



ESIA

Environmental and Social Impact Assessment (ESIA) for the Proposed Agro-Industrial Hub (AIH), Kaduna State Special Agro-Industrial Processing Zone, Km26, Abuja-Kaduna Expressway, Chikun LGA



DECEMBER, 2025



ENVIRONMENTAL AND SOCIAL IMPACT ASSESSEMENT REPORT

FOR THE

KADUNA STATE SPECIAL AGRO-INDUSTRIAL PROCESSING ZONE (SAPZ)

AGRO - INDUSTRIAL HUB (AIH)

KM 26, ABUJA-KADUNA EXPRESSWAY, DAKI TAKWAS,

CHIKUN LOCAL GOVERNMENT AREA

KADUNA STATE, NIGERIA

FINAL DRAFT REPORT

DECEMBER 2025



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LIST OF ABBREVIATIONS AND ACRONYMS

AC	Alternating current
AEDC	Abuja Electricity Distribution Company
AfDB	African Development Bank
AFSNS	Agricultural Sector Food Security and Nutrition Strategy
AIDS	Acquired Immunodeficiency Syndrome
AIH	Agro-Industrial Hub
APHA	American Public Health Association
APP	Agriculture Promotion Policy
ASTM	American Society for Testing and Materials
ATCs	Agricultural Transformation Centres
BAT	Best Available Technologies
BATNEEC	Best Available Technology Not Entailing Excessive Cost
BAU	Business-As-Usual
BDL	Below Detection Limit
BPO	Business Process Outsourcing
BTS	Base Transceiver Station
C of O	Certificate of Occupancy
CBD	Convention on Biological Diversity
CESMP	Contractor's Environment And Social Management Plan
Cfu/ml	Colony-Forming Unit per Millilitre
CIP	Clean-in-Place
CITES	Convention to Regulate international trade in Endangered species of Fauna and Flora
CMS	Conservation of Migratory Species of Wild Animals
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
COP	Conference of Parties
CSR	Corporate And Social Responsibility
CV	Curriculum vitae
DI	Ductile Iron
DO	Dissolved Oxygen
DSTV	Digital Satellite Television
EAD	Environmental Assessment Department
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ELSRs	Elevated-Level Service Reservoirs
EMP	Environmental Management Plan
ERGP	Economic and Recovery Growth Plan
ES	Executive Summary
ESAP	Environmental and Social Assessment Procedures
ESF	Environmental and Social Framework



ESHS	Environmental, Social, Health and Safety
ESIA	Environmental and Social Impact Assessment
ESMP	Mitigation and Environmental and Social Management Plan
ESS	Environmental and Social Standards
ETP	Effluent Treatment Plant
ETP	Energy Transition Plan
FCT	Federal Capital Territory
FEC	Federal Executive Council
FEPA	Federal Environmental Protection Agency
FGD	Focus Group Discussions
FGN	Federal Government of Nigeria
Fl	Flouride
FMAFS	Federal Ministry of Agriculture and Food Security
FMARD	Federal Ministry of Agriculture and Rural Development
FMEnv	Federal Ministry of Environment
GAAIZ	Green Agro-Allied Industrial Zone
GBV	Gender-Based Violence
GHG	Greenhouse Gas
GIS	Geographic Information System
GLO	Globacom
GPS	Global Positioning System
GRM	Grievance Redress Mechanism
GW	Gigawatts
GWC	Global Warming Convention
H ₂ S	Hydrogen Sulphide
HDPE	High-Density Polyethylene
HEC	Hydrologic Engineering Centre's
HIV	Human Immunodeficiency Virus
HSE	Health, Safety, and Environmental
ICT	Information and Communication Technology
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
IGR	Internally Generated Revenue
IsDB	Islamic Development Bank
ISS	Integrated Safeguards System
ISS	Integrated Safety Systems
IT	Information Technology
KADGIS	Kaduna Geographic Information Service
KAEDCO	Kaduna Electricity Distribution Company
KDSG	Kaduna State Government
KEPA	Kaduna State Environmental Protection Agency
LAID	Land Acquisition and Involuntary Displacement
LED	Light Emitting Diode
LGA	Local Government Area
LRP	Livelihood Restoration Plan



LT/HT	Low Tension/High Tension
LULC	Land Use And Land Cover
MDAs	Ministries, Departments and Agencies
MDD	Maximum Dry Density
MENR	Kaduna State Ministry of Environment and Natural Resources
Mg/L	Milligrams per Litre
MPN	Most Probable Number
MSIP	Management Strategies and Implementation Plans
MTN	Mobile Telephone Network
NAFDAC	National Agency for Food and Drug Administration and Control
NALDA	National Agricultural Land Development Authority
NASA	National Aeronautics and Space Administration
NBS	National Bureau of Statistics
NDC	Nationally Determined Contribution
NE	North-Easterly
NEP	National Energy Policy
NEP	National Energy Policy
NESREA	National Standards and Regulations Enforcement Agency
NH ₃	Ammonia
NIN	National Identification Number
NLTP	National Livestock Transformation Plan
NO ₂	Nitrogen Dioxide
NPC	National Population Commission
NPC	National Population Commission
NPC	National Population Commission
NREEP	National Renewable Energy and Energy Efficiency Policy
NSIA	Nigeria Sovereign Investment Authority
NTU	Nephelometric Turbidity Unit
NURPA	Nigerian Urban and Regional Planning
OHS	Occupational Health And Safety
OS	Operational Safeguards
PAP	Projected Affected Persons
PCU	Program Coordinating Unit
PM	Post Meridian
PM _{2.5} /PM ₁₀	Particulate Matter
PMP	Project Management Professional
POWER	Prediction of Worldwide Energy Resources
PPE	Personal Protective Equipment
PPM	Part Per Million
PPP	Public–Private Partnership
PtCo	Platinum-Cobalt (Scale for colour measurement)
PV	photovoltaic
QA/QC	Quality Assurance/Quality Control
RAP	Resettlement Action Plan
RTCs	Rural Transformation Centres



SAPZ	Special Agro-Industrial Processing Zone
SDGs	Sustainable Development Goals
SE	South-Easterly
SEA	Sexual Exploitation and Abuse
SEMS	Smart Energy Management System
SEP	Stakeholder Engagement Plan
SEPAs	State Environmental Protection Agencies
SO ₂	Sulfur Dioxide
SPIU	State Project Implementation Unit
SRTM	Shuttle Radar Topography Mission
TBD	To be determined
TGN	Technical Guidance Notes
TRIMING	Transforming Irrigation Management in Nigeria
TRIR	Total Recordable Incident Rate
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
TVOC	Targeted Volatile Organic Compopund
UGS	Multiple underground storage tanks
UGS	Underground Storage
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
US	United State
USD	United State Dollar
VAC	Violence Against Children
VES	Vertical Electrical Sounding
VNR	Voluntary Natioal Review
VOC	Volatile Organic Compounds
WB	World Bank
WHO	World Health Organization
WMP	Waste Management Plan



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Executive Summary

ES1. Introduction

This Environmental and Social Impact Assessment (ESIA) has been prepared for the proposed Agro-Industrial Hub (AIH) under the Kaduna State Special Agro-Industrial Processing Zone (SAPZ) program. The project is implemented by the Federal Ministry of Agriculture and Food Security (FMAFS) through the Kaduna State Ministry of Agriculture (KDMA), coordinated by the National Project Coordination Unit (NPCU), with technical and financial support from the African Development Bank (AfDB).

The ESIA was undertaken to ensure that the AIH project is planned and executed in an environmentally sound, socially inclusive, and economically sustainable manner. It identifies, predicts, and evaluates the potential impacts of the proposed development and provides mitigation, monitoring, and institutional measures to manage those impacts.

The ESIA process adhered to the following key instruments:

- AfDB Integrated Safeguards System (ISS, 2023)
- FMEv Environmental Impact Assessment Act (EIA) Cap E12 LFN 2004)
- NESREA Environmental Regulations (2009–2022)
- Kaduna State Environmental Protection Authority (KEPA) Edict (1999)

The study covered all project phases — pre-construction, construction, operation, and decommissioning — and integrated biophysical, socio-economic, and institutional assessments through field data collection, laboratory analyses, and stakeholder consultations.

ES2. Project Description and Location

The proposed AIH SAPZ project is designed to catalyze agro-industrial growth by establishing a multi-commodity processing, storage, and logistics hub at Daki Takwas, Chikun Local Government Area (LGA), Kaduna State. It seeks to enhance value addition, stimulate agricultural productivity, create jobs, and improve livelihoods across the region.

Project Coordinates and Land Area



The project site lies between the geographic coordinate 10° 10' 30"N; 7° 21' 05"E and 10° 11' 40"N; 7° 22' 10"E, with a land area coverage of 250 hectares respectively

Host and Adjoining Communities

The primary host communities are Daki - Takwas while neighboring settlements include Ungwan Dawaki and Ungwan Sarki. These communities are predominantly agrarian, with smallholder farmers forming the main economic base.

Land Tenure and Existing Land Use

The project site is government owned and presently used for rain-fed agriculture, seasonal grazing, and fallow cultivation. A Resettlement Action Plan (RAP) has been prepared to ensure fair compensation, livelihood restoration, and compliance with AfDB Operational Safeguard 2 (Involuntary Resettlement) and relevant Nigerian legislation.

Physical and Ecological Setting

The existing LULC characteristics observed in the project area shows a mosaic of sparse components of savanna woodlands with shrubs, arable agricultural lands with shrubs, scattered trees, bare land and water bodies typically found in the north western region of Nigeria. The land use characteristics of the SAPZ AIH project area consists primarily of agricultural lands comprising of non-forest savannah woodlands, arable agricultural lands with components of woodlands, shrubs and grassland interspersed with bare surfaces. The SAPZ AIH project site lies on a relatively slopy topography with elevations ranging from 372 to 879 meters above mean sea level (amsl). This simply means the SAPZ AIH footprint landscape is a 507 meters relief that lies within a 2.58 km². Thus, the site is a complex topography that is generally steep and not uniformly flat. *(Refer to Figures 3.1 and 3. : map and survey plan of the SAPZ AIH Project Site in the main ESIA report.)*

ES3. Policy, Legal and Institutional Framework

The ESIA aligns with applicable national, state, and AfDB safeguard policies, ensuring full regulatory compliance and institutional coordination.

Key Legal and Policy Instruments

- FMEEnv EIA Act (Cap E12, LFN 1992) – mandates environmental assessment for major development projects.



- NESREA Regulations (2009–2022) – covering air quality, noise, waste, and water quality standards.
- KEPA Edict (1999) – provides state-level oversight of environmental compliance.
- Labour Act (2004) and Public Health Act (2007) – govern occupational safety and public health protection.
- AfDB Operational Safeguards (OS1–OS5) – with emphasis on OS1 (Environmental and Social Assessment) and OS2 (Involuntary Resettlement).

Institutional Responsibilities

- **FMAFS/NPCU:** National-level coordination, safeguard oversight, and reporting.
- **KDMA/SPIU:** Project-level implementation, contractor supervision, and safeguard compliance.
- **FME_{env} & KEPA:** ESIA review, approval, and environmental monitoring.
- **AfDB:** Independent safeguard oversight and compliance assurance.

ES4. Analysis of Alternatives

Three principal alternatives were evaluated:

1. **No-Project Alternative:** Avoids environmental disturbance but perpetuates rural poverty, post-harvest losses, and unemployment.
2. **Alternative Sites (Ungwan Dawaki, Kasarami):** Rejected due to inadequate land area, poor drainage, and remoteness from the main transport corridor.
3. **Technology and Design Options:** The selected design integrates solar hybrid energy, rainwater harvesting, wastewater recycling, and modular waste management systems, reducing pollution and operational costs.

The Daki–Takwas site provides the best balance of environmental suitability, accessibility, and socio-economic benefits.

ES5. Environmental and Social Baseline

Baseline data (collected May–June 2025) establish the pre-project environmental and socio-economic conditions.

Physical Environment



Parameter	Range	FMEnv/WHO Limit	Interpretation
Air Quality (PM ₁₀)	45–72 µg/m ³	150 µg/m ³	Within limit; rural background
PM _{2.5}	18–29 µg/m ³	75 µg/m ³	Acceptable air quality
Noise Level	44–52 dB(A)	55 dB(A)	Quiet rural environment
Soil pH	6.2–7.0	6.0–8.5	Suitable for agriculture
Water pH	6.8–7.4	6.5–8.5	Safe for domestic/agricultural use
EC (µS/cm)	406–1231	2500	Low salinity and ionic content
TDS (mg/L)	264–800	1000	Freshwater suitable for irrigation

The results indicate that environmental quality is good, with minimal pollution and healthy ecosystem conditions.

Biological Environment

Vegetation is moderately degraded due to bush burning and grazing. No endangered or endemic species were recorded. Fauna includes *Thryonomys swinderianus*, *Agama agama*, and *Turtur abyssinicus*.

Riparian vegetation provides moderate ecological sensitivity, and a 20 m buffer zone will be maintained along seasonal streams.

Socio-Economic Environment

Chikun LGA has an estimated population of 550,500 (2024) with a growth rate of ~3%.

Livelihoods depend primarily on crop farming (maize, sorghum, groundnut), livestock rearing, and petty trade. Key challenges include inadequate healthcare, youth unemployment, and poor road access. Strong traditional governance systems exist and play key roles in dispute resolution and community development.

ES 6; Stakeholder Engagement and Disclosure

Stakeholder engagement for the AIH Daki-Takwas SAPZ Project was conducted between June and August 2025, in line with AfDB Operational Safeguards (OS1–OS10) and FMEnv EIA



Guidelines (2017). Consultations involved government agencies, traditional leaders, women/youth groups, civil society organisations, and Project Affected Persons (PAPs) within a 5 km radius of the project area.

Key concerns included land acquisition, compensation, employment opportunities, flood risks, and environmental management. A Resettlement Action Plan (RAP) identified 27 PAPs, and a Livelihood Restoration Plan (LRP) was developed to support affected farmers through compensation, vocational training, and farm input assistance.

Stakeholder Concerns and Project Responses

Key Concern	Raised By	Project Response
Land acquisition and compensation	PAPs, traditional leaders	RAP prepared; compensation and LRP to restore livelihoods
Local employment opportunities	Youth, women groups	70% of unskilled jobs reserved for host communities
Environmental and flood risks	Farmers, CSOs	ESMP includes erosion control, drainage, and dust suppression
Community inclusion and communication	Local leaders	Continuous dialogue via Community Liaison Officers (CLOs)
Health and safety	Health workers	Integration of OHS and community health plans

ES7. Key Impacts and Mitigation Measures

The assessment identified potential biophysical and social impacts across project phases. After mitigation, all residual impacts are expected to be low to moderate.

Impact Area	Potential Effect	Mitigation Measures
Soil & Land	Erosion, sedimentation	Phased clearing, erosion bunds, landscaping and establish setbacks from slope crests and avoid locating heavy structures close to unstable slope edges.
Air & Noise	Dust, noise from machinery	Water sprinkling, install mufflers, noise barriers and provide ear plugs to construction workers
Water Quality	Runoff contamination	Minimize exposed land surfaces by clearing vegetation in phases, and avoid stripping the entire site at once; Bunded fuel storage, wastewater treatment
Biodiversity	Habitat disturbance	20 m riparian buffer, native replanting



Impact Area	Potential Effect	Mitigation Measures
Livelihoods	Temporary displacement	RAP/LRP implementation, skill training
Community Health	Diseases, accidents	PPE, HSE awareness, sanitation facilities
Traffic Safety	Increased movement	Implement the Traffic Management Plan (TMP), speed control, signage

(See full ESMP Table, in Chapter 7.)

ES8. Institutional Capacity and Training

Capacity assessment indicates that while FMAFS and KDMA have functional safeguard structures, SPIU and local authorities require further strengthening. Key capacity-building areas include:

- Environmental monitoring and compliance
- Occupational Health and Safety (OHS)
- GBV/SEA prevention
- Stakeholder engagement and GRM management

A budget of ₦36.8 million is allocated for training and institutional strengthening.

ES9. Grievance Redress Mechanism (GRM)

A three-tier GRM will ensure timely and transparent resolution of grievances within 30 days:

1. **Community Level:** Reporting through CLOs or suggestion boxes.
2. **Project Level:** SPIU GRM Committee review within 14 days.
3. **State/National Level:** Escalation to KDMA/FMEnv if unresolved.

Annual Estimated GRM operation cost: ₦35 million.

ES10. ESMP Budget Summary

Component	Description	Estimated Cost (₦)



Mitigation Measures	Pollution control, erosion, biodiversity	67,000,000
Environmental & Social Monitoring	Sampling, audits, lab analysis	45,699,123
Staff Remuneration	Environment staff including Technicians, CLO etc.	38,400,000
Capacity Building & Training	HSE, ESMP, GBV/SEA	36,800,000
Grievance Redress Mechanism	Awareness, documentation, committee	35,000,000
ESMP Disclosure & Communication	Media outreach, signage	1,200,000
Total		₦224,099,123

ES11. Conclusion

The AIH Daki-Takwas is environmentally and socially sustainable. When implemented with the prescribed ESMP, RAP, and LRP, it will:

- Create over 3,500 jobs (direct and indirect);
- Strengthen agro-value chains and rural economies;
- Improve infrastructure and living standards; and
- Maintain full compliance with AfDB ISS (OS1–OS10), FMEnv, and KEPA regulations.

The ESIA therefore recommends the project for AfDB and FMEnv approval, subject to strict adherence to all safeguard requirements



CHAPTER ONE: BACKGROUND AND INTRODUCTION

1.1 Introduction

The Kaduna State Government (KDSG), in collaboration with the African Development Bank (AfDB) and the Federal Government of Nigeria (FGN), is implementing the Special Agro-Industrial Processing Zone (SAPZ) Phase I Project to promote inclusive, sustainable, and market-driven agro-industrial development. Fully financed by the AfDB, the project seeks to enhance agricultural productivity, value addition, and rural livelihoods through the establishment of two key facilities in Kaduna State:

- The Agro-Industrial Hub (AIH) at Daki-Takwas, Chikun Local Government Area (LGA)
- The Agricultural Transformation Centre (ATC) at Dutsen-Wai–Kuzuntu, Kubau LGA

These interventions target value chains in maize, ginger, and tomato, among others, to foster economic diversification, private sector participation, and food and nutrition security.

1.2 Project Development Objective (PDO)

The overall goal of the SAPZ Project is to increase household incomes, generate employment (particularly for youth and women), and enhance food and nutritional security through sustainable agro-industrial development. The specific objectives are to:

1. Promote inclusive and climate-smart agro-industrial growth;
2. Enhance agricultural productivity and competitiveness;
3. Expand rural employment and income generation;
4. Strengthen food and nutrition security; and
5. Leverage private investment for agricultural value chain development.

1.3 Project Background

The SAPZ initiative aligns with the Federal Government’s Agricultural Transformation Agenda and the AfDB’s Feed Africa Strategy, both aimed at unlocking Nigeria’s agricultural potential through industrialization and value addition. In Kaduna State, the SAPZ programme focuses on building enabling infrastructure—roads, energy, water, ICT, and processing facilities—within designated agro-industrial enclaves.

The programme emphasizes climate-smart technologies, post-harvest loss reduction, market access, and skills development, targeting inclusive participation of smallholder farmers and agribusinesses. It is expected to catalyze rural transformation by improving livelihoods, reducing poverty, and advancing sustainable agricultural practices.

Given its potential environmental and social implications—such as land take, biodiversity disturbance, and displacement—the Kaduna SAPZ has been classified as a Category 1 project



under the AfDB Integrated Safeguards System (ISS, 2023), necessitating a full Environmental and Social Impact Assessment (ESIA).

The KDSG engaged Prestine Green Environmental Safety Consulting Nigeria Limited to undertake the ESIA in line with the Environmental Impact Assessment Act (Cap E12 LFN 2004) and relevant AfDB Operational Safeguards (OS1–Environmental and Social Assessment, OS2–Involuntary Resettlement, OS3–Biodiversity and Ecosystem Services). The ESIA evaluates potential impacts, explores alternatives, and recommends mitigation measures to ensure sustainability throughout the project lifecycle.

1.4 Project Proponent and Institutional Arrangements

The Kaduna State Government (KDSG) is the principal proponent, with implementation led by the Kaduna State Ministry of Agriculture and the Kaduna Investment Promotion Agency (KADIPA) through the Project Coordinating Unit (PCU). The AfDB provides financial and technical support, while the FGN ensures policy alignment with national agricultural transformation and economic diversification strategies.

1.5 Project Location and Components

The Kaduna SAPZ Project spans **two LGAs** strategically selected for their agricultural potential, land availability, and connectivity.

- **Agro-Industrial Hub (AIH):** Located at Daki-Takwas, Chikun LGA, between coordinates 10°10'30"N–10°11'40"N and 7°21'05"E–7°22'10"E, covering 250 hectares of predominantly agricultural land. The area hosts smallholder production of maize, rice, soybeans, ginger, tomatoes, and sorghum. It is accessible via existing road networks linking Kaduna metropolis and regional markets. Key facilities to be developed include processing plants, bulk storage silos, warehouses, cold-chain systems, energy and water infrastructure, wastewater treatment units, internal access roads, and administrative offices. The layout will be refined following geotechnical studies and ESIA recommendations.
- **Agricultural Transformation Centre (ATC):** Situated at Dutsen-Wai–Kuzuntu, Kubau LGA (approx. 10.7886°N, 7.6293°E), the ATC covers 30 hectares of government-owned land previously used for subsistence farming and grazing. Host communities include Kuzuntu-Dutsen-Wai, with adjoining communities of Jenau, Mah, Kurmin-Dogo, and Anchau.
The ATC will function as an aggregation, input distribution, and service centre, providing certified seeds, agrochemicals, mechanization services, training, and produce aggregation for onward processing at the AIH.

A Resettlement Action Plan (RAP) has been prepared for 27 Project-Affected Persons (PAPs) whose land and livelihoods were impacted by land acquisition for the AIH site. Compensation and livelihood restoration measures are being implemented in accordance with AfDB's OS2 and Nigerian EIA requirements.



1.6 Project Phasing

The project will be implemented in four main phases:

1. **Pre-construction:** Land acquisition, compensation, detailed designs, and permitting.
2. **Construction:** Site clearing, infrastructure and facility installation.
3. **Operation:** Agro-processing, storage, and logistics activities.
4. **Decommissioning:** Restoration or conversion of facilities for alternative uses upon project closure.

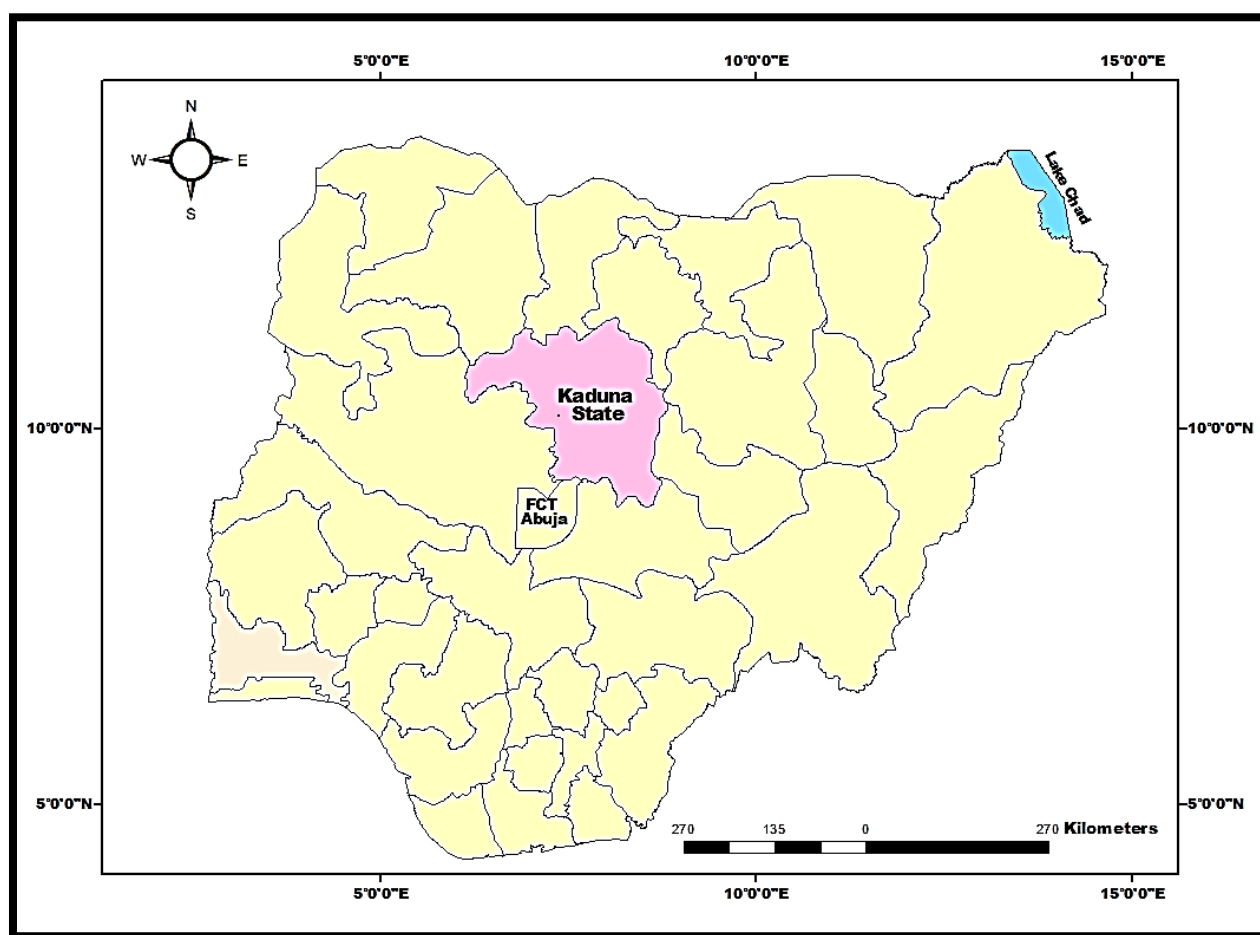


Figure 1.1 Map of Nigeria showing Kaduna State, the host of the SAPZ Agro-Industrial Hub

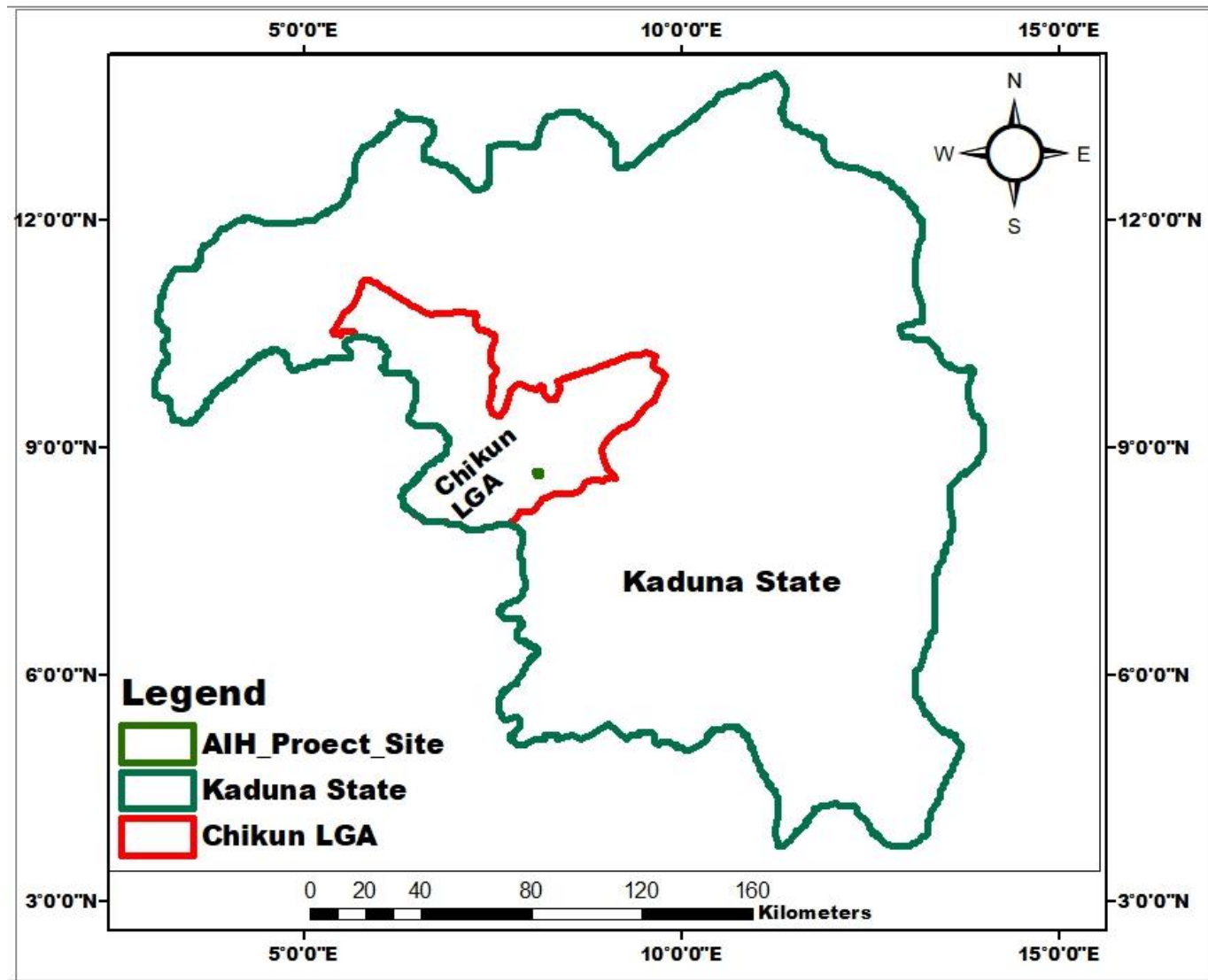
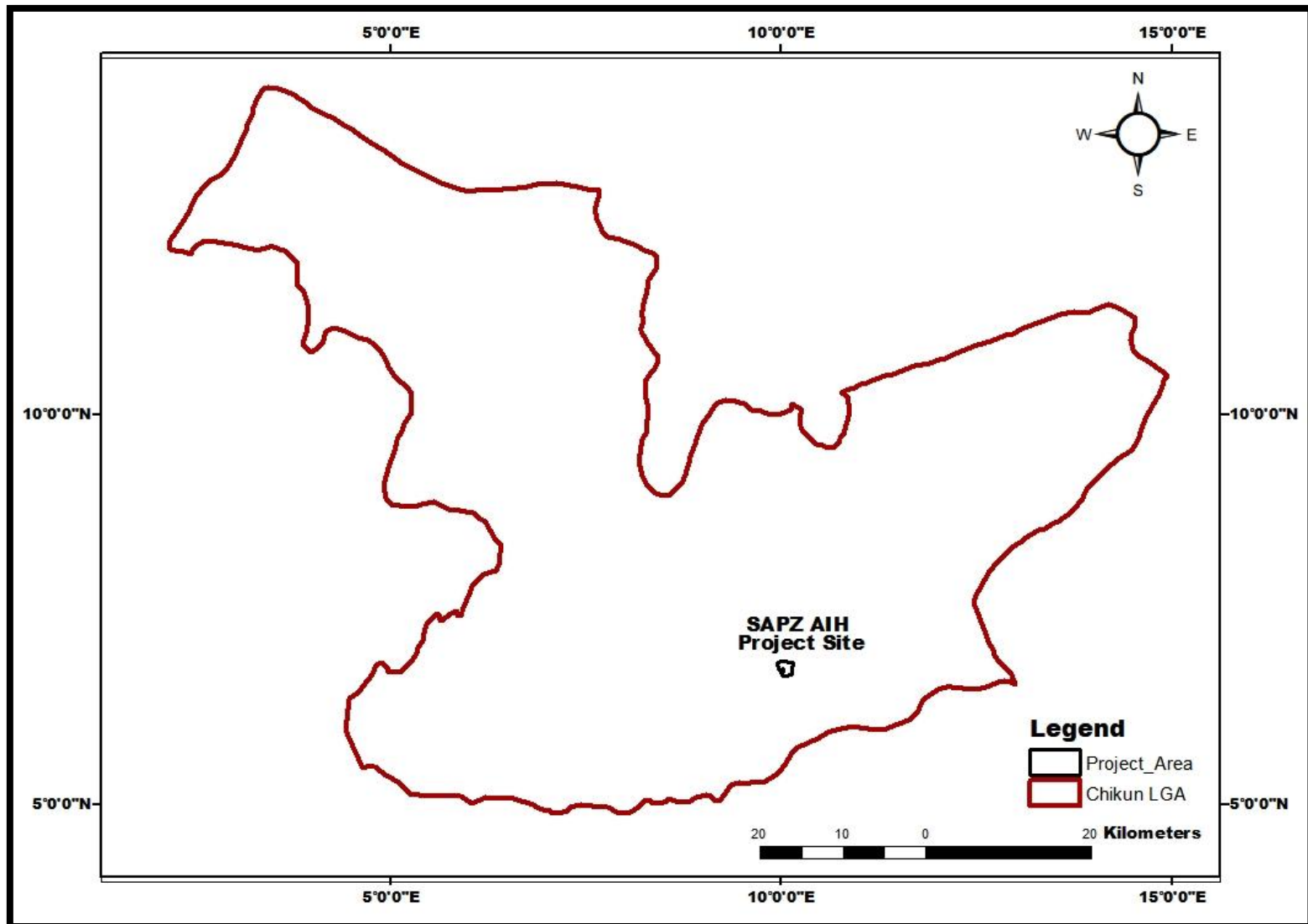


Figure 1.2 SAPZAIH Project Site within Chikun LGA and Kaduna State



Figure 1.3 The map of Chikun Local Government Area showing the SAPZ AIH site within it





1.7 Objectives of the Environmental and Social Impact Assessment (ESIA)

The ESIA for the Agro-Industrial Hub (AIH) at Daki Takwas, Km 26, Kaduna-Abuja-Zaria Expressway, Chikun LGA, Kaduna State is purposed to assess and document the potential impacts / risks of the proposed SAPZ AIH project and recommend appropriate measures to manage and mitigate those adverse impacts / risks. The ESIA is designed to ensure that the adverse impacts / risks that could arise from the execution of all project activities during the site clearing and preparation, construction, operation and closure (decommissioning) phases of the AIH project are effectively anticipated, and controlled using either avoidance, minimization, mitigation, compensation, or offset measures, while enhancement measures are used to promote environmental and social benefits of the project in an equitable manner among the local (resident) communities.

The specific objectives of the ESIA for the Agro-Industrial Hub, at Daki Takwas, Kaduna State are to:

- 1) Define the scope of the SAPZ AIH project and the potential interactions of the project activities with the environmental, social, public health and socio-economics aspects of the project areas of influence;
- 2) Describe the proposed project activities and the existing physical, chemical, biological, socio-economic and human environment that those project activities would interact with;
- 3) Assess the baseline conditions of the environmental and social aspects of the project areas of influence of the Agro-Industrial Hub (AIH) at Daki Takwas, Kaduna-Abuja Express Road, of Chikun LGA of Kaduna State;
- 4) Assess and identify the potential impacts of the proposed SAPZ AIH project activities on the physical, chemical, biological and social aspects of the project environment throughout the project life cycle;
- 5) Determine the extent, magnitude and concentration of pollutants that could potentially emanate from all the project activities associated with the SAPZ AIH development;
- 6) Propose impact mitigation measures in line with the impact mitigation hierarchy to avoid, minimise, mitigate, compensate or offset adverse impacts, and enhance positive impacts of the project;



- 7) Develop a cost-effective and actionable Environmental and Social Management Plan (ESMP) to guide the implementation of all impact/risk mitigation measures recommended in the safeguard instruments (ESIA, RAP, ARAP, LRP, PMP and SEP) established for the project, and manage residual impacts and non-compliances observed during the monitoring of ESMP implementation from the site clearing and preparation phase through the construction, operation, and closure phases of the project
- 8) Engage local communities, farmers, vulnerable groups (e.g., women, youth), and other stakeholders in Chikun LGA through inclusive consultations to incorporate their concerns and expectations into the ESIA process.
- 9) Align the AIH development project with national agricultural policies and global goals, such as the United Nations Sustainable Development Goals (SDGs) 2 (Zero Hunger) and SDG 8 (Decent Work and Economic Growth); and
- 10) Comply with the National Regulatory Framework and AfDB ISS

1.8 Scope of the ESIA

The scope of work performed in this ESIA Study involved field data collection and laboratory analysis to determine the existing condition of the environment within and around the SAPZ AIH project area, identify the project impacts, recommend impact mitigation measures and develop an Environmental and Social Management and Monitoring Plan for the project. Hence, the scope of work performed in the SAPZ AIH ESIA project involved the following:

- ☐ Extensive literature review of relevant past environmental studies reports on the study area to acquire background information on the environmental characterisation of the study area
- ☐ Identify and study the various environmental and social aspects within the project environment;
- ☐ Identify the existing biophysical, chemical and socio-economic setting of the immediate project environment;
- ☐ Investigate the ecological impacts the proposed project could pose to the environmentally sensitive ecosystems in the area;
- ☐ Carry out a comprehensive impact identification, evaluation and assessment;



- Determine the significance of the impacts identified on the environment, including, but not limited to, impacts on:
 - (i). Air Quality; Climate;
 - (ii). Vegetation;
 - (iii). Noise;
 - (iv). Surface and Groundwater Water Quality;
 - (v). Soil;
 - (vi). Public Health;
 - (vii). Socio-Economic Aspects; and
 - (viii). Surface Hydrology of the project area;
 - (ix). Propose appropriate impact mitigation measures; and
 - (x). Develop a comprehensive, cost-effective and actionable Environmental and Social Management Plan for the project

1.9 Administrative and Legal Framework

This section reviews the relevant legal and administrative framework governing the project to ensure environmental sustainability. The study was conducted according to approved regulations, guidelines and standards of the FMEnv, the AfDB's Integrated Safety Systems (ISS), and all other applicable national legislation and international agreements and conventions to which Nigeria is a signatory. These laws, regulations, guidelines and policies form the proposed project's administrative and legal framework.

1.9.1 The Nigerian Constitution and the National Policy on the Environment

The Constitution of the Federal Republic of Nigeria (Section 20) provides a constitutional framework for Nigeria to “Protect and improve the environment and safeguard the water, air and land, forest and wildlife of Nigeria.” In 1991, Nigeria published its first National Policy on the Environment, which was revised in 2016. The Policy detailed the framework for managing the environment and natural resources for sustainable development. Under Paragraph 9.2, the Policy emphasised the need for the involvement of the private sector, the public sector, civil society organisations, local communities and individuals in its implementation. Federal regulatory bodies with responsibilities for achieving the objectives of the National Policy on Environment are the



Federal Ministry of Environment and the National Environmental Standards and Regulations Enforcement Agency (NESREA), amongst others.

National Policy on the Environment, 1989 (Revised 2016): The policy identifies key sectors requiring integration of environmental concerns and sustainability with development and presents their specific guidelines;

1.9.2 The Federal Ministry of Environment (FMEnv)

The Federal Ministry of Environment was established in 1999 through a Presidential Proclamation, as the ministry is the federal body in charge of matters concerning the Nigerian environment. The ministry emerged from the defunct Federal Environmental Protection Agency (FEPA), established by Decree No. 58 of 1988, and 59 (Amended) of 1992, which had responsibility for environmental protection. Following its establishment, the FMEnv, through its Environmental Assessment Department (EAD), has been responsible for ensuring that all developmental projects comply with relevant environmental laws and regulations to ensure environmental sustainability.

To help deliver her mandates, the FMEnv has several departments, such as Environmental Assessment and Climate Change, as well as parastatals, including the National Environmental Standards Regulatory and Enforcement Agency (NESREA), the federal agency responsible for the enforcement of environmental standards, regulations, rules, laws, policies and guidelines.

1.9.3 EIA Act and FMEnv Guidelines and Standards

1.7.3.1 Environmental Impact Assessment (EIA) Act Cap E12 LFN 2004

The EIA Act Cap E12 LFN 2004, first enacted as the EIA Decree 86 of 1992, sets out the general principles, procedures and methods to prepare the EIA of qualifying public and private projects. The Act's objective is to promote the implementation of appropriate policies consistent with all the laws and decision-making processes to achieve its goals and objectives. The Act encouraged the development of procedures for information exchange, notification and consultation between the organs and persons when proposed projects or activities are likely to have significant environmental effects on different spatial extents ranging from village, city, state and inter-state spatial coverages.



