers to manage and monitor the process, ensuring all complaints are logged, acknowledged, and addressed in a timely manner.

Documentation: Maintenance of a grievance log to track all received complaints, resolutions, and any follow-up actions.

7.2.2 Security Management Plan

The Security Management Plan addresses the protection of project assets, personnel, and the surrounding community. Key elements include:

Risk Assessment: Identification of potential security threats and vulnerabilities related to the project.

Security Measures: Implementation of physical security measures such as fencing, surveillance cameras, and security personnel.

Protocols: Establishment of security protocols for various scenarios, including theft, vandalism, and emergency evacuations.

Community Relations: Coordination with local law enforcement and community leaders to ensure a collaborative approach to security.

7.2.3 Resettlement Action Plan (RAP) and Livelihood Restoration Plan (LRP)

The RAP and LRP are developed to mitigate the adverse impacts of land acquisition and ensure affected persons' livelihoods are restored or improved. Key elements include:

Resettlement: Detailed plans for relocating affected individuals, including compensation for lost assets and assistance with moving and rebuilding homes.

Livelihood Restoration: Programs to restore income and livelihood activities, such as skills training, employment opportunities, and support for small businesses.

Consultation: Ongoing engagement with affected communities to ensure their needs and concerns are addressed throughout the resettlement process.

Monitoring and Evaluation: Regular monitoring to assess the effectiveness of resettlement and livelihood restoration efforts and make necessary adjustments.

7.3 Environmental Health and Safety Plan

A Health and Safety Plan will be prepared for the construction, operation, and decommissioning phases of the project to ensure compliance with the Ministry of Health Guidelines for Occupational Health and Safety and IFC guidelines.

To ensure the health and safety of its employees, the SAPZ – AIH, LAU plan will address the following topics:

- Safety devices to protect employees from injuries or hazardous conditions.
- Provision of safe drinking water.
- Immunizations, as applicable.
- Maintenance of a clean eating area.
- Availability of first aid facilities.
- Maintenance of sanitary conditions.
- Waste management, including bathrooms and proper disposal procedures.
- Provision of appropriate signage.
- Installation of fire prevention facilities, along with training and awareness programs.
- Provision of Personal Protective Equipment (PPE).

A safety specialist shall be responsible for preparing, implementing, and maintaining a comprehensive safety program, which will be periodically evaluated. The safety specialist will be provided with written safety instructions, including guidance on the correct storage, handling, and disposal of hazardous waste, as well as written contingency plans/guidelines for accidents, spills, and fires. The responsibility of the safety specialist includes conducting safety training, safety inspections, sessions, and drills. Additionally, the safety specialist will be responsible for investigating accidents. A safety committee would be formed and organize regular safety meetings.

7.3.1 Health, Safety, and Environment (HSE) Training Plan

The HSE Training Plan aims to ensure that all project personnel are adequately trained to perform their duties safely and responsibly. Key elements include:

Training Programs: Development of comprehensive training modules covering topics such as workplace safety, emergency response, environmental protection, and first aid.

Audience: Targeting different training programs for various groups, including management, workers, and contractors.

Frequency: Regular training sessions to ensure ongoing compliance and awareness, with refresher courses at specified intervals.

Evaluation: Assessing the effectiveness of training programs through feedback, quizzes, and practical drills.

7.4 Emergency Response Plan

An Emergency Preparedness and Response Plan (EPRP) will be prepared to assist project staff in effectively responding to emergencies associated with project hazards. The EPRP will comply with the Federal Ministry of Environment, Nigeria, EIA Procedural Guidelines, the ISO 14001 approach, and the Hazard and Effect Management Process (HEMP), International Labour Organization (ILO), Nigeria, Occupational Safety guidelines and performance standards. The EPRP will include:

- Roles and responsibilities of emergency personnel.
- Emergency contacts and communication systems/protocols, including procedures for interaction with local and regional emergency authorities.
- Specific emergency response procedures.
- Design and implementation of an emergency alarm system audible across the entire site and at the sub-stations.
- An evacuation plan will be read and practiced by all employees and contractors. The evacuation plan will include emergency escape routes, procedures for accounting for employees after an evacuation, and roles and responsibilities of personnel during an evacuation.
- Identification of supplies and resources to be utilized during an emergency event, including emergency equipment, facilities, and designated areas.

- A training plan, which includes specific training and drill schedules for personnel who are responsible for rescue operations, medical duties, spill response, and fire response.

If an emergency develops, all persons on-site will be notified immediately, and efforts will be coordinated with others in the vicinity surrounding the project area to reduce impacts, if applicable. The National Emergency Management Agency (NEMA), Taraba State regional /local contact, local police, and all necessary authorities will be immediately notified. If an emergency is imminent, but has not yet begun, steps will be initiated to immediately advise persons in the vicinity of the emergency to evacuate, and notifications will be made to NEMA, the County Superintendent, local police, and all other authorities responsible for the emergency.
If there is a slowly developing emergency or an unusual situation where an emergency is not imminent but could occur if no action is taken, project personnel will notify NEMA, the local police, and all other authorities of the potential problem and keep them advised of the situation. These agencies will be requested to indicate if there are any immediate actions that should be taken to reduce the risk or severity of the emergency, and if necessary, what preventative actions will be implemented. In an emergency situation, equipment and supplies will be needed on short notice. Therefore, the Lau, SAPZ – AIH will maintain an accurate inventory of emergency response equipment and supplies.