1.9.3.2 EIA Procedural Guidelines

In response to the promulgation of the EIA Act of 1992, the FMEnv developed a National EIA Procedure in 1995, updated to EIA Procedural Guidelines 2017. The procedural guidelines provide a step-by-step process, from project conception to commissioning stages, to ensure that a qualifying project is implemented with maximum consideration for the environment. The procedure is generally characterised by certain technical activities, as depicted in Figure 1.3. It also identifies three categories of projects that qualify for EIA studies. The location of a project in environmentally sensitive areas (ESAs) is an important criterion in the project categorisation. The areas categorised as ESAs include coral reefs, mangrove swamps, small islands, tropical rainforests, areas with erosion-prone soils and natural conservation areas.

The three categories of projects include:

1. **Category I:** Projects are subject to full-scale EIA, and they consist of petroleum projects such as oil and gas fields, construction of offshore pipelines over 50 kilometres in length, construction of oil and gas separation, processing, handling and storage facilities, and large-scale construction of depots for storage of petroleum products, and others. The SAPZ programme falls under this category.
2. **Category II:** A project in this category may not require a full-scale EIA except when located in an ESA. In that case, the project will be assigned to Category I. The requirement for Category II projects is a partial EIA. Also, mitigation measures or changes in project design (depending on the nature and magnitude of the environmental impacts), and further actions, may be required from the proponent.
3. **Category III:** This includes projects expected to have beneficial impacts on the environment. For projects in this category, the Ministry will issue an EIS. This category includes family planning programmes, institutional development, environmental awareness projects, among others.

1.9.3.3 National Guidelines for Decommissioning of Facilities in Nigeria

This guideline outlines how to safely and sustainably decommission facilities that are either past their shelf life or have been abandoned for at least three years in the case of BTS infrastructure. It



provides a step-by-step process to ensure the land is suitable for future use. Chapter 6 of this report explains the decommissioning process in detail.

1.9.3.4 National Interim Guidelines and Standards for Industrial Effluent, Gaseous Emissions and Noise Limitations 1991

The national interim guidelines and standards for industrial effluent, gaseous emissions and noise limitations were published by FEPA in 1991. The guideline and standards document aimed to support the implementation of the National Policy on the Environment and the environmental pollution abatement strategy by prescribing guidelines and limitations on discharging pollutants into the Nigerian environment. The guidelines and standards outlined in the document relate to six areas of environmental pollution control, which include:

- 1) Effluent limitations
- 2) Water quality for industrial water uses at the point of intake
- 3) Industrial emission limitations
- 4) Noise exposure limitations
- 5) Management of solid and hazardous wastes
- 6) Pollution abatement in industries

1.9.3.5 Management of Hazardous and Solid Wastes Regulation

The Management of Hazardous and Solid Waste Regulation, S.1.15 of 1991 (No.102, Vol. 78, August 1991), defines the requirements for groundwater protection, surface water impoundment, land treatment, waste piles, landfills, incinerators, and others. It states the procedure for inspection, enforcement and penalty.

1.9.3.6 National Environmental (Sanitation and Wastes Control) Regulations (2009)

The purpose of the Regulation is the adoption of sustainable and environmentally friendly practices in environmental sanitation and waste management to minimize pollution. The Instrument amongst others makes provisions for the control of solid wastes and hazardous wastes;

1.9.3.7 Water Resources Act, 1993 (Cap W2, LFN 2004)

This Act governs the use and protection of water resources in Nigeria. The AIH's water-related activities, such as boreholes or small-scale irrigation for demonstration farming, must comply with



regulations to prevent over-extraction or contamination of surface and groundwater resources in Kubau and Chikun LGA's;

1.9.3.8 Factories Act, 1990 (Cap F1, LFN 2004)

This Act regulates workplace safety and health, relevant for the construction and operation of AIH facilities. The ESIA will address occupational health and safety risks for workers involved in building/construction of training centers, storage units, and access roads, ensuring compliance with safe working conditions;

1.9.3.9 National Agricultural Policy, 2016

This policy supports agricultural transformation and food security, aligning with the AIH's objectives to enhance productivity and market access for maize, soybeans, ginger, and tomatoes. The ESIA and LRP will ensure the project contributes to these goals while mitigating environmental and social risks;

1.9.3.10 National Environmental (Soil Erosion & Flood Control) Regulations (S.I. 12) 2011

The purpose of these Regulations is to establish technically feasible and economically reasonable standards and procedures to achieve appropriate level of management and conservation practices to abate soil erosion, siltation, and sedimentation of the waters of Nigeria, due to soil erosion and flood aggravated by non-agricultural earth-disturbing activities;

1.9.3.11 National Environmental (Noise Standards and Control) Regulations, 2009

The objective of the Regulations is to ensure maintenance of a healthy environment for all people in Nigeria, the tranquillity of their surroundings and their psychological wellbeing by regulating noise levels. The Instrument prescribes maximum permissible noise levels for construction as 60dB (A) and 40dB(A) for day and night respectively;

1.9.3.12 National Environmental (Construction Sector) Regulations (S.I No. 19), 2011

The purpose of these regulations is to prevent and minimize pollution from construction, decommissioning and demolition activities in the Nigerian environment. It stipulates that new projects in the construction sector shall apply cost-effective, up-to-date, efficient, best available technology, to minimize pollution to the barest degree practicable. In addition, every operator or



facility shall carry out an EIA and submit an EMP for new projects or modification including expansion of existing ones before commencement of activity;

1.9.3.13 Nigerian Land Use Act of 1978

The law establishes the legal framework for government expropriation of land from individuals and communities, when it is required for “overriding public interest/good”. It prescribes the circumstances under which the State can revoke rights of occupancy to the land and the compensation provisions that are required;

1.9.3.14 National Policy on Occupational Safety and Health, revised 2020

This policy was approved by the Federal Executive Council (FEC) in September 2020. It provides a guide for voluntary compliance and serves as a basis for Occupational Health And Safety (OHS) programs for workers even under such development projects;

1.9.3.15 Nigeria Labour Law (2024)

The Labour Act of 2024 set the standard for the minimum amount of naira a worker in Nigeria is supposed to make. In 2024, the National Minimum Wage was set to ₦70,000.00 per month;

1.9.3.16 Employees’ Compensation Act (2010)

The Employees’ Compensation Act (2010) makes provisions for the payment of compensation to workmen for injuries suffered in the course of their employment;

1.9.4 National Environmental Standards and Regulations Enforcement Agency (NESREA)

The NESREA Act No. 25 2007 (Amended as **NESREA (Establishment) (Amendment) Act, 2018**) established the National Environmental Standards and Regulations Enforcement Agency (NESREA). The agency is “charged with the responsibility for the protection and development of the environment in Nigeria, and related matters.” In addition to ensuring the protection and development of the environment, biodiversity conservation and sustainable development of Nigeria’s natural resources, NESREA has the mandate to coordinate and liaison with relevant stakeholders within and outside Nigeria on matters of enforcement of environmental standards, regulations, rules, laws, policies and guidelines. Part II (7) of the NESREA Act enumerates the specific powers of enforcement granted to the Agency, including but not limited to:



- Enforcement of compliance with laws, guidelines, policies and standards on environmental matters;
- Enforcement of compliance with policies, standards, legislation and guidelines on water quality, environmental health and sanitation, including pollution abatement;
- Enforcement of compliance with guidelines and legislation on sustainable management of the ecosystem, biodiversity conservation and the development of Nigeria 's natural resources;
- Enforcement of compliance with any legislation on sound chemical management, safe use of pesticides and disposal of spent packages thereof;
- Enforcement through compliance monitoring, the environmental regulations and standards on noise, air, land, seas, oceans and other water bodies other than in the oil and gas sector;
- Conduction of environmental audit and establish data bank on regulatory and enforcement mechanisms of environmental standards other than in the oil and gas sector;
- Creation of public awareness and provide environmental education on sustainable environmental management, and
- Carrying out such activities as are necessary or expedient for the performance of its functions.

The NESREA Act establishes standards for environmental protection, including air quality, water quality, waste management, and biodiversity conservation. The AIH project must comply with NESREA regulations, such as the National Environmental (Sanitation and Waste Control) Regulations, 2009, for managing waste from storage and training operations, and the National Environmental (Surface and Groundwater Quality Control) Regulations, 2011, to prevent contamination from water use in agricultural activities.

1.9.5 NESREA Regulations

1.9.5.1 National Environmental (Noise Standards and Control) Regulations 2009

These regulations aim to ensure the maintenance of a healthy environment for all people in Nigeria and the tranquillity of their surroundings and psychological well-being by regulating noise levels and elevating their standard of living. It prescribes the maximum permissible noise levels of a



facility or activity to which a person may be exposed. It also provides for the control of noise and mitigating measures to reduce noise.

1.9.5.2 Pollution Abatement in Facilities Generating Wastes Regulation

The Pollution Abatement Regulation, S.1.9 of 2004, restricts the release of toxic substances into the environment and stipulates requirements for pollution monitoring units, machinery for combating pollution and contingency plans by industries. No facility shall release hazardous or toxic substances into the air, water or land of Nigeria's ecosystems beyond limits approved by the Federal Environmental Protection Agency. The Regulation also provides for the protection of workers, safety requirements, environmental audit (or environmental impact assessment for new industries) and penalty for contravention.

1.9.5.3 National Environmental (Air Quality Control) Regulations 2014

The objective of the National Environmental (Air Quality Control) Regulations 2014 is for improved control of Nigeria's air quality for enhancement of flora and fauna, human health and other resources affected by air quality deterioration. The Regulations also reaffirm citizens' right to clean air, sustainable management of natural resources and access to information concerning the nature and extent of potential hazards that may result in the accidental or deliberate release of harmful or hazardous substances into the atmosphere. Activities with the potential to emit pollutants require permits for air quality control under the Regulations. The Air Quality Control Regulations also set permissible limits for emissions for groups of pollutants such as heavy metals, hydrocarbons (HCs), hydrogen sulphide (H₂S), oxides of nitrogen (NO_x), particulate matter, and more. These limits account for the source of the emissions, for example, stacks, mobile sources, and others. Failure to comply with the emission standards incurs fines.

1.9.5.4 National Environmental (Food, Beverages and Tobacco Sector) Regulations 2009

These Regulations were established "to prevent and minimise pollution from all operations and ancillary activities of Food, Beverages and Tobacco Companies to the Nigerian environment." The Regulations require companies to employ cost-effective cleaner technologies to minimise

1.9.5.5 Nigerian Safety and Security of Radioactive Sources Regulations of 2006

The Regulations serve to ensure the following, amongst others:



- Regulate the possession and application of radioactive substances and devices emitting ionising radiation;
- Ensure protection of life, health, property, and the environment from the harmful effects of ionising radiation while allowing beneficial practices involving exposure to ionising radiation; and
- Regulate the introduction of radioactive sources, equipment and practices involving workers and the general public exposure to ionising radiation.

1.9.5.6 National Environmental (Control of Vehicular Emissions) 2011

The National Environmental (Control of Vehicular Emissions from Petrol and Diesel Engines) Regulations 2009 aims to “restore, preserve and improve the quality of air.” Schedules II and VIII of the Regulations specify the emission limits for carbon monoxide, hydrocarbons (HCs), nitrogen oxides (NOx) and combined masses of HCs and NOx for petrol and diesel engines. The limits aim to protect citizens’ right to clean air, reduce and prevent air pollution and improve the health of Nigerians. The Regulations, which became enforceable on 28th April 2011, also specify fines for violating the standard.

1.9.5.7 National Environmental (Surface and Groundwater Quality) Control Regulation 2011

To restore, enhance and preserve the integrity of Nigeria's surface water, maintain existing water uses and control pollution of water bodies. The Regulations also set the standard for water quality and prohibit discharges that could result in the deterioration of water quality without approval granted under the Regulations.

1.9.5.8 National Environmental (Sanitation and Wastes Control) Regulations 2009

To minimise pollution and promote the adoption of sustainable and environment-friendly practices in environmental sanitation and waste management. These Regulations make adequate provisions for waste control and environmental sanitation, including punishments in cases of malfeasance.

1.9.5.9 National Environmental (Ozone Layer Protection) Regulations 2009

The Regulations prohibit the importation or manufacture, either in part or whole, of facilities that produce any ozone-depleting substance. The Regulations also prohibit the release of any ozone-



depleting substance into the atmosphere from any equipment, part of equipment or fire extinguishing equipment, except during firefighting.

1.9.5.10 National Guidelines on Environmental Audit in Nigeria, 1999 (Revised in 2011)

The National Guidelines on Environmental Audit in Nigeria was first published in 1999 by the then FEPA. NESREA published an updated version of the guidelines in 2011 due to emerging trends and issues relating to the environment. The revised document also placed NESREA in better stead to oversee and regulate environmental audits of the regulated Community.

1.9.6 Agricultural Framework

1.7.6.1 Agricultural (Control of Importation) Act Cap A13 LFN 2004

The Agricultural (Control of Importation) Act regulates the import of agricultural items to prevent the spread of plant diseases and pests. This is done by controlling the import of plants, seeds, soil, and other agrarian materials that could be contaminated. The Act helps protect local agriculture and biodiversity.

1.9.6.2 The National Agricultural Seeds Council Act 2019

The Act regulates the seed industry in Nigeria. It aims to ensure high-quality seeds are available to farmers by promoting seed production, controlling seed registration, and preventing the sale of poor-quality seeds. This Act is important for the project because it guarantees the use of certified seeds that will improve agricultural productivity and overall project success.

1.9.6.3 Agriculture Promotion Policy 2016

Also known as the Green Alternative, the Agriculture Promotion Policy (APP) was launched in 2016 to guide Nigeria's agricultural development from 2016 to 2020. The policy focuses on achieving food security, diversifying the economy through agriculture, developing agricultural value chains, and creating jobs, especially for youth and women. It emphasises private sector involvement and improving access to finance, technology, and market infrastructure to boost productivity and reduce reliance on food imports.



1.9.6.4 The Agricultural Sector Food Security and Nutrition Strategy (AFSNS) 2016

The AFSNS is a strategy to improve food security and nutrition for all citizens. It recognises that agriculture is critical for many Nigerians, but food production hasn't kept up with population growth.

The AFSNS objective includes to:

- Increase food security at all levels (national, community, household)
- Reduce malnutrition, especially in children and women
- Prevent diet-related diseases
- Improve people's knowledge of nutrition
- Build stronger food and nutrition systems
- Integrate food security into government agricultural plans

Aligning with the strategy will ensure that the Anambra State SAPZ project achieves positive outcomes by enhancing food security, improved nutrition, sustainable practices, and empowerment for women and vulnerable groups.

1.9.6.5 National Livestock Transformation Plan (NLTP) 2019-2028

The NLTP is a 10-year strategy to modernise Nigeria's livestock industry and reduce conflict between herders and farmers. It focuses on creating permanent ranches with improved technology to boost production and sustainability. The NLTP also has a social development aspect, addressing the needs of herders and farmers impacted by the changes. Following the NLTP, the Anambra State SAPZ project can ensure its livestock development aligns with national goals and promotes peaceful coexistence.

1.9.7 Other Relevant Statutory and Policy Documents

1.9.7.1 Land use Act Cap L5, LFN 2004

The Land Use Act (LFN 2004) establishes a framework for land management in Nigeria. It designates all land ownership to the state governor, who acts as a trustee managing the land to benefit all citizens. The Act outlines a process for allocating land rights for various uses, including commercial and agricultural purposes, through a system of statutory and customary rights of occupancy. Following this Act ensures your project adheres to legal land acquisition procedures, safeguards existing land rights, and promotes responsible land use practices.



1.9.7.2 Nigerian Urban and Regional Planning Act Cap N138, LFN 2004

The NURPA sets the rules for planning and development in Nigeria. This includes creating national physical development plans (Section 13) and regional, rural, and specific subject plans (Sections 25 & 26). These plans establish zoning regulations for different areas. By following NURPA, the Anambra State SAPZ project can ensure its development aligns with national guidelines, promoting sustainable growth and considering environmental and social factors.

1.9.7.3 National Building Code Act 2005

The National Building Code Act 2005 prescribed a set of rules that specify the standards for constructed objects such as buildings and non-building structures. Buildings/structures must conform to the code to obtain planning permission. The main purpose of building codes is to protect public health, safety and general welfare as they relate to the construction and occupancy of buildings and structures. This project complies with the National Building Code Act 2005.

1.9.7.4 The Fire Service Act Cap F29, LFN 2004

The key objectives of the Act are:

- To prevent uncontrolled fires in our environment, especially our markets, public and private buildings and structures and reduce the incidence of loss of lives and property;
- Enhance response capabilities of the Fire Services and strengthen the regulatory and revenue generation potentials of government as it relates to the distribution and maintenance of fire protection equipment; and
- Promote inter-agency collaboration in distributing and maintaining fire protection equipment to minimise fire incidences.

1.9.7.5 The Harmful Waste Act (1988)

The Harmful Waste Act (1988) strictly prohibits the illegal dumping or disposal of harmful waste in Nigeria. It mandates proper handling, treatment, and disposal of any waste generated during the project, including construction waste and transformer oils. Following this Act safeguards the environment and avoids hefty fines or penalties.



1.9.7.6 Natural Resources Conservation Act Cap 286 LFN 1990

The Natural Resources Conservation Act Cap 268 LFN 1990 is the most direct extant piece of legislation on natural resource conservation in Nigeria. The Act establishes the Natural Resources Conservation Council, empowered to address soil, water, forestry, fisheries and wildlife conservation by formulating and implementing policies, programmes and projects to conserve the country's natural resources.

1.9.7.7 The Endangered Species Act Cap E9 LFN 2004

This Act focuses on protecting and managing Nigeria's wildlife, including those in danger of extinction due to overexploitation.

The following sections are noteworthy:

- Section 1 prohibits, except under a valid licence, the hunting, capture or trade of animal species, either presently or likely to be in danger of extinction;
- Section 5 defines the liability of any offender under this Act; and
- Section 7 provides for regulations to be made necessary for environmental prevention and control as it concerns the purposes of the Act.

1.9.7.8 Forestry Law CAP 51 LFN 1994

The Forestry Law prohibits any act that may lead to the destruction of or cause injury to forest products, forest growth or forestry property in Nigeria. The law prescribes the administrative framework for the management, utilisation and protection of forestry resources in Nigeria. The Act aims to protect and conserve Nigeria's forests while ensuring their sustainable use.

1.9.7.9 Labour Act Cap L1 LFN 2004

The Labour Act provides comprehensive legislation on conditions of work and employment.

- Part I sets out general provisions relating to wages, contracts and terms of employment. Employers shall not advance more than one month's wages to an employee (Section 4). Section 8 requires medical examination of workers entering a contract at the employer's expense. Section 20 governs redundancy;
- Part II regulates recruiting, including the licensing of recruiters (Section. 25), and the right to be accompanied by family (not exceeding two wives) (Section 34);



- Part III relates to special classes of workers, including apprentices (Sections 49-53), women (Sections 54-58) and young persons (Sections 59-64). In general, women and young persons are prohibited from performing underground and night work. Section 73 prohibits forced labour; and
- Part IV contains supplemental provisions relating to the administration and the settlement of disputes. Section 90 repeals the Labour Code Act.

1.9.7.10 National Policy on Occupational Safety and Health 2006 (Revised 2020)

The National Policy on Occupational Safety and Health derived its main ground from the 1999 constitution, which in section 17 (3c) prescribes that the Nigerian State shall make laws and bye-laws to preserve the health and well-being of workers in workplaces. The goal of the National Policy on Occupational Safety and Health 2020 is to facilitate the improvement of occupational safety and health performance in all sectors of the economy and ensure the harmonisation of workers' rights protection with regional and international standards.

1.9.7.11 Employee Compensation Act of 2010

An Act to provide compensation for injuries and death suffered by workers in the course of their employment. This legislation, the first of its kind in Nigeria, sought to incorporate international standards as they relate to worker's compensation. It caters to the welfare of injured workers.

The Act makes the following mandatory for employers:

- Pay compensation to any of their employees who suffers injury from any accident arising out of and in the course of his employment; and
- Pay compensation to the person or persons entitled to the estate of any of his employees who dies from an accident arising out of and in the course of his employment.

1.9.7.12 Factories Act CAP F1 LFN, 2004

The Factories Act (1987) governs health and safety in Nigerian workplaces. It protects workers from occupational hazards by setting health and safety standards in factories and likely construction sites. The Act is enforced by the Director of Factories and includes provisions for inspectors to address safety hazards. Ensuring compliance with this Act is vital for creating a safe work environment for personnel and others on the site.



1.9.7.13 The Nigeria National Health Act 2014

The Act aims to establish a national framework for the regulation, development and management of a national health system and set standards for rendering health services in Nigeria. Other key provisions include:

- The establishment of the National Health Systems;
- An exemption from payment for health services in public health establishments; and
- The establishment of the Basic Health Care Provision Fund

1.9.7.14 National Environmental Health Practice Regulation Act 27, 2016

The purpose of the Act is to:

- Provide a guideline for the enforcement of the regulatory powers in the Act;
- Prevent and abate nuisances;
- Protect, preserve and promote the physical and social well-being of the public;
- Prevent and control the incidence of communicable diseases through environmental health intervention;
- Reduce environmental hazards to health;
- Safeguard and maintain the aesthetic value of the environment;
- Promote the general welfare of the public by regulating the sanitary construction and sanitation of all premises; and
- Regulate private and public sector collaborations for purposes of maintaining adequate sanitation and promoting public health and safety.

1.9.7.15 Public Health Laws

In Nigeria, there is no single comprehensive public health law that governs all aspects of public health and safety. Instead, a range of federal and state-level laws, regulations, and policies address different aspects of public health management. For this SAPZ AIH ESIA project, key legal instruments regulating public health and safety include environmental regulations and policies aimed at protecting air, water, and land, as well as waste management, sanitation, occupational health and safety, and specific health-related laws.



1.9.7.16 The National Gender Policy 2006

The National Gender Policy 2006 is a critical framework that seeks to improve the lives of Nigerian women and children across all sectors. By aligning with this policy's goals of empowerment, shared responsibility, women's leadership, fair labour practices, and gender mainstreaming, the Anambra State SAPZ project can help create a more equitable and inclusive environment in line with the 1999 Constitution of the Federal Republic of Nigeria, which prohibits discrimination based on places of origin, sex, religion, status, ethnic or linguistic association.

1.9.7.17 Climate Change Act 2021

The Climate Change Act 2021 provides a framework to help Nigeria achieve low levels of greenhouse gas emissions, ultimately contributing to achieving the ETP net-zero carbon target by 2060.

- Part II of the Act establishes the National Council on Climate Change with powers to “make policies and decisions on all matters concerning climate change in Nigeria.” Part V of the Act deals with setting a carbon budget and climate change action plan to be overseen by the FMEnv and the Federal Ministry responsible for National Planning
- Part VI of the Act articulates the obligations of Ministries, Departments and Agencies (MDAs) and public and private entities, the need to partner with Civil Society Organisations (CSOs) to achieve carbon targets and the need to integrate climate change education into all subjects and levels of Nigeria’s educational curriculum.

1.9.7.18 National Energy Policy (2003) and the Energy Transition Plan (2021)

The National Energy Policy (NEP) establishes guidelines for the protection of the environment in the exploitation of Nigeria's fossil fuels. The policy also emphasises the exploration of renewable and alternative energy sources, primarily solar, wind and biomass. It was projected that renewable electricity would contribute about 20% of the total national electricity supply mix by 2030 while observing energy efficiency and conservation best practices.

In 2015, the Federal government approved the National Renewable Energy and Energy Efficiency Policy (NREEP). The policy seeks to establish a policy framework for developing Nigeria’s abundant renewable energy sources and efficiency in energy services and supply. The NREEP



outlines a blueprint for the development, supply, and utilisation of renewable energy resources within the economy and comprising of both on-grid and off-grid energy solutions.

In 2021, President Muhammadu Buhari announced during the 26th Conference of Parties (COP 26), a detailed energy transition plan (ETP) that would see Nigeria become carbon neutral by 2060, end energy poverty and lift 100 million people out of poverty

The plan, which replaces the 2003 NEP hinged on the development of the local natural gas sector, which would support the energy sector until 2040, without detracting from the goals of the Paris Agreement on climate change. However, there is an inclusion of adding 30 gigawatts (GW) by 2030 with 30% renewable energy. The Nigerian government formally launched the plan on 24 August 2022 demonstrating the government's commitment to a clean and sustainable future. According to the government, an annual investment of US\$10 billion in the energy sector is required to achieve the plan's objectives

1.9.7.19 National Policy on Waste Battery Management 2022

This policy recognises that batteries used to power automobiles, industrial equipment and alternative energy systems may contain lead, lead alloys, lead and lithium compounds and dilute sulphuric acid, which if not correctly managed in an environmentally sound manner, can contaminate the environment and pose health risks to the people. The policy identifies the proper management of waste batteries as a priority issue, taking into consideration the objectives of the National Policy on Environment, the Harmful Waste Act Cap HI LFN 2004 and the United Nations Basel and Bamako Conventions, of which Nigeria is a signatory. The specific objectives of the policy include the provision of standard guidelines regulating waste batteries management and strengthening institutions and human capacities for effective implementation of waste batteries policy in Nigeria, amongst others.

1.9.7.20 Nigeria Cultural Policy 1988

Introduced in September 1988, the Nigeria Cultural Policy document defines culture as “the totality of the way of life evolved by a people in their attempt to meet the challenges in their environment which gives order and meaning to their social, political, economic, aesthetic and religious norms and modes of an organisation; thus, distinguishing a people from their neighbour.”



The Policy notes the need to understand the nation's cultural conditions, needs, aspirations and goals, and based on that understanding, to develop the means to achieving set goals. The Policy sets the following objectives:

- To mobilise and motivate the people by disseminating and propagating ideas which promote national pride, solidarity and consciousness;
- To evolve from our plurality, a national culture, the stamp of which will be reflected in African and world affairs;
- To promote an educational system that motivates and stimulates creativity and draws largely on our tradition and values, namely: respect for humanity and human dignity, for legitimate authority and the dignity of labour, and respect for positive Nigerian moral and religious values;
- To promote creativity in the fields of arts, science and technology;
- To ensure the continuity of traditional skills and sports and their progressive updating to serve modern development needs as our contribution to a world growth of culture and ideas;
- To establish a code of behaviour compatible with our tradition of humanism and a disciplined moral society;
- To sustain environmental and social conditions which enhance the quality of life, produce responsible citizenship and an ordered society;
- To seek to enhance the efficient management of national resources through the transformation of the indigenous technology, design resources and skills; and
- To enhance national self-reliance and self-sufficiency, and reflect our cultural heritage and national aspiration in the process of industrialisation.

1.9.7.21 Criminal Code Act Cap C38 LFN, 2004

The Nigerian Criminal Code makes it an offence punishable with up to 6 month's imprisonment for any person who:

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



1.9.8 State Ministries/Environmental Protection Agencies

Section 25 of the FEPA Act 1992 encourages States and local government councils to set up their environmental protection bodies to maintain good environmental quality in the areas of related pollutants under their control. The functions of state environmental protection agencies (SEPAs) include:

Some of the functions of the state ministries of environment include:

- Co-operating with FMEnv and other Agencies in the performance of environmental functions, including environmental education/awareness to the citizenry;
- Monitoring waste management standards;
- Liaising with the FMEnv to achieve healthy and better management of the environment via the implementation of the National Policy on Environment; and
- Monitoring the implementation of EIA studies and other environmental studies for all development projects in the State.

1.9.8.1 Kaduna State Legal, Institutional and Regulatory Framework

The following Kaduna State -level regulations apply to the SAPZ AIH project:

a) Kaduna State Ministry of Environment and Natural Resources (MENR)

- Implements state-level environmental policies and reviews state-level EIA processes; and
- Works with the Federal Ministry for projects of national interest and oversees environmental compliance.

b) Kaduna State Environmental Protection Agency (KEPA) Law, 2018:

KEPA oversees environmental management in Kaduna State, including waste management, pollution control, and environmental impact assessments for state-level projects. The ESIA will coordinate with KEPA to obtain necessary permits and ensure compliance with state-specific environmental standards;

c) Kaduna State Land Use Regulations:

These regulations govern land acquisition, use, and compensation in Kaduna State. The AIH project must adhere to state procedures for securing land in Dutsen-Wai-Kuzuntu and AIH at



Daki Takwas Kaduna-Abuja Express way, ensuring fair compensation and consultation with affected communities, as outlined in the LRP;

d) Kaduna State Agricultural Development Policy:

This policy supports agro-industrialization and rural development, aligning with the AIH's goals of providing inputs, training, and market linkages. The ESIA and LRP will support Kaduna State's commitment to allocate N74.2 billion (10% of its 2025 budget) to agriculture, ensuring sustainable implementation of the AIH;

e) Kaduna State Climate Change Policy (2024):

This policy provides a strategic framework to build resilience, reduce emissions, and integrate climate action into development planning. It aligns with national and global climate goals, emphasizing inclusive, low-carbon growth. The policy targets sectors like agriculture, energy, and health while prioritizing vulnerable populations.

1.9.8.2 Local Government Area By-Laws

Local government bylaws typically regulate smaller-scale environmental and public health issues within a community. This may include waste collection and disposal, noise pollution control, sanitation, local zoning rules, and land use regulations that align with broader state and national laws. These laws and regulations provide a framework for ensuring the health, safety, and environmental sustainability of the affected regions.

1.9.9 International Conventions, Protocols and Agreements

Nigeria is a signatory to multiple International Conventions, Agreements and Protocols.

1.9.9.1 The United Nations Conferences, Conventions and Agreements on the Environment

The United Nations Conference on Environment and Development (UNCED) was the first global conference to bring environmental issues to the world stage, giving rise to the Stockholm Declaration and Action Plan for the Human Environment and several resolutions. The Stockholm Declaration contained 26 principles¹ that marked the start of the conversation to solve



environmental issues. Highlighted below are some of the Principles of the Stockholm Declarations grouped under the following themes:

- **Human-centric (Principles 1 and 15):** Establishing rights and responsibility to protect the environment and the right to planned settlements and urbanisation.
- **Sustainable development (Principles 2, 3, 4, 5, 13 and 14):** Warns of duty to protect natural resources, preserve renewable resources, conserve wildlife, preserve non-renewable resources, manage resources rationally and rationally implement development activities;
- **Preventive actions (Principles 6, 7, 8 and 18):** Principles 6 and 7 address the management of environmental pollution and the management of sea pollution, respectively, while Principle 8, Social and Economic Development, recognises that improvement in social and economic wellbeing should not be achieved at the expense of the environment. On the other hand, Principle 18, Application of Science, stresses the indispensability of science and technology in identifying and controlling environmental risks as well as finding solutions for environmental issues; and
- **Cooperation (Principles 24 and 25):** These Principles emphasise the importance of cooperation and coordination among nations to achieve holistic global environmental targets through multilateral and bilateral agreements to control, prevent, and reduce environmental risks. They also recognise each State's right to legislate on internal matters.

In June 2022, the global Community came together again for the Stockholm +50 Conference to take stock of the state of the environment. At the end of the convention, the ten (10) actionable recommendations “for accelerating action toward a healthy planet for the prosperity of all” agreed upon include:

- 1) Place human well-being at the centre of a healthy planet and prosperity for all;
- 2) Recognise and implement the right to a clean, healthy, and sustainable environment;
- 3) Adopt system-wide change in the way our current economic system works to contribute to a healthy planet;
- 4) Strengthen national implementation of existing commitments for a healthy planet;
- 5) Align public and private financial flows with environmental, climate, and sustainable development commitments;



- 6) Accelerate system-wide transformations of high-impact sectors, such as food, energy, water, buildings and construction, manufacturing, and mobility;
- 7) Rebuild relationships of trust for strengthened cooperation and solidarity, though, inter alia, enabling the meaningful participation of all relevant stakeholders, including youth, women, rural communities, Indigenous Peoples, interfaith groups, and local communities, in policy formulation and implementation at the national and international levels;
- 8) Reinforce and reinvigorate the multilateral system, including by ensuring “a fair and effective multilateralism” and strengthening the environmental rule of law;
- 9) Recognise intergenerational responsibility as a cornerstone of sound policymaking; and
- 10) Take forward the Stockholm+50 outcomes by reinforcing and re-energising the ongoing international processes.

1.9.9.2 UN Conference on Environment and Development (UNCED), Rio 1992

Popularly called the Earth Summit, this conference held in Rio de Janeiro, Brazil, produced the signing of two important treaties:

- The Convention on Biological Diversity (CBD): Requires nations to take inventories of their faunal and floral communities and protect their endangered species; and
- The United Nations Framework Convention on Climate Change (UNFCCC): Also known as the Global Warming Convention (GWC): Requires nations to reduce their emissions of greenhouse gases such as carbon dioxide, methane, and others. Other important outcomes of the Rio Summit include:
 - The Statement of Principles on Forests to reserve the world’s rapidly vanishing tropical rainforests. The statement is non-binding and recommends that nations monitor and assess the impact of development on their forest resources and take steps to limit the damage done to them.
 - Agenda 21 outlined global strategies for cleaning up the environment and encouraging environmentally sound development.
 - The Declaration on Environment and Development, also known as the Rio Declaration², is made up of 27 broad, nonbinding principles for environmentally sound development.



1.9.9.3 Kyoto Protocol and The Paris Agreement

The Paris Agreement sets out a global framework to avoid dangerous climate change by limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C. Over 190 countries adopted the Agreement made at the Conference of the Parties (COP) 21 held in Paris, France, in December 2015. The Agreement aims to strengthen countries' ability to deal with the impacts of climate change and support them in their efforts. It builds on the 1997 Kyoto Protocol, which operationalises the UNFCCC by committing industrialised countries and economies in transition to limit and reduce greenhouse gas (GHG) emissions per agreed individual targets.

The Agreement, which came into force on 4 November 2016, differs from the Kyoto Protocol by being binding to all countries, including developing countries. Also, while the Kyoto Protocol focused on reducing GHG emissions, the Paris Agreement focuses on preventing global average temperature rise due to GHG and does not target specific greenhouse gases. The first phase of the Kyoto Protocol was also to be completed by 2012, whereas the Paris Agreement timeline varies, with most nations intending to accomplish their target goals by 2025-2030.

Nigeria ratified the Kyoto Protocol on 10 December 2004 and signed and ratified the Paris Agreement on 22 September 2016 and 16 May 2017, respectively. In May 2017, the country submitted its nationally determined contribution (NDC), targeting a 20% emissions reduction against 2030 business-as-usual (BAU) projections. In July 2021, Nigeria announced an updated NDC target³ of 20% unconditional or 45% conditional reduction. In the updated NDC, Nigeria proposes to mitigate four greenhouse gases, including carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and hydrofluorocarbons (HFCs), as against the three GHG (CO₂, CH₄ and N₂O) proposed in the initial NDC submitted.

1.9.9.4 Agenda 2030 for Sustainable Development Goals (SDGs)

Agreed upon by the United General Assembly in 2015. The Sustainable Development Goals (SDGs) consist of seventeen (17) goals designed to provide “a shared blueprint for peace and prosperity for people and the planet, now and into the future”. While the 17 Goals are interrelated, SDG-6 (Clean



water and sanitation), SDG-7 (Affordable and clean energy), SDG-11 (Sustainable Cities and Communities), SDG-12 (Responsible Consumption and Production), SDG-13 (Climate Action), 14 (Life below Water) and SDG-15 (Life on Land) directly address environmental sustainability. SDG-16 (Peace, Justice and Strong Institutions) and SDG-17 (Strong partnership) are critical for devising, collaborating, implementing and assigning accountability for the realisation of the Goals. The SDGs build directly from the 27 goals set by Agenda 21 and re-assert them as the basis for sustainable development on the concept of people, planet, prosperity, peace, and partnership.

Furthermore, the 2030 Agenda for Sustainable Development encourages member states to "conduct regular and inclusive reviews of progress at the national and sub-national levels, which are country-led and country-driven." The reviews, called voluntary national reviews (VNRs) are voluntary and "aim to facilitate the sharing of experiences, including successes, challenges and lessons learned to accelerate the implementation of the 2030 Agenda." The VNRs also seek to strengthen policies and government institutions and mobilise multistakeholder support and partnerships for SDGs implementation.

In 2017, Nigeria submitted its first VNR⁴ outlining the institutional dimensions for creating an enabling policy environment for SDGs implementation through its Economic and Recovery Growth Plan (ERGP) (2017-2020). The ERGPs focus on economic, social and environmental dimensions of development, making them consistent with the aspirations of the SDGs. Nigeria also submitted a second VNR in 2020 with a focus on Poverty (SDG-1), Inclusive Economy (SDG-8), Health and Well-being (SDG-3), Education (SDG-4), Gender equality (SDG-5), enabling an environment of Peace and Security (SDG-16) and Partnerships (SDG-17). This focus is based on Nigeria's current development priorities and development objectives. It is instructive that the updated VNR was developed during the COVID-19 pandemic amidst falling oil prices, which accounted for 86% of public revenue from oil and gas.

1.9.9.5 Other International Agreements

These include:



1. Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention) (1968) - (Signatory only)
2. African Convention on the Conservation of Nature and Nature Resource (1968)
3. Convention to Regulate international trade in Endangered species of Fauna and Flora (CITES) (1973)
4. Convention on the Protection of the World Cultural and Natural Heritage (World Heritage Convention), Paris (1975)
5. Convention on Conservation of Migratory Species of Wild Animals (1979)
6. Occupational Safety and Health Convention (C155) (1981)
7. Occupational Safety and Health Recommendation (R164) (1981)
8. Vienna Convention on the Ozone Layer (1985)
9. Montreal Protocol on Substances that Deplete the Ozone Layer (1987)
10. Basel Convention on the Control of Tran boundary Movements of Hazardous Wastes and their Disposal (1989)
11. United Nations Framework Convention on Climate Change (UNFCCC) (1992)

1.9.10 The African Development Bank (AfDB)

The African Development Bank's (AfDB) Integrated Safeguards System (ISS) is fundamental to ensuring that the Bank's projects promote environmental and social sustainability. The ISS aims to mitigate any potentially negative impacts of projects and ensure that the outcomes are beneficial and inclusive.

The ISS comprises four interrelated components, which can be summarised as follows:

- 1) Integrated Safeguards Policy Statement: This outlines the AfDB's commitment to environmental and social sustainability and serves as a foundational policy that guides all of the Bank's operations.
- 2) Operational Safeguards (OS): These are specific requirements that borrowers or clients must meet to comply with the ISS. They cover key areas such as environmental assessment, involuntary resettlement, biodiversity conservation, pollution prevention, and labour conditions.
- 3) Environmental and Social Assessment Procedures (ESAP): These procedures provide a framework for identifying, assessing, and managing the environmental and social risks and



impacts associated with the Bank's projects. They ensure that projects are screened, categorised, and subjected to appropriate levels of assessment.

- 4) Technical Guidance Notes (TGN): These notes offer detailed guidance on implementing the Operational Safeguards. They provide practical advice and examples to help borrowers and clients understand and apply the safeguards effectively.

These components work together to ensure that AfDB-funded projects are environmentally sustainable and socially inclusive, protecting both people and the environment from adverse impacts.

1.9.10.1 The Integrated Safeguards Policy Statement

The AfDB's Integrated Safeguards Policy Statement describes the common objectives of the Bank's safeguards and establishes policy principles to be applied across current and future lending modalities. It considers the various capacities and needs of regional member countries in both the public and private sectors. This policy statement sets out the Bank's commitments and responsibilities to ensure the systematic assessment of environmental and social (E&S) impacts and risks.

1.9.10.2 Operational Safeguards (OSs)

The Operational Safeguards are a set of ten specific safeguard requirements that Bank's clients must meet when addressing social and environmental impacts and risks. Bank staff employ due diligence, review, and supervision to ensure compliance with these requirements during project preparation and implementation. The Bank may, over time, adopt additional safeguards or update existing ones to enhance effectiveness, respond to changing needs, and reflect evolving best practices.

The ten Operational Safeguards are:

- 1) OS 1: Assessment and Management of Environmental and Social Risks and Impacts
- 2) OS 2: Labour and Working Conditions
- 3) OS 3: Resources Efficiency and Pollution, Prevention and Management
- 4) OS 4: Community Health, Safety, and Security
- 5) OS 5: Land Acquisition, Restrictions on Access to Land and Land Use, and Involuntary Resettlement



- 6) OS 6: Habitat and Biodiversity Conservation, and Sustainable Management of Living Natural Resources
- 7) OS 7: Vulnerable Groups
- 8) OS 8: Cultural Heritage
- 9) OS 9: Financial Intermediaries
- 10) OS 10: Stakeholder Engagement and Information Disclosure.

The AfDB's safeguards are designed to:

- Better integrate considerations of E&S impacts into Bank operations.
- Promote sustainability and long-term development in Africa.
- Prevent adverse effects on the environment and local communities, or where prevention is not possible, minimise, mitigate, and/or compensate for such effects.
- Maximise development benefits.
- Ensure systematic consideration of climate change impacts on project sustainability and contribution to global greenhouse gas emissions.
- Clearly define the roles and responsibilities of the Bank and its borrowers or clients.
- Enhance local participation.
- Strengthen the safeguard systems and capacities of regional member countries and borrowers/clients to manage E&S risks.

Table 1.1 below shows the environmental and social operational safeguards (OS) applicable to the SAPZ project E&S impacts and risks.

Table 1.1: Applicability of AfDB Operational Safeguards to the SAPZ Project (Kaduna State)

Operational Safeguard (OS)	Description	Triggered/ Not Triggered	Applicability to Proposed Project
OS 1: Assessment and Management of Environmental and Social Risks and Impacts	Foundation safeguard for identifying E&S risks based on project category. Risks are managed through site-specific Environmental and Social Management Plans (ESMPs).	Triggered	Developing and rehabilitating agricultural infrastructure can create environmental and social risks. These will be managed through site-specific ESMPs in Kaduna.



OS 2: Labour and Working Conditions	Ensures workers' rights, safe conditions, and protection from abuse or exploitation. Aligns with international labour standards.	Triggered	Contractors must comply with Nigerian labour laws and international best practices for occupational health and safety (OHS).
OS 3: Resource Efficiency and Pollution Prevention and Management	Focuses on pollution, waste, and hazardous materials management, with reference to global standards and GHG accounting.	Triggered	Agricultural activities will involve fertilizers, agrochemicals, and potential waste. Pollution prevention and waste management will be integrated into the ESMP.
OS 4: Community Health, Safety, and Security	Seeks to minimise health and safety risks to communities. Emphasises emergency preparedness and responsible security measures.	Triggered	Increased traffic, chemical exposure, and other risks may arise. Comprehensive risk assessments and mitigation measures will protect communities and workers.
OS 5: Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement	Addresses land acquisition and displacement impacts. Aims to minimise involuntary resettlement and ensure fair compensation and livelihood restoration.	Triggered	Land will be acquired for the AIH (Chikun LGA). Resettlement Action Plan (RAP) will ensure compensation, livelihood restoration, and compliance with AfDB standards.
OS 6: Habitat and Biodiversity Conservation, and Sustainable Management of Living Natural Resources	Protects biodiversity and promotes sustainable use of natural resources. Translates AfDB's integrated resource management policy into practice.	Triggered	Water, soil, and natural resources will be used for agro-industrial activities. Biodiversity management and sustainable resource practices will be integrated into project operations.
OS 7: Vulnerable Groups	Protects the rights of vulnerable groups, ensuring cultural identity, land, and natural resources are respected. Promotes inclusion and equity.	Triggered	Rural communities in Kaduna include vulnerable groups such as women, youth, and resource-dependent households. OS 7 ensures they are identified, consulted, and supported.



OS 8: Cultural Heritage	Safeguards tangible and intangible cultural heritage from adverse impacts. Requires consultation and preservation efforts.	Not Triggered	Preliminary assessments and consultations in Kubau and Chikun LGAs confirmed that no physical cultural resources or sites of recognized cultural significance are located within the proposed project footprints.
OS 9: Financial Intermediaries	Requires financial intermediaries to manage E&S risks through ESMS.	Not Triggered	The AfDB is directly funding the project; no intermediaries are involved.
OS 10: Stakeholder Engagement and Information Disclosure	Promotes open, transparent, and inclusive engagement, ensuring affected people are informed and consulted throughout the project.	Triggered	The SAPZ project directly affects local communities. OS 10 ensures participatory engagement, transparency, grievance redress, and equitable benefit-sharing.



1.9.10.3 Environmental and Social Assessment Procedures (ESAPs)

The African Development Bank's (AfDB) Environmental and Social Assessment Procedures (ESAPs) provide detailed guidelines for the Bank and its borrowers or clients to ensure compliance with the OSs throughout the Bank's project cycle. The ESAPs enhance the E&S performance of the Bank's operations, ultimately improving project outcomes. By adhering to these procedures, the ESAPs facilitate better decision-making and project results, ensuring that Bank-financed operations conform to the requirements of the OSs and are sustainable.

1.9.10.4 Environmental and Social Assessment of Nigerian Policies and Legislations and AfDB Safeguard Systems

The Nigerian EIA Procedural Guidelines address most of the key elements required for projects involving multiple subprojects, including the differentiated treatment of vulnerable groups, which are adequately covered by the AfDB safeguard systems. Despite this alignment, challenges remain, particularly due to the overlapping functions of different agencies responsible for enforcing these policies, guidelines, regulations, and legislative provisions.

To ensure effective E&S safeguarding during project implementation, both the Nigerian and AfDB E&S safeguard systems will be employed. However, where divergences or gaps exist between the two regulations, the AfDB safeguard system with the more stringent requirements will take precedence. This approach ensures the highest standards of environmental and social protection are maintained throughout the project lifecycle.

Table 1.2: Comparison of Nigerian E&S Safeguards with AfDB's ISS for SAPZ Project in Kaduna

Key Element	Nigerian Provisions	AfDB Integrated Safeguards System (ISS, 2023)	Provision to be Adopted for SAPZ Kaduna (ATC)
Environmental and Social Assessment	EIA Act Cap E12 LFN 2004	OS1: Environmental and Social Assessment – comprehensive ESIA for defined project components	Conduct detailed ESIA in line with AfDB OS1 and Nigerian EIA requirements
Screening	EIA Act Cap E12 LFN 2004	OS1: Screening and categorization based on risk and impact level	Apply both AfDB OS1 and Nigerian screening procedures
Scoping	EIA Act Cap E12 LFN 2004	OS1: Scoping to define area of influence,	Follow both AfDB OS1 and Nigerian scoping requirements



		potential impacts, and stakeholder interests	
ESIA Process	EIA Act Cap E12, 1995 Guidelines, Sectoral Guidelines	OS1: Comprehensive Environmental and Social Impact Assessment	Conduct ESIA consistent with AfDB OS1 and FMEEnv/KEPA guidelines
Environmental Categorization	EIA Procedural Guidelines (Categories I, II, III)	OS1: Categories 1, 2, 3, FI	Apply AfDB's categorization system for clarity and risk alignment
Environmental and Social Management Plan (ESMP)	EIA Act Cap E12	OS1: Environmental and Social Management Plan	Prepare ESMP meeting AfDB OS1 and Nigerian standards
Consultation and Participation	EIA Act Cap E12	OS10: Stakeholder Engagement and Information Disclosure	Integrate AfDB OS10 and national consultation requirements
Involuntary Resettlement and Compensation	Land Use Act CAP L5 LFN 2004; relevant acquisition laws	OS5: Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement	Adopt OS5 ensuring full replacement cost, livelihood restoration, and resettlement support
Pollution Prevention and Waste Management	National Environmental Regulations (1991), Harmful Waste Act (2004)	OS3: Resource Efficiency and Pollution Prevention	Implement OS3 for pollution prevention and sustainable resource use
GHG Emissions and Climate Risk Management	National Environmental Regulations (1991)	OS1 + OS3: GHG screening and emission control	Conduct GHG screening under OS1 and manage emissions under OS3
Resource Use and Conservation	Natural Resources Conservation Act (1990)	OS6: Habitat, Biodiversity, and Resource Management	Adopt OS6 for sustainable use of biodiversity and natural resources
Labour and Working Conditions	Labour Act (2004), Employee Compensation Act (2010)	OS2: Labour and Working Conditions	Apply OS2 to ensure fair labour practices, worker welfare, and occupational safety



Community Health and Safety	Factories Act (2004)	OS4: Community Health, Safety, and Security	Implement OS4 to ensure robust health, safety, and emergency response measures
Habitat and Biodiversity Conservation	Endangered Species Act (2004), Forestry Law (1994)	OS6: Habitat and Biodiversity Conservation	Apply OS6 for protection of natural habitats and ecosystem balance
Gender Equality	National Gender Policy (2010)	AfDB Gender Marker System	Integrate Gender Action Plan in line with AfDB Gender Policy
Vulnerable Groups Inclusion	Gender Policy, Child Rights Act	OS7: Vulnerable and Marginalized Groups	Apply OS7 to ensure inclusive participation and equitable benefits
Environmental and Social Monitoring	EIA Act Cap E12	ESAP: Monitoring and Supervision	Implement AfDB ESAPs and comply with FMEnv monitoring provisions
Disclosure and Access to Information	EIA Act Cap E12	OS10: Stakeholder Engagement and Information Disclosure	Apply OS10 for transparent, inclusive, and culturally appropriate engagement

1.9.11 Institutional and Administrative Framework

1.9.11.1 Institutional Framework Responsibilities

The following institutions will play key roles in the ESIA and LRP processes:

- *The Federal Government of Nigeria:* The Nigerian Constitution mandates the government to protect the environment, linking this responsibility to fundamental human rights. The executive council is responsible for approving national policies, including the National Policy on Environment.
- **Federal Ministry of Agriculture and Food Security (FMAFS):** FMAFS regulates agricultural research and practices across Nigeria, managing agencies that oversee fisheries and livestock.
- **Federal Ministry of Environment (FMEnv):** Oversees ESIA review and approval; setting national environmental policies; and monitors compliance with national regulations;



- **NESREA:** Enforcement of environmental regulations and compliance monitoring;
- **Kaduna State Ministry of Environment and Natural Resources:** Oversees environmental protection and sustainable resource management across the state, and State-level EIA enforcement, public consultation, and compliance;
- **Kaduna State Environmental Protection Agency (KEPA):** Ensures state-level environmental compliance, public consultation, and issues permits;
- **Kaduna State Ministry of Agriculture:** Coordinates agricultural aspects of the AIH and ensures alignment with state policies;
- **Kubau and Chikun Local Government Authority:** Facilitates community engagement and local approvals through traditional rulers;
- **AfDB, IsDB, and IFAD:** Provide oversight to ensure compliance with their safeguard policies for donor-funded projects, and project audits;
- **National Agricultural Land Development Authority (NALDA):** Supports land allocation and agricultural development components.

1.9.11.2 Permitting Requirements

The AIH project will require the following permits and approvals:

- Environmental and Social Impact Assessment Certificate from FMEnv, following ESIA report approval;
- Environmental Permit from KEPA for construction and operational activities;
- Water Use Permit from the Federal Ministry of Water Resources for boreholes or irrigation systems;
- Waste Management Permit from NESREA and KEPA for managing waste from AIH operations; and
- Certificate of Occupancy (C of O) from the Kaduna State Government for land acquired in Daki Takwas Kaduna-Abuja Express Way.

1.9.11.3 Administrative Framework Relevant to the ESMP

The implementation of the Environmental and Social Management Plan (ESMP) for the Kaduna State Special Agro-Industrial Processing Zone (SAPZ) AgroIndustrial Hub (AIH) at Daki-Takwas in Chikun LGA will be guided by national and state level environmental legislations and oversight



institutions. The ESMP shall also comply with the environmental and social safeguard policies of the African Development Bank (AfDB).

The administrative and regulatory framework that shall guide the ESMP implementation include:

(i) The Federal Ministry of Environment (FMEnv):

The Federal Ministry of Environment is the highest policy-making authority responsible for environmental protection and sustainable development in Nigeria. The Ministry ensures that all development projects comply with national environmental standards and guidelines, particularly through the enforcement of the Environmental Impact Assessment (EIA) Act CAP E12 LFN 2004. This Act mandates that no public or private sector project can proceed without evaluating the potential environmental and social impacts. For the SAPZ project, the FMEnv will play a critical role in reviewing, approving, and monitoring the ESIA and ESMP documents prepared for the SAPZ AIH project. The Ministry's regulatory oversight will ensure that land acquisition, construction, agroprocessing, and related project activities are conducted in accordance with established environmental procedures;

(ii) Kaduna State Ministry of Environment and Natural Resources / Kaduna State Environmental Protection Authority (KEPA):

The Kaduna State Ministry of Environment and Natural Resources, along with KEPA, enforces environmental regulations and supports FMEnv mandates within the state. KEPA issues EIA certificates, monitors compliance, and will coordinate environmental reviews and site monitoring for the SAPZ project. Both institutions also promote sustainability through policy, outreach, and oversight of agroprocessing impacts, including pollution, deforestation, and climate mitigation. They play a key role in reviewing safeguard instruments (ESIA, ESMP, RAP, LRP, PMP, SEP) and ensuring environmental and social risk management throughout the project lifecycle;

(iii) Federal Level Coordination (National Project Coordination):

The Environmental and Social Safeguards Unit of AfDB, IsDB, and IFAD. ensures compliance with national regulations and AfDB's ISS, supports ESIA, RAP, and LRP processes, and provides technical guidance and capacity building to State Project Implementation Units (SPIUs);

(iv) State Project Implementation Unit (SPIU):

The SPIU, under the State Ministry of Agriculture, manages day-to-day implementation of the SAPZ project, including procurement, disbursement, financial management, M&E, and



environmental and social safeguards. The PIU is responsible for the comprehensive delivery of AfDB-funded projects. The SPIU's key responsibilities include conducting ESIA studies, implementing the ESMP, supervising contractors, managing resettlement processes, and producing compliance monitoring reports throughout the project lifecycle.

It reports to the State Steering Committee through the State Project Coordinator. The SPIU's Environmental and Social Safeguards Unit ensures compliance with national regulations and AfDB's Integrated Safeguards System, overseeing ESIA, RAP, and LRP implementation.

1.9.11.4 National Agricultural Land Development Authority Act

Established in 1992, this Act provides public support for land development, essential for agricultural projects.

1.9.11.5 Federal Ministry of Health

A. National Agency for Food and Drug Administration and Control (NAFDAC)

NAFDAC ensures compliance with safety standards for food, drugs, and chemicals, preventing substandard products from entering the market and enforcing food safety regulations.

1.10 Reporting

ESIA Report Structure

The structure of this ESIA report is as presented below

- **Executive Summary**
- **Chapter 1: Introduction.** This Chapter provides a background to the proposed Project and the ESIA. It provides information about the project proponent and also includes the Institutional and Legal Framework within which the ESIA was undertaken. This includes environmental legislation, standards and guidelines applicable to the Project.
- **Chapter 2: Project Justification.** This chapter discusses the project justification, need/value and its envisaged sustainability as well as the project development and options considered.
- **Chapter 3: Project Description.** This chapter describes the project in detail, including information regarding the project phases and schedule as well as the waste management policies and procedures that will be adopted.



- **Chapter 4:** Biophysical and Socioeconomic Baseline. The chapter defines the areas of direct and indirect influence of the Project. It describes the biophysical and socioeconomic baseline of the Project's areas of influence and presents the public participation process in the ESIA.
- **Chapter 5:** Impact Assessment. The chapter presents the approach and methodology for the ESIA process. It identifies and assesses potential Project impacts (biophysical and socioeconomic impacts).
- **Chapter 6:** Mitigation Measures. This chapter defines relevant mitigation measures to avoid, reduce, compensate or enhance Project impacts (as applicable).
- **Chapter 7:** Environmental and Social Management Plan (ESMP). It presents the Project ESMP, organising all mitigation, management and monitoring requirements and management programs.
- **Chapter 8:** Stakeholders Consultation
- **Chapter 9:** Conclusion and Recommendation
- **References**
- **Appendices**



CHAPTER TWO: PROJECT JUSTIFICATION AND RATIONALE

2.0 Introduction

This chapter presents the justification for the SAPZ–AIH project at Daki Takwas, highlighting its anticipated socio-economic and environmental benefits, its long-term sustainability, and the options and alternatives evaluated during the planning stage. Kaduna State possesses vast agricultural potential, a strategic central location within Nigeria, and a rapidly growing population that offers significant opportunities for agro-industrial development. The Kaduna State Government (KDSG), in partnership with the African Development Bank (AfDB) and other stakeholders, is committed to transforming the state’s economy from a predominantly subsistence-based agricultural system into a structured, competitive, and agro-industrially driven economy.

The SAPZ initiative—specifically the establishment of the Agro-Industrial Hub (AIH) at Daki Takwas, Chikun LGA—is designed to harness these socio-economic strengths by promoting value addition, attracting private sector investments, stimulating inclusive growth, creating employment opportunities, reducing post-harvest losses, and expanding export potential. The project aligns with Kaduna State’s agricultural transformation agenda, food security strategies, and rural industrialization goals, and serves as a critical pathway for economic diversification. During the planning process, various options and potential sites were assessed, with Daki Takwas selected based on its accessibility, proximity to major farming communities, availability of suitable land, and consistency with regional development plans.

2.1 Rationale for the Project – Development Objectives

The SAPZ project in Kaduna State is designed to accelerate agricultural transformation by enhancing the efficiency, productivity, and competitiveness of agro-industrial enterprises. The Agro-Industrial Hub (AIH) at Daki Takwas will serve as a modern center for agro-processing, aggregation, and value chain integration, strategically located near primary production clusters. This location ensures reduced post-harvest losses, lower logistics costs, and improved market access for smallholder farmers.

The AIH will generate substantial employment opportunities, particularly targeting youth and women, thereby contributing to poverty reduction and inclusive economic development within Chikun LGA and across Kaduna State. Furthermore, the project will promote the adoption of



modern and climate-smart agricultural technologies, improve access to high-quality inputs, and strengthen linkages between farmers, processors, and markets. By doing so, the AIH will foster resilient agricultural value chains, enhance food security, and drive industrialization in line with Kaduna State's vision for rural transformation and Nigeria's national agenda for economic diversification.

Strategic Importance of the AIH SAPZ Project at Daki-Takwas

The Agro-Industrial Hub (AIH) at Daki-Takwas, Chikun LGA, represents a flagship component of Kaduna State's Special Agro-Industrial Processing Zone (SAPZ) initiative. Its strategic importance lies in its ability to accelerate agricultural industrialization and rural transformation in line with Nigeria's broader economic diversification agenda. By fostering agro-processing and value-added agricultural production, the project directly supports national objectives to reduce reliance on food imports, enhance exports of processed commodities, and strengthen non-oil revenue streams.

The Daki-Takwas AIH is strategically located in a peri-urban agricultural zone that serves as a convergence point for multiple farming communities. Its proximity to major highways and markets within Kaduna and neighboring states enhances its logistical advantage, making it an attractive destination for private sector investment and agribusiness expansion. The hub will provide a structured platform for integrating smallholder farmers into modern, competitive value chains, supported by improved infrastructure, storage facilities, and market linkages. By addressing existing supply chain bottlenecks, the AIH is poised to become a catalyst for inclusive and sustainable agricultural industrialization across Kaduna and beyond.

Socioeconomic Benefits

The anticipated socioeconomic benefits of the AIH at Daki-Takwas are both direct and far-reaching. The project will generate about twenty thousand direct employment opportunities during the construction phase and about eighty thousand employment opportunities during the operations phase, spanning sectors such as civil construction works, supply of construction materials, transportation services, farming, agro-processing, packaging, logistics, and ancillary services. Indirect jobs will also be created through micro, small, and medium enterprises (MSMEs) linked to the hub, including transport services, input suppliers, and hospitality businesses.



Human capital development will be a core feature, with targeted capacity-building programs designed to empower local farmers, women, and youth. These initiatives will include training on modern farming techniques, agribusiness management, and climate-smart practices. By enhancing productivity and reducing post-harvest losses, smallholder farmers will realize higher incomes and more stable livelihoods. Women's cooperatives and youth groups will be prioritized in access to skills training, financial services, and market linkages, ensuring equitable participation and benefits. Strengthened food systems and increased local processing capacity will also improve food security and nutritional outcomes. The project will reduce dependency on imported food items, stabilize commodity prices, and enhance resilience against supply shocks. Collectively, these benefits will contribute to poverty reduction, rural development, and inclusive economic growth not only in Chikun LGA but across Kaduna State and Northern Nigeria.

2.2 Need for the Project

Despite its agricultural potential, Chikun LGA and surrounding communities face persistent challenges including high youth unemployment, underdeveloped infrastructure, and weak value chain integration. Smallholder farmers dominate production but remain constrained by low mechanization, inadequate access to inputs, poor storage, and limited connectivity to profitable markets. Post-harvest losses are widespread, undermining incomes and food availability.

Recent data from the NBS highlights that Kaduna's poverty rate is put at 43.48% (official NBS "Poverty & Inequality in Nigeria 2019") and this affects the rural and peri-urban areas such as Chikun LGA.. These conditions underscore the urgent need for transformative interventions that can modernize the agricultural economy, create jobs, and improve rural livelihoods.

The AIH at Daki-Takwas has been conceptualized to meet this need by serving as a centralized hub for aggregation, processing, extension services, and technology transfer. The hub will feature demonstration farms and technology centers promoting climate-smart agriculture, resource-efficient irrigation systems, and sustainable land-use practices. By providing storage, processing facilities, and market access, the hub will significantly reduce losses, increase farmer profitability, and attract private investors to the rural economy.



Inclusive development is a guiding principle of the project. Women, youth, and other vulnerable groups will be deliberately integrated into value chains, ensuring broad-based benefits. The hub will also strengthen backward and forward linkages across the agricultural sector, promoting MSMEs in processing, transport, input supply, and services.

Ultimately, the AIH at Daki-Takwas will play a pivotal role in enabling Kaduna State's vision of transitioning from subsistence agriculture to a modern, market-oriented agricultural economy. By addressing structural constraints, empowering local communities, and fostering sustainable agribusiness, the project will significantly enhance food security, rural prosperity, and economic resilience in line with both state and national development priorities.

Expected Benefits of the AIH at Daki-Takwas

The Agro-Industrial Hub (AIH) at Daki-Takwas is expected to deliver wide-ranging benefits that will contribute to the transformation of Kaduna State's agricultural sector and align with Nigeria's broader development priorities. Key anticipated benefits include:

- **Improved agricultural productivity and processing efficiency:** The hub will introduce modern technologies and infrastructure to enhance staple crop production, reduce post-harvest losses, and increase processing capacity for value-added products.
- **Community empowerment through capacity building:** Farmers, women, and youth will gain access to training, agricultural extension services, and agribusiness development support, thereby improving skills, productivity, and competitiveness.
- **Job creation along the agricultural value chain:** It is estimated that 20,000 will have direct employment through masons, excavation, trench construction, soil stabilization etc., while, 80,000 will have indirect employment through sundry activities such as farming, agro-industrial processing, logistics, services, and allied industries operations, thus providing income opportunities at the SAPZ AIH project site for local households.
- **Enhanced rural livelihoods and income diversification:** By integrating smallholder farmers into structured value chains, the hub will open up new livelihood opportunities and reduce economic vulnerability in surrounding communities.
- **Increased Internally Generated Revenue (IGR):** The hub will contribute to revenue growth for Kaduna State and Chikun LGA through increased economic activity, taxation, and expanded agribusiness operations.



- **Stimulation of rural commerce and private sector growth:** The AIH will act as a growth pole for rural economies by attracting MSMEs, encouraging entrepreneurship, and expanding markets for goods and services.
- **Promotion of private investment and local content:** By providing an enabling environment, the hub will attract private capital and ensure that local actors—farmers, processors, and service providers—are central to agro-industrial development.

Through the establishment of the AIH at Daki-Takwas, the SAPZ project will serve as a transformative driver of agricultural industrialization in Kaduna State. Beyond its local impact, the project will advance Nigeria’s national objectives of food security, poverty reduction, and economic diversification, while positioning the state as a regional hub for agro-industrial growth.

2.3 Envisaged Sustainability

The proposed SAPZ Agro-Industrial Hub (AIH) at Daki-Takwas will be developed in full alignment with the sustainability principles and operational safeguards of the African Development Bank (AfDB), the Federal Ministry of Environment (FMEnv), and the Kaduna State Environmental Protection Authority (KEPA). The project is designed to balance technical efficiency, economic viability, environmental protection, and social inclusion, ensuring long-term resilience and broad-based benefits for Kaduna State and Nigeria at large.

2.3.1 Technical Sustainability

The technical sustainability of the AIH will be anchored on a robust project delivery team, comprising engineers (civil, structural, electrical, and mechanical), agronomists, geologists, and environmental and social specialists. This multi-disciplinary expertise will guarantee that designs, construction, and operations adopt best-practice, environmentally responsible approaches.

All machinery and processing equipment procured for the AIH will be carefully selected to minimize emissions, noise, vibration, and other environmental impacts. Modern energy-efficient technologies will be prioritized to optimize productivity while reducing operational costs. The AIH will integrate renewable energy solutions, particularly solar power, to supplement national grid supply, thereby enhancing energy reliability and reducing greenhouse gas emissions. In addition, wastewater treatment and recycling systems will be deployed to reduce water demand and protect surrounding natural water sources. The project’s technical design will adhere to the BATNEEC principle (Best



Available Technology Not Entailing Excessive Cost), ensuring that innovations are both cost-effective and environmentally sustainable over the hub's entire lifecycle.

Table 2.1: Technical Sustainability

Sustainability Dimension	Indicator	Baseline	Target	Monitoring Frequency	Responsible Party
Energy Efficiency	Share of renewable energy in total power supply	0%	≥ 30% by Year 3	Quarterly	SPIU / Contractor (Energy Engineer)
Resource Efficiency (Water)	Proportion of wastewater recycled and reused	0%	≥ 50% of wastewater by Year 2	Quarterly	SPIU / Environmental Officer
Operational Reliability	Equipment downtime (% of operational hours)	N/A (Pre-operation)	≤ 5% by Year 3	Monthly	Plant Manager / Maintenance Engineer
Environmental Performance	Noise and air emission levels meeting FMEnv/WHO limits	Baseline: within rural limits	Maintain compliance throughout operation	Bi-annually	SPIU / KEPA / Independent Monitor
Local Employment and Capacity Building	Share of local workers in unskilled and semi-skilled positions	Baseline 15%	Target 50% by Year 3	Quarterly	SPIU / Contractor (HR Officer)

2.3.2 Economic Sustainability

The AIH is expected to be a catalyst for agro-industrial growth and a key driver of Kaduna State's economic diversification agenda. By improving agro-processing, logistics, and market systems, the hub will transform agricultural productivity into tangible economic gains. Its economic sustainability rests on five pillars:



- **Job Creation and Livelihood Opportunities:** It was estimated that 20,000 direct employment and 80,000 indirect employment opportunities will be generated during both construction and operational phases. Jobs will arise not only within the hub but also across support services such as logistics, marketing, equipment maintenance, and input supply. Priority will be given to hiring local labor to maximize community benefits.
- **Market Access and Profitability:** By providing structured agro-processing infrastructure near production clusters, the AIH will minimize post-harvest losses, enhance product quality, and expand access to national and regional markets. Crops such as maize, soybean, sorghum, and horticultural produce will become more competitive, thereby boosting farmer incomes and profitability.
- **Value Chain Development and Agro-Industrial Growth:** The AIH will integrate farmers, processors, traders, and distributors into resilient value chains supported by modern technology and infrastructure. This will attract private sector investments, strengthen linkages between production and processing, and stimulate the growth of a rural agro-industrial economy in Kaduna State.
- **Support for MSMEs and Capacity Building:** The hub will provide MSMEs with access to common processing facilities, training, financing, and technology transfer. Dedicated skills development programs will build technical and managerial competencies among local farmers, youth, and women, fostering long-term entrepreneurship and self-reliance.
- **Economic Multipliers and Regional Competitiveness:** The hub will stimulate associated industries such as transport, construction, warehousing, and retail trade. These multiplier effects will not only expand the tax base but also strengthen Kaduna State's competitiveness as a **regional agricultural and agro-industrial hub** in Northern Nigeria.

Overall, the AIH at Daki-Takwas will serve as a transformative anchor for inclusive, resilient, and sustainable rural economic growth, driving agricultural modernization, food security, and income diversification. Its impact will extend beyond Kaduna State to contribute to Nigeria's national goals of poverty reduction, employment creation, and economic diversification.



2.3.3 Environmental Sustainability

The SAPZ Agro-Industrial Hub (AIH) at Daki-Takwas has been designed with a strong commitment to environmental sustainability, ensuring that agro-industrial growth is achieved without compromising the integrity of the surrounding ecosystem. The site selection process was guided by an environmental sensitivity screening, which sought to avoid critical habitats, densely populated settlements, cultural heritage sites, and ecologically fragile zones as much as possible.

Environmental considerations have been embedded across all phases of the project—planning, design, construction, operation, and eventual decommissioning—to guarantee compliance with applicable standards. Specifically, the project will adhere to:

- Nigeria’s National Environmental Regulations and FMEnv guidelines,
- Kaduna State Environmental Protection Authority (KEPA) requirements, and
- The African Development Bank’s Integrated Safeguards System (ISS, 2023).

A comprehensive Environmental and Social Management Plan (ESMP) has been prepared (see Chapter 7 of this report), detailing specific mitigation measures to address potential impacts such as:

- soil disturbance and erosion,
- noise and air emissions from machinery,
- water resource abstraction and use,
- solid and liquid waste generation, and
- biodiversity loss.

The project proponent is committed to establishing a dedicated Environmental and Social Safeguards Unit within the State Project Implementation Unit (SPIU), or alternatively assigning trained environmental and social staff to oversee compliance and monitoring. This will ensure that ESMP measures are effectively implemented and tracked through regular audits, reporting, and adaptive management. Furthermore, the AIH will integrate green technologies and sustainable practices, including:

- solar power systems to reduce reliance on fossil fuels,
- wastewater recycling and treatment systems to conserve water and protect local streams,
- erosion control and stormwater drainage structures to preserve soil stability, and



- the adoption of Best Available Technology Not Entailing Excessive Cost (BATNEEC) for all agro-processing activities.

These measures will reduce the project's ecological footprint, minimize ecosystem disruption, and ensure that ESIA recommendations are embedded into engineering and operational designs, thereby reinforcing long-term environmental sustainability.

2.3.4 Social Sustainability

The AIH SAPZ project at Daki-Takwas is equally committed to social sustainability, with the overarching goal of delivering inclusive and long-term benefits to host communities in Chikun LGA and the wider Kaduna State. The project will prioritize employment creation, livelihood enhancement, and social inclusion, particularly targeting women, youth, and vulnerable groups.

During construction and operation, the project will prioritize local labor recruitment, with an estimated 70%–85% of unskilled and semi-skilled positions expected to be filled by workers from Daki-Takwas and neighboring communities. This approach will maximize community participation, strengthen local ownership, and contribute to poverty reduction and economic empowerment.

Social sustainability will also be ensured through continuous stakeholder engagement. Consultations carried out during the ESIA scoping and baseline studies highlighted a strong willingness among communities to support the project, provided their concerns—such as land use, fair compensation, and community benefits—are adequately addressed. To this end, a Stakeholder Engagement Plan (SEP) has been designed to guide regular communication, grievance redress, and inclusive decision-making throughout the project lifecycle.

The project will comply with national social and labor regulations while fully aligning with the AfDB's Operational Safeguards (OS):

- OS1: Environmental and Social Assessment:** Ensures identification and management of environmental and social risks through instruments like the ESIA and ESMP.
- OS2: Labour and Working Conditions:** Promotes fair labor practices, safe working conditions, and protection of workers involved in construction and operations.
- OS3: Resource Efficiency and Pollution Prevention:** Encourages efficient use of energy, water, and raw materials, and control of emissions, waste, and pollution from processing activities.



- iv. **OS4: Community Health, Safety, and Security:** Addresses risks to nearby communities from project activities, including traffic, noise, GBV, and access to clean water and sanitation.
- v. **OS5: Land Acquisition and Involuntary Resettlement:** Ensures compensation, livelihood restoration, and fair resettlement for persons displaced by land acquisition.
- vi. **OS6: Habitat and Biodiversity Conservation and Sustainable Management of Living Natural Resources:** This safeguard ensures the protection, conservation, and sustainable management of biodiversity, natural habitats, and living natural resources that may be affected by project activities.
- vii. **OS7: Vulnerable Groups:** is designed to protect the rights and interests of vulnerable or disadvantaged groups, ensuring they are not excluded from project benefits and are meaningfully consulted throughout the project cycle.
- viii. **OS10: Stakeholder Engagement and Information Disclosure:** Requires meaningful consultations, grievance redress mechanisms, and public access to key project documents.

In addition, the capacity of the State Project Implementation Unit (SPIU) will be strengthened through periodic training and capacity-building programs, conducted in collaboration with AfDB. These will cover environmental and social risk management, gender mainstreaming, grievance redress, and community development.

2.4 Project Alternatives and Options

In designing and implementing the Special Agro-Industrial Processing Zone (SAPZ) Agro-Industrial Hub (AIH) in Daki Takwas, Chikun LGA, Kaduna State, a range of alternatives were carefully evaluated to ensure the project delivers maximum socioeconomic benefits while minimizing environmental and social risks. The evaluation process considered project necessity, site suitability, technology selection, waste management approaches, and sourcing of agricultural inputs. This section presents the main alternatives assessed and the rationale for the preferred choice.



2.4.1 Project Options

2.4.1.1 Option One: No Project Option

This scenario assumes that the SAPZ AIH project in Kaduna State is not implemented. While avoiding environmental and social risks associated with construction and operations, the “No Project” option carries significant opportunity costs, including:

- Continued underutilization of Kaduna’s agricultural processing and industrial potential;
- Persistent rural and peri-urban poverty, with limited employment opportunities for youth and women;
- Absence of large-scale agro-processing facilities to reduce post-harvest losses and add value to agricultural produce;
- Limited access to regional and international markets for farmers and agribusinesses;
- Loss of private investment and government revenue streams that would have been generated;
- Weakening of Kaduna State’s competitive edge in agricultural value chains.

This option is inconsistent with Kaduna State’s and Nigeria’s agricultural transformation agenda and undermines strategic plans for industrialization, food security, and inclusive growth. Therefore, it is not considered viable.

2.4.1.2 Option Two: Delayed Project Option

The delayed project option considers postponing the SAPZ AIH implementation to a future date due to possible financial, political, or administrative constraints. While technically feasible, this approach would introduce major challenges:

- Higher costs from inflation, re-mobilisation, and delays in procurement;
- Reduced investor confidence and donor support;
- Risk of losing current community goodwill and stakeholder momentum;
- Missed opportunities for immediate job creation and infrastructure development;
- Declining competitiveness of Kaduna State in regional agricultural markets.



Given that political will, technical readiness, and stakeholder support are currently aligned, deferring the project would jeopardize its strategic momentum. For this reason, the delayed option is not recommended.

2.4.1.3 Option Three: Go-Ahead Project Option (Preferred Option)

The “Go-Ahead” option represents the preferred and most viable pathway for implementing the SAPZ Agro-Industrial Hub at Daki Takwas. This alternative was selected based on its strong alignment with economic, technical, environmental, and social objectives. The expected long-term benefits include:

- Creation of employment and business opportunities for surrounding communities;
- Reduction in post-harvest losses and enhancement of agricultural value addition;
- Improved food security through increased availability of processed and packaged agricultural products;
- Attraction of private sector investment and stimulation of rural infrastructure development;
- Contribution to Kaduna State’s economic diversification agenda;
- Promotion of sustainable agricultural practices and resource-efficient agro-processing.

The “Go-Ahead” option strikes the best balance between economic viability, social inclusion, and environmental sustainability, making it the most desirable and strategic choice for implementation of the SAPZ AIH in Daki Takwas.

Table 2.2: Comparative Analysis of Project Alternatives

Option	Environmental Trade-offs	Social Trade-offs	Economic/Technical Trade-offs	Overall Assessment (Score*)
Option 1: No Project	Avoids habitat disturbance and emissions but leaves existing degradation from unregulated land use unaddressed.	No resettlement impacts; however, continued rural poverty and underemployment persist.	Loss of investment opportunity, continued post-harvest losses, and weak value chain linkages.	Low (Score: 2/10)



Option 2: Delayed Implementation	Temporary avoidance of environmental impacts; risk of site encroachment and land degradation over time.	Short-term avoidance of displacement but delays in livelihood improvement and infrastructure provision.	Increases project costs, erodes investor confidence, and delays economic benefits.	Moderate (Score: 5/10)
Option 3: Go-Ahead (Preferred Option)	Minor, site-specific impacts (e.g., vegetation clearance, soil disturbance) mitigable through ESMP.	Short-term resettlement of 27 PAPs; long-term gains in employment, market access, and income generation.	High technical and economic feasibility; strong institutional support and long-term sustainability.	High (Score: 9/10)

2.4.2 Project Location Alternatives

2.4.2.1 Location Selection for the Agro-Industrial Hub (AIH)

The AIH is to be sited at Daki Takwas in Chikun LGA, Kaduna State, following a detailed assessment of economic, logistical, and environmental parameters. The location was selected for its suitability to host large-scale agro-industrial activities and its strategic position within an agriculturally productive zone. Daki Takwas is surrounded by farming communities producing key crops such as maize, soybeans, sorghum, ginger, and livestock products, ensuring a steady raw material supply. The site benefits from proximity to Kaduna metropolis and regional markets, accessible via major transport corridors including the Kaduna–Abuja expressway and adjoining feeder roads.

Key advantages that justified the location choice include:

- **Agro-Production Zone:** The surrounding landscape lies within one of Kaduna’s high-output agricultural belts, ensuring reliable supply of commodities to sustain agro-industrial processing.



- **Strategic Market Access:** The site's closeness to Kaduna metropolis and connectivity to national highways enhances linkages with domestic and regional markets, including Abuja and other northern trade hubs.
- **Infrastructure Readiness:** Planned infrastructure upgrades—such as road improvements, grid extension, solar installations, and water systems—can be readily integrated into the AIH design.
- **Environmental Feasibility:** The site is not located within a critical ecosystem or protected area. Identified environmental risks (soil disturbance, water use, waste generation) can be mitigated through the project's Environmental and Social Management Plan (ESMP).
- **Institutional and Legal Compliance:** The site falls entirely within Kaduna State jurisdiction, ensuring straightforward administrative processes for land acquisition, permitting, and long-term operations.

2.4.3 Processing Technologies Alternatives

The SAPZ Agro-Industrial Hub at Daki Takwas was designed with careful consideration of processing technologies and operational systems to ensure efficiency, sustainability, and competitiveness. Technology selection is critical to achieving the project's objectives of enhancing productivity, reducing post-harvest losses, creating value-added products, and promoting environmentally responsible operations.

The Kaduna State Government, with support from the African Development Bank (AfDB), is investing in enabling infrastructure—roads, reliable energy (grid and solar hybrid systems), industrial water supply, and wastewater treatment facilities—to support agro-industrial operations at the hub. The actual processing facilities will be established by private investors under Public–Private Partnership (PPP) arrangements, with operations guided by the ESMP to safeguard environmental and social performance.

2.4.3.1 Context of Technology Alternatives

The AIH is structured to support multi-commodity agro-processing, with emphasis on maize, soybeans, sorghum, and livestock value chains. Each value chain requires tailored processing technologies that maximize yield, ensure food safety, reduce waste, and remain cost-effective. Several technology alternatives were evaluated under the following categories:



2.4.3.1.1 Processing Technology Options

- **Traditional vs. Modern Systems:** Traditional processing methods—such as manual threshing or local oil pressing—are low-cost but inefficient, producing variable quality and limiting competitiveness. Modern systems—such as automated grain sorters, dryers, extruders, oil presses, and meat/fish processing lines—offer higher efficiency, hygiene, and output quality. Though they require higher capital investment, modern systems are more sustainable and aligned with the industrial scale of the AIH.
- **Automated vs. Manual Operations:** Automated systems enable large-scale, consistent, and high-quality processing with reduced dependence on manual labour. While manual systems may benefit micro or small-scale enterprises, they are unsuitable for industrial throughput. The AIH project will favour semi-automated to fully automated technologies to meet both domestic and export market standards while maintaining flexibility for local operators.
- **Conventional vs. Green Technologies:** Conventional processing equipment often relies heavily on fossil-fuel energy and generates significant waste streams. In contrast, green technologies—such as energy-efficient machinery, solar-powered dryers, biomass boilers, and wastewater recycling systems—offer long-term sustainability benefits. The AIH will adopt best available technologies (BAT) that minimize resource use and environmental footprint, consistent with AfDB safeguards.