The EPRP will include an evacuation plan that will be read and practiced by all employees and contractors. The evacuation plan will include emergency escape routes, procedures for accounting for employees after an evacuation, and roles and responsibilities of personnel during an evacuation. In general, the following evacuation procedures should be followed:

- Alert the Emergency Response Team to assist in the evacuation.
- Use communication tools that are appropriate for the type of incident and the time of occurrence, such as alarms or loudspeakers.
- When communicating an evacuation, speak clearly and succinctly: We have a [state the type of emergency]. Evacuate to [state the assembly point].
- Turn equipment off, if possible.
- Take emergency supplies and staff rosters, if possible.
- Account for personnel.
- Wait at the assembly point for further instructions.

The EPRP will have specific information on fire safety and explosion response, which will provide additional details specific to these emergencies.

7.5 Waste Management Plan

Waste management guidelines and disposal options is very necessary for the running of a plant. The continuous use of the principle of waste reduction, recycling, recovery and reuse will make the company to be more environmentally friendly.

The LAU, SAPZ – AIH will develop a project-specific waste management plan to ensure proper management of all waste generated during project activities, including agricultural waste and waste from agro-allied industrial development, in accordance with applicable laws, regulations, and international standards relevant to the power distribution industry. The Waste Management Plan will encompass:

- Description of the types of waste generated, including agricultural waste and agro-allied industrial development related waste.
- Opportunities for waste minimization, including strategies tailored to agricultural and agro-allied industrial activities.
- Methods for waste management, addressing the unique characteristics of agricultural waste and agro-allied industrial development related waste.
- Good housekeeping practices, including manifest and waste tracking forms specific to agricultural and agro-allied industrial waste.

In addition to the previously mentioned waste categories, agricultural waste like crop residues, processing by-products, and packaging materials, will be considered. These waste types will be managed through appropriate methods, including composting, recycling, and reuse, where feasible and environmentally sound. During the construction phases, efforts will be made to minimize agricultural waste generated from land clearing activities and to properly manage any waste produced. Similarly, waste generated from agro-allied industrial development activities, such as processing operations, will be managed according to the Waste Management Plan's guidelines.

Chemical waste generated from agricultural activities, such as pesticide containers and residues, will be segregated and managed in accordance with hazardous waste protocols outlined in the plan. Similarly, waste from agro-allied industrial processes, such as chemical processing or manufacturing, will be handled according to relevant regulatory requirements. The Waste Management Plan will outline specific procedures for the storage, handling, and disposal of chemical and agricultural waste, ensuring their proper management throughout the project lifecycle.

For proper handling and disposal, wastes shall be well defined at source and the definition transmitted along with the waste to the final disposal points. The required basic information that would be provided, as a minimum, for adequate definition of wastes include:

- Waste type identification.
- Proper waste categorization.
- Waste segregation information.
- Location of generation.
- Recommended management practices.

Waste Characterization and Quantification

- Conduct a comprehensive waste characterization and quantification study to identify the types, quantities, and sources of waste generated by the project activities, including solid waste, liquid waste, and hazardous waste.
- Classify waste streams based on their composition, toxicity, and potential environmental impacts to facilitate appropriate management practices.

Waste Reduction and Minimization

- Implement measures to reduce waste generation at the source through process optimization, resource efficiency, and product design improvements.
- Promote the use of eco-friendly materials, packaging, and technologies that minimize waste generation and facilitate recycling and reuse.
- Encourage the adoption of circular economy principles, such as closed-loop systems and product stewardship, to minimize waste and maximize resource efficiency.

Waste Segregation and Collection

- Establish a waste segregation program to separate different types of waste at the source, including organic waste, recyclables, and hazardous waste.
- Provide adequate waste collection infrastructure, such as bins, containers, and collection points, to ensure proper segregation and containment of waste materials.
- Train project staff and contractors on waste segregation protocols and best practices to minimize contamination and facilitate recycling and recovery efforts.

Recycling and Resource Recovery

- Develop partnerships with local recycling facilities and waste management companies to facilitate the recycling and recovery of recyclable materials, such as plastics, glass, paper, and metals.
- Establish on-site facilities for composting organic waste and converting biomass into renewable energy sources, such as biogas or biofuels.
- Explore opportunities for value-added utilization of waste materials, such as converting agricultural residues into bio-based products or using treated wastewater for irrigation.

Hazardous Waste Management

- Identify hazardous waste generated by project activities, including agrochemicals, pesticides, and chemical solvents.
- Implement procedures for the safe handling, storage, transportation, and disposal of hazardous waste in compliance with regulatory requirements.
- Provide training and personal protective equipment (PPE) to personnel involved in hazardous waste management to minimize health and safety risks.

Monitoring and Reporting

- Establish monitoring protocols to track waste generation, segregation, collection, recycling rates, and disposal practices.
- Regularly monitor and evaluate the effectiveness of waste management measures and adjust strategies as needed.
- Prepare periodic reports on waste management performance and compliance with regulatory requirements for submission to relevant authorities.

The project hopes to construct the following infrastructures below as part of the common structures in the AIH

- **Sewerage Collection and Treatment System**: An underground sewerage network has been designed to collect sewage from each plot and convey it to a sewage treatment plant (STP). At the STP, the sewage would be treated to acceptable standards and the treated sewage will be used for irrigation purpose for which pipe network is considered.

- **Effluent Collection and treatment system**: The major effluent generated will be from the Yam processing plant through washing and from the cassava processing plant generated through washing and from the centrifuge. The effluent treatment will be through a series of anaerobic and aerobic treatment. The treated effluent will meet the standard to be supplied back for washing and agriculture purposes.