2.4.3.1.2 Scale of Operations Alternatives

- **Small-Scale Facilities:**
Small-scale facilities, usually cooperative- or community-managed, are capable of handling limited processing volumes. They require relatively low capital investment and can serve as training or incubation hubs for agro-entrepreneurs. However, such facilities are insufficient to meet the regional demand for agro-industrial services at Daki Takwas and cannot deliver the economies of scale required for competitive processing.
- **Large-Scale Industrial Facilities:**
Large-scale industrial hubs are designed to handle bulk agricultural produce, thereby delivering operational efficiency, reduced cost per unit of output, and consistent product quality. Given the significant production capacity within Chikun LGA and surrounding



catchment areas, the SAPZ project prioritises the establishment of **medium- to large-scale facilities** at the AIH. These facilities will process multiple commodities—including maize, sorghum, soybeans, ginger, and livestock products—ensuring both economic viability and long-term scalability.

2.4.3.1.3 Product Scope Alternatives

- **Specialized Processing Units:**

This option entails dedicated processing lines for high-value commodities such as soybean oil, poultry and livestock feed, tomato paste, or ginger extracts. These units deliver premium product quality and efficiency but are vulnerable to supply chain fluctuations and changes in market demand. Specialized units are best suited where there is a reliable raw material base and stable market demand.

- **Diversified Processing Units:**

This option involves multi-purpose processing lines that can adapt to seasonal crop availability and market demand shifts. Such flexibility reduces supply chain risks, enhances year-round utilisation of infrastructure, and enables the AIH to support multiple value chains. However, diversified units often require higher management capacity and more sophisticated operational planning.

2.4.3.1.4 Justification for No Singular Preferred Technology Option

Given the diversity of commodities expected to be processed at the AIH in Daki Takwas—ranging from cereals and oilseeds to livestock and horticultural products—no single technology or processing method can effectively serve all value chains. The project therefore adopts a hybrid approach, integrating modern automated systems with semi-mechanised technologies.

This strategy balances operational efficiency, cost considerations, environmental footprint, and local context. Final technology choices will be determined by private investors and facility operators under Public–Private Partnership (PPP) arrangements, guided by feasibility studies and the Environmental and Social Management Plan (ESMP).

This multi-technology approach, supported by Kaduna State Government’s investment in enabling infrastructure (roads, energy, water, and wastewater treatment), ensures that the AIH will remain flexible, resilient, and responsive to market dynamics and technological innovations.



2.4.4 Energy Options

A reliable and resilient energy system will be critical for operating the SAPZ Agro-Industrial Hub at Daki Takwas, particularly given the high energy demands of agro-processing facilities, cold storage, and ancillary services.

2.4.4.1 Integration with National Grid

The AIH will be connected to the Kaduna Electricity Distribution Company (KAEDCO) grid through upgraded LT/HT lines and potentially a dedicated **33/11kV transformer substation**. This will provide foundational electricity supply for early-stage operations and anchor tenants.

- **Advantages:**

- Provides a stable baseline power supply leveraging existing infrastructure.
- Reduces upfront capital costs during the initial implementation phase.
- Scalable with KAEDCO's planned grid expansion.

- **Disadvantages:**

- Grid instability and frequent outages remain a challenge.
- Limited project control over tariffs and supply reliability.
- May necessitate costly backup systems to ensure uninterrupted operations.

2.4.4.2 Onsite Renewable Energy

The AIH at Daki Takwas will incorporate **solar photovoltaic (PV) systems** on rooftops and open areas to complement grid supply. This renewable option will reduce dependence on fossil fuels, align with climate change mitigation goals, and lower the carbon footprint of agro-industrial operations.

Advantages:

- Environmentally sustainable and renewable source
- Long-term operational savings on energy costs
- Enhances energy independence and resilience against grid instability

Disadvantages:

- High upfront capital investment
- Energy generation is weather-dependent
- Requires storage or hybridisation for round-the-clock reliability



2.4.4.3 Diesel Generators

Although not a preferred solution, **diesel generators** may be deployed as backup systems, particularly during the construction phase or in cases of prolonged grid outages.

Advantages:

- Provides immediate power during outages
- High reliability for short-term or emergency needs

Disadvantages:

- High fuel and maintenance costs
- Greenhouse gas (GHG) emissions and noise impacts
- Unsustainable for long-term operations

2.4.4.4 Scaling Energy with Demand

The energy system for the AIH will follow a phased development approach: initial reliance on KAEDCO grid supply, integration of solar PV systems, and eventual transition to hybrid or mini-grid solutions as energy demand expands with full hub operations.

Advantages:

- Flexible, phased investment aligned with project growth
- Avoids overcapitalization in early stages
- Supports gradual integration of renewable energy

Disadvantages:

- Requires robust demand forecasting and coordination
- Risk of interim supply gaps if scaling is not well managed

2.4.4.5 Preferred Energy Strategy

The preferred energy solution for the Daki Takwas AIH is a hybrid system combining KAEDCO grid supply with onsite solar PV. Diesel generators will only serve as auxiliary backup. This strategy ensures operational reliability while balancing cost efficiency and environmental sustainability, consistent with AfDB's green growth agenda.



2.4.5 Water Source Options

Water will be essential for agro-industrial activities, including washing, steaming, cooling, and sanitation. A sustainable and secure multi-source water strategy will be implemented to guarantee year-round availability.

2.4.5.1 Municipal Supply

Currently, there is no municipal water infrastructure serving Daki Takwas, rendering this option infeasible.

- *Advantages:* Treated and regulated supply
- *Disadvantages:* Infrastructure absent in the project area

2.4.5.2 Surface Water

Seasonal streams near the site may be harnessed through small reservoirs, surface water harvesting, or ponds for non-potable uses such as irrigation and cleaning.

- *Advantages:* Reduces pressure on boreholes, available during rainy season
- *Disadvantages:* Seasonal variability; requires treatment and ecological safeguards

2.4.5.3 Groundwater

Groundwater abstraction through boreholes, validated by hydrogeological assessments, will serve as the **primary water source** for the AIH.

- *Advantages:* Reliable and less sensitive to seasonal variation
- *Disadvantages:* The risks of over-abstraction of groundwater include decline in groundwater levels with resultant impact of reduced groundwater availability for ecosystems and domestic well water supply to the community; drying of streams and wetlands because of loss of baseflows that sustains rivers during dry seasons; and over-abstraction of groundwater can result in land subsidence with resultant gradual sinking or compaction of land due to aquifer depletion. Also, over-abstraction of groundwater could result in groundwater scarcity for domestic and agricultural water uses as a result of reduced groundwater availability for household, irrigation and agro-industrial usage. Ultimately, land subsidence would also lead to damaging the infrastructure of the SAPZ AIH through creation of cracked buildings and roads thereby resulting in increased maintenance costs for utilities



and drainage systems. Moreover, reduced access to clean groundwater supply due to the impact of over-abstraction of groundwater could result in public health risks leading to hygiene and sanitation issues for the local communities. The mitigation of this require: implementation of sustainable groundwater abstraction limits; .enforcement of allocation and abstraction licensing; prohibit and restrict groundwater abstraction near sensitive ecosystems and river corridors in the project area;.consistent groundwater level and quality monitoring, and maintenance of sustainable pumping rates.

2.4.5.4 Rainwater Harvesting

Rooftop harvesting and storage systems will be installed to capture rainwater during the wet season, primarily for non-potable uses.

- *Advantages:* Environmentally friendly and cost-effective; supplements boreholes
- *Disadvantages:* Seasonal dependency; requires significant storage capacity

2.4.5.5 Preferred Water Strategy

The AIH will adopt a blended water sourcing approach, combining groundwater (as the main source), rainwater harvesting, and supplementary surface water systems. Storage tanks, treatment units, and monitoring protocols will be integrated to ensure water quality, sustainable abstraction, and resilience against seasonal fluctuations.

This integrated system strengthens operational reliability, environmental sustainability, and water security across all project phases.

2.4.6 Waste Management Alternatives

Effective waste management will be central to the sustainability of the SAPZ Agro-Industrial Hub (AIH) in Daki-Takwas, Chikun LGA, given the anticipated volume and diversity of waste streams generated from large-scale agro-processing, packaging, and auxiliary industrial activities. Waste types will include organic residues (husks, peels, stalks, chaff), wastewater sludge, packaging waste (plastics, cartons), and minor quantities of hazardous materials (lubricants, cleaning agents).

Conventional Landfill Disposal



The traditional approach to waste management in rural Nigeria is landfill or dumpsite disposal. In the Daki-Takwas context, this may provide a short-term solution for non-recyclable and inert wastes. Landfills are relatively simple to operate and provide a structured disposal mechanism. However, they present significant long-term environmental and social risks:

- Greenhouse gas emissions (notably methane and CO₂ from organic decomposition) contribute to climate change.
- Odour nuisances from ammonia and sulphides affect local air quality and community well-being.
- Leachate infiltration can contaminate groundwater sources, which are vital for local water supply.
- Pest proliferation and disease vectors (rodents, flies, mosquitoes) pose health hazards.
- Limited landfill capacity in rural Kaduna could result in early saturation without careful planning.

Innovative Waste Management Approaches

Aligned with AfDB's sustainability standards and FMEnv policy priorities, the AIH will explore integrated and circular waste management solutions:

- **Composting and Biofertilizer Production:** Organic residues from maize, ginger, soybean, and cowpea processing will be composted into biofertilizers. This improves soil fertility, reduces dependence on chemical fertilizers, and promotes climate-smart agriculture.
- **Animal Feed Production:** By-products such as maize bran and chaff can be processed into livestock feed, providing an additional revenue stream for the hub and supporting local livestock farmers.
- **Recycling and Recovery:** Plastics, cartons, and packaging waste will be collected, sorted, and recycled through partnerships with local recycling firms, thereby reducing landfill dependency.
- **Waste-to-Energy Pilots:** In the medium term, organic residues could be valorized through biogas digesters or biomass energy, supporting the hub's renewable energy goals.



While these approaches require capacity building, upfront investment, and proper pest/odour management, they deliver long-term environmental, economic, and social benefits by promoting resource recovery and advancing a circular bioeconomy.

Preferred Waste Management Strategy

For the AIH Daki-Takwas, integrated waste management and valorization will be prioritized over landfill disposal. The chosen approach will combine composting, recycling, and animal feed conversion, with landfills reserved strictly for non-recyclable residues. This model ensures environmental protection, operational efficiency, and rural livelihood enhancement.

2.4.7 Supply Chain Alternatives

A resilient and inclusive supply chain is essential to the successful operation of the SAPZ AIH in Daki-Takwas, which will serve as a major processing hub for maize, ginger, soybean, cowpea, and related commodities. The sourcing model must balance local empowerment, cost-effectiveness, and supply security.

Local Sourcing (Preferred Strategy)

The primary strategy will be to source raw materials from smallholder farmers and cooperatives within a 25–50 km radius of Daki-Takwas, covering parts of Chikun, Kajuru, Igabi, and Kachia LGAs. Advantages include:

- Strengthening the rural economy by directly engaging local farmers.
 - Reducing transportation costs and post-harvest losses due to shorter logistics chains.
 - Improving traceability and quality control, essential for agro-industrial processing.
 - Creating strong farmer–processor linkages, boosting household incomes and food security.
- This approach also aligns with Kaduna State’s SAPZ development objective of enhancing inclusive agricultural growth.

Long-Distance and Regional Sourcing

To complement local procurement, the hub may occasionally source commodities from outside the immediate catchment, including other LGAs in Kaduna State or neighboring states (Plateau, Kano,



Katsina). This strategy will ensure year-round supply stability in case of local shortfalls, climate-induced shocks, or market fluctuations. Benefits include diversified sourcing and access to larger volumes, though challenges include higher transport costs, potential delays, and reduced local multiplier effects.

Hybrid Approach

The AIH will adopt a hybrid supply chain strategy, where local sourcing will remain the backbone, supplemented by strategic long-distance sourcing to maintain uninterrupted processing. This balance ensures resilience, minimizes risks, and safeguards the competitiveness of agro-industrial operations.

Preferred Supply Chain Strategy

The local-first supply chain model, reinforced by selective regional sourcing, will be the preferred option. This guarantees sustainability, economic integration, and inclusive growth while preserving operational flexibility.

2.5 Conclusion

The selection of the Agro-Industrial Hub (AIH) site at Daki-Takwas in Chikun LGA has been guided by its strategic location, availability of supportive infrastructure, and close proximity to major agricultural production zones within Kaduna State. The site's positioning near high-yield farming communities, combined with access to regional and national road networks, will enable efficient sourcing of raw materials and seamless distribution of processed products to key markets.

The AIH is designed around a sustainability-driven development model, incorporating a blend of renewable energy solutions (such as solar photovoltaics), innovative and circular waste management systems (including composting, recycling, and by-product valorization), and a local-first supply chain strategy.

These measures will reduce environmental footprints, enhance operational efficiency, and foster strong linkages between processors and smallholder farmers in Chikun and surrounding LGAs.

Furthermore, the adoption of a hybrid energy mix, coupled with progressive supply chain scaling, will improve the hub's resilience against market and climatic shocks. This integrated approach



demonstrates a commitment to balancing environmental responsibility with economic competitiveness and social inclusion.

Through these carefully considered alternatives and strategies, the SAPZ AIH at Daki-Takwas is well positioned to become a transformative catalyst for agricultural industrialization in Kaduna State. The project is expected to deliver significant improvements in agricultural productivity, generate direct and indirect employment opportunities, support rural livelihoods, and strengthen state revenue. Ultimately, the hub will contribute meaningfully to Nigeria's national objectives of food security, poverty reduction, and economic diversification, while promoting sustainable agro-industrial growth in the region.



CHAPTER THREE: PROJECT DESCRIPTION

3.0 Introduction

This chapter provides a comprehensive description of the proposed Special Agro-Industrial Processing Zone (SAPZ) Agro-Industrial Hub (AIH) to be established at Daki-Takwas in Chikun Local Government Area of Kaduna State (Table 3.2). It highlights the key features of the project, outlining the design, components, and phased implementation of the core facilities that will drive agro-industrial processing, value addition, and market integration within the SAPZ framework. The description also covers the project site's strategic advantages, including its proximity to productive agricultural zones, available infrastructure, and connectivity to major regional and national markets.

The AIH will be developed in four key lifecycle phases—pre-construction, construction, operation and maintenance, and eventual decommissioning. Each phase will involve specific activities and inputs, carefully designed to maximize efficiency while minimizing potential biophysical and socio-economic impacts. Waste management, a critical aspect of project sustainability, will be embedded within all phases. Anticipated waste streams, their sources, and sustainable management strategies will be detailed, ensuring alignment with both environmental regulations and the project's commitment to circular bioeconomy principles. A project schedule will also guide phased execution, highlight implementation milestones and expect completion timelines.

3.1 Project Components

The SAPZ project in Kaduna State—particularly the establishment of the Agro-Industrial Hub at Daki-Takwas in Chikun LGA—is structured around four major components that collectively aim to accelerate agricultural industrialization through infrastructure development, productivity enhancement, institutional reform, and program management.

Component 1: Climate-Resilient Infrastructure Development and Zone Management.

The AIH will benefit from large-scale infrastructure investments under the SAPZ Program, focusing on the development of the **Green Agro-Allied Industrial Zone (GAAIZ)** in Kaduna State. With financing support of USD 144.97 million, this component emphasizes the creation of an enabling environment for agribusiness growth. It will target key value chains such as maize, soybeans,



groundnuts, and ginger, while supporting private sector investment in agro-processing. Infrastructure development at Daki-Takwas will include access and internal roads, fencing, drainage systems, power supply, water systems, waste and effluent treatment, health and safety facilities, and general service layouts. In addition, specialized services such as quarantine units, quality control laboratories, certification centers, and business support hubs will be established to ensure international competitiveness. Implementation will be guided by Environmental and Social Management Plans (ESMPs), ensuring that development remains sustainable, socially inclusive, and compliant with regulatory standards.

The Nigeria Sovereign Investment Authority (NSIA), the Kaduna State Government, and the African Development Bank (AfDB) will play central roles in overseeing implementation. They will coordinate the engagement of technical advisers, design consultants, and contractors, ensuring alignment of the AIH's infrastructure with broader program objectives. The Daki-Takwas AIH forms part of the first phase of the national SAPZ Program and will serve as a critical platform for agricultural transformation, private sector investment, and job creation in Kaduna State.

Component 2: Agricultural Productivity and Production.

This component, supported by USD 46.07 million in financing, will strengthen raw material supply chains for the AIH through targeted investments in farm-level productivity and aggregation systems. Interventions will include land rehabilitation, irrigation development, feeder roads, and rural water supply, enabling farmers to deliver consistent raw materials to the hub. The AIH at Daki-Takwas will be supported by a network of Agricultural Transformation Centers (ATCs) and Aggregation Centers (ACs) located within farming communities across Chikun and surrounding LGAs. These centers will facilitate farmer access to improved inputs such as quality seeds, fertilizers, agro-chemicals, mechanization services, and digital platforms for extension and subsidy distribution.

Ownership of the AIH will rest with the Kaduna State Government, but operational management will be delegated to private operators under Public-Private Partnership (PPP) arrangements. The project will also prioritize training for farmers on climate-smart practices, food safety, and quality standards. To improve market access, a robust agro-dealer and mechanization service network will



be developed, while ICT platforms will be deployed for registration, input tracking, and service delivery across the agricultural ecosystem. Special attention will be given to youth, women, and Micro, Small and Medium Enterprises (MSMEs), with support from institutions such as the Bank of Industry (BoI) to provide entrepreneurship training, business development services, and access to finance.

Component 3: Policy and Institutional Development.

Backed by USD 6.75 million in financing, this component will focus on strengthening Kaduna State's policy, legal, and institutional frameworks to support the effective establishment and management of the AIH. It will involve policy reviews, regulatory reforms, and the creation of a more business-friendly environment through streamlined procedures, digital registration platforms, and a One-Stop Shop for investors. Investment promotion campaigns will be rolled out to position Kaduna as a competitive agro-industrial destination, attracting both local and international investors.

Capacity building will also be central, with training provided for state institutions responsible for SAPZ oversight, including the adoption of IT-enabled systems and standard operating procedures. Market sounding exercises will be conducted to align infrastructure development with private sector expectations, ensuring that the AIH remains responsive to investor needs while safeguarding inclusivity and sustainability.

Component 4: Program Coordination and Management.

The fourth component, supported by USD 12.22 million, will strengthen institutional capacity for program delivery at federal and state levels. A Special Delivery Team will be established within Federal Ministry of Agriculture and Food Security (FMAFS), while the Kaduna State Project Implementation Unit (SPIU) will coordinate implementation at state level. Activities will include staff training, financial and technical audits, and feasibility studies to support the rollout of future phases of the SAPZ program.

Together, these four components reflect Kaduna State's vision of agricultural modernization, rural transformation, job creation, and economic diversification. The AIH at Daki-Takwas will serve as a flagship agro-industrial platform, integrating infrastructure, policy reforms, and farmer



productivity initiatives to deliver lasting socio-economic benefits for both Kaduna State and Nigeria as a whole.

3.2 Project Location Description

The Agro-Industrial Hub (AIH) is proposed to be established at Daki Takwas in Chikun Local Government Area of Kaduna State as shown on Figure 3.1.

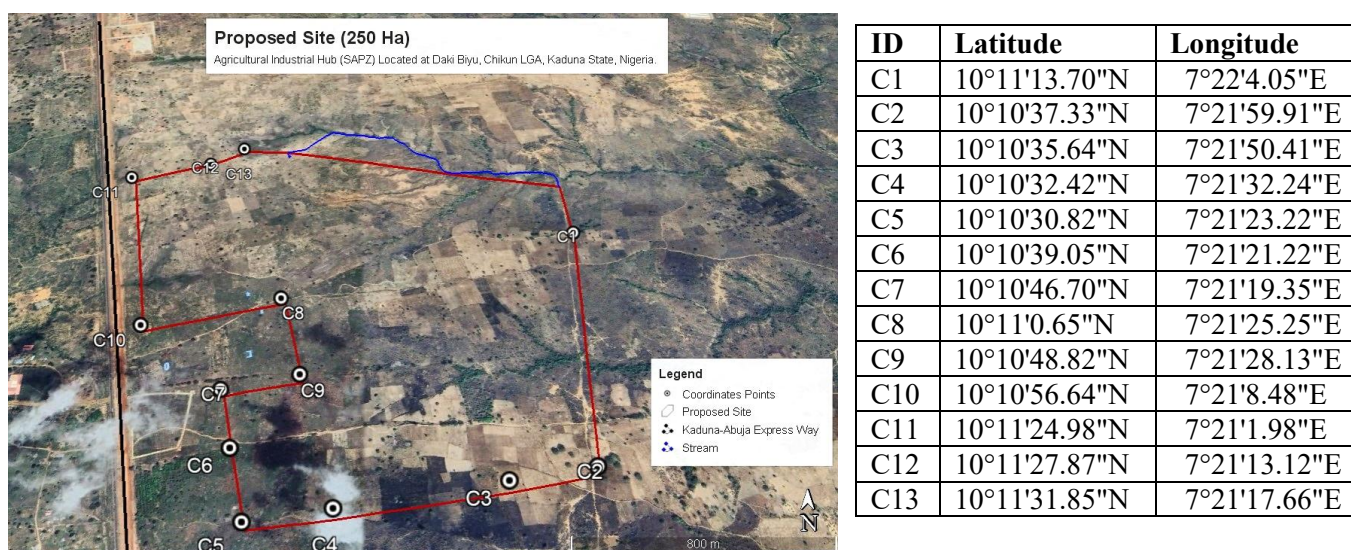


Figure 3.1 Google Earth Imagery of SAPZ AIH Project Site

The location was strategically chosen based on its proximity to high agricultural production clusters, availability of land, and strong connectivity to Kaduna's urban markets and regional trade corridors. The site benefits from existing road infrastructure linking it to Kaduna metropolis, southern Kaduna, and neighboring states, thereby enhancing logistics, supply chain efficiency, and access to both domestic and export markets. The Daki Takwas area is characterized by intensive agricultural production, with crops such as maize, soybeans, rice, ginger, tomatoes, and sorghum forming the backbone of farming activities. The project site comprises predominantly agricultural land with relatively low levels of ecological sensitivity, making it suitable for large-scale infrastructure and industrial development. The availability of a skilled and semi-skilled local workforce, coupled with access to water and energy resources, further strengthens the site's suitability for hosting an agro-industrial hub. The AIH at Daki Takwas will serve as the central processing, storage, and distribution hub for agricultural produce, complementing the satellite ATCs within the Kaduna SAPZ



framework. Facilities to be developed include industrial-scale agro-processing plants, bulk storage silos, warehouses, cold-chain facilities, energy and water supply systems, wastewater treatment plants, internal access roads, and administrative complexes. The site layout will be finalized following detailed Environmental and Social Impact Assessment (ESIA) recommendations and geotechnical investigations to ensure compliance with sustainability standards. A survey plan of the project site is presented on Figure 3.2. A detailed site layout and map of the proposed AIH at Daki Takwas will be presented in the subsequent section of this report.

Figure 0.2 Survey Plan of SAPZ AIH Project Site

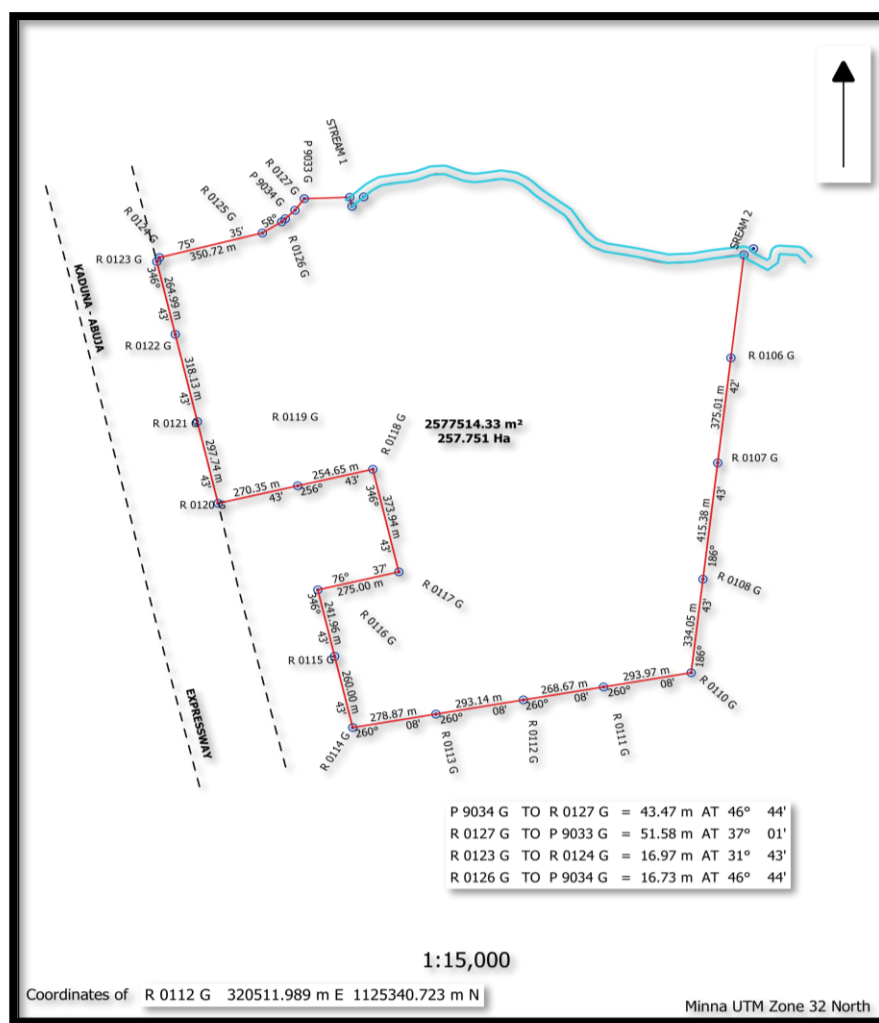


Figure 3.2: Survey plan of the project site



3.2.1 APZ Agro-Industrial Hub (AIH), Daki Takwas, Chikun LGA

The proposed AIH site lies within the designated Special Agro-Industrial Processing Zone (SAPZ) development area for Kaduna State and is strategically positioned to anchor agro-industrialization in Kaduna and adjoining agricultural clusters. The coordinates of the AIH site are approximately 10.4157° N latitude and 7.6164° E longitude. The site covers an estimated 250 hectares of land owned by Kaduna State Government. The 250 hectares land consist largely of agricultural and fallow land with scattered economic trees and seasonal farming plots. The terrain is generally flat to gently undulating, with elevations between 610 and 650 meters above sea level, making it well-suited for industrial construction and large-scale infrastructural deployment.

The boundary coordinates of the SAPZ AIH project site is shown in Figure 3.1 and Table 3.1.

Table 3.1: Boundary coordinates of the SAPZ AIH project site

ID	Latitude	Longitude
C1	10°11'13.70"N	7°22'4.05"E
C2	10°10'37.33"N	7°21'59.91"E
C3	10°10'35.64"N	7°21'50.41"E
C4	10°10'32.42"N	7°21'32.24"E
C5	10°10'30.82"N	7°21'23.22"E
C6	10°10'39.05"N	7°21'21.22"E
C7	10°10'46.70"N	7°21'19.35"E
C8	10°11'0.65"N	7°21'25.25"E
C9	10°10'48.82"N	7°21'28.13"E
C10	10°10'56.64"N	7°21'8.48"E
C11	10°11'24.98"N	7°21'1.98"E
C12	10°11'27.87"N	7°21'13.12"E
C13	10°11'31.85"N	7°21'17.66"E

Soils in the area are mainly ferruginous tropical soils, moderately fertile, and widely used for cereal and legume cultivation. 'Rafin Sarki stream is a seasonal stream that traverses the northern edge of the site. The water supply requirements of the project will be supplemented by accessible groundwater resources underlying the project site, which can be harnessed through boreholes to meet the water demands of processing and ancillary activities. The AIH site is directly accessible through the Kaduna–Kachia Road and linked to the Kaduna–Abuja Expressway, providing excellent connectivity for the inflow of raw materials and outflow of processed goods. Surrounding communities, including Daki Takwas, Kujama, and Kakau, are actively engaged in farming and



agribusiness, and consultations have revealed broad community support for the project due to its anticipated socio-economic benefits.

The AIH is designed to host state-of-the-art agro-processing plants, produce aggregation and distribution centers, cold-chain facilities, logistics hubs, research and training centers, renewable energy systems, and support infrastructure. Its location, resource endowment, and connectivity make it the flagship hub of the Kaduna SAPZ, driving agricultural transformation, value addition, job creation, and industrial growth in Kaduna State and beyond.

Sensitive Areas

The proposed Agro-Industrial Hub (AIH) site at Daki-Takwas, Chikun LGA, is located within a mixed agricultural landscape of cultivated farmlands, seasonal fallows, and patches of natural vegetation. Although not classified as forest land, the site contains riparian corridors and low-lying seasonal wetlands that become active during the rainy season and are sensitive to disturbance, particularly in terms of hydrology, soil stability, and biodiversity.

The nearest settlement, Alheri Camp, is approximately 716 m from the site and is characterized by limited, largely seasonal human activity. The project area itself is largely uninhabited, with very low permanent human presence, making it suitable for agro-industrial development.

The terrain is flat to gently undulating, underlain by ferruginous tropical soils that are moderately fertile but erosion-prone if vegetation is removed. A seasonal stream traverses the northern part of the site and serves as a water source for livestock and nearby users. This surface water feature, together with underlying groundwater, is considered environmentally sensitive and will require protection from sedimentation, effluent discharge, and chemical contamination through buffer zones, erosion control, and wastewater management systems.

Current land use is dominated by seasonal smallholder farming, including maize, soybean, and sorghum cultivation. Conversion of the land for the AIH may result in economic displacement, which will be addressed through the implementation of a Resettlement Action Plan (RAP) providing compensation and livelihood restoration in line with AfDB ISS requirements.



In summary, while the site does not overlap with any protected or critical habitats, its seasonal wetlands, surface water features, and agricultural use represent key environmental and social sensitivities. These will be managed through appropriate safeguards, including erosion control, water-resource protection, waste and effluent management, and livelihood restoration measures (Figure 3.3; Plates 4.2–4.6).

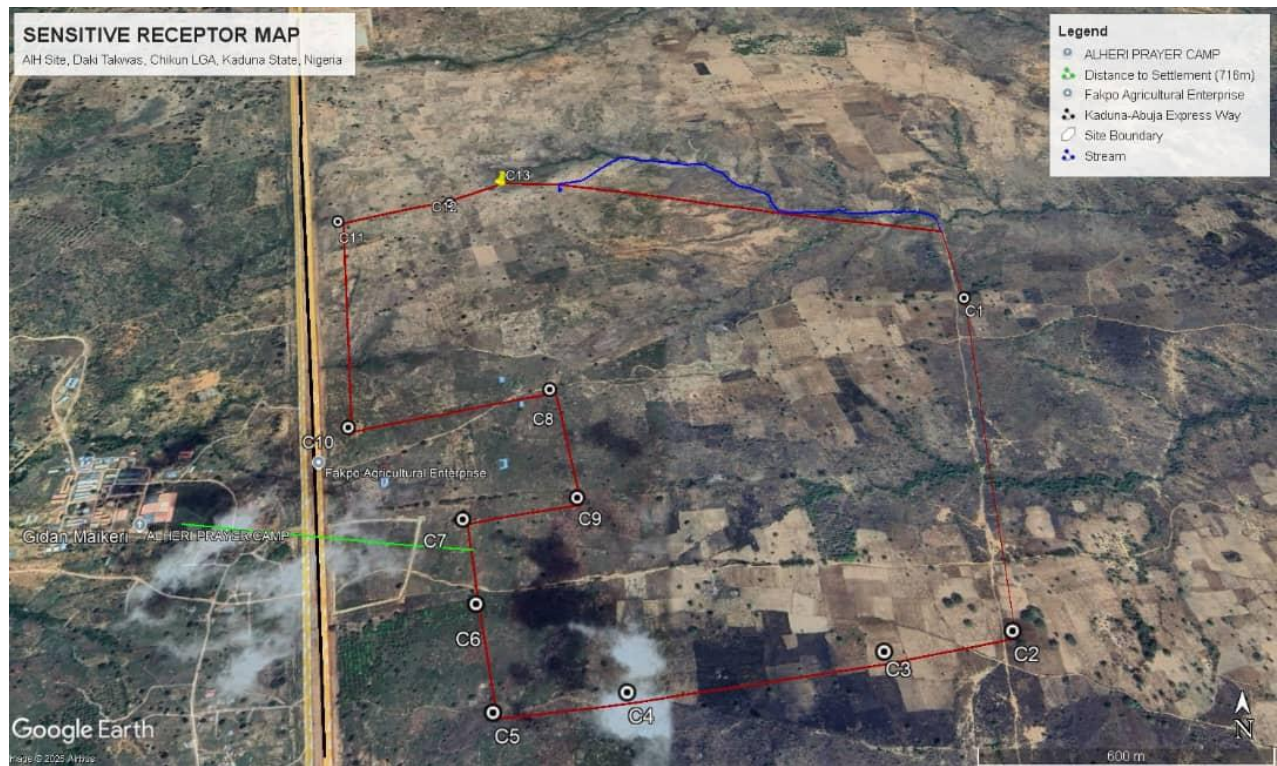


Figure 3.3: Sensitive Receptor Map



Table 3.2: Project Description

Item	Description
Project Title	Kaduna State Special Agro-Industrial Processing Zone (SAPZ) – Agro-Industrial Hub (AIH), Daki-Takwas
Project Proponent	Kaduna State Government (KSG) through the Kaduna SAPZ Project Implementation Unit (SPIU)
Funding Agency	African Development Bank (AfDB) and other development partners
Project Location	Daki-Takwas Community, Chikun Local Government Area (LGA), Kaduna State, North-West Nigeria
Geographical Coordinates	Within Chikun LGA; precise boundary coordinates defined by the approved survey plan (refer to Figure 2.1)
Project Category (AfDB ISS, 2023)	Category 1 Project – Full Environmental and Social Impact Assessment (ESIA) required
Project Type	Agro-Industrial Processing Hub
Overall Objective	To establish a modern agro-industrial processing hub that supports value addition, storage, processing, and marketing of agricultural produce, while promoting inclusive economic growth, job creation, and sustainable land use in Kaduna State
Project Components	• Agro-processing facilities (multi-commodity processing units) • Warehousing and cold storage facilities • Internal road network and parking areas • Utilities (power, water supply, wastewater and stormwater systems) • Administrative buildings and service areas • Waste management and effluent treatment facilities • Green areas, buffer zones, and landscaping
Land Requirement	Land acquired by Kaduna State Government for SAPZ development; subject to RAP/LRP implementation where land acquisition or economic displacement is triggered
Current Land Use	Predominantly undeveloped land with mixed uses including fallow agricultural land and sparse vegetation
Project Phases	• Pre-construction • Construction • Operation and Maintenance • Decommissioning and Site Restoration
Construction Activities	Site clearance, earthworks, grading, foundation works, building construction, installation of utilities, road paving, landscaping



Operational Activities	Agro-processing, storage, logistics, transportation of goods, waste management, facility maintenance
Estimated Project Lifespan	30–40 years
Employment Generation	Direct and indirect employment during construction and operation phases; priority to local workforce and vulnerable groups
Key Raw Materials	Agricultural produce (grains, roots, tubers, legumes, oil crops), packaging materials, water, energy
Utilities and Services	• Electricity (grid and/or embedded generation) • Water supply (boreholes and/or treated supply) • Wastewater treatment system • Solid and hazardous waste management facilities
Environmental Sensitivity	No designated protected areas within the immediate project footprint; potential impacts on air quality, noise, soil, water resources, and vegetation assessed in the ESIA report
Social Sensitivity	Presence of host communities (Daki-Takwas and environs); potential issues related to land acquisition, livelihoods, labor influx, community health and safety, and GBV/SEA risks
Applicable Safeguards	AfDB Integrated Safeguards System (ISS, 2023); Nigerian environmental laws and regulations; Kaduna State environmental requirements
Associated Safeguard Instruments	ESIA, RAP/LRP , Stakeholder Engagement Plan (SEP), Pest Management plan
Project Status	ESIA preparation stage



3.3 Project Technology and Processes

3.3.1 SAPZ Agro-Industrial Hub (AIH), Daki Takwas, Chikun LGA

The Agro-Industrial Hub (AIH) at Daki Takwas is conceived as the flagship agro-processing and logistics hub of the Kaduna SAPZ, designed to handle large-scale value addition across multiple priority commodities including maize, soybean, rice, ginger, and tomato. It will operate as the central industrial anchor, linking upstream Agricultural Transformation Centres (ATCs) in surrounding LGAs with downstream markets, processors, and off-takers. A layout of plan for the AIH is presented on Figure 3.3.

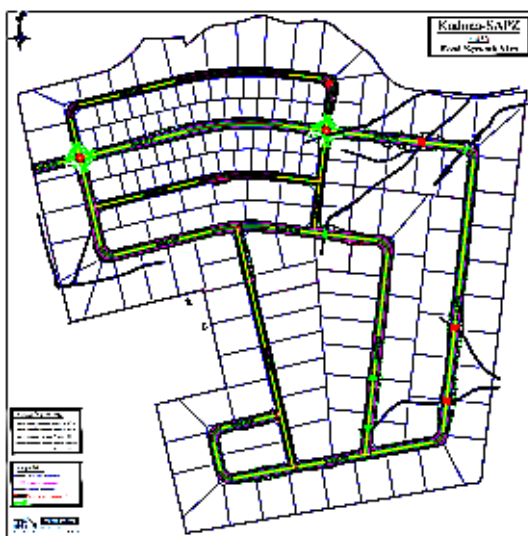


Figure 3.4: Masterplan of a Typical AIH – Source: Kaduna SAPZ (2025)

Core Processing Technologies and Infrastructure at the AIH will include:

- **Cereal and Grain Processing Complex:** Facilities for cleaning, milling, drying, and packaging maize, rice, and sorghum into flour, grits, and bran, supporting both human consumption and livestock feed.
- **Oilseed Crushing and Processing Unit:** Machinery for processing soybean and groundnut into edible oil, meal, and related by-products.
- **Ginger Processing Facility:** Dedicated units for cleaning, slicing, drying, pulverizing, and packaging ginger for local consumption and export markets.



- **Tomato and Horticultural Processing Plant:** Integrated processing lines for producing tomato paste, puree, dried tomatoes, and related horticultural products. Cold storage and packaging sections will support quality preservation and market readiness.
- **Bulk Storage and Warehousing Infrastructure:** Large silos, ventilated warehouses, and cold chain facilities for the storage of raw produce and processed goods.
- **Quality Control and Food Safety Laboratory:** A well-equipped lab for aflatoxin testing (maize and groundnuts), oil quality analysis, moisture determination, pesticide residue screening, and microbiological testing, ensuring compliance with domestic and international standards.
- **Packaging and Export Readiness Unit:** Automated and semi-automated packaging lines with labelling facilities tailored to market requirements.
- **Training, Research, and Innovation Centre:** A center for capacity building, farmer training, and applied research in post-harvest handling, processing technologies, and sustainable agribusiness practices.
- **ICT-Enabled Logistics and Supply Chain Hub:** A digital platform to manage aggregation, warehousing, inventory tracking, and market linkages, integrated with dispatch bays for truck loading and distribution.

Supporting infrastructure will include:

- Solar-hybrid energy systems to ensure reliable power.
- Boreholes, treatment plants, and water distribution systems.
- Waste management and recycling facilities (e.g., composting of organic residues, livestock feed production from by-products).
- Internal road networks, drainage, and landscaping.
- Administrative offices, training halls, and service facilities.

Through this integrated technological deployment, the Daki Takwas AIH will serve as the central engine of agro-industrialization in Kaduna State, driving value addition, reducing post-harvest losses, creating rural and urban jobs, and positioning Kaduna as a competitive hub for agribusiness in Nigeria.



3.3.2 Agro-Industrial Hub (AIH)

3.3.2.1 Effective Procurement Zone for the SAPZ

The **SAPZ Agro-Industrial Hub (AIH) at Daki Takwas** is strategically located to serve as the principal aggregation and large-scale processing facility for the Kaduna SAPZ. Its effective procurement zone spans multiple LGAs—including Chikun, Kajuru, Kachia, Giwa, and parts of Kubau—encompassing a highly productive agricultural belt. The hub will receive a steady flow of maize, soybeans, rice, ginger, and tomatoes, ensuring round-the-year operations at optimal capacity. Key factors influencing this procurement model include proximity to major farm clusters, access to arterial road networks linking Daki Takwas to Zaria, Kaduna, and Abuja, and the diversity of available crops. Sub-zoning assessments identified Daki Takwas as a strategic location due to its central position within production clusters, established logistics corridors, and strong market linkages to both domestic and export outlets.

3.3.2.2 Feeder Zone Potential

The feeder zone around the AIH has significant potential to sustain raw material inflows if land use optimization, climate-smart farming, and structured farmer support systems are prioritized (Figure 3.4).