7.6 Climate Management Plan

Using the Climate and Disaster Risk Screening Tool, a comprehensive assessment was conducted for the proposed site, enabling the consideration of both short- and long-term climate and disaster risks during the early stages of project design. Integrating resilience-building measures against climate and geophysical hazards is crucial in combating poverty and promoting sustainable development. By screening for risks associated with these hazards, the likelihood and longevity of project success are significantly enhanced.

The project-level Climate and Disaster Risk Screening facilitates preliminary evaluation of climate and disaster risks during the conceptual phase of project development. The results of this screening tool, focusing on selected subsectors such as crops and land management, livestock, rural transport, and storage and processing, indicate the types of Climate Risk Management Measures to be implemented for the project (Table 7.1).

To ensure the adoption of Climate-smart agriculture (CSA) practices at the farm level, the project should prioritize enhancing livelihoods and food security, particularly for smallholders, through improved management and utilization of natural resources. This involves implementing suitable approaches and technologies for the production, processing, and marketing of agricultural commodities.

Key elements to be integrated into climate-smart agricultural approaches for the project include:

- Enhanced management of farms, crops, livestock, aquaculture, and capture fisheries to optimize resource utilization, increase productivity, and enhance resilience.
- Ecosystem and landscape management strategies aimed at conserving critical ecosystem services to improve resource efficiency and bolster resilience.
- Provision of support services for farmers and land managers to facilitate the adoption of necessary changes and ensure the successful implementation of climate-smart agricultural practices.

7.6.1 Greenhouse Gas (GHG) Emissions Mitigation

- A comprehensive GHG emissions assessment to identify sources and quantify emissions associated with the project activities will be conducted.

- Energy-efficient technologies and renewable energy sources (such as solar or biomass) for powering the ATC facilities to minimize carbon footprint will be implemented.
- Sustainable agricultural practices, including conservation agriculture and agroforestry, to sequester carbon in soils and vegetation will be promoted.
- The use of low-emission transportation methods for goods and personnel, such as electric vehicles or biofuel-powered vehicles will be implemented.

7.6.2 Climate Risk Assessment and Adaptation

- A climate risk assessment to identify potential climate hazards (e.g., flooding, drought, extreme temperatures) and their impacts on the project site and surrounding communities will be conducted.
- Infrastructure and facilities resilient to climate hazards, incorporating measures such as flood-resistant construction, water management systems, and heat-resistant building materials will be designed.
- Early warning systems and emergency response plans to mitigate the impacts of climate-related disasters on project operations and personnel will be developed.
- With local communities to integrate indigenous knowledge and traditional practices for climate adaptation into project planning and implementation will be engaged.

7.6.3 Monitoring, Reporting, and Evaluation

- To establish monitoring and evaluation mechanisms to track the implementation of climate management measures and their effectiveness in reducing emissions and enhancing climate resilience.
- Regularly report on climate performance indicators, including GHG emissions reductions, climate risk management outcomes, and sustainable resource management practices.
- Conduct periodic reviews and assessments to identify lessons learned, update climate management strategies, and ensure continuous improvement in environmental performance.

Table 7.1: Climate Risk Management Measures

Objective	Focus
Optimize crops and land management practices	- Tailoring cropping practices to suit specific crops and anticipated rainfall patterns. - Advocating for investments in sustainable land use practices. - Broadening agricultural production to reduce reliance on rainfed crops. - Advocating for land tenure and property rights reforms to enhance local natural resource management. - Equipping farmers with drought- and heat-tolerant crop varieties. - Creating new insurance mechanisms to mitigate climate-related risks. - Assisting smallholders in crop diversification to enhance resilience against changing climate conditions. - Implementing measures to curtail detrimental agricultural practices that contribute to erosion and soil degradation.
Improve livestock practices	- Enhance national animal health services. - Advocate for the adoption of livestock breeds suited to the local climate. - Promote integrated crop-livestock systems and improved water, feed, and animal management practices to enhance livestock productivity.
Improved Irrigation and Drainage	- Prioritize irrigation for drought-sensitive farming and ecosystems. - Enhance capacity to incorporate climate change scenarios into water resources policy planning. - Implement technical measures to enhance water use efficiency in rainfed and irrigated agriculture. - Adopt high-efficiency irrigation methods, such as drip and trickle irrigation. - Explore techniques for water reuse, rainwater harvesting, and sustainable drainage. - Utilize farm ponds, farm drainage, and expand micro irrigation systems. - Evaluate investments in small and medium reservoirs and water supply projects for irrigation purposes. - Enhance water supplies for agricultural use.

Protect/Harden	- Revise design standards to incorporate anticipated storm surge levels. - Deploy wind protection strategies to mitigate potential damage. - Restore vegetation on unstable slopes to stabilize soil and prevent erosion. - Enhance drainage infrastructure to manage increased rainfall and mitigate flooding.
Retreat/Relocate	- Assess the feasibility of raising critical facilities to mitigate overflow and inundation risks. - Develop relocation plans for affected communities to safer areas. - Consider relocating crops to alternative land plots to avoid flood-prone areas. - Explore options for moving infrastructure to more inland locations to reduce vulnerability to coastal hazards.
Build training and information systems	- Enhance institutional capacity to comprehend and manage the impacts of climate change on both institutions and rural communities - Expand accessibility to climate information, including long-term weather forecasts and improved seasonal predictions for informed decision-making in agricultural activities - Establish early warning systems offering daily weather updates and seasonal forecasts to aid in crop selection and timing - Enhance training and educational programs focused on sustainable agriculture practices and the adoption of efficient irrigation techniques
Strengthen policies, planning and systems	- Incorporate climate information into system planning processes. - Enhance coordination of policies and programs among agriculture ministries and other government agencies to address climate change challenges. - Bolster the capabilities of disaster risk management and meteorological departments to enhance the quality of decision-making information.

7.7 Environmental Management Plan

The primary object of environmental monitoring is to ensure that mitigation measures are implemented and the potential negative impacts are reduced, minimized to acceptable levels. The primary objective of the Special Agro-Industrial Processing Zone Monitoring Plan includes the following:

- To assess the changes in environmental conditions
- To assess performance and the effectiveness of the mitigation measures adopted
- To determine project compliance with regulatory requirements and adopt remedial action
- To identify potential gaps and promptly implement of corrective measures

The project monitoring scope is divided into two (2) main phases namely;

1. Impact detection monitoring which includes periodic sampling to assess the impact of project operations on the environment and human health, and to ensure progress towards minimizing project's negative impact. This is also referred to as Institutional monitoring which be conduct by the project Environmental Officer and team of sustainable staff.
2. Compliance monitoring is conducted to ensure that all project and sub-project activities are in full compliance with the Environmental Protection Agency regulations and standards. It is usually commissioned by a Third-Party Evaluator accredited by the FMEnv.

7.7.1 Monitoring Parameters

The receptors required monitoring include:

a) Air Quality
b) Water Resources
c) Soil Quality
d) Waste Generation & Management
e) Occupational Health and Safety
f) Odor
g) Noise Quality
h) Landscape and Visual
i) Biodiversity

EHS Management Plan to Be Developed for The Project Include:

- Development of an Environmental Health and Safety Plan
- Development of a Project Specific Emergency Response plan

- Development of a Project Specific management Plan
- Development of a Spill Contingency Management Plan
- Completion of a "Bridging" process with contractors to evaluate their EHS procedures.

7.7.2 Development of an Environmental Health and Safety Plan

A Health and Safety Plan will be prepared for the construction, operation and decommissioning phases of the project to ensure compliance with the Ministry of Health Guidelines for Occupational Health and Safety and IFC guidelines.

To ensure its employees' health and safety, the SAPZ plan will address the following topics:

- Safety device to protect employees from injuries or hazardous conditions;
- Safe drinking water;
- Immunizations, as applicable;
- Clean eating area;
- First aid facilities;
- Sanitary conditions;
- Waste management, including bathrooms, and proper disposal procedures;
- Appropriate signage;
- Fire prevention facilities, training, and awareness; and
- Personal Protective Equipment (PPE).

A safety specialist assigned by SAPZ II will be responsible for the preparation, implementation and maintenance of a comprehensive safety program, which will be periodically evaluated. The safety specialist will be provided with written safety instructions including instructions on correct storage handling and disposal of hazardous waste, and written contingency Plans / guidelines of action for accidents, spills, and fire. The responsibility of the safety specialist includes performing safety training and conducting safety inspections, sessions and practice. The safety specialist will also be responsible for the investigation of accidents. A safety committee should be formed by SAPZ II and regular safety meetings should be organized.

7.7.3 Development of an Emergency Response Plan

- An Emergency Preparedness and Response Plan (EPRP) will be prepared to assist project staff in effectively responding to emergencies associated with project hazards. The EPRP will comply with the IFC Occupational Safety guidelines and performance standards. The EPRP will include:

- Roles and responsibilities of emergency personnel;
- Emergency contacts and communications systems/protocols, including procedures for interaction with local and regional emergency authorities;
- Specific emergency response procedures;
- Design and implementation of an emergency alarm system audible across the entire site at the sub-stations;
- An evacuation plan will be read and practice by all employees and contractors. The evacuation plan will include emergency escape routes, procedures for accounting for employees after an evacuation, and roles and responsibilities of personnel during an evacuation;
- Identification of supplies and resources to be utilized during an emergency event, including emergency equipment, facilities, and designated areas; and
- A training plan, which includes specific training and drill schedules for personnel
- Who are responsible for rescue operations, medical duties, spill response, and fire response?

If an emergency develops, all persons on site will be notified immediately and efforts will be coordinated with others in the vicinity surrounding the project area in order to reduce impacts, if applicable.

The EPRP will include an evacuation plan which will be read and practiced by all employees and contractors. The evacuation plan will include emergency escape routes, procedures, for accounting for employees after an evacuation, and roles and responsibilities of personnel during an evacuation. In general, the following evacuation procedures should be followed:

- Alert the Emergency Response Team to assist in the evacuation.
- Use communications tools that are appropriate for the type of incident and the time of occurrence, such as alarms or loud speakers.
- When communicating an evacuation, speak clearly and succinctly: “we have a [state the type of emergency]. Evacuate to [state the assembly point]”.
- Turn equipment off, if possible.
- Take emergency supplies and staff roasters, if possible.
- Account for personnel.
- Wait at the assembly point for further instructions.

The ERPP will have specific information on the fire safety and explosion response, which will provide additional details specific to these emergencies.