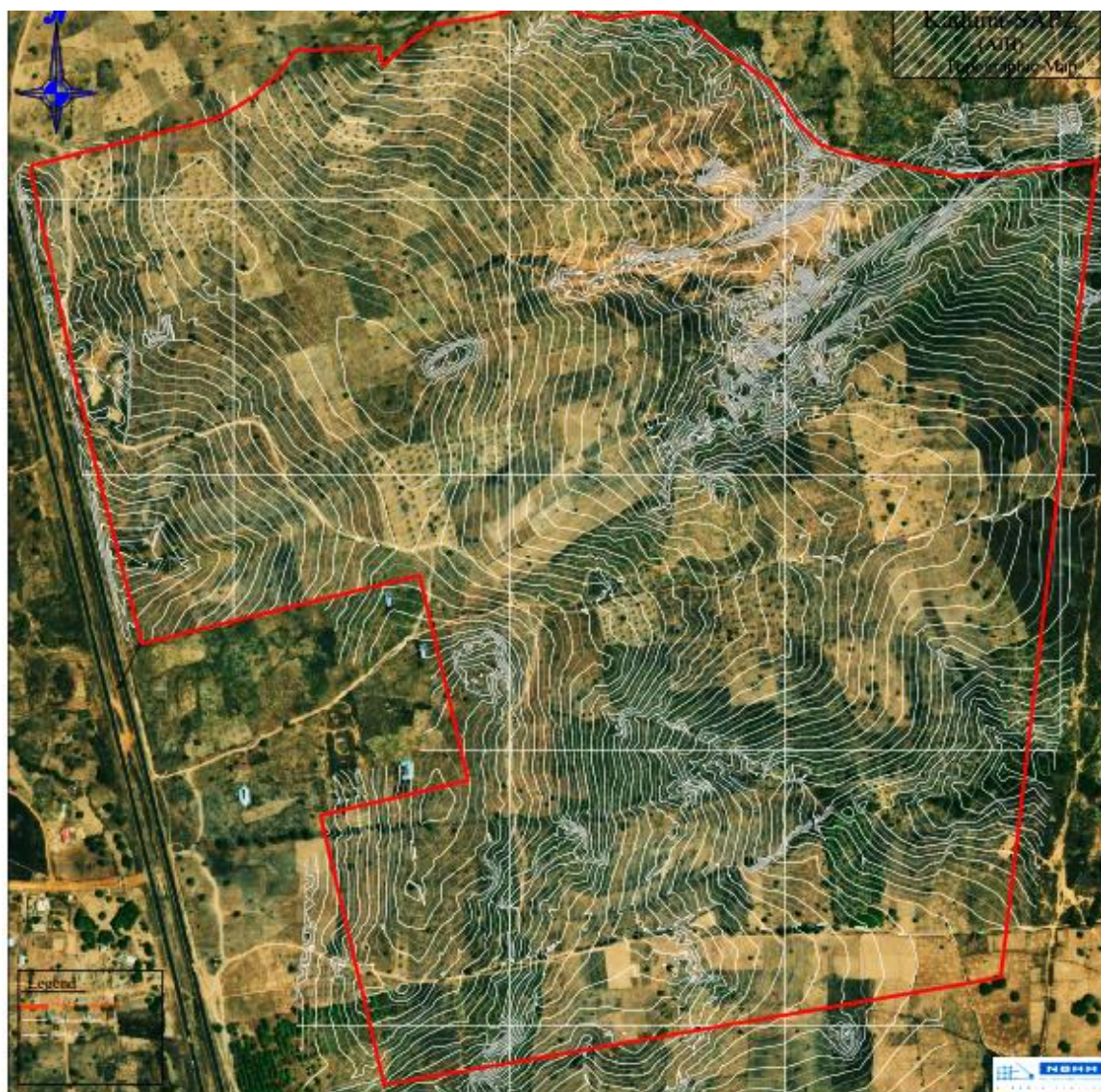


Figure 3.5: Bird's Eye View of a Typical AIH – Source: Kaduna SAPZ (2025)

While the hub will primarily rely on surrounding LGAs, total dependence on the feeder zone is only feasible with:

- Promotion of SAPZ-priority crops through extension services and contract farming,
- Strengthening of farmer cooperatives for bulk aggregation and negotiation,
- Access to affordable finance, irrigation, and inputs (fertilizer, seeds, mechanization),
- Risk mitigation strategies to reduce vulnerability to crop failure, climate shocks, or market volatility.



To ensure resilience, the SAPZ AIH will adopt a dual sourcing model—anchored in strong local procurement while retaining flexibility to supplement with supply from other regions in Kaduna and neighboring states if needed.

3.3.2.3 Infrastructure

The AIH at Daki Takwas will host comprehensive infrastructure designed to enable large-scale agro-industrialization, market efficiency, and inclusive farmer participation. Infrastructure categories include:

A. Support Infrastructure

- **Quality Control & Food Safety Lab:** Testing for aflatoxins, pesticide residues, and microbiological standards.
- **Agro-Commodities Auction House:** Transparent trading platform for bulk produce.
- **Agri-Clinic:** Advisory services for crops and livestock.
- **Certification Centre:** Ensuring compliance with national and export market standards.
- **Training & Innovation Centre:** For capacity building in processing, packaging, and agribusiness.
- **Animal Inspection Facility:** Veterinary surveillance and health checks.

B. Specialized Infrastructure

- Bulk Storage Systems: Silos, ventilated warehouses, and cold rooms.
- Processing Plants: Dedicated lines for cereals, oilseeds, tomatoes, and ginger.
- Agricultural Equipment Leasing Hub: Tractors, planters, and threshers.
- Input Distribution Depot: Safe storage and distribution of fertilizer, agro-chemicals, and seeds.
- Soil & Water Testing Laboratory: Precision agriculture services.
- Centre of Excellence (CoE): Research, innovation, and technology transfer.

C. Social Infrastructure

- Primary Health and Maternity Clinic: Serving workers and surrounding communities.
- Childcare and Mother Support Facility.
- Public Sanitation Blocks.
- Administrative Complex: Offices, monitoring and evaluation units.



- Residential houses

D. Commercial Infrastructure

- **Banking & Microfinance Facilities:** Access to credit and digital payments.
- **Agribusiness BPO & ICT Hub:** Market intelligence, logistics coordination, and digital services.
- **Food Court & Commercial Stalls:** For workers, visitors, and small entrepreneurs.

3.3.2.5 Centre of Excellence (CoE)

The Centre of Excellence (CoE) within the Daki-Takwas AIH will serve as the hub for skills development, innovation, and knowledge transfer. Core functions will include:

- Delivering training on precision agriculture, climate-smart technologies, and agro-industrial best practices,
- Showcasing integrated models across crop production, livestock, aquaculture, and agro-forestry,
- Conducting applied research on high-yield crop varieties, pest and disease management, and sustainable irrigation,
- Providing extension services in collaboration with universities, research institutes, and private-sector partners.

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3.3.2.6 Knowledge Cell and Market Information Centre

To strengthen farmer and agribusiness decision-making, the AIH will establish a Knowledge and Market Information Cell, offering:

- Real-time commodity price updates,
- Seasonal forecasts and weather advisory services,
- Guidance on input optimization and sustainable farming practices,
- Access to digital platforms, mobile-based services, and interactive portals,
- Collaboration with national, regional, and international research and innovation networks.



3.3.2.7 Land Use Statement

The Agro-Industrial Hub (AIH) at Daki-Takwas is strategically planned to maximize operational efficiency, facilitate value chain integration, and support sustainable industrial development within the Kaduna SAPZ framework. The hub will occupy a total area of approximately 250 hectares, systematically allocated across industrial, commercial, and transport infrastructure to optimize functionality.

1. Industrial Zone – 77% of the Site

The industrial zone will constitute the largest portion of the AIH, covering approximately 192.5 hectares. This area will accommodate:

- Agro-processing facilities for maize, ginger, tomato, and other prioritized crops.
- Cold storage units, warehouses, and silos for raw material and finished product storage.
- Research and innovation facilities including demonstration areas, pilot processing lines, and mechanization testing grounds.
- Utility infrastructure such as water treatment plants, power substations, and waste management facilities.

This concentration ensures that production, processing, and value addition activities are spatially integrated for maximum efficiency, minimizing transport distances and optimizing workflow.

2. Commercial Zone – 8% of the Site

Approximately 20 hectares will be allocated to commercial uses. This will include:

- Retail and service outlets for agricultural inputs and machinery.
- Offices for agribusiness enterprises, logistics companies, and supporting service providers.
- Training and extension centers for farmer engagement and capacity building.

The commercial zone will serve as a vibrant interface between the industrial operations and local/regional stakeholders, providing business support and facilitating market linkages.

3. Road Corridor and Transport Infrastructure

A total of 40 hectares will be designated for road corridors, haulage routes, internal circulation, and loading/unloading zones. This network will:

- Ensure seamless connectivity between industrial and commercial areas.
- Provide safe and efficient movement of raw materials, finished goods, and personnel.



- Support future expansion and integration of additional logistic functions within the hub.

Summary:

The deliberate zoning of 77% industrial, 8% commercial, and 16% road/transport infrastructure ensures that the AIH Daki-Takwas operates efficiently, promotes value chain integration, and maintains functional flexibility for future growth (Figure 3.6). This spatial plan balances production capacity, business support, and logistics while minimizing operational bottlenecks and enhancing environmental and economic sustainability across the hub.

Table 3.3: The Layout Summary

Layout Summary		
Commercial	194,479.92	8%
Industrial	1,977,618.56	77%
Roads Corridor	399,282.63	16%
Total	2,571,381.12	100%

Layout Summary			
Small Plots	55.00	277,389.95	14%
Medium Plots	25.00	259,181.10	13%
Large Plots	72.00	1,441,047.52	73%
Total	152.00	1,977,618.57	100%

3.4 Raw Materials and Resources

3.4.1 Raw Materials

The SAPZ Agro-Industrial Hub (AIH) at Daki-Takwas is designed to process multiple priority agricultural value chains, leveraging raw materials sourced from Chikun LGA and surrounding production belts across Kaduna State. Key raw materials expected to be handled at the AIH include:

- **Cereals and grains** (maize, sorghum, and soybeans) for large-scale cleaning, drying, grading, milling, and feed production,
- **Legumes and oilseeds** (cowpea and groundnuts) for processing into food products, oils, and by-products,



- **Horticultural crops** (tomatoes, ginger, and peppers) for packaging, dehydration, puree production, and cold storage.

These inputs will feed into the AIH's industrial processing clusters, supporting local consumption, regional market distribution, and supply to national and international off-takers.

3.4.2 Water Needs and Infrastructure

Water is a critical enabler of agro-industrial activities, required for operations such as washing, steaming, cooling, sanitation, and auxiliary processes. For the Daki-Takwas AIH, substantial water resources will be necessary to sustain daily operations at industrial scale.

- The estimated daily water demand is projected at 2,500–3,000 m³/day, covering potable water (for processing and staff use) and non-potable water (equipment cooling, cleaning, and landscaping).
- Additional allocations will be provided for **fire suppression systems**, including hydrants, sprinklers, and emergency reserves.

To meet this demand, a robust water infrastructure system will be developed, comprising:

- Multiple underground storage tanks (UGS) to segregate potable and non-potable water,
- Elevated-Level Service Reservoirs (ELSRs) sized to sustain at least 6 hours of peak demand,
- Water supply sources including a combination of high-yield boreholes, treated surface water from nearby perennial streams, and supplementary rainwater harvesting systems.

The detailed engineering design will determine final storage capacities, pumping requirements, treatment units, and redundancy measures to ensure uninterrupted supply.

Sustainable Water Management Measures

Efficient and sustainable water use is central to the operational and environmental goals of the Daki-Takwas AIH. The following measures will be incorporated:

- Smart water metering and monitoring to track real-time usage, detect leakages, and optimize distribution,
- Wastewater recycling and reuse (e.g., greywater treatment for irrigation, cleaning, and dust suppression),



- Rainwater harvesting integrated into roof structures to supplement supply during wet seasons,
- Loss minimization strategies, targeting <10% distribution losses through durable piping, preventive maintenance, and leak-detection technologies.

The reticulation system will deploy ductile iron (DI) pipes in high-pressure zones and high-density polyethylene (HDPE) pipes in medium- and low-pressure sections to ensure resilience against corrosion, wear, and pressure fluctuations. This integrated water management approach will ensure operational reliability, aquifer protection, and alignment with sustainability objectives, while securing the water needs of agro-industrial processing, staff facilities, and demonstration farms within the AIH.

Table 3.4 Projected Daily Water Demand – Daki-Takwas AIH

Category	Sub-Uses / Scope	Key Assumptions	Estimated Demand (m ³ /day)	Primary Source	Reuse Potential
A. Processing & Utilities	Grain cleaning, wet milling, conveying washdowns	High-throughput lines (maize/sorghum/soy)	800	Potable for food-contact; non-potable for washdowns	Greywater recovery for non-contact cleaning
	Horticulture (tomato & ginger) washing, blanching, trimming	Multiple lines, seasonal peaks	650	Potable for food-contact	Rinse-water cascade systems
	Clean-in-Place (CIP) & sanitation	Daily CIP cycles	120	Potable	Partial reuse after filtration where permitted
	Boiler/steam make-up	Two small industrial boilers	90	Treated (softened/RO)	Blowdown to non-potable uses
	Cooling/evaporative losses	Cooling towers & process cooling	220	Treated non-potable	Tower bleed to dust control/landscaping
Subtotal A			1,880		
B. People & Services	Staff/domestic (sanitation, hand-wash, drinking)	~1,200 persons across shifts @ ~80 L/person/day	100	Potable	—



	Admin blocks, security posts	Offices, ablutions	20	Potable	—
	Clinic & canteen	Food prep, laundry, hygiene	35	Potable	Greywater to irrigation
Subtotal B			155		
C. Site Operations	Truck/crate/wheel-wash, logistics yard	Inbound/outbound fleet	110	Non-potable	Full reuse after settling/filtration
	Irrigation, landscaping, dust suppression	Dry-season average	180	Non-potable	Rain/treated greywater priority
	Lab, WTP backwash & sludge handling	QC lab, filters backwash	60	Potable (lab) / Non-potable (WTP)	Backwash to settling/ reuse
Subtotal C			350		
D. Losses & Contingency	Non-revenue water ($\leq 8\%$), minor leaks, startups	$\leq 8\%$ of A–C	191	—	—
Operational Daily Demand (A–D)			2,576	Mixed	Maximized per notes
E. Fire Safety Reserve (storage)	Hydrants/sprinklers dedicated reserve	Dedicated, not for routine use	300 (storage)	Non-potable	—

Design Check: Apply seasonal/peak factor 1.2 $\Rightarrow$ Design Day $\approx 3,090 \text{ m}^3/\text{day}$ (excludes dedicated fire reserve consumption; includes ability to replenish reserve after drills/incidents).

Storage & Distribution Sizing (summary)

- Underground Storage (UGS): $\geq 3,000 \text{ m}^3$ total across segregated tanks
 - Potable UGS: 1,200–1,500 m^3
 - Non-potable UGS: 1,500–1,800 m^3 (includes $\geq 300 \text{ m}^3$ dedicated fire reserve)
- Elevated Level Service Reservoirs (ELSRs): 800–1,000 m^3 (≈ 6 hours of peak-period supply at PF 1.2)
- Network Loss Target: $\leq 10\%$, with smart metering and leak detection
- Source Mix: High-yield boreholes + rainwater harvesting + reclaimed greywater for non-potable uses (cooling, washing, irrigation)

Notes:



1. Values are planning estimates for ESIA/engineering; final figures will be confirmed during detailed design and equipment selection.
2. Reuse hierarchy prioritizes food-safety compliance (potable for food-contact; treated non-potable/greywater elsewhere).

3.4.3 Energy Demand and Supply – AIH Daki-Takwas

During the construction phase, the Agro-Industrial Hub (AIH) at Daki-Takwas will require an estimated 15–20 kVA of electrical power. This energy will be used for site preparation, temporary offices, lighting, construction equipment, and security systems. Power will primarily be sourced through temporary grid connections where available, supplemented by portable diesel generators (20–40 kVA) to meet fluctuating site demands.

In the operational phase, the AIH is projected to have a peak energy demand of approximately 30 kVA, reflecting the scale of its multi-commodity agro-industrial operations. This demand will cover core processing lines (cereals, legumes, and horticultural products), cold storage facilities, packaging units, quality assurance laboratories, logistics infrastructure, ICT-enabled systems, and administrative blocks.

The energy supply strategy for the AIH will adopt a **hybrid model**:

- **Primary Supply:** Grid electricity from the Kaduna Electricity Distribution Company (KEDCO), through a dedicated 33 kV feeder line to the hub, ensuring stable supply capacity.
- **Renewable Integration:** Rooftop and ground-mounted solar photovoltaic (PV) systems will supplement daytime operations, offset grid dependency, and contribute to climate-smart, low-carbon development. The PV system's scale will be determined during detailed engineering and energy audits.
- **Backup Systems:** High-capacity diesel standby generators (≥ 1 MVA) will be installed to guarantee uninterrupted operations during grid outages, ensuring critical systems such as refrigeration, processing lines, and water pumping are not disrupted.

This energy mix will enhance operational reliability while aligning with AfDB's Integrated Safeguards System (ISS, 2023) and sustainability requirements, promoting renewable energy integration and resilience in agro-industrial infrastructure.



3.5 Operational and Resource Management

The Agro-Industrial Hub at Daki-Takwas is designed with an operational lifespan of 20 years, supported by a robust operations and maintenance (O&M) framework to ensure efficiency, resilience, and sustainability across its value chains.

Operational and Maintenance Standards:

- **Energy Requirements:** Specific power needs for cereal milling, oilseed pressing, fruit/vegetable cold storage, and logistics operations will be defined during equipment procurement. These will be integrated into a smart energy management system (SEMS) to optimise consumption, reduce losses, and monitor usage in real time.
- **Preventive Maintenance:** All core machinery—including dryers, oil presses, milling systems, cold rooms, and automated packaging units—will follow OEM-based preventive maintenance schedules, ensure peak performance and extend equipment life cycles.
- **Operating Conditions:** Key operational parameters such as processing temperatures, cooling efficiency, vibration tolerance, and load factors will be monitored and benchmarked post-installation to preserve product quality and machinery durability.
- **Noise Management:** Anticipated noise from heavy-duty agro-processing and logistics operations will be assessed and controlled. Mitigation measures (e.g., acoustic enclosures, green buffer zones, and compliance monitoring) will ensure adherence to KEPA and FMEnv noise standards.
- An Environmental and Social Management System (ESMS) will be established and maintained for the AIH at Daki Takwas, Chikun LGA—aligned with the SAPZ Programme’s ESMS framework—to ensure effective identification, assessment, monitoring, and management of all environmental, social, health, and safety (ESHS) risks in compliance with national regulations and AfDB’s Integrated Safeguards System (ISS).

This structured approach will ensure that the AIH functions efficiently, sustainably, and in line with national energy transition priorities, while strengthening Kaduna State’s role in Nigeria’s agro-industrial development.

Raw Material Sourcing



The Agro-Industrial Hub (AIH) at Daki-Takwas will source its raw material inputs—primarily cereals (maize, sorghum, rice), legumes (soybeans, groundnuts), and horticultural produce (tomatoes, ginger, vegetables)—from farming communities within Chikun LGA and the wider procurement and feeder zones of Kaduna State. Additional supply will be drawn from neighbouring LGAs and regional clusters to stabilize volumes during off-peak seasons and ensure uninterrupted operations.

This **local-first sourcing model** is designed to:

- Improve supply chain efficiency and reliability,
- Reduce transportation costs and minimize post-harvest losses,
- Strengthen backward linkages with farmers and cooperatives,
- Build robust aggregation and distribution networks that directly connect producers to processors and off-takers.

Workforce Sourcing and Local Content

The AIH at Daki-Takwas will prioritize inclusive employment across all labour categories, with a strong emphasis on local content:

- Unskilled and semi-skilled labour (e.g., loaders, cleaners, sorters, field assistants, equipment operators) will be recruited from host communities such as Daki-Takwas, Sabon Birnin Kasarami, and neighbouring settlements.
- Skilled and professional staff (e.g., agro-process engineers, quality control specialists, ICT/logistics officers, and food technologists) will be sourced locally where possible. Where expertise is limited, external recruitment will be conducted, coupled with structured knowledge-transfer programmes.

To maximize community benefits:

- A skill-transfer and training programme will be institutionalized within the AIH, targeting youth and women for capacity-building in processing, quality assurance, cold storage handling, and logistics.
- Partnerships with Kaduna State University, agricultural colleges, vocational institutes, and extension services will be established to build a sustainable pipeline of skilled workers and reduce dependency on external expertise over time.



This integrated approach will help the AIH at Daki-Takwas achieve sustained productivity, compliance with environmental and labour standards, and inclusive socio-economic development.

3.6 Project Phases for Kaduna SAPZ Agro-Industrial Hub Development

The project activities to be implemented phase-by-phase for the development of the Agro-Industrial Hub in Kaduna SAPZ include:

3.6.1 Pre-Construction Phase

- Land Acquisition:
Acquisition of land and compensation of project affected persons or communities if required;
- AIH site surveying for mapping, demarcation and beaconing of plots of land according to the final designed project layout plan. It is at this stage that the surveyors will demarcate on ground and establish the actual location of each plot of land according to the layout zoning indicating the proposed final use of each plot for either commercial land use, industrial land use, or construction of roads;
- Stakeholder Engagement: Consultation with local communities, government agencies and other relevant stakeholders;
- Site clearing and preparation: Site grubbing, removal of vegetation, shrubs, and trees within the designated project site;
- Earthworks: Site grading, excavation works, backfilling, and leveling of land to prepare for construction works;
- Demarcation and fencing: Installation of perimeter fencing for security and zoning of the industrial and support services areas;
- Utility route planning works: This involves the design, surveying and mapping to align on ground the Right-of-Way of the routes designated for power lines, water pipes, ICT cables, etc.
- Mobilisation of equipment and materials to site: Transportation of construction machinery and materials to the project site;



- Setting up of temporary facilities on the construction site: Establishment of temporary contractor camps, storage areas, equipment laydown areas, and sanitary facilities.

3.6.2 Construction Phase

- Mobilization of equipment and construction workers to the AIH project site;
- Civil construction works: Construction of buildings, onstruction of roads, side drains, culverts, retaining walls, and site grading;
- Utility infrastruaction construction works: Construction and installation of electricity infrastructure, water supply systems, sewer lines, ICT infrastructure, waste management facility, etc.;
- Construction of core processing facilities: Building of rice mills, tomato processing factory, feed mills, ginger drying and processing factory, soy oil manufacturing factory, etc;
- Construction of support service infrastructure: Construction of storage warehouses, cold chain rooms, silos, and packaging units;
- Construction of Administrative and Training Blocks: Construction of Offices, Staff Quarters, Meeting / Training Halls, Laboratories, and ICT / Data Centers;
- Construction of Social Infrastructure: Construction of Clinics, Recreation Areas, Canteens, Restrooms, and Community Facilities;
- Construction of Fire Fighting Facility, and Safety Systems: Installationof Hydrants, Alarms, Fire Extinguishers, Emergency Exits, Sinages;
- Installation of AIH Machineries: Placement and testing of AI Production Machinery and Processing Lines;
- Landscaping and Development of Green Buffers: Planting of Vegetation to control dust, enhance aesthetics and act as environmental buffers
- Waste Management Systems: Construction of solid waste and liquid waste collection, treatment, and recycling systems
- Environmental impact mitigation measures implementation and compliance monitoring: ESMP implementation of dust control, noise abatement, erosion control, health and



safety mitigation measures enforcement, and ESHS mitigation measures compliance monitoring activities.

3.6.3 Operation and Maintenance Phase

- AIH Facility Commissioning: Testing and validation of processing units, utilities, and safety systems before operation;
- Treruitment and Training of Personnel: Hiring of skilled / unskilled labor, including operators, technicians, administrative staff, and security staffs;
- Agricultural Coordination: Linking with outgrowers and suppliers of tomatoes, maize, soybeans and ginger;
- Agro-Processing Operations: Full-scale operation of value chain processing / facilities and related logistics;
- Maintenance and Repairs Operations: Routine and preventive maintenance of machinery, roads, and utilities;
- Quality Control, Research and Development Operations: Monitoring of AIH product standards, and implementation of continuous improvements
- Monitoring and Reporting: Environmental and Social Management Plan implementaion in the Operation Phase, ESHS Performance Monitoring and Compliance Audits;
- Agro-Industrial Hu Business Operations: Product Packaging, Branding, Marketing, Sales, and Distribution;
- Waste Generation, Storage, Collection, Treatment and Disposal: Daily management of solid, liquid, and hazardous wastes in line with regulations;
- Community Engagement and Consultations: Sustained consultation and grievance redress mechanisms with host communities.

3.6.4 Decommissioning Phase

- AIH Closure Planning: Preparation of a decommissioning and site rehabilitation plan;
- Stakeholder Consultation: Engagement with communities and regulators on closure intent and procedures;
- AIH Equipment Dismantling: Safe removal and recycling / disposal of machinery, piping, tanks and other materials;



- Demolition of Structure: Demolition of non-reusable buildings, followed by debris clearance;
- AIH Site Cleanup: Removal of contaminants, residual waste, and reinstatement of topsoil;
- Waste Disposal; Environmentally compliant disposal of hazardous or non-recyclable waste materials;
- Restoration and Revegetation of the AIH: Replanting and greening of the site for ecological recovery or alternative land use;
- Final Post-Decommissioning Audit: Submission of environmental closure reports and post-decommissioning audit report.

3.6.5 Estimated Labour Requirement by Project Phase

In line with the scale and scope of the Kaduna SAPZ Agro-Industrial Hub (AIH), the estimated labour demand for both skilled and unskilled workers has been projected for each phase of project implementation. Labour requirements are indicative and will be refined during detailed design and contractor mobilization stages.

Table 3.5: Estimated Labour Requirement by Project Phase

Project Phase	Estimated Duration	Skilled Labour (Approx.)	Unskilled Labour (Approx.)	Remarks
Pre-Construction Phase	2–3 months	40–60 (engineers, surveyors, E&S specialists, administrative staff)	80–100 (clearing crew, site helpers, security)	Labour intensity moderate; primarily site preparation, survey, and stakeholder engagement.
Construction Phase	18–24 months	150–200 (civil, electrical & mechanical engineers, technicians, supervisors, safety officers)	300–400 (construction labourers, equipment operators, drivers, artisans, cleaners)	Peak labour demand phase; bulk of infrastructure and facility construction occurs.



Operation & Maintenance Phase	Continuous	100–150 (managers, operators, technicians, quality control staff, admin, security)	150–200 (factory hands, cleaners, drivers, maintenance crew)	Labour demand stabilizes; focus on production, logistics, and maintenance.
Decommissioning Phase	3–6 months (if applicable)	30–40 (engineers, safety/environmental officers, demolition specialists)	70–100 (demolition crew, waste handlers, cleaners)	Temporary employment; labour needs decline after decommissioning.

3.7 Health, Safety, and Environmental Management

3.7.1 Health and Safety Management

The AIH at Daki-Takwas places top priority on the health, safety, and welfare of its workforce, surrounding communities, and all stakeholders interacting with the hub. A dedicated **Health, Safety, and Environmental (HSE) framework** will guide both the construction and operational phases, aligning with:

- The **Nigerian National Policy on Occupational Safety and Health (2006)**
- The **Factories Act (1987)**
- The **African Development Bank’s Operational Safeguard 5 (Labour Conditions, Health, and Safety)**

Key components of the AIH HSE framework include:

- **Occupational Health and Safety (OHS) Policy:** A customised OHS policy will address sector-specific risks such as maize dust inhalation, chemical exposure during soybean processing, dairy spoilage-related pathogens, and risks associated with heavy-duty machinery.
- **Safety Training:** Regular training sessions for all categories of personnel—including technical staff, machine operators, drivers, cleaners, and supervisors—on hazard identification, emergency procedures, fire safety, and hygiene standards required in food-grade processing facilities.



- **Personal Protective Equipment (PPE):** Strict enforcement of PPE use, including gloves, helmets, masks, protective footwear, aprons, and hairnets. Dairy handlers will be trained on cold-room safety, while soybean workers will receive guidance on chemical handling.
- **Emergency Response Planning:** A documented emergency preparedness and response plan will cover fire outbreaks, chemical leaks, electrical hazards, mechanical breakdowns, and medical emergencies. Fire drills and evacuation simulations will be conducted quarterly.
- **Incident Reporting and Investigation:** A centralised reporting system will be maintained to track all safety-related incidents. Root cause analyses will guide corrective actions and ensure continuous improvement in workplace safety.
- **Fire Safety Systems:** Comprehensive fire prevention infrastructure will include hydrants, extinguishers, smoke detectors, and sprinkler systems. Fire water storage tanks and a hydrant ring main will be installed. Collaboration with the Kaduna State Fire Service will enhance rapid response capability.
- **Safety Signage and Protocols:** Multilingual safety signs and hazard protocols will be displayed across all high-risk areas, including boiler rooms, cold storage units, solvent extraction zones, and heavy equipment workshops.

3.7.2 Environmental Management – AIH Daki-Takwas

The Agro-Industrial Hub (AIH) at Daki-Takwas will adopt a proactive Environmental Management Framework aimed at safeguarding the natural environment, minimising ecological disturbance, and ensuring long-term sustainability throughout the hub's lifecycle. Given the hub's agro-industrial focus on maize, soybean, and dairy value chains, tailored safeguards will be integrated into design, construction, and operations.

An overarching Environmental Policy will be developed to prioritise pollution prevention, climate resilience, circular economy principles, and full compliance with FMEnv, KEPA, and AfDB's environmental safeguards.

- **Air and Noise Quality Management:** Emission and noise mitigation measures will be applied across the hub's operations. Dust collectors and air filtration systems will be installed in maize milling units; solvent recovery systems will control volatile emissions from



soybean oil extraction; and noise buffers and low-noise machinery will be used across dairy and logistics facilities.

- **Soil Management:** To prevent contamination and erosion, all storage facilities for fuels, lubricants, and chemicals will be paved, bunded, and regularly inspected. Erosion control structures, native vegetation buffers, and soil conservation measures will be applied, particularly around dairy wastewater lagoons and soybean storage areas. Routine soil testing will form part of the environmental monitoring framework.
- **Water Management:** Given the intensive water needs of dairy cooling, maize soaking, and soybean cleaning, smart water metering will track consumption. Rainwater harvesting systems will supplement supply, while wastewater (e.g., dairy effluents, wash water, and cooling discharges) will undergo treatment in an effluent treatment plant (ETP) before reuse for non-potable purposes (e.g., irrigation, cleaning). This will minimise freshwater abstraction and protect local aquifers.
- **Waste Management:** A structured **Waste Management Plan** will apply the “5Rs” (Refuse, Reduce, Reuse, Recycle, Recover). Organic waste (maize husks, soybean cake residues, dairy sludge) will be repurposed as animal feed or compost. Plastics, metals, and packaging waste will be sorted and channelled to recycling streams in collaboration with licensed handlers. Hazardous waste (spent oils, solvents, expired chemicals) will be safely stored and disposed of by KEPA accredited contractors.
- **Biodiversity Protection:** The hub will establish green belts, shelterbelts, and biodiversity buffer zones around its perimeter to reduce dust, absorb noise, and provide habitat for pollinators and beneficial species critical to surrounding farmland. Where possible, native tree planting will offset carbon emissions and enhance local ecosystems.
- **Environmental Monitoring:** Continuous monitoring will focus on air emissions, wastewater quality, soil integrity, energy consumption, and biodiversity indicators. Monitoring results will be documented and shared with regulators and stakeholders to ensure transparency.
- **Sustainable Practices:** The hub will integrate **renewable energy solutions** (e.g., rooftop solar PV, biogas recovery from dairy waste), energy-efficient machinery, water-efficient



fixtures, and circular economy practices to strengthen its contribution to climate-smart agriculture and low-carbon industrialisation.

This integrated approach will ensure that the AIH at Daki-Takwas achieves operational efficiency while protecting ecosystems, conserving resources, and supporting environmental sustainability.

3.7.3 Implementation and Compliance – AIH Daki-Takwas

To ensure effective implementation of health, safety, and environmental (HSE) measures at the AIH in Daki-Takwas, a structured compliance framework will be established. This will be tailored to the hub's large-scale maize, soybean, and dairy processing operations.

- **Designated HSE Unit:** A dedicated HSE Unit will be established within the AIH, staffed with trained professionals responsible for monitoring occupational safety, environmental protection, and community health safeguards. This team will enforce HSE standards, conduct inspections, and promote a culture of safety and sustainability.
- **Compliance with Regulations:** The hub will strictly comply with all applicable environmental and occupational health regulations, including FMEnv, KEPA, and national labour and safety laws. In addition, operations will align with AfDB's Integrated Safeguards System (ISS), particularly OS1 (Environmental and Social Assessment), OS3 (Biodiversity and Ecosystem Services), and OS5 (Labour Conditions, Health, and Safety). Regular internal audits and external compliance reviews will be conducted.
- **Stakeholder Engagement:** Continuous stakeholder consultation will be prioritised, ensuring that host communities, local farmers, cooperatives, women's associations, and local government representatives are engaged throughout the project lifecycle. Grievance redress mechanisms will be implemented to ensure timely response to community concerns. Partnerships will also be developed with local youth and women's groups for environmental sanitation and awareness campaigns.
- **Continuous Improvement:** A system of adaptive management will be embedded in operations. Lessons learned from daily HSE practices, new technological advancements (e.g., low-emission boilers, advanced effluent treatment), and evolving regulatory requirements will guide periodic updates to the hub's environmental and safety management systems.



3.8 Waste Management

The Agro-Industrial Hub (AIH) at Daki-Takwas is committed to maintaining environmental integrity through a robust Waste Management Plan (WMP). The AIH will generate multiple categories of waste across its maize milling, soybean processing, and dairy operations, including:

- **Organic residues:** maize husks, soybean cake, dairy sludge, and other by-products;
- **Packaging waste:** plastics, jute sacks, cardboard, and crates;
- **Liquid effluents:** process water containing solids and nutrients;
- **Hazardous or electronic waste:** oils, lubricants, electrical components, and laboratory equipment.

Waste management at AIH Daki-Takwas will comply with national and state regulations, including:

- National Environmental (Sanitation and Waste Control) Regulations, 2009
- National Environmental (Hazardous and Solid Waste Management) Regulations, 1991
- National Policy on Waste Battery Management, 2022
- Kaduna State Environmental Protection Authority (KEPA) Guidelines
- Federal Ministry of Environment Waste Management Framework

The AIH will apply the internationally recognised **5Rs hierarchy**—Refuse, Reduce, Reuse, Recycle, and Recover—prioritising waste prevention and minimisation across all processing lines. Licensed and certified contractors (NESREA and KEPA) will manage regulated and hazardous waste streams, including non-biodegradable materials and high-volume organic residues.

3.8.1 Waste Management Approach

A structured and traceable waste management system will be implemented, consisting of:

1. **Segregation:** Waste sorted at the point of generation into organic, recyclable, packaging, and hazardous streams.
2. **Inventorying:** Documentation of waste types, sources, and volumes at each processing stage.
3. **Classification:** Categorisation of waste into biodegradable, non-biodegradable, recyclable, and hazardous for proper treatment.
4. **Quantification:** Accurate measurement of waste volumes and weights, critical for high-output streams like maize husks, soybean cake, and dairy effluent.



5. **Tracking:** Monitoring of waste from generation through storage, treatment, transport, and final disposal to ensure compliance.
6. **Disposal and Recovery:** Organic waste will be converted to compost, animal feed, or bioenergy; recyclables sent to accredited centres; and non-recoverable waste disposed of in certified landfills or treatment facilities.

This systematic approach will support a **circular economy** and sustainable agro-industrial processing in Kaduna State.

3.8.2 Waste Streams – AIH Daki-Takwas

The hub is expected to generate **solid, liquid, gaseous, and electronic waste streams**, all managed to ensure environmental compliance:

Solid Waste Streams:

- Agricultural residues: maize husks, cobs, soybean cake, dairy manure, and sludge.
- Packaging: plastics, jute, cartons, and crates.
- Construction and maintenance debris: wood, scrap metal, and concrete.

Liquid Waste Streams:

- Process water from maize soaking, soybean washing, and dairy cleaning, containing organic solids.
- Used oils, lubricants, and cleaning chemicals.
- Sanitary wastewater from staff facilities.

All liquid waste will be **treated on-site** or handled by licensed contractors per **KEPA regulations**.

Gaseous Emissions:

- Diesel generator and vehicle exhausts.
- Fugitive dust from maize and soybean processing.
- Biogenic gases (e.g., methane, ammonia) from decomposing organic residues.
- Air quality measures, including enclosed storage and regular monitoring, will be implemented.

3.8.2.1 Electronic Waste (E-Waste)

E-waste generated at AIH Daki-Takwas includes:

- Backup batteries (lithium or lead-acid) for generators and solar systems.



- Solar panels for renewable energy (lifespan up to 25 years).
- Damaged control boards, wiring, and switchgear from processing and utility systems.
- Office electronics such as printers, LEDs, and air conditioners.

Management measures:

- Original Equipment Manufacturer (**OEM**) **buy-back agreements** for batteries, solar panels, and sensitive equipment.
- **Licensed disposal** of non-OEM e-waste through KEPA/NESREA-certified handlers.

This cradle-to-cradle approach ensures environmentally sound handling of all e-waste generated by maize, soybean, and dairy operations.

Table 3.6: Proposed Waste Streams and Sources

Project Phase	Waste Source	Potential Waste	State	Type	Disposal / Management Method	Est. Qty (Tonnes/Day)
Pre-Construction	Land clearing	Vegetation (grasses, maize stalks, shrubs, branches, soybean residues)	Solid	Non-hazardous	Composting / Sale as biomass / Mulching	5.0 – 8.0
	Site grading	Topsoil from earthworks	Solid	Non-hazardous	Reuse for landscaping, bunding, site rehabilitation	15.0 – 25.0 <i>(temporary)</i>



Construction	Site works & infrastructure	Scrap metals, timber offcuts, concrete debris, sandbags, bricks	Solid	Non-hazardous	Reuse / Recycle / State-accredited vendors	2.0 – 3.5
	Construction packaging	Cardboard, plastic wraps, nylon bags	Solid	Non-hazardous	Sorting and collection by KEPA-certified vendors	0.5 – 0.8
	Construction crews	Food waste, drink containers, sanitary waste	Solid	Non-hazardous	Municipal waste services (KEPA)	0.3 – 0.6
Operational	Agro-processing (maize, soybean, dairy)	Husks, cobs, bran, soybean cake, dairy sludge, spoiled produce	Solid	Non-hazardous	Composting / Biogas / Animal feed	12.0 – 18.0
	Processing activities	Process water (washing, boiling, pasteurization)	Liquid	Non-hazardous	Onsite treatment & reuse (irrigation, cooling)	250 – 400 m³/day (<i>≈0.25–0.40 kt</i>)



	Packaging operations	Plastic films, jute sacks, cartons, crates	Solid	Non-hazardous	Segregation & recycling via KEPA/NESREA vendors	1.0 – 1.8
	Office operations	Paper, printer cartridges, stationery waste	Solid	Non-hazardous	Reuse / Recycling	0.05 – 0.1
	Onsite personnel	Food remnants, sanitary waste, plastic containers	Solid	Non-hazardous	KEPA-accredited waste collectors	0.8 – 1.2
	Maintenance activities	Spent oil, lubricants, grease, oil filters	Liquid / Solid	Hazardous	Bunded storage & NESREA-licensed disposal	0.02 – 0.05
	E-waste	Solar panels, batteries, AC units, LED bulbs, control boards	Solid	Hazardous	OEM buy-back / licensed recyclers	0.01 – 0.03
	Livestock / demo plots	Animal droppings (manure)	Solid	Non-hazardous	Composting / Biogas digestion	2.5 – 4.0



	Crop handling & storage	Straw, maize stalks, soybean stalks, fodder residues	Solid	Non-hazardous	Mulching / Composting	6.0 – 10.0
Wastewater	WWTP operations	Sludge from sedimentation tanks & filters	Liquid / Solid	Non-hazardous	Dewatering & composting (KEPA-compliant)	0.4 – 0.7
Decommissioning	Infrastructure dismantling	Concrete rubble, bricks, roofing sheets, steel	Solid	Non-hazardous	Reuse / Sale to accredited vendors	8.0 – 12.0 <i>(temporary)</i>
	Retired machinery	Scrap metals, wiring, motors	Solid	Non-hazardous	Recovery & recycling	1.5 – 3.0 <i>(temporary)</i>

Notes:

- Waste quantities peak during construction and decommissioning and stabilize during operation.
- Organic waste constitutes over 65% of operational solid waste, justifying biogas and composting facilities.
- Hazardous waste is <1% of total waste, manageable through NESREA-compliant systems.
- Wastewater estimates are provided in m³/day, consistent with industrial ESIA standards.
- All hazardous waste will be managed in strict compliance with NESREA, FMEnv, and KEPA guidelines.
- Circular economy approaches reuse, recycling, composting, and biogas conversion will be prioritised across all value chains.