7.7.4 Development of a Waste Management Plan

The SAPZ will develop a project specific waste management plan to ensure that all waste for the project activities are properly managed in accordance with applicable laws and regulations, and international standards relevant to the power distribution industry. The waste Management Plan will include:

- Description of the types of waste that will be generated
- Waste minimization opportunities
- Waste management methods
- Good housekeeping practices, including manifest and waste tracking forms

The following general categories of waste are anticipated to be generated from the project at this time:

- Hazardous waste such as construction wastes and debris from exaction materials, unused paint, lubricant, batteries, or similar chemicals that exhibit flammability, corrosive or reactive characteristic
- Liquid waste discharged such as sanitary wastewater and gray water, macerated food waste
- Solid wastes, such as packaging materials, containers, used PPE
- Special and recyclable waste, e.g. Batteries, used oil, paper aluminum cans, fluorescent light boils, mercury light builds
- Domestic waste, e.g. refuse

The plan will specify the proper storage, handing and disposal procedures for each waste identified.

During the construction phases, these will be generation of construction debris as a result of various construction activities. The generate materials will be used for reclamation purposes whenever applicable. Nevertheless, care will be taken to ensure the absence of contaminated fill material and the adequacy of the physical and chemical properties of such material to limit potential adverse impacts on water and soil and ensure the safety of the project. Construction waste will also be minimized through careful planning during the design stage, whereby reducing or elimination overpowering of construction materials to decrease waste generation and reduce project costs (cost of surplus materials). Sorting of construction and demolition waste will be encouraged, as well as, adoption of a re-use/recycle program on site whenever deemed feasible.

Chemical waste generated include containers that were used for storage of chemical waste on site, the chemical residue as well as contaminated material. These materials will be segregated as hazardous and non-hazardous and properly stored and disposed of. Storage will be place in a separate area t6hat has an impermeable floor, adequate ventilation and a roof to prevent rainfall from entering. In addition, all chemical waste must be clearly labeled in English, stored in corrosion resistant containers and arranged that incompatible materials are adequately separated.

7.7.5 Spill Contingency Management Plan

The SAPZ will prepare and implement a spill contingency management plan that identifies this procedure to prevent, contain, cleanup, and report spill and release of fuel oil and their hazardous materials. Mitigation measure to prevent contamination from hazardous materials are primarily aimed at preventing their release into the environment in the first place and will include:

- Keeping equipment maintained.
- Inspecting equipment and containers for spill and leaks, corrosion, or other signs of deterioration,
- Maintaining spill response equipment near material storage areas and on heavy equipment.
- Training employees on material storage, transfer, and transportation procedures, spill response procedures, and reporting requirements.

If a fuel spill occurs at the project sites, prompt action will be taken to contain the leakage or spillage in the event of a spill of leak, all combustible, flammable, and ignition sources (such as running engines) likely to result in a fire will be removed from the vicinity of the spill and anyone in the area will be advised to stay upwind. Spill kits will be kept at the project sites and the transport vehicles to readily clean up small spills. Large spills will be contained by constructing a berm around the spell area to control runoff to surface water.
All soil contaminated by previous spills will be excavated and disposed of in accordance with the SAPZ hazardous waste management procedures.

Contractor Management

SAPZ will expect its contractors to follow IFC Guidelines for Occupational Health and Safety and Environmental Management. SAPZ will issue a set of Environmental, Social, Health and Safety safeguards to the construction contractor to follow, which include standards that are expected to be followed and programs that the contractors are expected to have in place (e.g. Environmental Health and Safety Management System).

Air Quality: Generation of Air Emissions from Disturbance

Control techniques for minimizing temporary particulate matter (PM) emission during construction will involve watering of surfaces, chemical stabilization, or surface wind speed with windbreak or source enclosures. Furthermore, surface improvements offer long-term control techniques. These includes covering the road surface with a new material of lower site content, such as covering a dirt road with gravel or slag. Also, regular maintenance practices, such as grading of gravel roads, help to retain larger aggregate size on the traveled portion of the road and thus help reduce emissions. The amount of emissions reduction is tied directly to the reduction in surface site content.

Other mitigation measures include, maintaining good housekeeping prates throughout the construction phase. These low-cost measures include:

- Proper site enclosure through appropriate hoarding and screening
- On-site mixing and unloading operations.
- Proper handling of cement material.
- Maintain minimal traffic speed on-site and on access roads to the tower construction sites.
- Covering all vehicles hauling materials likely to give off excessive dust emissions.
- Ensure adequate maintenance and repair of construction machinery and vehicle
- Avoid burring of material resulting from site clearance
- Cover any excavated dusty materials or stockpile of dusty materials entirely by impervious sheeting.
- Proper water spraying when necessary.

Generation of Air Emission from Vehicles and Equipment Engines

In addition to PM generation, emissions will consist of combustion emission from vehicles and diesel-driven mobile construction equipment (such as, concrete trucks, dump trucks, excavators, and backhoes. The engines emit primarily CO2, Co, NO2, Sox, and HC. Measures to reduce combustion emissions include proper truck and engine maintenance, adoption of a traffic management plan while avoiding congested routes, proper maintenance of construction equipment, and the quality of diesel fuel used. In addition, equipment will be turned off when not in use, while would reduce power needs as well as emissions of pollutants. The supervising consultant will have the responsibility of ensuring the implementation of these measures by the contractor.

Degradation of Water Quality Due to Storm Water Runoff

The removal of vegetation and disturbance of soil in the construction work areas may result in erosion and sedimentation causing increased turbidity in water within the project area.

Additionally, degradation of water quality may occur from pollutants in storm water runoff from material and equipment storage areas and spills and leaks from construction equipment

Special care must be taken to decrease impacts where work is or near the marshland/wetland and mangrove areas so as to keep disturbance of the ecosystems to a minimum.