3.9 Project Schedule

The Agro-Industrial Hub (AIH) at Daki-Takwas, under the Kaduna State SAPZ initiative, is planned for implementation over a five-year period using a phased approach. The AIH will support priority



value chains maize, soybean, and dairy/fodder crops and early operationalization is prioritized to accelerate industrial integration, local employment, and value addition across the SAPZ.

Table 3.7: Proposed Implementation Schedule for AIH Daki-Takwas SAPZ Project

Project Phase	1–6 Months	7–24 Months	25–54 Months	55–60 Months
Phase 1: Pre-Development	Conduct feasibility studies and market assessments	Secure regulatory approvals (FMEnv, KEPA)	Mobilize project partnerships and financing	—
Phase 2: Planning & Design	—	Finalize AIH master plan and facility layout	Design shared infrastructure for processing, logistics, and storage; prioritize maize, soybean, and dairy/fodder value chains in design	—
Phase 3: Construction & Infrastructure	—	—	Construct AIH buildings and utility infrastructure; install processing and storage equipment for priority crops	Complete phased construction; onboard agro-processors, SMEs, and investors
Phase 4: Operations & Integration	—	—	—	Facilitate full AIH operations; monitor value chain efficiency; integrate AIH into SAPZ ecosystem; plan for future expansion or upgrades

Notes on AIH Daki-Takwas Schedule:

- **1–6 Months:** Establish a strong institutional and technical foundation for AIH development.
- **7–24 Months:** Complete design and planning for infrastructure and priority value chains.
- **25–54 Months:** Execute phased construction of buildings, processing units, utilities, and logistics systems; enable private sector engagement.



- **55–60 Months:** Operationalize AIH, integrate activities into the wider SAPZ value chains, and implement monitoring and adaptive management for scaling and performance optimization.



CHAPTER FOUR: DESCRIPTION OF CURRENT PROJECT ENVIRONMENT

4.1 Study Approach

Baseline environmental and social studies for the SAPZ Agro-Industrial Hub (AIH) at Daki-Takwas, Chikun LGA, Kaduna State were conducted in line with the Terms of Reference (ToR) approved by the Federal Ministry of Environment (FMEnv). The study approach integrated field investigations with secondary data reviews to comprehensively characterise the existing conditions of the project area. Field investigations included in-situ measurements and direct observations to assess:

- **Climate and Meteorological Conditions:** Temperature, rainfall patterns, relative humidity, and wind dynamics were evaluated using historical data from the Nigerian Meteorological Agency (NiMet) and real-time readings collected during the July 2024 field survey.
- **Ambient Air Quality:** Monitored for particulate matter (PM_{2.5}, PM₁₀), carbon monoxide (CO), sulfur dioxide (SO₂), and nitrogen dioxide (NO₂) at strategic locations around Daki-Takwas.
- **Noise Levels:** Measured at multiple receptors to establish baseline ambient noise conditions for construction and operational planning.
- **Land Use and Land Cover:** Determined through satellite imagery analysis, GIS mapping, and field validation to identify agricultural lands, built-up areas, natural vegetation, and ecological features.
- **Landscape Features:** Assessed topography, elevation, and natural drainage patterns influencing project layout, access roads, and infrastructure siting.
- **Geology and Soil:** Evaluated soil types, lithology, and subsurface stability to support foundation design, stormwater management, and agricultural plots.
- **Groundwater:** Borehole depth and quality were measured to assess suitability for irrigation, processing, and potable use within the AIH.
- **Surface Water:** Nearby streams, ponds, and drainage channels were sampled to assess flow regimes, seasonal variability, and water quality.
- **Sediment Quality:** Collected from surface water bodies to identify potential contamination and nutrient levels.



- **Hydrobiological Studies:** Included plankton, benthic organisms, and aquatic life surveys to understand the health of local water ecosystems.
- **Water Microbiology:** Assessed faecal and total coliforms, E. coli, and other indicators to determine biological contamination risks.
- **Vegetation:** Floristic surveys catalogued native plant species, assessed biodiversity status, and identified sensitive or protected flora.
- **Socioeconomic Characteristics:** Collected through household surveys, stakeholder consultations, and key informant interviews to establish livelihoods, land use practices, and community priorities.
- **Health Assessment:** Baseline health indicators, including access to healthcare, waterborne disease prevalence, and nutrition status, were documented to inform mitigation and community development planning.

These multidimensional assessments provide a holistic view of the existing environment in the AIH project area and underpin the Environmental and Social Impact Assessment (ESIA) for the successful implementation of the SAPZ AIH. The environmental and social information compiled in this chapter establishes the foundational baseline conditions for the SAPZ AIH at Daki-Takwas. It serves as a reference point for:

- Assessing potential environmental and social impacts associated with the AIH project.
- Designing mitigation measures and monitoring frameworks tailored to local conditions.
- Ensuring the AIH's sustainability, social acceptability, and long-term operational success within the Kaduna SAPZ initiative.

By providing a detailed understanding of the existing environment, this chapter underpins responsible planning, supports regulatory compliance, and informs decision-making throughout the project lifecycle.



Table 4.1 Summary of Data Used for the ESIA – SAPZ AIH Daki-Takwas

Parameter	Source	Date
In-situ meteorological data, air quality, noise levels, surface water, groundwater, soil, land use, sediment, vegetation, and aquatic assessments	SAPZ AIH Daki-Takwas ESIA Field Data (Primary data collection conducted in host communities)	July 2024
Wildlife, socioeconomics, and community health baseline studies (covering livelihoods, infrastructure, and health indicators)	Primary surveys, focus group discussions, key informant interviews, and structured questionnaires in Daki-Takwas and neighbouring settlements	July 2024
Meteorological parameters including temperature, rainfall, relative humidity, and wind characteristics	Nigerian Meteorological Agency (NiMet) – Long-term historical climate data	1991–2020
Baseline groundwater, surface water, and soil quality data for comparable agro-industrial hubs in Kaduna State	Secondary data from previous Environmental Impact Assessment (EIA) reports approved by FMEnv and KEPA	2020 Dry Season (varied)
Land use, vegetation cover, and topography data, supplemented by satellite imagery and GIS spatial analysis	Kaduna State Ministry of Agriculture and Kaduna Geographic Information Service (KADGIS)	2023–2024

Notes:

- Primary data collection focused on host communities and immediate surroundings of Daki-Takwas AIH to capture relevant baseline environmental and social conditions.
- Secondary data were used to supplement gaps and provide comparative insights from similar agro-industrial developments within Kaduna State.
- The table establishes the baseline reference framework for the Environmental and Social Impact Assessment (ESIA) and informs the identification of potential impacts and mitigation strategies for the AIH project.

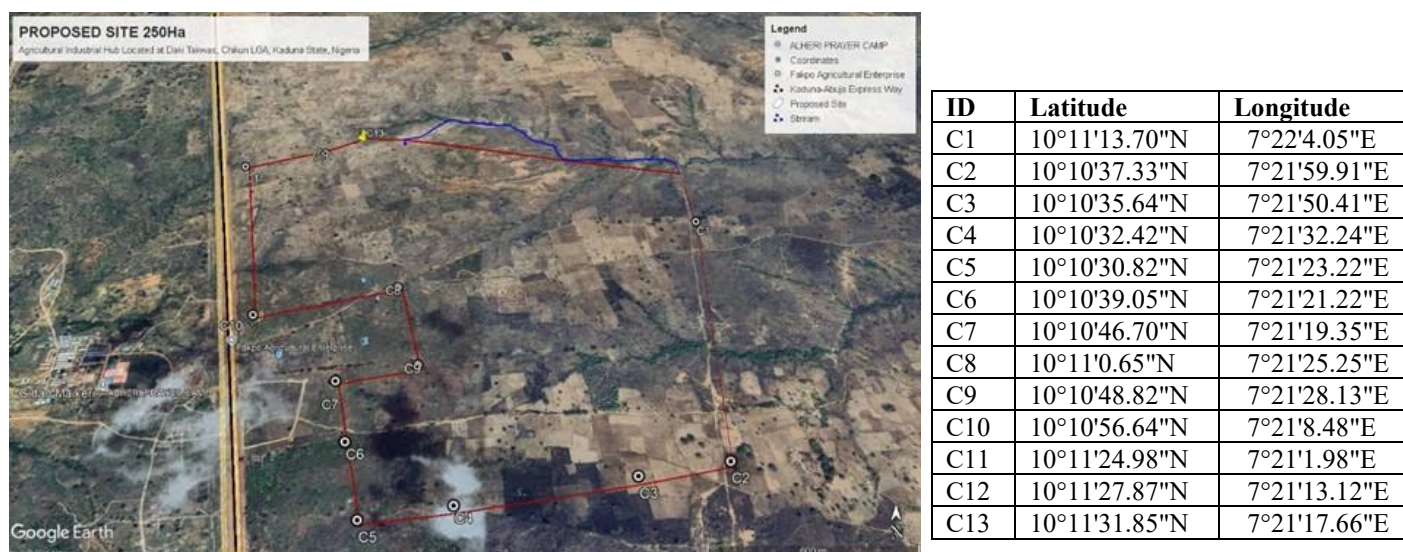


Figure 4.1: Satellite Imagery of AIH Daki-Takwas, Chikun LGA, Kaduna, Nigeria

4.1.1 Scoping Workshop

A Scoping Workshop and Site Verification exercise for the AIH SAPZ project at Daki – Takwas, Chikun LGA, Kaduna State, was conducted on 15 August 2025. The exercise brought together key stakeholders to validate the project concept, assess the site, and identify environmental and social issues requiring further consideration during the ESIA process. The workshop was attended by representatives of the Federal Ministry of Environment (FMEnv), the Kaduna State Environmental Protection Agency (KEPA), the Environmental Officer SAPZ and Kaduna State Ministry of Environment and Natural Resources which serves as the Program Coordinating Unit (PCU) for the SAPZ project on behalf of the Kaduna State Government.

Also, in attendance were community leaders, traditional rulers, women’s groups, youth representatives, and farmers’ associations from the host communities of Daki – Takwas and surrounding settlements, who will be directly affected by the project. Their inputs provided critical insights into local concerns, including land use, livelihood impacts, cultural sensitivities, and security considerations.

The Scoping Workshop and Site Verification activities were supervised by officers of the FMEnv, with technical participation from the Kaduna State Environmental Protection Authority (KEPA).



These engagements ensured compliance with national environmental assessment requirements and aligned with AfDB's Operational Safeguards on early stakeholder participation, transparency, and inclusivity.



Plate 4.1: Photos from scoping activities

4.1.2 Baseline Data Acquisition Method

Baseline data for the AIH Daki-Takwas were collected using a multi-method approach combining literature review, reconnaissance visits, and extensive field surveys. A multidisciplinary methodology was applied to characterize both the biophysical and socioeconomic aspects of the project area.

Primary Data Collection: Involved rigorous fieldwork, including in-situ measurements, observations, and sampling of environmental media at designated points. Assessed parameters included groundwater, hydrobiology, soil quality, air and noise levels, meteorology, and surface water quality, following standardized protocols to ensure reliability and accuracy. Primary data were collected through field surveys conducted during the rainy season of June–July 2024, complemented by a review of relevant environmental reports and studies from comparable agro-industrial developments within Kaduna State.

This included prior Environmental Impact Assessment (EIA) reports approved by the Federal Ministry of Environment (FMEnv) and the Kaduna State Environmental Protection Authority (KEPA). In line with FMEnv guidelines, one-season sampling was undertaken to evaluate key biophysical parameters, including:

- Soil quality and suitability for industrial and agricultural activities.



- Groundwater and surface water availability and quality.
- Air and noise quality in the vicinity of the AIH site.
- Existing vegetation cover and biodiversity, including fauna presence.

Additionally, climate trends were assessed using over 30 years of meteorological data from the Nigerian Meteorological Agency (NiMet), supplemented by real-time weather observations during the survey period.

Socioeconomic Data Collection: A parallel socioeconomic assessment was conducted in host and neighboring communities surrounding Daki-Takwas, drawing from data provided by the National Bureau of Statistics (NBS), National Population Commission (NPC), and Kaduna State Bureau of Statistics. This assessment examined:

- Population demographics and settlement patterns.
- Livelihoods and primary economic activities.
- Availability and access to infrastructure, education, and health services.
- Land use patterns and tenure systems.
- Social cohesion, local institutions, and community governance structures.
- Participatory engagement methods—including focus group discussions, key informant interviews, and structured questionnaires—were central to the assessment, ensuring that local perspectives, priorities, and concerns were integrated into the project baseline. Furthermore, the socioeconomic data collection involved household surveys, and consultations with local residents, traditional leaders, farmers, traders, and vulnerable groups.
- **Seasonal Coverage:** Fieldwork was carried out during June and July 2024 to capture the peak rainy season, supplemented with dry season reference data to ensure seasonal representation. Socioeconomic data collection continued throughout the ESIA process to maintain comprehensive coverage.



4.1.3 Sampling Design

The Kaduna SAPZ (ATC/AIH) field campaign of 14 July 2025 followed FMEnv/NESREA protocols, with all measurements benchmarked against FMEnv Air Quality Control, Soil and Water Pollution Control Guidelines, and WHO environmental standards. Equipment calibration, field duplicates, and control sampling ensured data reliability, establishing a sound baseline for ESIA compliance and environmental management. Field sampling for the description of the baseline condition of the SAPZ AIH project site was carried out in compliance with the Environmental Impact Assessment (EIA) Act CAP E12 LFN 2004 and the FMEnv EIA Procedural Guidelines 2017. Both grid and transect sampling methods were employed for the soil and air quality baseline sampling and investigation while point sampling 2 was used for surface water sampling.

Table 4.2 Data Collection Summary for AIH SAPZ Daki-Takwas, Kaduna State

S/N	Environmental Components	Sample Number / Station	Parameters / Requirements
1	Surface Water	6 1 control (W6)	Physicochemical analysis, heavy metals, microbiological assessment Sampling was designed to represent upstream, midstream, and downstream flow
2	Air Quality	15 1 control (outside influence area)	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂ , CH ₄ , CO ₂ , H ₂ S, CO, VOCs, O ₃ monitoring Sampling stations was spread within SAPZ AIH footprint and surrounding receptor zones
3	Noise Measurements	15	Instantaneous ambient noise levels at key receptor points
4	Meteorology	8	Rainfall, air temperature, relative humidity, wind' speed and direction
5	Soil Sampling	15 2 control samples	Physicochemical parameters, heavy metals, microbiological assessment Sampling was designed to spread within the project site
6	Vegetation and Terrestrial Wildlife	40	Biodiversity assessment: species inventory, presence of endangered or protected species



S/N	Environmental Components	Sample Number / Station	Parameters / Requirements
7	Socioeconomic Survey	3 Host Communities	Household surveys, key informant interviews, focus group discussions (FGDs), vulnerability mapping

Note: Communities within and surrounding the **Daki-Takwas AIH project area in Chikun LGA** were engaged as part of the baseline socioeconomic assessment. Data collection was conducted in **June–July 2024**, covering both **biophysical and social baseline conditions** to support the Environmental and Social Impact Assessment (ESIA) and project planning.

Environmental sampling was carried out in compliance with the Environmental Impact Assessment (EIA) Act CAP E12 LFN 2004 and the FMEnv EIA Procedural Guidelines 2017. Both 87 | Final AN SAPZ ESIA Report ESIA Report for the Anambra Special Agro-industrial Processing Zone (SAPZ II) 88 | Final AN SAPZ ESIA Report grid and transect sampling methods were employed for the environmental parameters under investigation. Detailed sampling coordinates are presented in Table 4.3, while Figures 4.2 – 4.4 show maps of their corresponding locations. Tables 4.4, 4.5 and 4.6: shows details on: the sampling heights and depths; sampling duration and frequency; and reference regulatory limits used for air quality/noise, soil quality, and surface water quality monitoring

Table 4.3: Sampling Coordinates

Sample ID	Sample Type	Latitude (°N)	Longitude (°E)
AQ&SO-01	Air & Soil	10.1788	7.3643
AQ&SO-02	Air & Soil	10.1997	7.3552
AQ&SO-03	Air & Soil	10.1913	7.3587
AQ&SO-04	Air & Soil	10.1891	7.3668
AQ&SO-05	Air & Soil	10.1879	7.3567
AQ&SO-06	Air & Soil	10.1719	7.3630
AQ&SO-07	Air & Soil	10.1797	7.3534
AQ&SO-08	Air & Soil	10.1931	7.3500
AQ&SO-09	Air & Soil	10.1872	7.3526
AQ&S-O10	Air & Soil	10.1827	7.3661
AQ&SO-11	Air & Soil	10.1869	7.3618



Sample ID	Sample Type	Latitude (°N)	Longitude (°E)
AQ&SO-12	Air & Soil	10.1902	7.3519
AQ&SO-13	Air & Soil	10.1846	7.3536
AQ&SO-14	Air & Soil	10.1812	7.3603
AQ&SO-15	Air & Soil	10.1777	7.3587
WQ-01	Water	10.1920	7.3549
WQ-02	Water	10.1930	7.3596
WQ-03	Water	10.1904	7.3634
WQ-04	Water	10.1905	7.3706
WQ-05	Water	10.1915	7.3766
WQ-06	Water	10.1886	7.3809

Table 4.4: Sampling Heights and Depths

Medium	Sampling Height / Depth	Notes
Ambient Air / Noise	1.5–1.8 m (air); 1.2–1.5 m (noise)	Human breathing zone and receptor height
Soil	0–15 cm	Topsoil collected using augers and clean polythene containers
Surface Water	≈0.3 m depth	Grab samples from midstream flow using sterilised containers



Table 4.5: Sampling Duration and Frequency

Medium	Duration / Frequency	Remarks
Air Quality & Noise	30 minutes per parameter per point	Gas, particulate, and noise parameters logged concurrently
Soil and Water	Single baseline campaign	Grab and composite sampling; APHA/ASTM protocols

Quality Assurance / Quality Control (QA/QC)

- ☐ All instruments calibrated prior to deployment with valid certificates.
- ☐ Duplicate and control readings; daily zero/span checks on gas meters
- ☐ Samples handled under clean and preserved conditions (cooling for water, sealed bags for soil).
- ☐ Laboratory analyses followed APHA, ASTM, and FMEnv-approved protocols with blanks and standards.

Table 4.6: Reference Regulatory Limits Used

Parameter	Regulatory Source	Key Limits Applied
Air / Noise	FMEnv (2011) / NESREA (2014)	PM _{2.5} : 25 µg/m ³ ; PM ₁₀ : 50 µg/m ³ ; TSP: 250 µg/m ³ ; CO: 10 mg/m ³ ; SO ₂ : 0.5 ppm; NO ₂ : 0.085 ppm; H ₂ S: 0.008 ppm; Noise: 90 dB(A)
Soil	FMEnv (1991)	pH 6.0–8.5; Pb ≤ 0.5 mg/kg; Cd ≤ 0.01 mg/kg; Cr ≤ 0.1 mg/kg; Zn ≤ 50 mg/kg; Fe ≤ 20 mg/kg
Surface Water	FMEnv (1991) / WHO (2006)	pH 6.5–8.5; TSS ≤ 30 mg/L; Turbidity ≤ 5 NTU; Nitrate ≤ 10 mg/L; Sulphate ≤ 100 mg/L; COD ≤ 40 mg/L; BOD ₅ < 6 mg/L; Pb ≤ 0.01 mg/L; Cd ≤ 0.003 mg/L

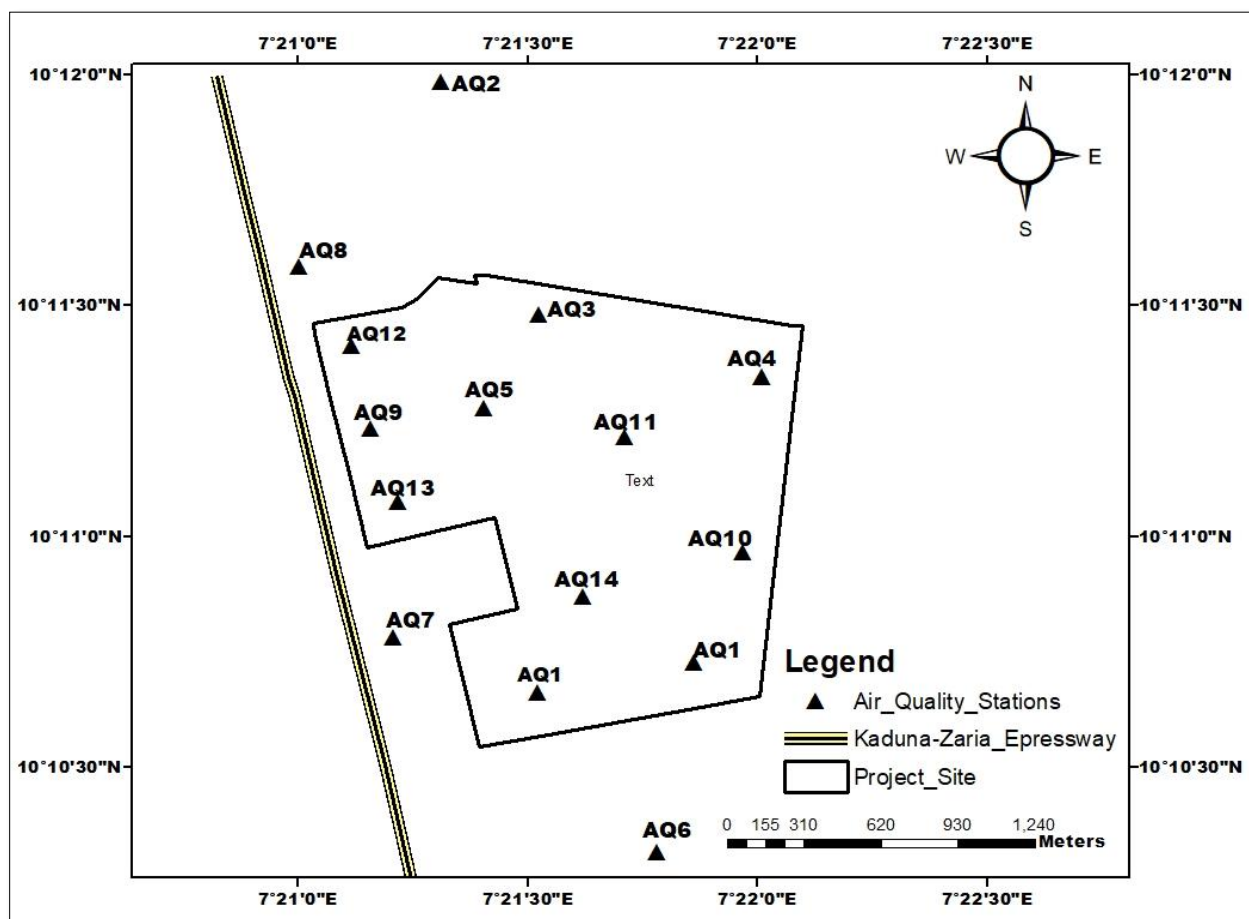


Figure 4.2: Map showing Air Quality Monitoring Locations within SAPZ AIH project site

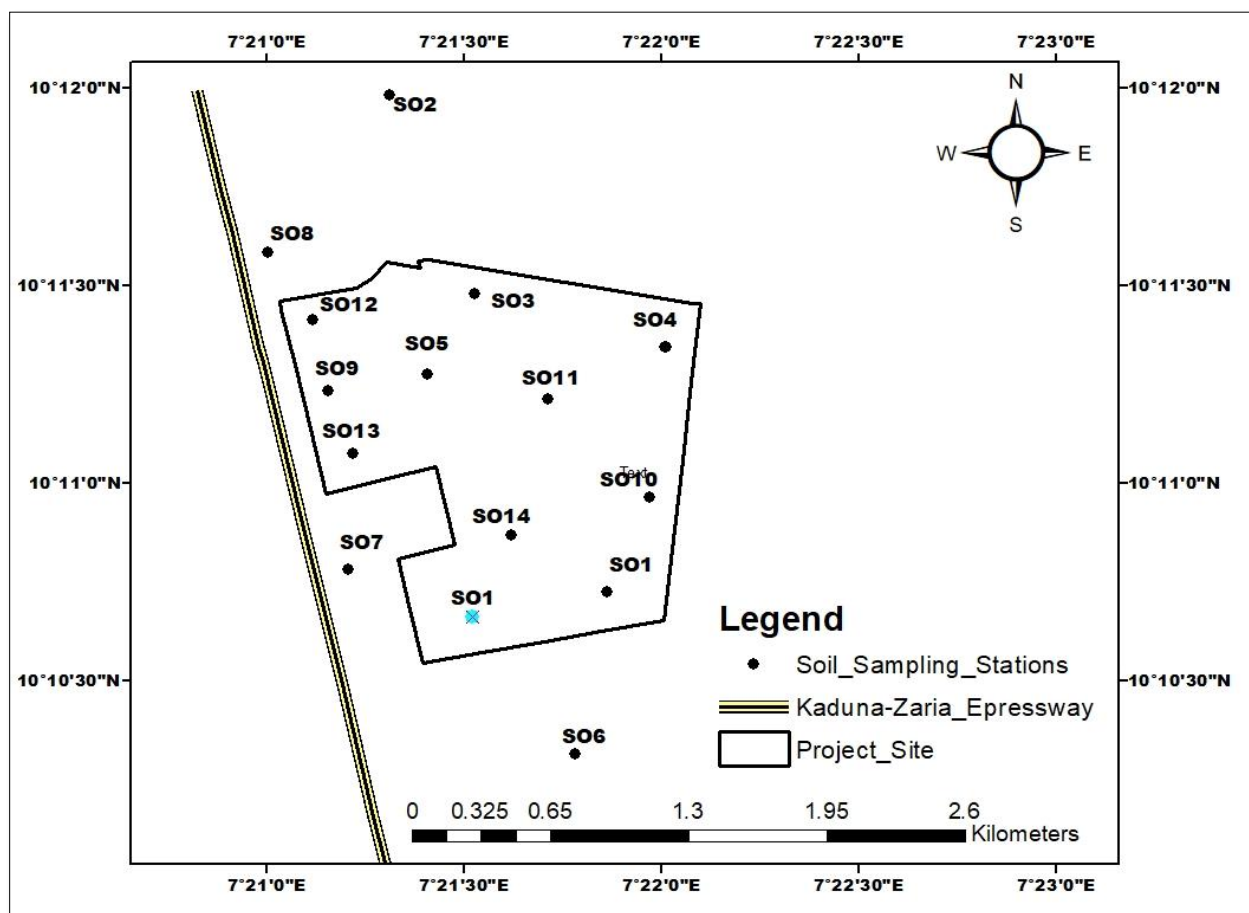


Figure 4.3: Map showing Soil Sampling Locations within SAPZ AIH project site

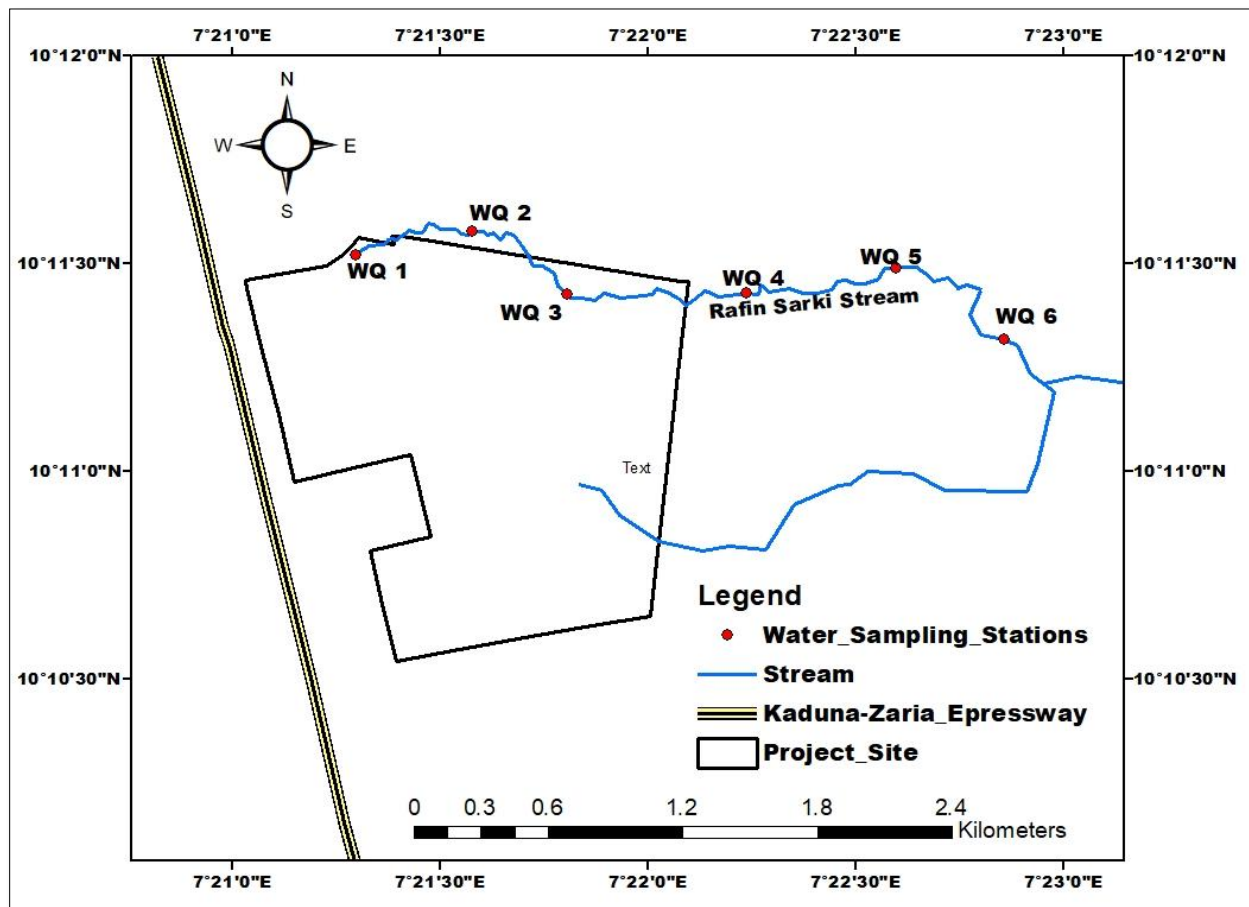


Figure 4.4: Map showing Surface Water Sampling Locations within SAPZ AIH project site

To ensure data quality and integrity, rigorous QA/QC protocols were implemented, covering sample collection, handling, laboratory analysis, and reporting. All field procedures swas performed be in accordance with general QA/QC requirements, specifically:

- The contamination of samples was avoided by use of “clean” field sampling techniques
- In-situ measurements of parameters with very short or no-holding analytical time were transported out of the field on a daily basis
- Separate samples were collected for parameters requiring different treatment / preservation before analysis
- A minimum of one selected field duplicate (sediment and water) were collected to assess field variability



- Field blanks and equipment blanks were collected, as appropriate, for sediment and water
- Samples were adequately preserved and labeled.

Chain of custody procedures were maintained. All laboratory analyses were conducted at the FMEnv-accredited KEPA Laboratory, Kaduna adhering to federal and international standards. The confirmation of the type and number of analyses is included as Appendix 2. Secondary data involves identifying and analyzing relevant literature to establish the project baseline characteristics. This was done through desktop studies.

4.1.4 Biophysical Field Sampling Procedures

4.1.4.1 Desktop Studies

A thorough desktop review was conducted to compile and analyze existing environmental, social, and health information relevant to the proposed AIH SAPZ project site in Daki-Takwas, Chikun LGA, Kaduna State. Sources included datasets and publications from the Federal Ministry of Environment (FMEnv), National Environmental Standards and Regulations Enforcement Agency (NESREA), Kaduna State Environmental Protection Authority (KEPA), National Bureau of Statistics (NBS), National Population Commission (NPC), and other regulatory institutions. In addition, peer-reviewed scientific literature and environmental assessments from agro-industrial projects within Kaduna State and the Northern Nigeria ecological zone were reviewed. Long-term climate data from the Nigerian Meteorological Agency (NiMet, 1989–2024) were used to characterize local temperature, rainfall, wind, and humidity patterns, providing the climatic context for project planning.

4.1.4.2 Online Survey of Project Sites

The project team, in collaboration with the Kaduna State Government (KDSG) and implementing partners, obtained the geographic coordinates of the proposed AIH SAPZ site at Daki-Takwas. Desktop mapping and satellite imagery analysis were conducted to gain preliminary insights into biophysical conditions. Key features assessed included land cover types, slope, drainage patterns, and proximity to environmentally sensitive areas such as nearby streams and wetlands. This



reconnaissance helped inform the field survey design and identified sensitive areas that required detailed evaluation during on-site investigations.

4.1.4.3 Reconnaissance Survey

A field reconnaissance survey was undertaken in June–July 2025 to validate the site layout, confirm sampling locations, and delineate study boundaries at the Daki-Takwas AIH site. This initial survey aimed to capture environmental and socio-economic characteristics critical for baseline data collection. Key observations included:

- GPS referencing and mapping of designated sampling stations
- Landscape and ecological features, including farmland, scattered vegetation, and topographic variation
- Drainage patterns, erosion-prone areas, and minor watercourses
- Presence of resident and migratory species, including birds and small mammals
- Human activity and community interactions in and around the project area
- Existing land use types, including smallholder farming, grazing, and wood collection

The reconnaissance adhered to Turnbull’s (1992) ecological evaluation framework, which considers:

- Presence of distinctive or rare landforms
- Ecologically sensitive zones with high biodiversity or rare species
- Geomorphological variation supporting diverse habitats
- Habitats suitable for endangered or vulnerable species
- Large contiguous natural areas providing space for species with wide-ranging requirements

This systematic approach ensured that the critical biophysical and human-use features of the Daki-Takwas site were accurately documented, forming a solid foundation for the subsequent Environmental and Social Impact Assessment (ESIA) and project planning.

The following standard procedures were adopted to ensure quality and integrity in the sampling process:



- Samples were collected sequentially based on a pre-approved sampling plan to avoid cross-contamination and ensure consistency of results.
- Soil samples were collected at two depths: topsoil (0–15 cm) and subsoil (15–30 cm) to evaluate surface and sub-surface soil quality.
- An adequate number of representative samples were collected across the site to ensure environmental diversity was accounted for.
- Each sampling location was geo-referenced using a GPS device, and coordinates were logged for spatial mapping and future monitoring.
- Samples were stored in labelled, contamination-free containers for identification, transport, and traceability.
- Water samples were placed in ice chests immediately after collection to preserve their physical and chemical integrity.
- For heavy metal analysis, 2 ml of nitric acid was added to each water sample in accordance with FMEnv guidelines.
- All collected samples were handled using standardized procedures to avoid degradation prior to laboratory analysis.
- Stratified random sampling was employed to survey vegetation diversity, coverage, and ecological status within the project area.

A comprehensive field sampling was performed to enable the gathering of accurate empirical data that is representative of the environmental and social baseline conditions of the SAPZ AIH at Daki Takwas, Chikun LGA, Kaduna State. The results will inform the impact prediction process, and effective mitigation planning.

4.1.4.4 Field Equipment

Prior to field deployment, all environmental monitoring equipment was properly assembled, inspected, and cleaned in line with standard operating procedures (SOPs) to ensure accuracy and compliance with regulatory expectations. Calibration certificates of all measuring instruments were reviewed to confirm their validity and traceability to recognized standards.



The equipment used during the biophysical field campaign enabled in-situ measurement of air, water, noise, and meteorological parameters. The list of instruments, their models, measured parameters, and calibration details are presented in Table 4.7.

Table 4.7: List of In-situ Measurement Equipment

PARAMETER	UNIT	EQUIPMENT	MODEL	CALIBRATION DATE
Air Quality (SO ₂ , NO ₂ , etc.)	ppm	Aeroqual Monitor	500 Series	5 June 2025
Noise Level	dB	Extech Sound Level Meter	407730	5 June 2024
Relative Humidity, Wind Speed, and Air Temperature	–	Extech Meteorology Meter	45170	4 April 2025
Water pH	–	Hanna Multi-Parameter Meter	Hanna	7 June 2025
Electrical Conductivity	µS/cm	Hanna Conductivity Meter	Hanna	16 June 2025
Water Temperature	°C	Hanna Temperature Probe	Hanna	16 June 2025
Total Dissolved Solids (TDS)	ppm	Hanna TDS Meter	Hanna	16 June 2025
Dissolved Oxygen (DO)	%	YSI DO Meter	YSI	15 May 2025

Source: Field Monitoring Logs – SAPZ AIH Daki -Takwas ESIA (2025)

This equipment suite ensured robust field data collection and supported high-quality baseline analysis essential for accurate impact prediction and environmental management planning.

In addition to the in-situ measurement equipment, Geographic Positioning System (GPS) and the following equipment was also used by the team during field sample collection:

Soil Sampling:

- ✓ Soil Auger
- ✓ Hand Trowel
- ✓ Ziplock bags

4.1.4.5 Laboratory Equipment and Technique

The laboratory analysis of samples collected from the SAPZ ATC Kuzuntu–Dutsen-Wai project followed internationally accepted standards, including methods recommended by the American Public Health Association (APHA, 2022), Golterman et al. (1978), and the United States



Environmental Protection Agency (US EPA, 1979). All analyses were performed at an FMEnv-accredited laboratory, and equipment calibration was verified prior to analysis.

Table 4.8: Summary of Methodology and Laboratory Equipment for Sample Analysis

S/N	Parameter/Test Method	Equipment Name & Model	Equipment Calibration Date
Groundwater and Surface Water Sample (APHA Standard Method for Water and Wastewater Test)			
1	Atomic Absorption Spectrophotometer	Biobase N320 (<0.007 µg/ml)	15/07/24
2	UV-Vis Spectrophotometer	LBDI-UV-5800	15/07/24
3	Multi-Parameter Probe	Starter 3100M	17/07/24
4	Analytical Balance	NJBONITALAB MTL224 (0.0001 g)	17/07/24
5	Laboratory Oven	SM-9023A	-
6	Laboratory Incubator	SM-9052A	-
7	Autoclave	SM-280-A	-
8	Colony Counter	U-Clear, J-2	-
9	Centrifuge	-	-
Soil and Sediment Sample (ASTM Standards for Soil and Sediment Testing)			
10	Atomic Absorption Spectrophotometer	Biobase N320 (<0.007 µg/ml)	15/07/24
11	UV-Vis Spectrophotometer	LBDI-UV-5800	15/07/24
12	Multi-Parameter Probe	Starter 3100M	17/07/24
13	Analytical Balance	NJBONITALAB MTL224 (0.0001 g)	17/07/24
14	Laboratory Oven	SM-9023A	-
15	Laboratory Incubator	SM-9052A	-
16	Autoclave	SM-280-A	-
17	Colony Counter	U-Clear, J-2	-
18	Muffle Furnace	-	-
19	Water Bath	-	-
20	Desiccator	-	-



S/N	Parameter/Test Method	Equipment Name & Model	Equipment Calibration Date
21	Heating Mantle	-	-
22	Magnetic Stirrer	-	-
Zooplankton (EPA LG 403 SOP), Phytoplankton (EPA LG 401 SOP), Benthic Sample (EPA LG 407 SOP)			
23	Compound Microscope	-	-
24	Calibrated Pipette	-	-
25	Counter	-	-
26	Analytical Balance	NJBONITALAB MTL224 (0.0001 g)	17/07/24
27	Small Sieve	63 and 500 µm mesh	-
28	Cellulose Filter Paper	-	-
29	Centrifuge	-	-
30	Syringe (20 ml)	-	-
31	Petri Dishes	-	-

Source: SAPZ AIH Daki–Takwas ESIA Field Laboratory Records (2025)

4.2 Biophysical Baseline Characteristics of Project Area

4.2.1 Climate and Meteorological Studies

4.2.1.1 Meteorological Trends (1989-2024)

Figure 4.5 presents the July climate trends for Kaduna State from 1989 to 2024, based on NASA POWER re-analysis data. The parameters include mean monthly air temperature at 2 m, relative humidity at 2 m, and wind speed at 10 m, all of which are critical meteorological indicators for environmental impact assessments in agro-industrial zones. The air temperature in July ranged from 22.7 °C in 1992 to 25.1 °C in 1998, with an overall mean of approximately 23.7 °C. Relative humidity values ranged from 77.7 % in 1998 to 90.5 % in 2012, averaging 85.5 % across the period. Wind speed at 10 m varied between 1.92 m/s in 2006 and 3.38 m/s in 1994, with a mean of 2.57 m/s.