Degradation of Water Quality Due to Accidental Spills and Leaks

SAPZ will develop and implement a measures/plan to prevent and mitigate spills of oils or hazardous material to surface water bodies and groundwater. Storage of fuel and hazardous material should not occur within 30m of a surface water body. If any pumps are needed for removal of water during tower construction within 30m of marshland/wetland water body. They will utilize proper secondary containment. Oil leakage or spillage will be contained and cleaned up immediately. Spent oil and lubricants will be collected and stored for recycling of proper disposal. In addition, all fuel tanks and chemical storage areas will be provided with locks and located within secondary containment structure. Oil/water separators will be installed at storm water channels to remove oils from contaminated waters such as from workshops.

Soil Contamination and Erosion Due to Erosion

Prior to commencement of construction activities, SAPZ will implement an erosion and sediment control Plan, SAPZ will demonstrate, to the satisfaction of NESERA that any substantial risk of increased sediment discharges from the project sites will not occur during any stage of the project

- Soils excavated for tower foundations will be used for re-filling and will not be left exposed to wind or water for long periods
- The contractor will avoid steep terrain during the transportation material by using alternative route or use light vehicles where appropriate
- Heavy machinery will be used as needed in the clearance of construction work areas in order to minimize soil compaction, which makes the soil susceptible for erosion
- Riverine and surface water body associated vegetation will be minimally disturbed during the construction phase to reduce soil erosion and safeguard bank protection

- Disturbed areas will be replanted with local species common in the area complement natural vegetation regeneration to improve cover
- In are prone to soil erosion, suitable sediment binding grasses will be planted in degraded substrates.

Noise Management

Typical mitigation measures that will be enforced during construction to minimize noise levels are:

- Effectively utilizing material stockpiles and other structures, where feasible; to reduce noise from on-site construction activities
- Choosing inherently quiet equipment
- Operating only well-maintained mechanical equipment on-site
- Keeping equipment speed as low as possible
- Shutting down or throttling down to minimum equipment that may be intermittent in use, between work periods
- Utilizing and properly maintaining silencer or mufflers that reduce vibration on construction equipment during construction works
- Restricting access to the site for truck traffic outside of normal working hours
- Utilizing proper site logistics and planning
- Limiting site working hours the morning hour
- Scheduling noisy activities strictly during the morning hours
- Consulting with local communities and informing the locals when noisy activities are planned
- Enforcing noise monitoring
- Enforce the use of hearing protection actively when the equivalent sound level over 8 hours reaches 85 dB(A), the peak sound levels reach 140dB(C), or the average maximum sound level reaches 110db(A)
- Installing warning signs in area high noise levels
- Consider the use of acoustic insulating materials, isolation of the noise source, and other engineering controls to minimize noise impact.

The noise control measure will be included within the construction contracts and be considered as requirements from contractors. The supervising consultant will have the responsibility of ensuring the implementation of these measure.

Impact Detection Monitoring

Includes periodic sampling to assess the impact of project operations on the environment and human health, and to ensure progress towards minimizing project's negative impact. This is also referred to as Institutional monitoring which be conduct by the project Environmental Officer and team of sustainable staff. The objective of Impact detection monitoring compliance monitoring includes:

- Identify the most probable source.
- Verify the proper implementation of the specified mitigation measures.
- Review the effectiveness of environmental management plans including mitigation measures and propose alternative actions as appropriate.

Compliance Monitoring

Compliance Monitoring is conducted to ensure that all project and sub-project activities are in full compliance with the Environmental Protection Agency regulations and standards. It is usually commissioned by a Third-Party Evaluator accredited by the Federal Ministry of Environment. Objectives of the party include;

- To monitor performance and effectiveness of environmental management plans.
- Evaluate project compliance with regulatory requirements.
- Provision of safety at all difference locations of the working area and retention of records.
- Capacity development and training of staff, operators, technicians, staff etc.
- Adequate analytical instrumentations.

Table 7.2: Summary of the Environmental and Social Management & Monitoring Plan

Project Phase	Project Activities	Associated and Potential Impacts	Mitigation Measure	Implementation Responsibility.	Parameters to be Measured	Method of Measurement	Performance Indicator	Responsibility Action party for Monitoring
Preconstruction Phase	Site survey and geotechnical investigations	Dust generation	- Use water spraying to control dust.	Contractor	Dust levels	Visual inspection, dust meters	Acceptable dust levels	Environmental Officer
	Land acquisition and compensation	Disruption of local water sources	- Conduct hydrological assessments and ensure alternative water supplies.	Project Proponent	Water quality parameters (pH, turbidity, etc.)	Water sampling and laboratory analysis	Water quality meets regulatory standards	Environmental Officer
	Community consultations and stakeholder engagement	Loss of vegetation	- Minimize vegetation clearing and promote reforestation efforts.	Contractor	Area of vegetation cleared	Site surveys and vegetation mapping	Minimal vegetation clearance	Environmental Officer
	Site clearing and excavation	Increased dust and emissions	- Use dust suppression techniques and maintain equipment.	Contractor	Dust and emission levels	Dust and emission monitoring equipment	Acceptable levels of dust and emissions	Environmental Officer
	Construction of infrastructure	Potential contamination	- Implement water	Contractor	Water quality	Water sampling and	Water quality meets	Environmental Officer