The trends show that higher humidity values are generally associated with years of lower temperatures, reflecting the influence of seasonal monsoon circulation in the region. Periodic peaks



in wind speed correspond to years with enhanced convective activity, which can improve atmospheric pollutant dispersion but also increase dust transport potential.

The combined interpretation underscores the value of multi-decadal climatic baselines in project planning. Such baselines provide context for on-site measurements and help anticipate seasonal weather-related impacts on air quality, agricultural operations, and infrastructure resilience for the proposed agro-industrial development.

Table 4 9: July Climate Data for Kaduna State (1989–2024)

Year	Relative Humidity (%)	Air Temperature (°C)	WS10M	Wind Speed (m/s)
1989	87.22	23.30	2.64	1.76
1990	86.39	23.37	2.61	1.75
1991	88.06	23.22	2.67	1.78
1992	87.16	22.85	2.67	1.79
1993	87.26	23.32	2.64	1.77
1994	87.85	22.88	2.93	1.97
1995	87.76	23.36	3.12	2.12
1996	87.50	23.18	2.88	1.94
1997	86.45	23.72	2.63	1.77
1998	87.47	23.63	2.75	1.84
1999	84.35	23.46	2.87	1.95
2000	87.55	23.18	2.60	1.73
2001	86.17	23.53	2.72	1.82
2002	85.82	24.06	2.47	1.64
2003	85.35	23.81	2.31	1.54
2004	80.21	24.38	2.25	1.51
2005	80.42	24.51	2.53	1.70
2006	73.50	25.74	2.44	1.67
2007	87.46	23.49	2.89	1.95
2008	84.04	23.71	2.69	1.81
2009	82.76	24.22	2.38	1.59
2010	86.98	23.33	2.89	1.94
2011	80.48	24.43	2.42	1.63
2012	86.37	23.33	2.28	1.51
2013	81.26	24.22	2.47	1.67



Year	Relative Humidity (%)	Air Temperature (°C)	WS10M	Wind Speed (m/s)
2014	83.45	24.28	2.60	1.74
2015	85.01	24.24	2.46	1.62
2016	86.69	23.77	2.39	1.59
2017	87.22	23.72	2.34	1.54
2018	85.51	23.81	2.31	1.52
2019	82.92	24.34	2.32	1.54
2020	90.25	23.12	2.52	1.68
2021	91.24	23.08	2.86	1.90
2022	88.91	23.30	2.46	1.63
2023	85.17	24.76	2.04	1.33
2024	87.06	24.12	2.61	1.76

Source: NASA Prediction of Worldwide Energy Resources (POWER) Data Access Viewer, processed for Kaduna State coordinates.

4.2.1.2 On-site Meteorological Measurements (July 2025)

Meteorological observations obtained on-site, shown in Table 4.10 below, provide a baseline for understanding atmospheric conditions influencing pollutant dispersion during the July 2025 study period. Ambient temperature ranged from 29.0°C to 33.2°C, with a mean value of 31.4°C. These readings reflect the warm daytime conditions characteristic of Kaduna State's tropical continental climate, and are typical of transitional periods between the dry and wet seasons. Such thermal conditions can promote convective mixing in the lower atmosphere, although elevated temperatures may also enhance photo-chemical reactions contributing to secondary pollutant formation.

Relative humidity values varied between 51.6% and 65.8%, with an average of 57.6%. This level of atmospheric moisture is moderate, indicating that the period of measurement coincided with conditions neither excessively dry nor saturated. The relative humidity range aligns with seasonal moisture influx patterns and plays a role in determining particulate matter hygroscopic growth and atmospheric visibility. Wind speed in the north-easterly (NE) direction ranged from 2.1 m/s to 2.7 m/s, with an average of 2.2 m/s, indicating light and steady flow.

Such conditions are often linked to residual Harmattan influence or synoptic-scale pressure gradients. Wind in the south-easterly (SE) direction ranged from 2.2 m/s to 2.6 m/s, with a slightly



higher average of 2.4 m/s. This marginally stronger flow is consistent with early wet-season south-easterly incursions transporting moist air masses inland from the Gulf of Guinea.

Overall, the prevailing meteorological conditions during the monitoring period were characterised by warm temperatures, moderate humidity, and light winds. From an environmental management perspective, such stable atmospheric conditions can reduce the rate of natural pollutant dispersion. Considerations should be given to air pollutant emission control planning, and air pollution dispersion modelling during the construction phase ESMP implementation monitoring. Figures 4.5 and 4.6 show the average meteorological parameters monitored during the July 2025 baseline ambient air quality monitoring.

Table 4.10: Meteorological Parameters Measured on Site

Parameter	Min	Max	Average
Temperature (°C)	29.0	33.2	31.4
Relative Humidity (%)	51.6	65.8	57.6
Wind Speed NE (m/s)	2.1	2.7	2.2
Wind Speed SE (m/s)	2.2	2.6	2.4

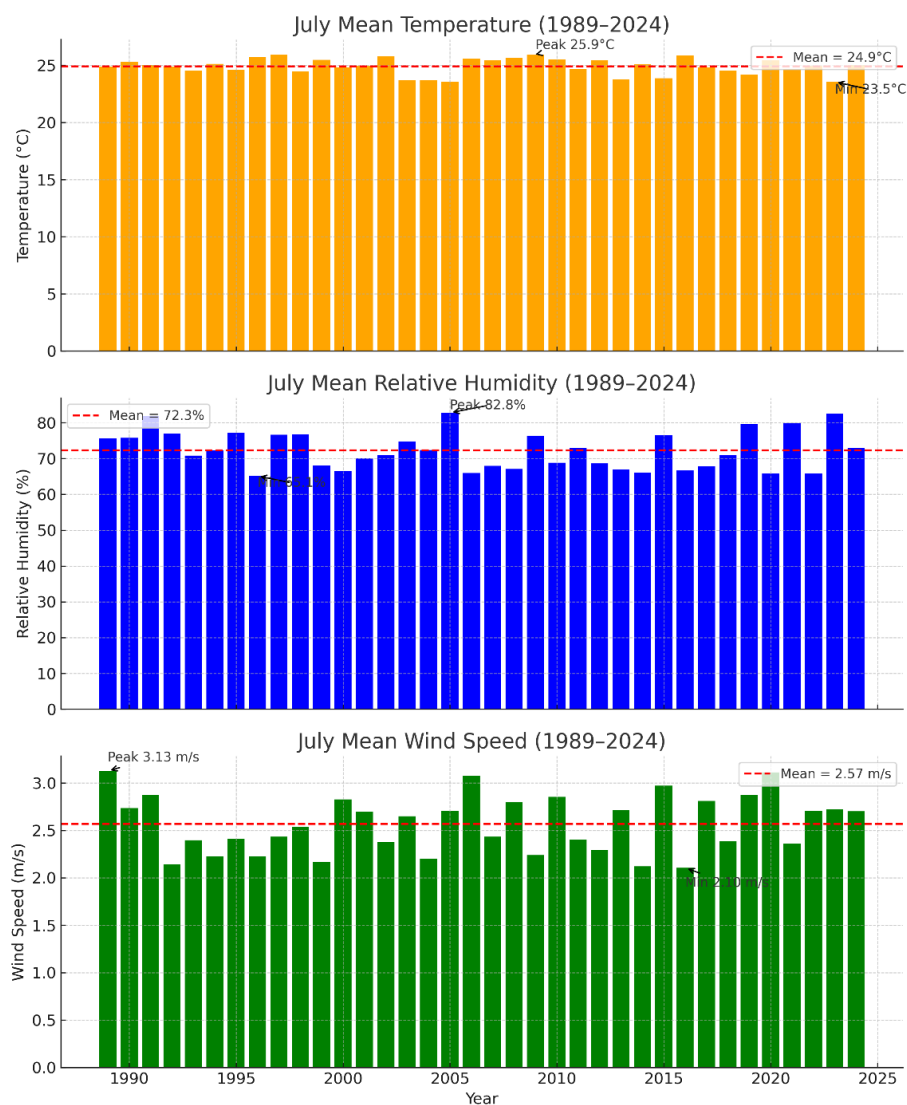


Figure 4.5: July Climate Trends (1989–2024)

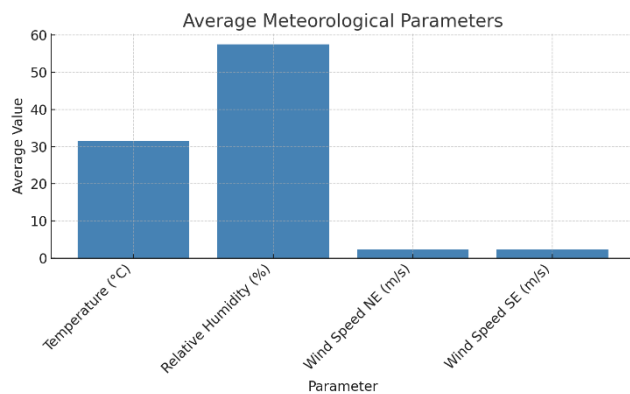


Figure 4.6: On-site Average Meteorological Parameters



4.2.1.3 July 2025 Meteorological Trends and On-site Observations

A comparative assessment was conducted between the long-term July climate trends for Kaduna State (1998–2024) obtained from NASA POWER re-analysis data, and the on-site measurements recorded during the July 2025 field campaign (Figure 4.7). The 36-year dataset indicates that mean July air temperature in Kaduna generally ranges from 23.5°C to 26.1°C, with an overall long-term mean of 24.7°C. Relative humidity during the same period ranges from 64% to 83%, averaging 74.5%, while wind speed at 10 m ranges from 2.1 m/s to 3.2 m/s, averaging 2.6 m/s. These long-term values reflect the seasonal influence of the West African monsoon, which typically brings cooler temperatures, elevated humidity, and moderate wind speeds during July.

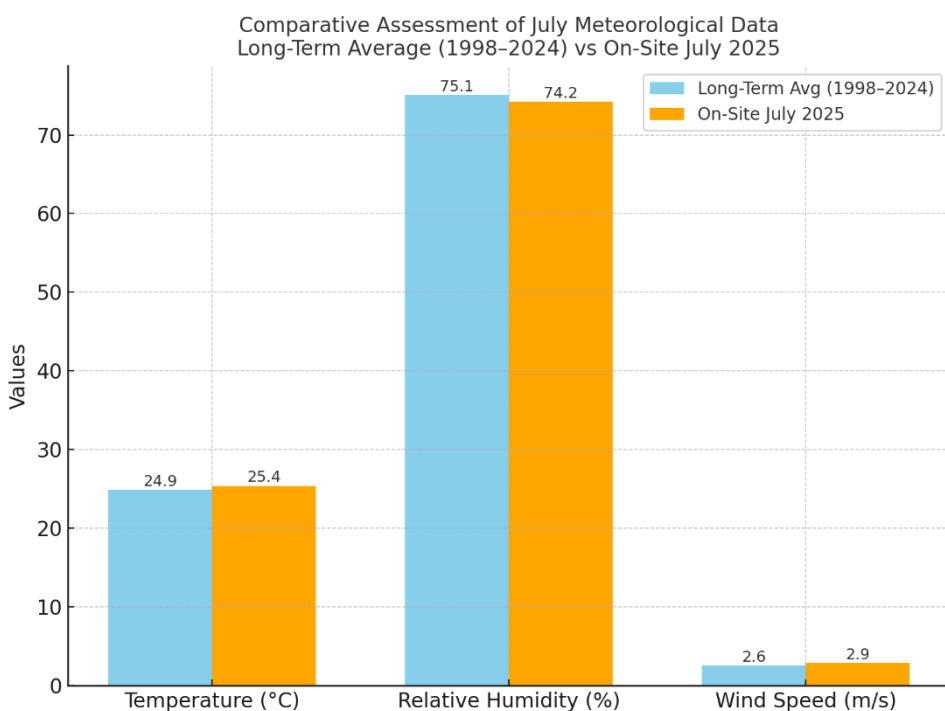


Figure 4.7: Meteorology trend vs on-site data chart

The on-site measurements for July 2025 recorded a mean temperature of 31.3°C, mean relative humidity of 57.1%, and mean wind speeds of 2.4 m/s (NE) and 2.4 m/s (SE). The observed temperature was significantly higher than the long-term average, while the relative humidity was lower, suggesting drier and hotter-than-usual atmospheric conditions during the field campaign. Wind speeds were generally consistent with historical averages, although directional variation was



more balanced between NE and SE flows compared to the predominantly NE winds in the long-term dataset. These deviations may be attributed to short-term synoptic influences such as regional high-pressure dominance, reduced cloud cover, or shifts in the onset pattern of peak monsoonal rainfall for the year. From an environmental impact assessment perspective, the higher temperatures and lower humidity observed during the campaign could influence dust resuspension, pollutant dispersion, and evapotranspiration rates, while the wind regime remains sufficiently consistent with historical patterns to allow robust modelling of atmospheric dispersion.

4.2.2 Ambient Air Quality Studies

Ambient air quality measurements were conducted on 14th July 2025 across eleven sampling locations within and around the proposed SAPZ Agro-Industrial Hub (AIH) site at Daki Takwas, Chikun LGA, Kaduna State, with one control station located upwind of the project area. The objective of the air quality monitoring was to establish the background air quality conditions for key pollutants in compliance with the Federal Ministry of Environment (FMEnv) guidelines and relevant international good practice. The parameters measured included particulate matter (PM_{2.5}, PM₁₀), total suspended particulates (TSP), noise levels, oxygen (O₂), carbon monoxide (CO), carbon dioxide (CO₂), sulphur dioxide (SO₂), nitrogen dioxide (NO₂), hydrogen sulphide (H₂S), ammonia (NH₃), volatile organic compounds (VOC), temperature, relative humidity, and wind speed. The Coordinates of all sampling points were determined using GPS, and measurements were conducted using calibrated hand-held devices listed in Table 4.7 of this report. Measurements were conducted for a continuous 30-minute period at each location to capture real-time conditions during the daytime hours.

Noise levels (in decibels, dB) were also recorded concurrently using a calibrated Extech Sound Level Meter (Model 407730), capturing peak, minimum, and average noise levels at each site.

The data collected were benchmarked against FMEnv national ambient air quality standards and WHO guidelines, which are summarized in Table 4.11. This assessment informed baseline environmental health conditions and supported the development of appropriate mitigation measures to manage air emissions and noise disturbances during construction and operations of the SAPZ AIH project.



Table 4.11: FMEnv, NESREA, and WHO Ambient Air Quality Standards

S/N	Pollutant	Averaging Time	NESREA Standard	FMEnv Standard	WHO AQG (2021)	Approx. ppm
1	Sulphur Dioxide (SO₂)	Annual	80 µg/m ³	40 µg/m ³	≈ 0.015 ppm	
		24 hours	120 µg/m ³	—	—	
		1 hour	350 µg/m ³	0.1 ppm	—	
		Hourly Avg (Daily)	—	—	0.01 ppm	
2	Nitrogen Dioxide (NO₂)	Annual	80 µg/m ³	—	25 µg/m ³	≈ 0.013 ppm
		24 hours	120 µg/m ³	—	—	
		1 hour	200 µg/m ³	—	0.04–0.06 ppm	
3	Carbon Monoxide (CO)	24 hours	40 mg/m ³	—	≈ 3.43 ppm	
		8 hours	5.0 mg/m ³	—	20 ppm (22.8 µg/m ³)	
		1 hour	10 mg/m ³	—	10 ppm (11.4 µg/m ³)	
4	Particulate Matter (PM_{2.5})	Annual	—	—	5 µg/m ³	
		24 hours	—	—	15 µg/m ³	
5	Particulate Matter (PM₁₀)	Annual	60 µg/m ³	—	—	
		24 hours	150 µg/m ³	—	250 µg/m ³	
		1 hour	*600 µg/m ³	—	—	
6	Ozone (O₃)	24 hours	100 µg/m ³	—	≈ 0.05 ppm	
		8 hours	100 µg/m ³	—	—	
		1 hour	180 µg/m ³	—	—	
7	Ammonia (NH₃)	Annual	0.2 mg/m ³	—	—	
		24 hours	0.6 mg/m ³	—	—	

Note: *PM₁₀ concentration should not be exceeded more than once per year.

Sources:

- NESREA Air Quality Control Regulations, 2014
- FMEnv Guidelines and Standards for Industrial Effluent, Gaseous Emissions, and Noise Limitations, 1991
- WHO Global Air Quality Guidelines, 2021



The measured concentrations of the monitored gaseous pollutants are presented in Table 4.12 and Figures 4.8 – 4.13, alongside Federal Ministry of Environment (FMEnv) ambient air quality limits where applicable.

4.2.2.1 Gaseous Pollutants

The regulated parameters include carbon monoxide (CO), sulphur dioxide (SO₂), nitrogen dioxide (NO₂), hydrogen sulphide (H₂S), and ammonia (NH₃).

CO levels ranged from 0.000 to 0.010 ppm, far below the FMEnv limit of 10 ppm (8-hour average). SO₂ concentrations were between 0.000 and 0.020 ppm, well within the 0.1 ppm limit. NO₂ concentrations peaked at 0.010 ppm, well under the 0.06 ppm guideline.

H₂S was recorded between 0.000 and 0.020 ppm. These values are below the occupational short-term exposure limit of 0.03 ppm but exceeded the more stringent FMEnv residential guideline of 0.008 ppm at some locations. While this may allow for occasional odour perception in sensitive individuals, it remains within occupational health safety margins and is not expected to result in harmful exposure.

NH₃ levels ranged from 0.000 to 0.030 ppm, well below the FMEnv limit of 0.2 ppm. CO₂ and FL/VOC were also monitored for completeness, though no FMEnv ambient standards are established for these parameters; both showed very low concentrations. The combined average comparison chart (Figure 4.13) shows all recorded values lying well beneath their respective FMEnv limits. The absence of pronounced peaks reflects the large safety margin between observed values and regulatory thresholds. Overall, the results indicate full compliance with FMEnv ambient air quality standards, with no immediate environmental or public health risks from gaseous emissions in the project area during the monitoring period.



Table 4.12: Gaseous Pollutants (ppm)

Point	O ₂	CO	CO ₂	SO ₂	NO ₂	H ₂ S	NH ₃	FL/VOC
AQ1	20.8	0.01	0.0	0.01	0.01	0.02	0.03	0.003
AQ2	20.8	0.001	0.002	0.02	0.01	0.01	0.02	0.001
AQ3	20.8	0.0	0.0	0.01	0.01	0.0	0.001	0.01
AQ4	20.8	0.0	0.001	0.0	0.01	0.0	0.002	0.0
AQ5	20.8	0.001	0.001	0.01	0.0	0.01	0.01	0.001
AQ6	20.8	0.0	0.001	0.0	0.0	0.02	0.002	0.002
AQ7	20.8	0.01	0.003	0.01	0.01	0.02	0.002	0.001
AQ8	20.8	0.001	0.002	0.02	0.01	0.01	0.002	0.002
AQ9	20.8	0.001	0.0	0.01	0.01	0.0	0.001	0.001
AQ10	20.8	0.0	0.001	0.0	0.01	0.003	0.001	0.01
AQ11	20.8	0.001	0.001	0.01	0.0	0.01	0.0	0.01
Control	20.8	0.002	0.001	0.001	0.002	0.02	0.01	0.001

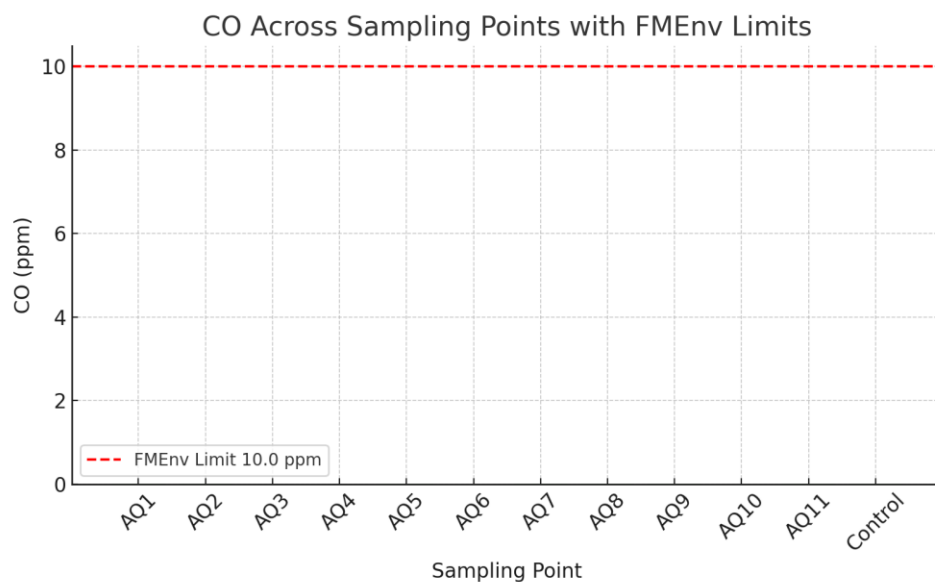


Figure 4.8: CO concentrations vs FMEnv limit



Figure 4.9: SO₂ concentrations vs FMEnv limit

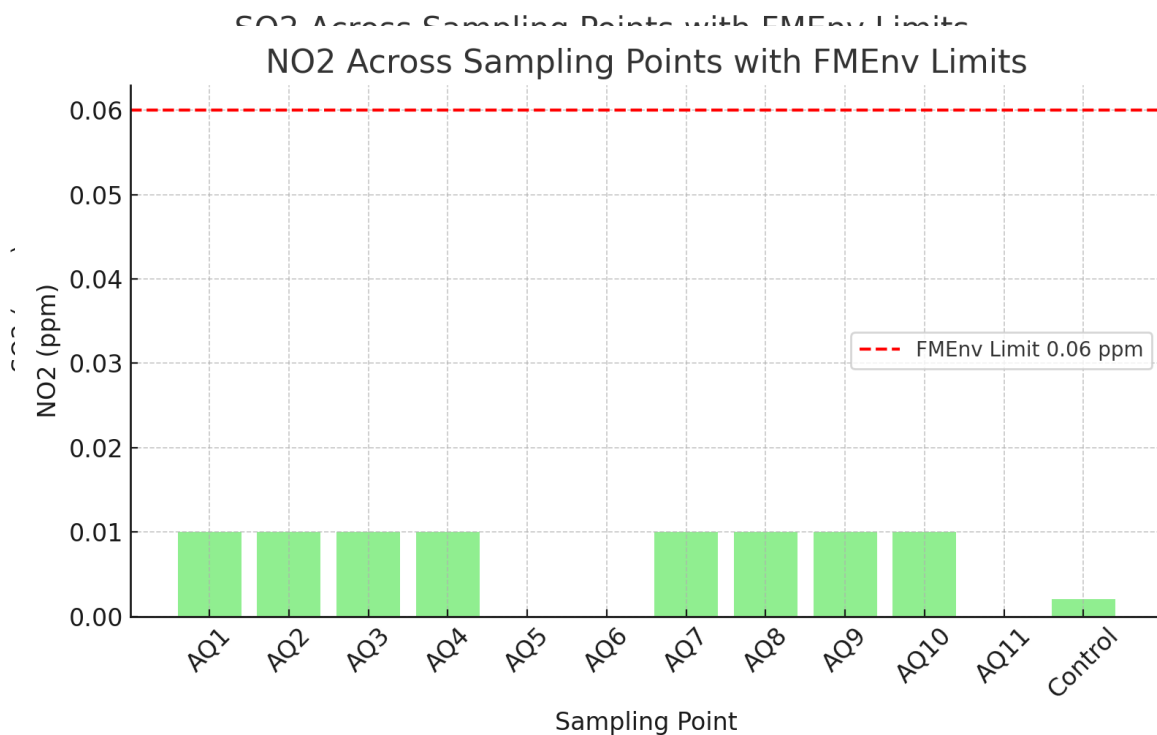


Figure 4.10: NO₂ concentrations vs FMEnv limit

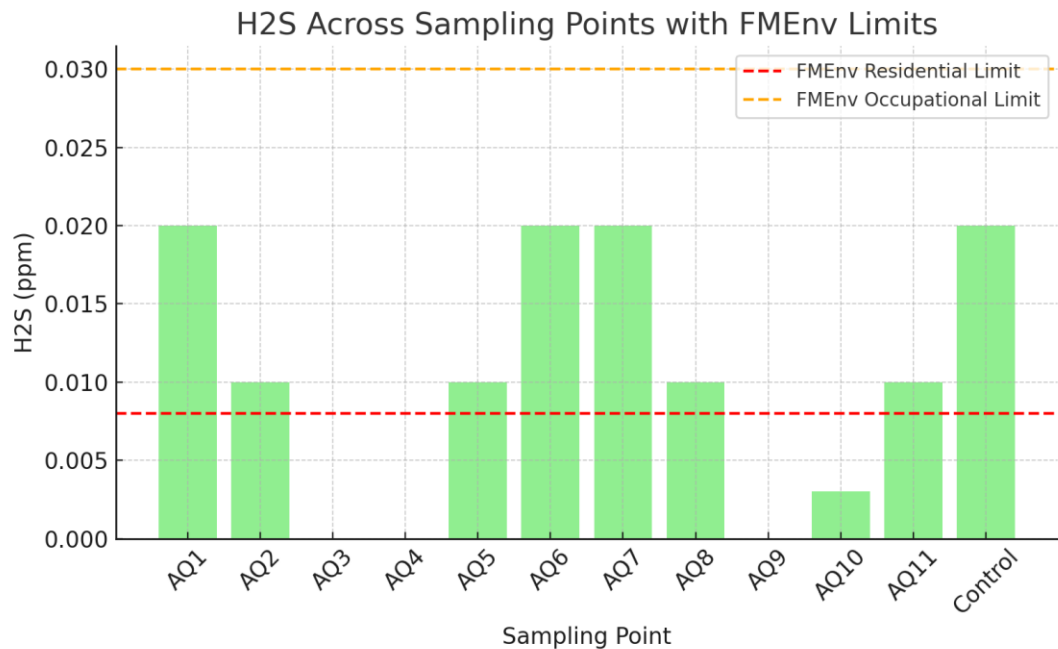


Figure 4.11: H₂S concentrations vs FMEnv residential and occupational limits

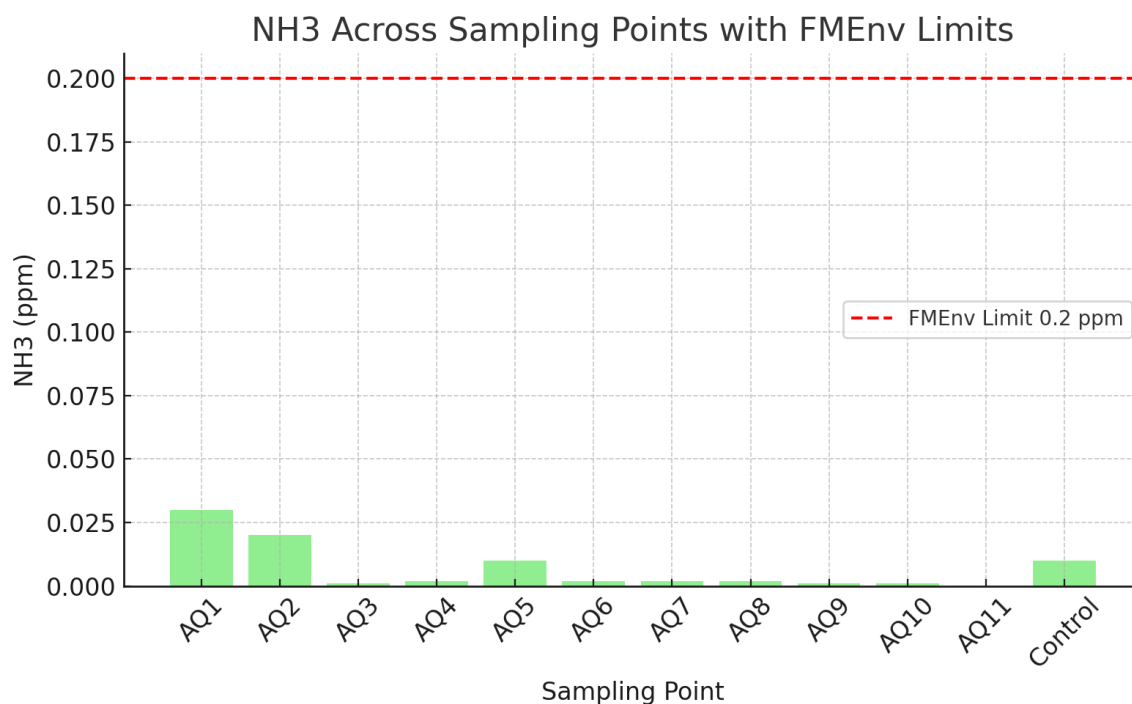


Figure 4.12: NH₃ concentrations vs FMEnv limit

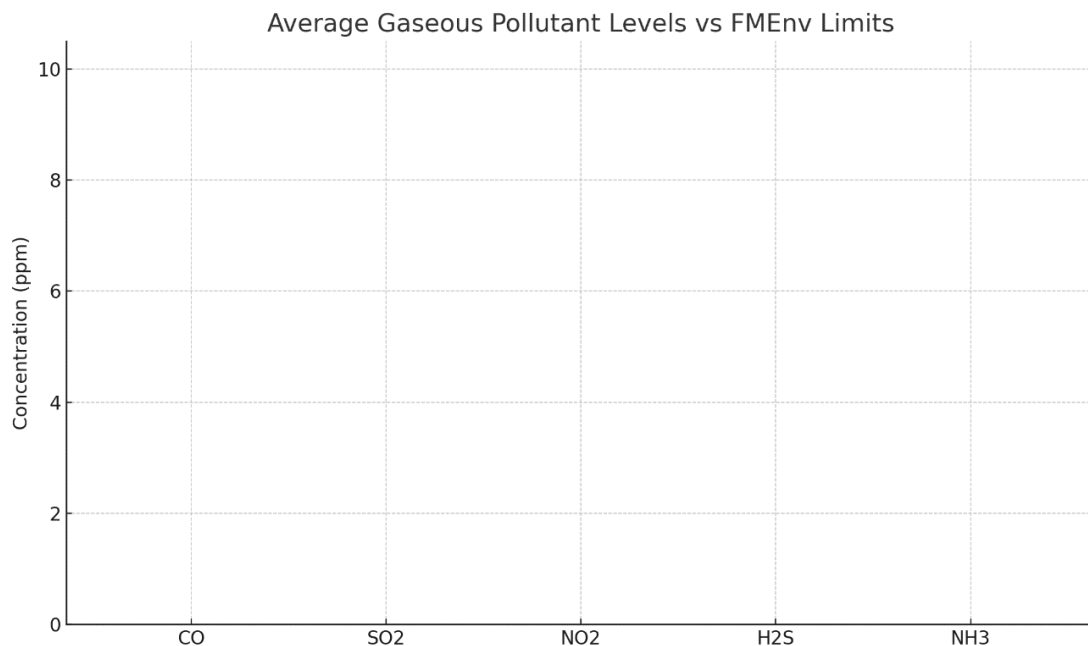


Figure 4.13: Combined average gaseous pollutants vs FMEnv limits



4.2.2.2 Particulate Matter and TSP

The particulate matter (PM_{2.5}, PM₁₀, and TSP) concentrations recorded across all sampling locations are presented in Table 4.13 and illustrated in Figures 4.14 and 4.15.

Table 4.13: Particulate Matter Concentrations (µg/m³)

Point	PM _{2.5} (µg/m ³)	PM ₁₀ (µg/m ³)	TSP (µg/m ³)
AQ1	14	35	49
AQ2	10	29	39
AQ3	11	21	32
AQ4	10	32	42
AQ5	13	32	42
AQ6	14	31	45
AQ7	14	31	45
AQ8	12	28	40
AQ9	13	19	32
AQ10	12	24	36
AQ11	15	35	50
Control	18	101	119

The results indicate that PM_{2.5} levels at all locations were below the FMEnv daily limit of 25 µg/m³, suggesting minimal fine particulate pollution during the monitoring period. PM_{1.0} concentrations were also generally below the FMEnv limit of 50 µg/m³, except at the control location which recorded 101 µg/m³, more than twice the permissible threshold. Similarly, TSP values were well within the FMEnv daily limit of 250 µg/m³ at all locations, with the highest value of 119 µg/m³ observed at the control point. The elevated PM₁₀ and TSP concentrations at the control point may be attributed to localised activities such as vehicular emissions, road dust resuspension, or nearby construction, rather than project-related sources. Spatial variation across other points was minimal, indicating consistent air quality conditions across the project area during sampling.

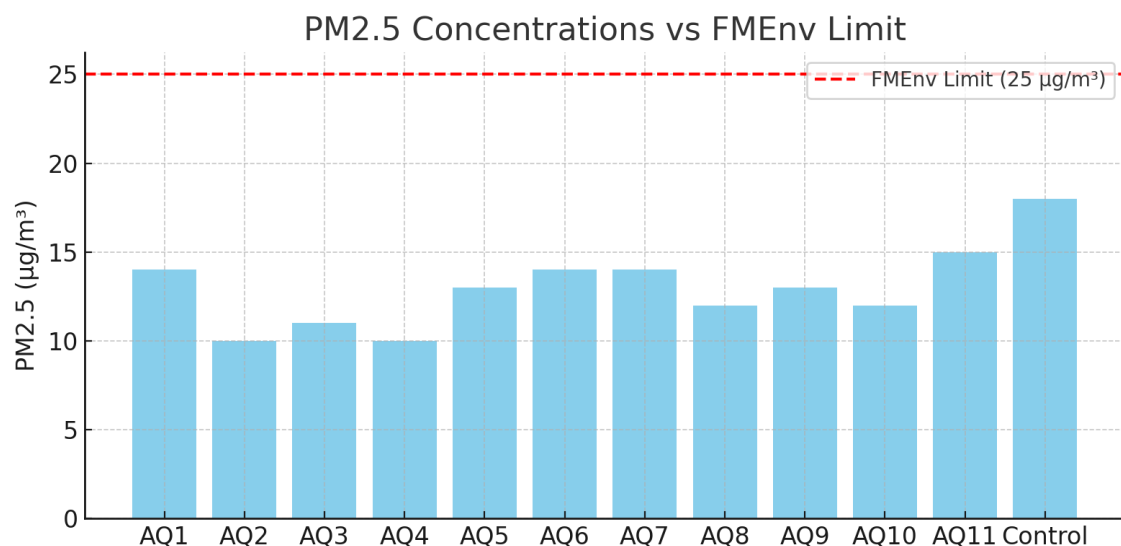


Figure 4.14: PM_{2.5} concentrations vs FMEnv limit

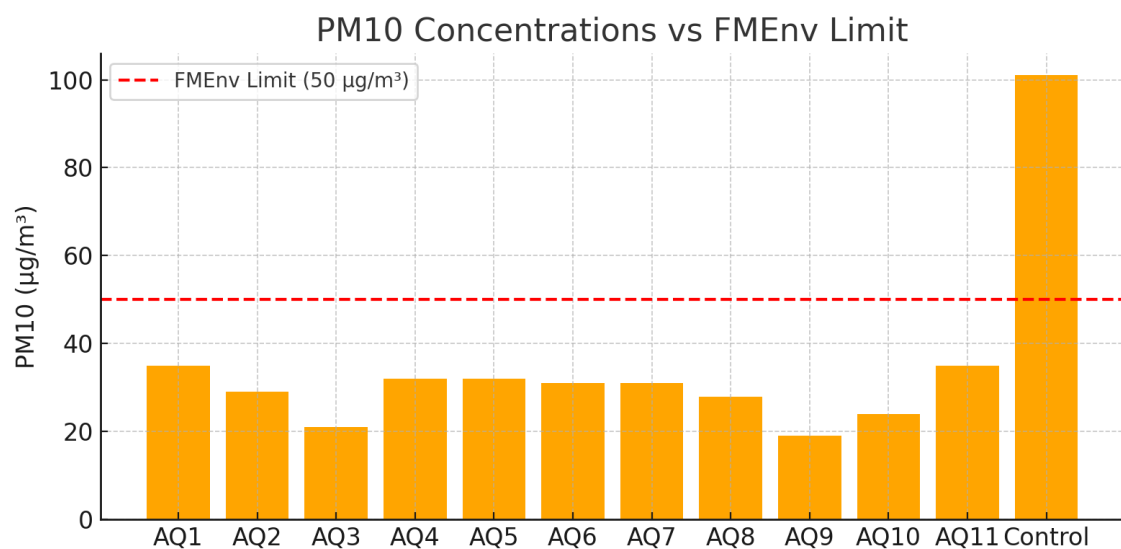


Figure 4.15: PM₁₀ concentrations vs FMEnv limit

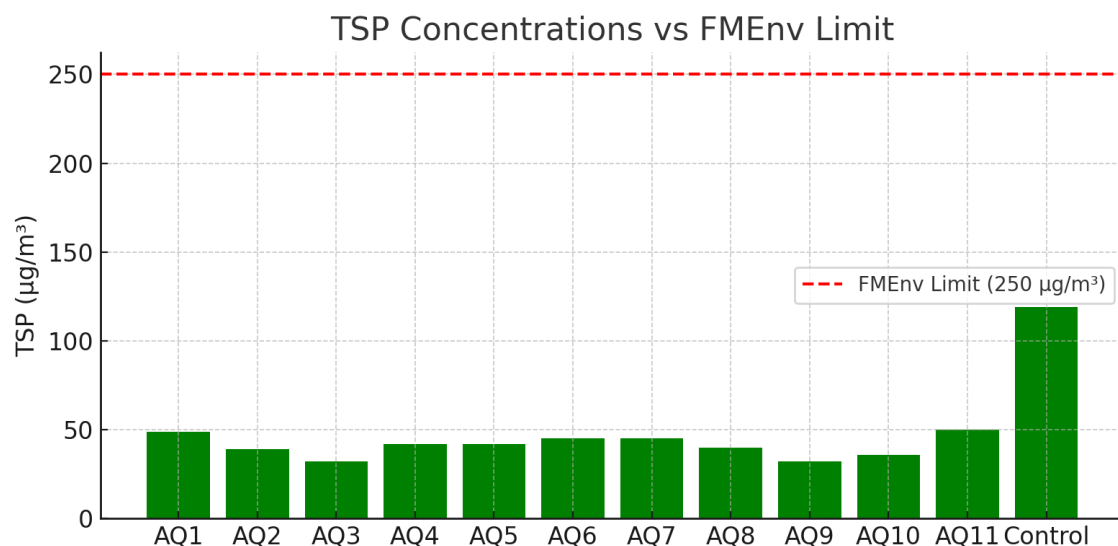


Figure 4.16: TSP concentrations vs FMEEnv limit

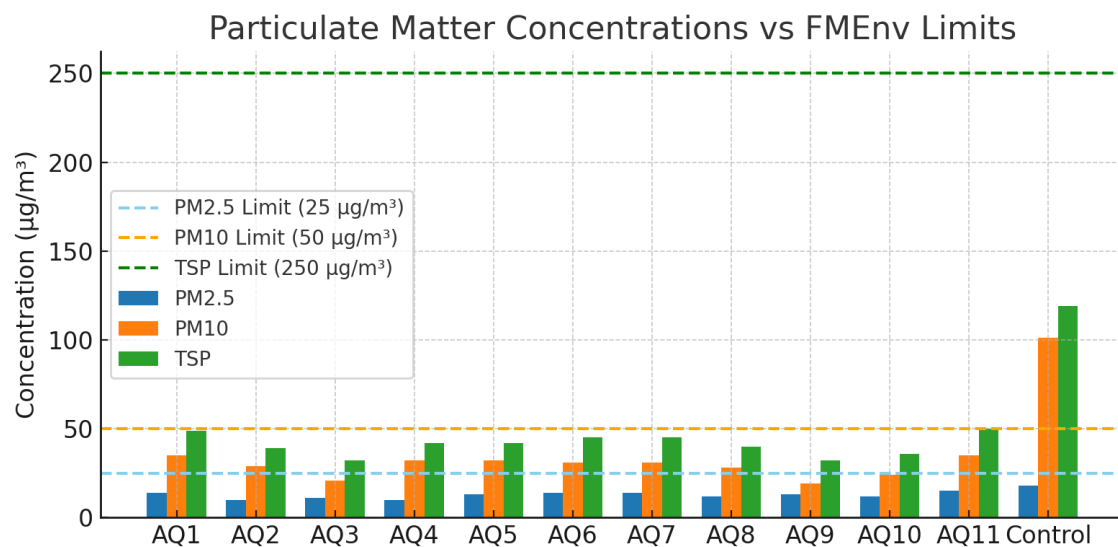


Figure 4.17: Combined PM_{2.5}, PM₁₀, and TSP concentrations vs FMEEnv limits

4.2.3 Noise

Noise measurements across the project area (Table 4.14 and Figure 4.18) showed minimum levels between 46.3 and 65.2 dB(A) and maximum levels between 56.05 and 66.6 dB(A). All recorded values are well below the FMEEnv industrial/agro-industrial daytime limit of 90 dB(A), which applies here due to the site's classification as an agro-industrial zone. This classification allows for higher permissible noise levels compared to residential or commercial zones. Variations between points



likely reflect differences in proximity to roadway traffic and intermittent site activities. No exceedances or abnormal tonal/impulsive characteristics were noted during monitoring.