Construction Phase		of water sources	management plans to prevent contamination.		parameters (pH, turbidity, etc.)	laboratory analysis	regulatory standards	
	Installation of utilities	Habitat destruction	- Create buffer zones, relocate fauna where necessary.	Contractor	Presence of buffer zones, relocated fauna	Site inspections, wildlife surveys	Established buffer zones, successful relocation	Environmental Officer
	General construction activities	Generation of construction waste	- Implement waste management plans, recycle where possible.	Contractor	Volume of waste generated, recycled waste	Waste tracking records	High recycling rate, proper waste disposal	Environmental Officer
	Use of machinery and equipment	Noise from construction activities	- Restrict construction to daylight hours, use noise dampening equipment.	Contractor	Noise levels	Noise monitoring equipment	Noise levels within acceptable limits	Environmental Officer
	Operation of facilities and equipment	Emissions from operational activities	- Use clean technologies and regularly maintain equipment.	Facility Operator	Emission levels	Emission monitoring equipment	Emissions within regulatory limits	Environmental Officer
	Routine maintenance and repairs	Water use and potential contamination	- Implement water conservation	Facility Operator	Water usage, water	Water meters, water	Efficient water use,	Environmental Officer

Operational & Maintenance phases			measures and monitor water quality.		quality parameters	sampling and analysis	water quality standards	
	Waste management and disposal	Generation of operational waste	- Implement comprehensive recycling and waste reduction programs.	Facility Operator	Volume of waste generated, recycled waste	Waste tracking records	High recycling rate, proper waste disposal	Environmental Officer
	Use of operational machinery	Noise from operational machinery	- Use noise reduction strategies and maintain equipment to minimize noise.	Facility Operator	Noise levels	Noise monitoring equipment	Noise levels within acceptable limits	Environmental Officer
	Dismantling and removal of structures	Dust and emissions from dismantling activities	- Use dust suppression and emission control measures.	Contractor	Dust and emission levels	Dust and emission monitoring equipment	Acceptable levels of dust and emissions	Environmental Officer
	Site cleanup and remediation	Potential contamination from dismantling waste	- Implement water protection measures and ensure proper waste disposal.	Contractor	Water quality parameters (pH, turbidity, etc.)	Water sampling and laboratory analysis	Water quality meets regulatory standards	Environmental Officer

Decommissioning Phase	Post-decommissioning land use planning	Habitat disruption and biodiversity loss	- Restore habitats and promote biodiversity in site restoration plans.	Contractor	Area restored, biodiversity indices	Site surveys, biodiversity assessments	Successful habitat restoration	Environmental Officer
	Disposal of dismantling waste	Generation of dismantling waste including hazardous substances	- Develop a waste management plan for safe disposal of all materials.	Contractor	Volume and type of waste generated, hazardous waste	Waste tracking records, hazardous waste manifests	Proper waste disposal, minimal hazardous waste	Environmental Officer
	Use of dismantling machinery	Noise from dismantling activities	- Schedule dismantling during less sensitive times, use noise barriers.	Contractor	Noise levels	Noise monitoring equipment	Noise levels within acceptable limits	Environmental Officer
	Cultural heritage assessments	Impact on cultural heritage during site clearance	- Monitor for cultural artifacts and consult with cultural heritage experts.	Contractor	Discovery of cultural artifacts	Site inspections, reports from cultural experts	Preservation of cultural heritage	Cultural Heritage Expert
	Health and safety assessments	Risks from dismantling activities to workers and	- Implement strict health and safety protocols,	Contractor	Number of incidents, use of PPE	Safety reports, incident logs	Zero incidents, proper use of PPE	Health and Safety Officer

		nearby communities	provide appropriate PPE and training.					

7.8 ESMP Costing and Schedule

To ensure the successful implementation of the environmental and social management measures proposed within the ESMP, the Taraba State Government (Ministry of Agriculture) will allocate the required budgetary resources for the project components. The tentative budget for each project will encompass environmental management expenses beyond standard engineering practices, including the costs associated with environmental and resettlement monitoring. Additionally, all administrative expenses related to ESMP costing is detailed in Table 7.2 while the implementation will be accounted for in the budget, as detailed in Table 7.3. The ESMP Implementation Schedule is delineated in Table 7.4.

Table 7.3: ESMP Costing

Monitoring Activity	Monitoring parameter	Monitoring location	Phase	Frequency Cost	Cost	Responsibility	Implementation responsibility
Air Quality							
Visual Assessment, routine and if necessary, in response to a compliant through the Grievance Mechanism	Dust levels in the atmosphere	Construction areas, places of heavy traffic flow	Construction	Daily & during period of dust generating activity or in response to a compliant through the Grievance Mechanism	Under the general responsibilities of the construction supervisor --No material additional costs associated with this activity	Construction Contractor (CC)	Construction Contractor (CC)
Soil Quality							
Soil sampling	Soil contaminants including heavy metals, non-	Specific sampling points identified at the project	Construction	Prior to construction and after remediation of	Laboratory fees		Environmental Manager

	metallic contaminants, organic and non-organic compounds, pesticides, and biological organisms	locations and areas where dangerous activities are ongoing		contaminated sites			
Water Resources							
Surface water	pH, Conductivity, RCRA, COC, SVDC, Suspended solids, dissolved solids, oil and grease, BTEX	Lake/River in closed proximity to the project location to be identified as monitoring point	Construction	Quarterly	Laboratory Fees	NIC	NIC Environmental Manager
Ground water	pH, Conductivity, Dissolved Oxygen, Temperature, & Turbidity	Groundwater wells in or around project location	Operation	Prior to commencement of construction, during and then quarterly during operations	Capital cost of Multiparameter probe		Environmental Manager
	RCRA, VOC, Suspended solids, dissolved solids oil	Ground water samples in close proximity to	Operation	Quarterly	Laboratory Fees:		Environmental Manager

	and grease BTEX	the project location					
Health and Safety							
Health and Safety surveys, documentation of injuries and accidents	Proper use of PPEs, Presence of signs, First Aid Kit, and Firefighting Devices	Construction and operation sites where activities are undertaking	Construction & Operation	Construction	Under the general responsibilities of the Environmental Manager—No significant material costs associated with this activity		Contractor and or Environmental Manager
Solid Waste							
Solid Waste Generation and Disposal	Visual inspection and photographic documentation and audit	Project site and disposal sites	Construction & Operation	Continuous	Under the General responsibilities of the Environmental Manager--- No significant material costs associated with this activity		Environmental Manager
Landscape and Visual Amenity							
Monitor to ensure that dust control and visual screening measures are	Ensure the effective implementation of mitigation measures	Entire project area where activities are undertaking	Construction & Operation	Quarterly	Under the General responsibilities of the Environmental Manager—No significant material costs		Environmental Manager

implemented effectively					associated with this activity		
Noise							
Measurements of existing ambient noise will be carried out at the most sensitive locations prior to the start of the construction	Noise level, LAeq, 1 hour	Nearest houses to the project construction sites	Construction	Prior to construction and during activities that are likely to produce the highest noise outputs	Capital costs (onsite noise monitoring meter-)		Qualified Acoustic Survey Technicians

Table 7.4: Summary of Indicative Budget for Implementing the ESMP

S/No	Element	Responsible	₦
1	Mitigation Measures	State Ministry of Agriculture, Investors, and Contractor	XXXXXX
2	Monitoring & Audit		XXXXXX
3	Training	Contractor/HSE Officer, Consultant, and Management	XXXXXX
Sub-total			
	10% contingency		
Grand total			XXXXXX

Table 7.5: ESMP Implementation Schedule

S/N	Activity Description	Responsible	Construction		
			Pre	During	Post
1	Disclosure of Environmental Assessment Report	Ministry of Agriculture			
2	Allocating Budget for ESMP	Ministry of Agriculture			
3	Appointing Support Staff of ESMP	Ministry of Agriculture			
4	Review and Approval of Contractor's ESMP and Safety Plan	Ministry of Agriculture			
5	Finalizing site and layout plan of constructionplan	Ministry of Agriculture			
6	Finalization of Borrow and Excavation Areas	Ministry of Agriculture			
7	Implementation of Mitigation Measures	Ministry of Agriculture			
8	Supervising ESMP Implementation	Ministry of Agriculture			
9	Environmental Auditing	Ministry of Agriculture			
10	Monitoring a Reporting on ESMPImplementation	Ministry of Agriculture			
11	Environmental Training	Ministry of Agriculture			

CHAPTER EIGHT
CONCLUSION AND RECOMMENDATION

The study indicates that the establishment of the proposed Special Agro-Industrial Processing Zones (SAPZ) – Agro-Industrial Hub (AIH) and Agricultural Transformation Centre (ATC) in Lau and Wukari Local Government Areas of Taraba State, Nigeria, will not severely or negatively impact the existing environmental, social, health, and safety conditions of the local, national, or international communities.

The project is highly desirable due to its significant environmental, health, and socio-economic benefits, which far outweigh any potential negative impacts that may arise during implementation. No impacts of sufficient magnitude were detected that could disrupt the project's execution. Although some negative impacts may occur due to project activities, adequate and SMART (Specific, Measurable, Achievable, Relevant, Time-bound) measures have been proposed to address them. Mitigation measures and management plans have been developed to handle these negative impacts, and an appropriate institutional framework will be established to implement these measures. The proposed monitoring programs will be activated as soon as possible.

Assessing and identifying potential environmental, social, cultural, and health risks and impacts, and recommending measures to mitigate, reduce, or offset these impacts to acceptable levels, ensures project acceptance by the local affected parties and successful implementation. While major stakeholders urgently support project approval and implementation, it is crucial to consider dissenting views and concerns expressed by affected parties and stakeholders to ensure the project is environmentally sound and socially sustainable. Therefore, a detailed assessment must be conducted to determine the level and extent of resettlement that may be required.

The overall impacts of the project are minimal, and the recommended mitigation measures are effective in addressing, reducing, and offsetting these impacts. Importantly, impacts identified during the construction phase range from direct, indirect, short-term, temporary, irreversible, and most often are under the proponent's control. The impacts during the operation phase are relatively low, and adequate environmental management systems will be employed to address and mitigate them. Baseline surface and groundwater within the project's area of influence were evaluated to assess their characteristics before the implementation of the project activities. Socio-economic surveys revealed that the majority of local and rural people are engaged in traditional agricultural practices, including farming, hunting, and charcoal production.

BOLBEN Ltd. asserts that all environmental and social impacts associated with the Taraba Special Agro-Industrial Processing Zones (SAPZ) – Agro-Industrial Hub (AIH) in Lau Local Government Area have been identified. The mitigation and management measures outlined are sufficient to address these impacts when implemented accordingly. Assessing and identifying potential environmental, social, cultural, and health risks is crucial for ensuring the project's acceptance and successful implementation by local affected parties. Implementing recommended measures to mitigate, reduce, or offset these impacts to acceptable levels is paramount. While there may be pressing demands from key stakeholders for project approval and implementation, it is essential to consider dissenting views and concerns expressed by affected parties and stakeholders to ensure the project's environmental and social sustainability.

It is recommended that a comprehensive stakeholder engagement plan be developed and implemented to address the concerns of all parties and to ensure transparent communication throughout the project's lifecycle.

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