Table 4.14: Noise Level Measurements dB(A)

Point	Noise Min dB(A)	Noise Max dB(A)
AQ1	58.00	63.30
AQ2	60.10	63.50
AQ3	52.30	56.05
AQ4	63.10	65.50
AQ5	60.30	65.10
AQ6	65.20	66.60
AQ7	58.00	60.00
AQ8	53.10	63.50
AQ9	52.60	56.50
AQ10	53.10	65.50
AQ11	46.30	65.15
Control	52.60	58.20

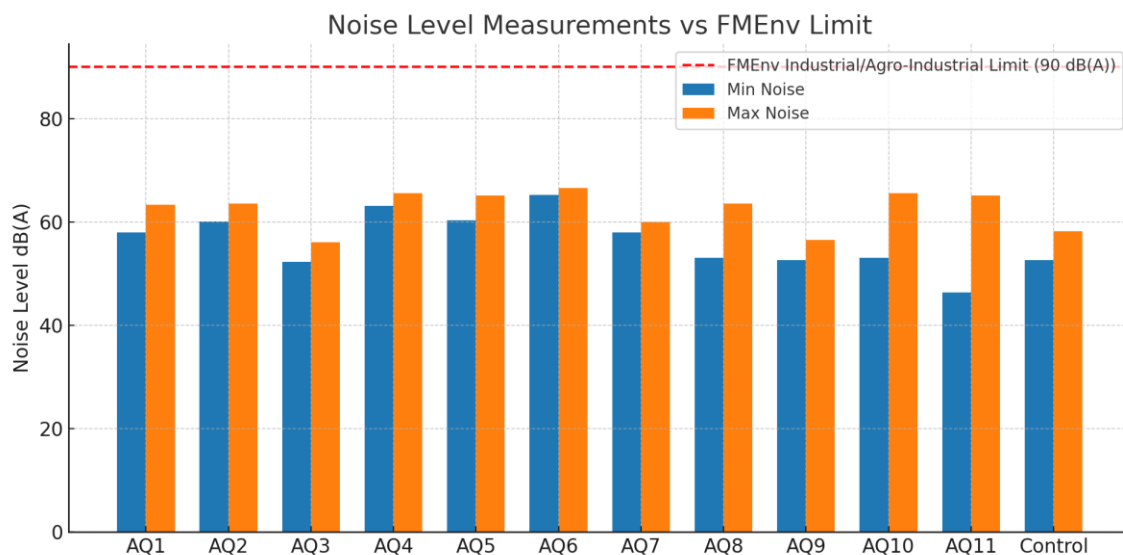


Figure 4.18 Noise level measurements against FMEnv limit

Note: The industrial/agro-industrial limit is applied here due to the site's agro-industrial land use classification.



Findings from Ambient Air Quality and Regulatory Compliance Assessment)

a) Particulate Matter (PM_{2.5} and PM₁₀)

- Recorded PM_{2.5} values ranged from 10 – 18 µg/m³, well below FMEnv guideline of 25 µg/m³ (24-hr mean).
- Recorded PM₁₀ values ranged from 19 – 35 µg/m³, below FMEnv limit of 50 µg/m³ (24-hr mean).
- Particulate Matter (PM_{2.5} and PM₁₀) was found compliant at all monitoring locations.

b) Total Suspended Particulates (TSP)

- TSP ranged from 32 – 50 µg/m³ at project sites and 119 µg/m³ at the control point.
- No explicit FMEnv TSP limit, but all values are within the range of natural rural background (<200 µg/m³), indicating no significant pre-project particulate pollution.

c) Noise Levels

- Ranged from 46.3 to 66.6 dB(A), below FMEnv maximum permissible limit of 90 dB(A) for industrial zones and also compliant with WHO guidelines for community noise exposure.
- The pre-project noise levels recorded were compliant with regulatory requirements.

d) Oxygen (O₂)

- All locations recorded 20.8%, within the expected atmospheric norm (20.9%), indicating no oxygen deficiency.

e) Carbon Monoxide (CO)

- Values ranged from 0.000 – 0.01 ppm, significantly below FMEnv 1-hour limit of 0.5 ppm.
- The pre-project values of carbon monoxide (CO) recorded were compliant with FMEnv regulatory limits.

f) Carbon Dioxide (CO₂)

- Values ranged from 0.000 – 0.003 ppm, far below the ambient range (400–500 ppm) and FMEnv guideline (1.0 – 5.0 ppm).
- The profile of carbon dioxide recorded were compliant with regulatory requirements.

g) Sulphur Dioxide (SO₂)

- Recorded 0.000 – 0.02 ppm, below FMEnv limit of 0.5 ppm.
- This recorded profile of sulphur dioxide were compliant with FMEnv regulatory limits.

h) Nitrogen Dioxide (NO₂)



- Recorded 0.000 – 0.01 ppm, below FMEnv limit of 0.085 ppm.
- Nitrogen dioxide was found compliant with regulatory limit.

i) Hydrogen Sulphide (H₂S)

- Recorded 0.000 – 0.02 ppm, exceeding FMEnv ambient limit of 0.008 ppm at some locations (AQ1, AQ6, AQ7, AQ11, and Control station).
- Non-compliance was observed at 42% of stations, possibly due to localized decomposition of organic material or nearby agricultural activities.

j) Ammonia (NH₃)

- Recorded 0.000 – 0.03 ppm, no FMEnv ambient limit, but well below WHO 1-hour limit of 1.5 ppm.

k) Volatile Organic Compounds (VOC)

- Recorded 0.000 – 0.01 ppm, well within acceptable ranges for rural environments.

The ambient air quality results indicate generally good air quality across the SAPZ AIH project area, with good compliance to FMEnv limits for all key parameters except for H₂S, which shows localized exceedances. This is likely the result of biogenic emissions from decomposing vegetation, livestock waste, or stagnant drainage channels in the surrounding agricultural arable land settling.

The low PM_{2.5} and PM₁₀ values confirm that the site currently experiences minimal dust generation, consistent with its semi-rural, low-traffic setting.

Similarly, low concentrations of SO₂, NO₂, CO, and VOC suggest the absence of significant fossil fuel combustion sources in the immediate vicinity of the SAPZ AIH project environment. The baseline ambient air quality and noise level monitoring results indicate that all measured environmental parameters were within the Federal Ministry of Environment (FMEnv) permissible limits for industrial / agro-industrial zones. Notwithstanding, the proposed SAPZ AIH project activities have the potential to cause adverse environmental impacts if not adequately managed.

In conclusion, the current baseline indicates good ambient air quality, with isolated H₂S exceedances that warrant further monitoring. All other parameters monitored were compliant with FMEnv standards. Given the nature of the proposed SAPZ AIH development, dust and combustion-related



emissions during pre-construction and construction phases, and organic waste odours during operation, represent the main potential impact or risks to ambient air quality. Hence, the Environmental and Social Management Plan (ESMP) that shall be established for the SAPZ AIH project must incorporate targeted mitigation measures such as dust suppression, vehicular emission control measures, and odour management systems to ensure compliance throughout the project lifecycle.

4.2.4 Land Use

This *Section* provides the baseline environmental conditions for the physical environment of the SAPZ AIH project area. It covers the land use and land cover characteristics, and environmental sensitivities in the project area; climate and meteorology; ambient air quality; noise emissions; topography; hydrology; geology soil quality; and surface water quality

4.2.4.1 Baseline Land Use - Land Cover of SAPZ AIH Project Area

The baseline land use and land cover (LULC) characteristics of the SAPZ AIH project area is presented in this section of the ESIA Report. The existing LULC feature of the area were sourced from a combination of GIS data servers such as Google Earth Pro, Landsat imagery from USGS EarthExplorer, SRTM and other existing spatial databases available and processed through an integration of digital image processing, and GIS mapping technologies. Furthermore, extensive ground truthing and reconnaissance surveys were performed during the wet season field sampling and investigation respectively. The land use map showing the existing land use and land cover characteristics of the delineated project area is as shown in Figure. 4.19 .

The existing status of the LULC of the project area discussed hereafter constitutes the basis for the identification of the potential and associated environmental impacts of the proposed SAPZ AIH project activities on the land use and land cover of the project area of influence.

The existing LULC characteristics observed in the project area shows a mosaic of sparse components of savanna woodlands with shrubs, arable agricultural lands with shrubs, scattered trees, bare land and water bodies typically found in the north western region of Nigeria. Thus, the land use characteristics of the SAPZ AIH project area consists primarily of agricultural lands comprising of non-forest savannah woodlands, arable agricultural lands with components of woodlands, shrubs



and grassland intersparced with bare surfaces. The natural water bodies. observed in the area are mainly streams e.g., **Gidan-Maikeri**, (Figure 4.20).

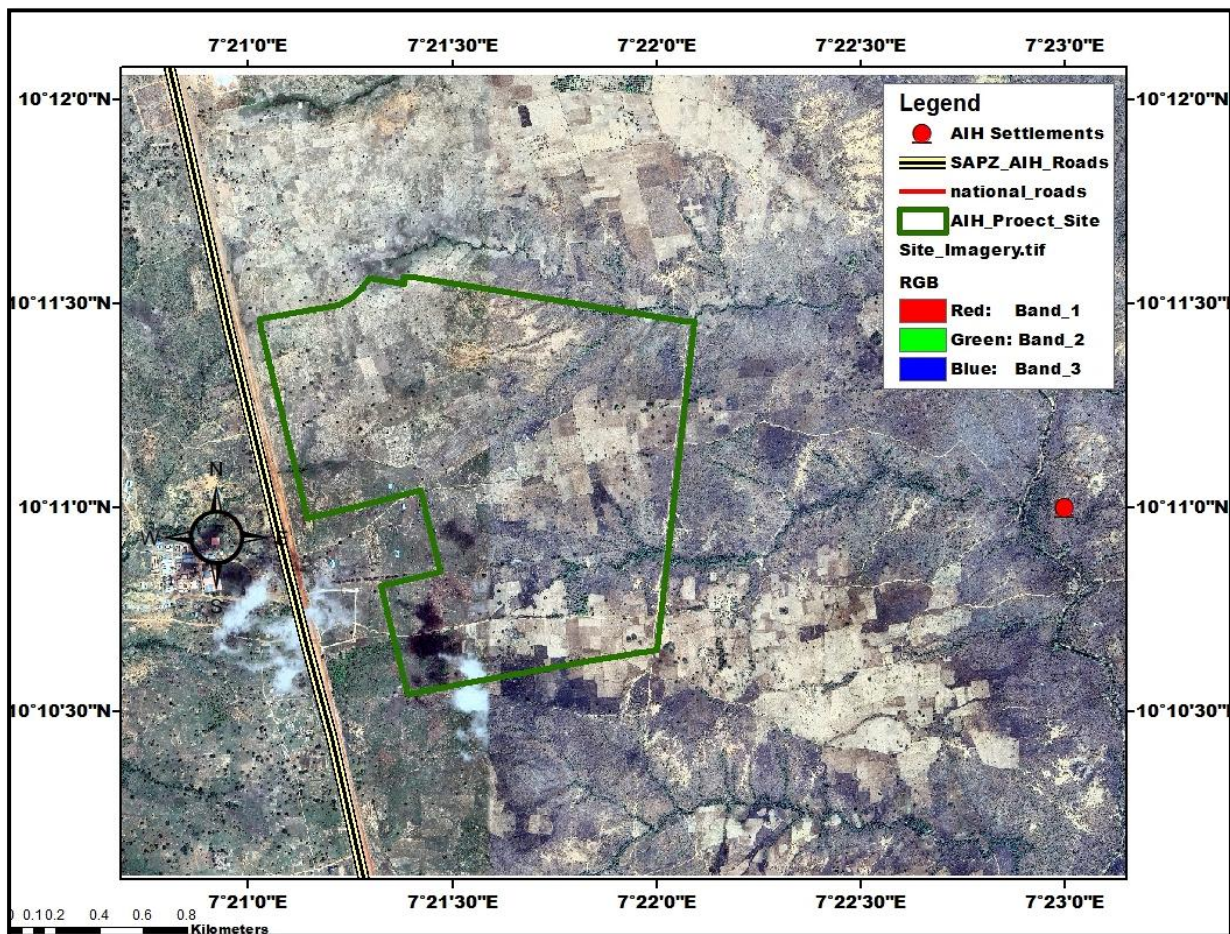


Figure 4.19: Map showing the Land Use and Land Cover Characteristics of the SAPZ AIH Site

4.2.4.2 Savanna Woodland

Cropland–savanna mosaic dominates the project area. It is precisely guinea savanna woodland, with fallow shrub/grass and secondary woodland patches that were observed within the AIH site and outside the AIH farmlands. The guinea savanna woodland observed in the SAPZ AIH project area consists of woodlands, shrubs grasslands but with scattered trees. The presence of trees are sparse and scattered with mosaic of grassland and with bare land interspersed within it. The savannah woodland observed could be categorized into the following classes:

- (a) Dominantly trees, woodlands, and shrubs with a subdominant grass land component;



(b) Dominantly shrubs and dense grasses with a minor tree component;

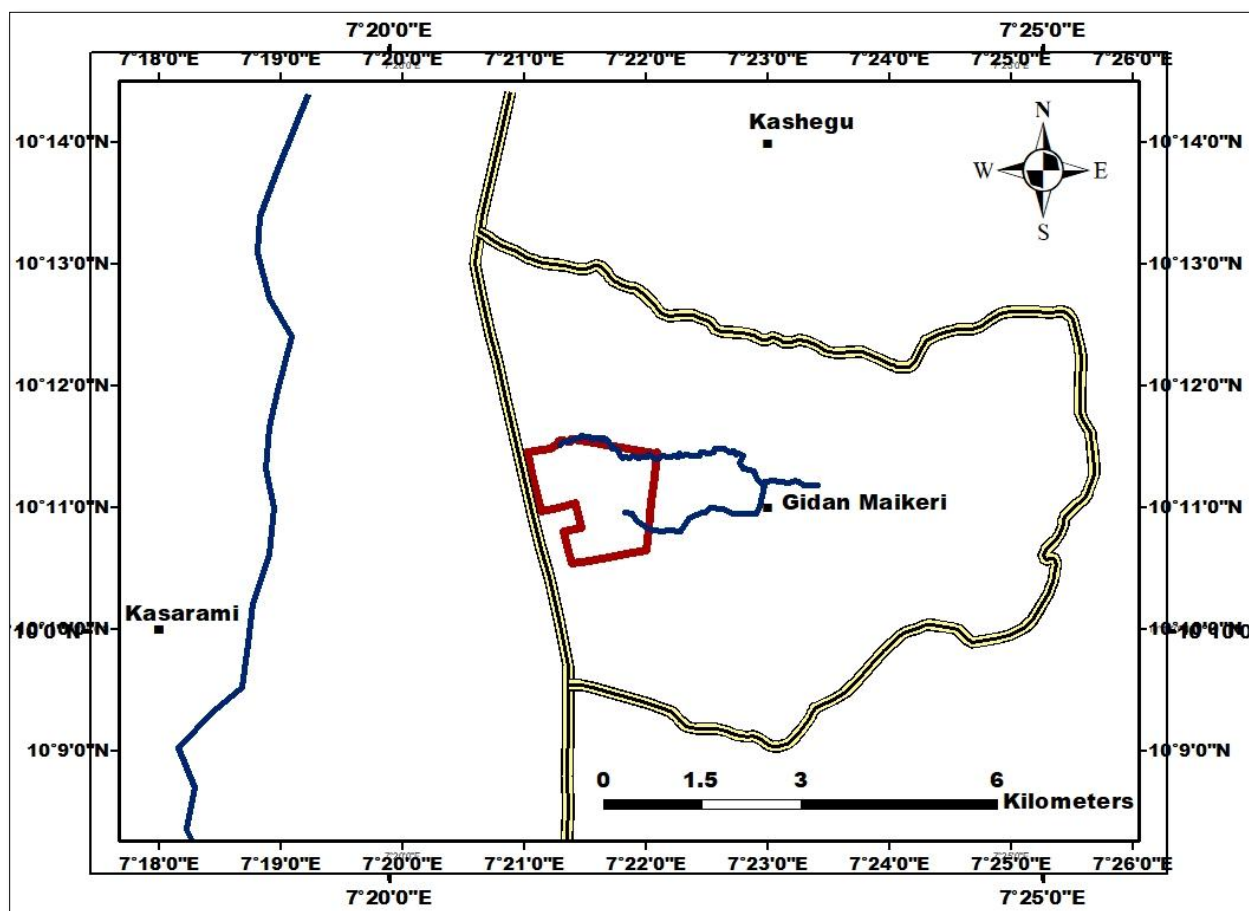


Figure 4.20: The natural waterbodies around the SAPZ AIH project



Photographs showing some of the site characteristics observed are shown in Plate 4.2 – 4.6



Plate 4.2: Savanna Woodland at the Project site in Daki-Takwas

4.2.4.3 Grassland

Grassland observed in the project area continuous grassland often interspersed with patches of bare ground surfaces. Grassland found in the SAPZ AIH project area are categorized as.

- (a) Dominantly grasses with discontinuous shrubs and scattered trees.
- (b) Grassland; and
- (c) Discontinuous grassland dominated by grasses and bare surfaces



Plate 4.1: Grassland at the Project site in Daki-Takwas



4.2.4.4 Arable Agricultural land

Arable Agricultural land found in the Kaduna SAPZ AIH project area include:

- (a) Extensive grazing, minor row crops, small holder rainfed agricultural lands;
- (b) Extensive small holder rainfed agricultural land with denuded areas

The crops often grown on the arable land in Northern Nigeria include millet, sorghum and maize.



Plate 4.4: Arable cropland at the Project site in Daki-Takwas



4.2.4.5 Bare Lands

Bare Surfaces which were observed as exposed ground surface without any vegetation cover and rock outcrop in some places.



Plate4.5: Bare land with sparse trees scattered within the Project site landscape in Daki-Takwas

4.2.4.6 Water Bodies

Water bodies were observed as natural water bodies such as streams, rivers, lakes or reservoirs.



Plate 4.6: Pond of depression storage water within the SAPZ AIH project site at the Project site in Daki-Takwas



4.2.4.7 Settlements

Small human settlements were situated outside the AIH project site, The dominant indigenous ethnic group among the resident population in the Kaduna SAPZ AIH project area is the Gwari or Gbagyi ethnic group followed by the Hausa-Fulani, and the other minority groups such as Kanuri, Nupe, and Yoruba. The community's resident in close proximity to the proposed AIH SAPZ include Daki-Takwas and surrounding settlements such as Unguwan Dawaki, Ungwan Sarki, Sabon Sara. Livelihoods among the communities are predominantly agriculture-based subsistence and commercial farming; enabled by the fertile soils and seasonal rainfall in the area which supports rainfed cultivation of crops such as: maize, sorghum, millet, cassava, yam, groundnut, cowpea, soya beans; and the cultivation of vegetables such as tomato, cabbage pepper, okra, leafy greens. Furthermore, the resident communities engage in small-scale livestock rearing such as poultry, goats, sheep, and cattle animal husbandry.

4.2.4.8 Transportation Land Use

The Abuja-Kaduna-Zaria expressway passes adjacent to the SAPZ AIH project site.



Plate 4.7: Abuja – Kaduna – Zaria expressway, adjacent to the AIH SAPZ site at Daki - Takwas

**4.2.4.9 Environmental Sensitivity of SAPZ AIH Project Area**

The SAPZ AIH project site is primarily a mosaic of agricultural arable cropland, guinea savanna woodland, interspersed with shrubs, grassland, bare surfaces, rock outcrops, water bodies (rivers and dried streams channels), and settlement clusters (e.g., Daki-Takwas and the surrounding communities). The sensitivity of the SAPZ AIH Land Use and Land Cover (LULC) resources to interactions with the proposed agro-industrial processing hub development project activities is conceptualized to be a reflection of the ecological value, hydrologic functions, erosion / flood risks and social proximity impacts that would arise from the project. This is intended to serve as the basis for impact identification and the preparation of an ESMP safeguard instrument for the project.

Table 4.15: Sensitivity of SAPZ AIH LULC features to interactions with proposed project activities

LULC Class	Key Concerns and Impacts of Proposed Project Activities	Indicative Sensitivity
Guinea savanna woodland mosaic with scattered trees, shrubs, grass	The clearing of the savannah woodland, mosaiced with minor trees, shrubs and grasses has the potential to result in: • Loss of habitat for wildlife (fauna); • Loss of agricultural and crop resources; • Loss of carbon storage; • Loss of biodiversity; • Topsoil exposure, soil stabilization and soil erosion problems; • Increased potentials for flooding and deterioration of surface water quality in downstream locations.	The sensitivity of the LULC features to the interactions of the project activities could range from Moderate–High, depending on magnitude and extent of land cover resources that has to be cleared from the project site for the development of the SAPZ AIH, and species of biodiversity present within the project site
Grassland (continuous or discontinuous with bare land patches)	The site clearing and grubbing project activities during the pre-construction phase will result in the removal of vegetal cover and increase the coverage of bareland within the AIH project site. This will increase the erosion potential of	The sensitivity ranges from Low–Moderate, but it could rise to Moderate–High if the AIH project site is situated on steep slopes or erodible lands



	the site and this has to safeguarded with appropriate measures	
Arable agricultural land (smallholder rain-fed: millet, sorghum, maize, etc.)	The SAPZ AIH development will inevitably result in: • Loss of productive arable crop lands and community livelihoods; • Surface water quality pollution from surface runoffs leaching agrochemical previously used on the farmlands • Topsoil erosion from surface runoffs during rainy seasons, and flooding risks; • Soil structure vulnerability	The sensitivity in this case is Moderate but near the drainage channel watercourses and community settlements, all AIH physical development activities must be avoided and limited to the AIH project site. Appropriate measures must be put in place to avoid or minimize the incidence of soil erosion, clearing of riparian vegetation near river banks or floodplains, etc.
Bare land / rocky outcrops	The proposed project would result in increased coverage of bare surfaces and increase surface runoff and erosion potential during the rainy season; complete conversion of a guinea savannah woodland into an agro-industrial processing land use, thereby resulting in depletion of wildlife and flora habitat value; and dust generation during the pre-construction and construction phases of the project.	The sensitivity ranges from Low–Moderate but it could increase where the topography is sloped or there is steep down-gradient in the landscape
Water bodies & riparian corridors	The sensitivity of the interaction of water resources and the vegetal cover in the riparian corridors is very critical. The potential impacts included: • Deterioration of the aquatic habitat, and fisheries;	The sensitivity in this case ranges from High–Very High. The project must establish no-go area restrictions or wide buffer



	• critical adverse impacts on hydrologic connectivity; • Depletion of the flood conveyance capacity of the river channels; and • Deterioration of downstream surface water quality and reduction in the sustainability of community water usage	zones the project footprint must not be allowed to encroached into.
Settlements & community land use areas	The resident communities in close proximity to the SAPZ AIH project site are the impact receptors and the Project Affected Persons that are exposed to the impacts of dust emissions, increased noise levels, traffic congestions, water quality deterioration, loss of cultural and livelihood assets. Among these communities are: Gbagyi, Hausa-Fulani, and other ethnic groups in Nigeria resident in the project area	In this instance we would have High social sensitivity with potentials to adversely impact on public health, community safety, and loss of access to community livelihoods)

Based on the indicative sensitivity specification in Table 4.15, the environmentally sensitive areas in the SAPZ AIH project area include:

- **Riparian zones and downstream surface waters resources** (streams, ponds, reservoirs). They all showed high ecological and hydrological sensitivity, and impacts of the proposed project on them adversely affect communities' livelihoods, water uses and downstream water quality.
- **Woody savanna lands** shows high environmental sensitivity because they retain canopy continuity or host native trees, and their clearance for AIH development would result in loss of local biodiversity refugia, carbon value.
- **Community interfaces** (Daki-Takwas and surrounding settlements; farm plots, grazing corridors) also shows high social sensitivity due to the high potentials for loss of livelihood and safety risks the resident communities would be exposed to;
- **Erodible bare grounds**, especially the landscapes on slopes or down-gradient of the flow direction of surface runoffs from the AIH project site towards the nearby stream or river



drainage channels are highly prone to soil erosion, leaching of the soil nutrients, during rainfalls, deterioration of surface water quality in downstream water bodies: and increased sediment delivery in downstream receptor water bodies.

Consequently, the SAPZ AIH project area contains high-value downstream riparian zones and waterbodies, socially sensitive settlement interfaces, and moderate-to-high sensitivity savanna woodland and grassland mosaics that support livelihoods and ecological functions. The greatest risks would arise from: the alteration of the hydrology of the project area; deterioration of downstream water quality; incidence of soil erosion; increased sediment delivery into downstream waterbodies, leaching of previously used agrochemical and organic pesticide residues, traffic congestion during the project lifecycle, and the resident community's access to livelihood assets, health and safety. With avoidance-first siting, engineered buffers and treatment, robust ESMPs, and transparent monitoring and stakeholders' engagement, the development can proceed while maintaining ESHS safeguard performance, and enhancing community resettlement, and livelihood restoration outcomes.

4.2.5 Characteristics of the Landscape of the Project Area

The SAPZ AIH project site lies on a relatively slopy topography with elevations ranging from 372 to 879 meters above mean sea level (amsl). This simply means the SAPZ AIH footprint landscape is a 507 meters relief that lies within a 2.58 km². Thus, the site is a complex topography that is generally steep and not uniformly flat. A close look at the topographic map in Figure 4.21 below shows that the SAPZ AIH project site falls right upon the watershed divide and the steep slopes of watershed 2 and 3 respectively. In situation of a heavy rainfall event, storm water would flow from the watershed divide down the slope towards the drainage channels of watersheds 2 and 3 (the two contiguous watersheds to the right in Figure 4.22).

The map shows that a significant portion of the 2.58 km² project site lies on slopy terrain that is highly prone to soil erosion. Surface runoffs from the project site would flow mainly into the drainage channels of watershed 2 and watershed 3, which both drains southwards into Kaduna River. The elevation range between 372 m and 879 m amsl that occurs *inside* a 267.751 ha site (≈ 2.68 km²) is a strongly undulating to steep terrain, that has implications on both slope-stability risk and



hydrology in major ways. The SAPZ AIH project site which is approximately 2.58 square kilometers could be estimated as a 1.61 km by 1.62 km project site, with a diagonal of 2.27 km. Since, it is the slope angle of a landscape that governs stability and runoff not absolute elevation, Then:

- 507 m landscape over the **1.61 km** side would produce an average grade $\approx 31.6\%$ ($\approx 17.5^\circ$).
- 507 m landscape over the **2.27 km** diagonal would result in the average grade $\approx 22.3\%$ ($\approx 12.6^\circ$).

This shows that the SAPZ AIH project site is a terrain with mix ridges, benches, and channels with some slope stability implications which include:

- **Higher inherent risk on natural slopes:** Expect shallow translational slips, rilling, and gullying on $>10\text{--}15\%$ grades, especially after intense storms or where soils are weathered/loose.
- **Cut/fill sensitivity:** Any platforming, roads, or terraces will create cut/fill batters that need the following engineering measures:
 - Keep permanent soil batters' **flatter than $\sim 1V:2.5\text{--}3H$** unless geotechnically justified.
 - Bench long slopes; key fills into competent subgrade; compact to $\geq 95\%$ **MDD** with moisture control.
 - Install **crest cut-off drains** and **toe drains**; intercept upslope runoff before it reaches batters.



- **Foundations & walls:** Anticipate retaining structures, slope reinforcement (geogrids/soil nails) in places, and setbacks from breaks-of-slope. Check global and local **FoS** under saturated conditions.

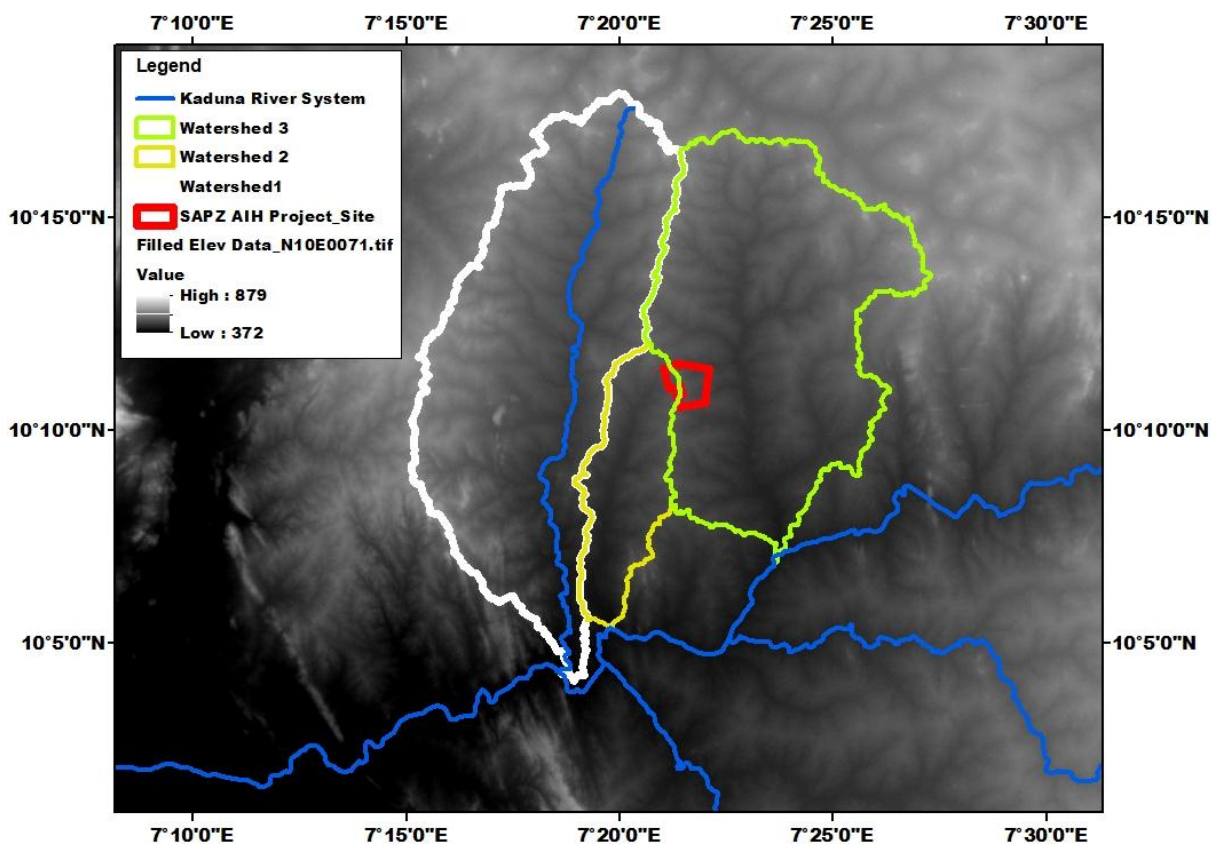


Figure 4.21: Three adjacent watersheds that defines the hydrology and drainage of the Project

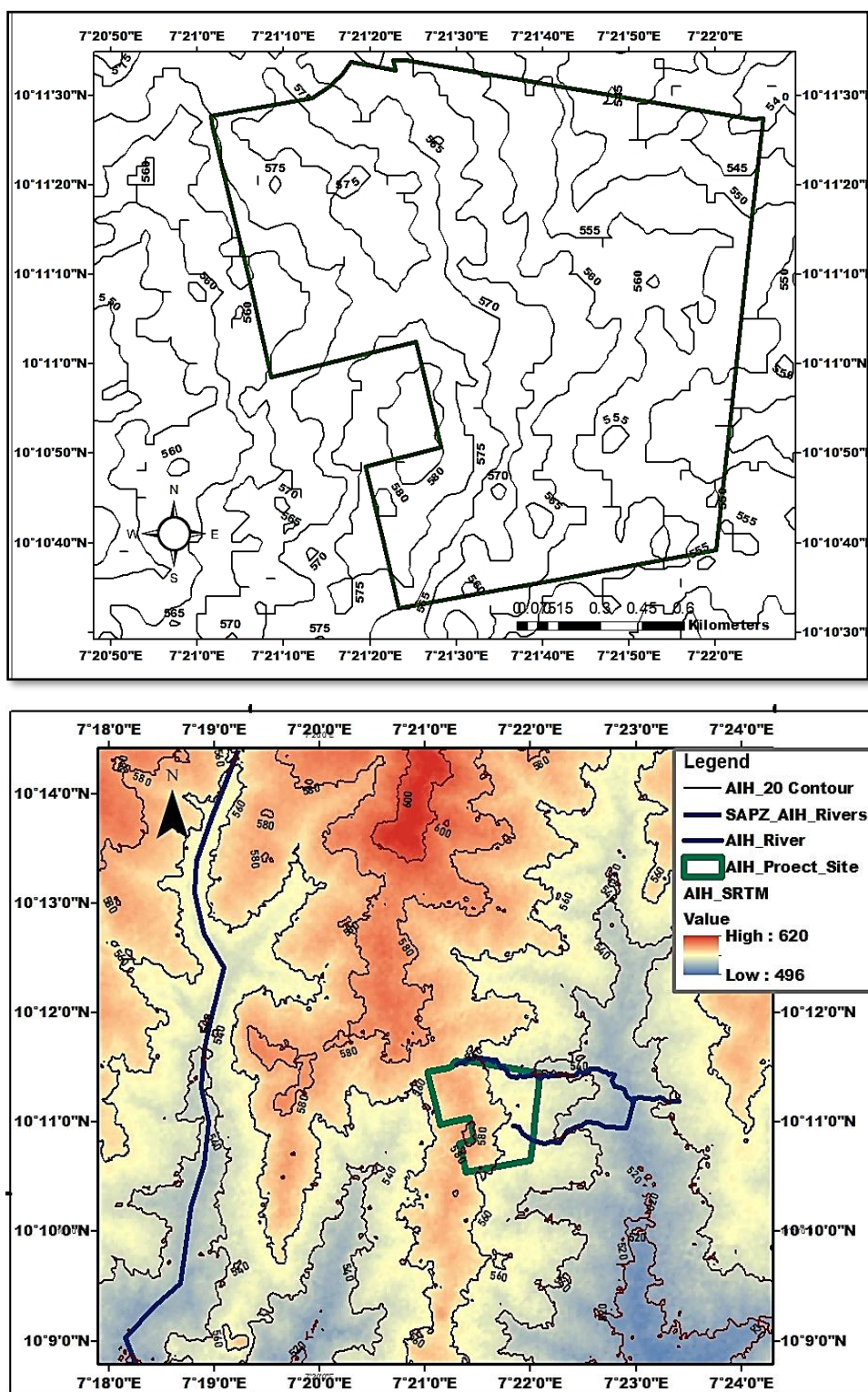


Figure 4.22 Maps showing the landscape and topographic characteristics of SAPZ AIH Site



4.2.6 Geology of the Study Area

The physiography and geology of the SAPZ AIH project site is undulating plains of the Precambrian Basement Complex (granites, gneiss, schists). Weathered fractured basement controls shallow aquifers; VES surveys around Rido–Ungwan Barde–Kipi-Nari show 3–4 geoelectric layers with aquiferous weathered/fractured zones averaging ~25 m thickness. The geology map of the SAPZ AIH project area is as shown in Figure 4.23.

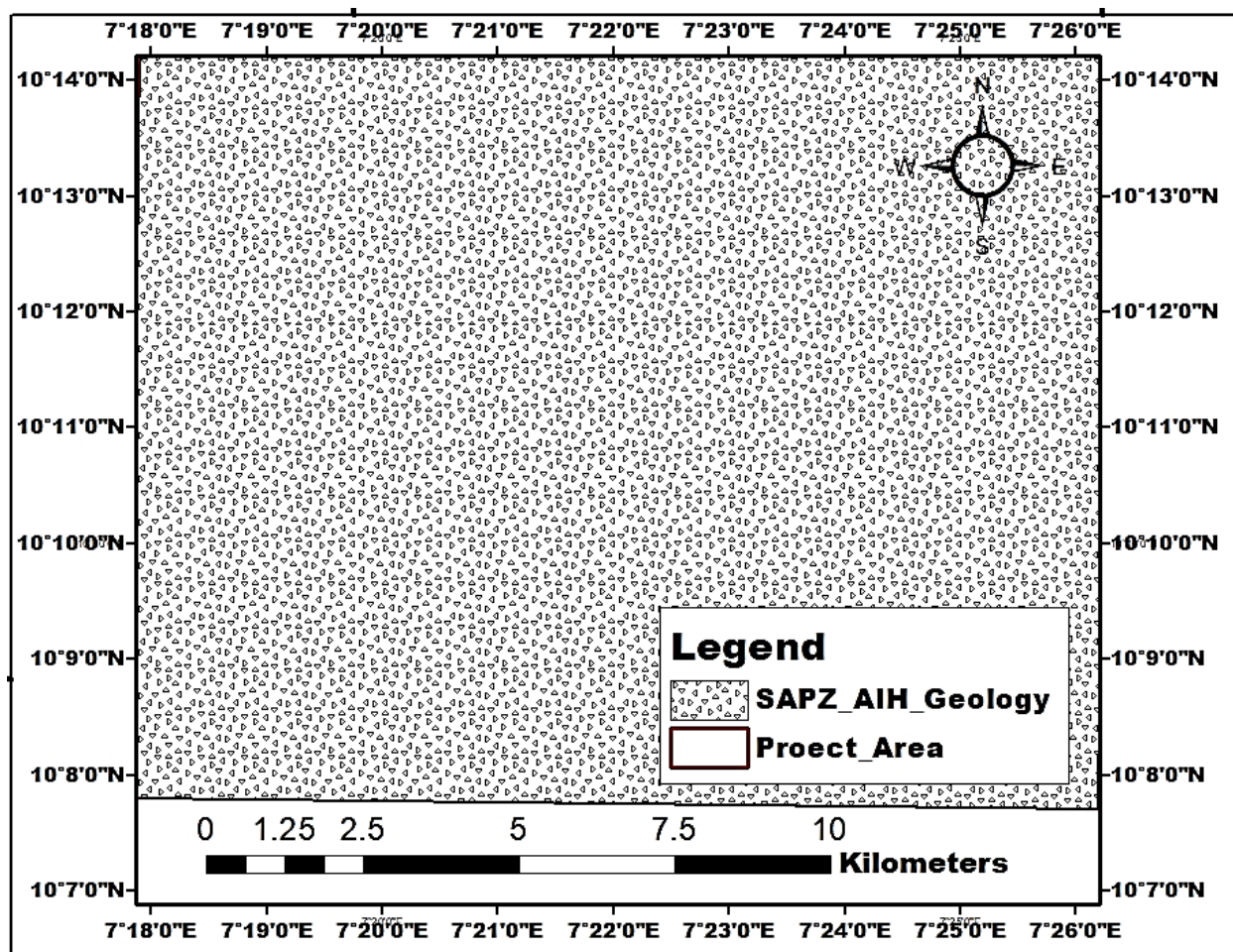


Figure 4.23: Geology Map of SAPZ AIH project area

4.2.7 Drainage System and Hydrology

The analysis of the hydrology of the SAPZ AIH project site shows three contiguous watersheds with clearly defined drainage channels of streams that drains southwards into Kaduna River (Figure



4.24). The two watersheds to the left (watershed 1) and right (watershed 2) sandwiched a rather small watershed (watershed 2) in the middle. The flow direction of surface runoffs from a rainfall event is defined by direction of steepes descent of stormwater from each terrain cell of the SRTM elevation data used for the flow direction analysis.

Figure 4.24: Map showing the flow direction analysis.

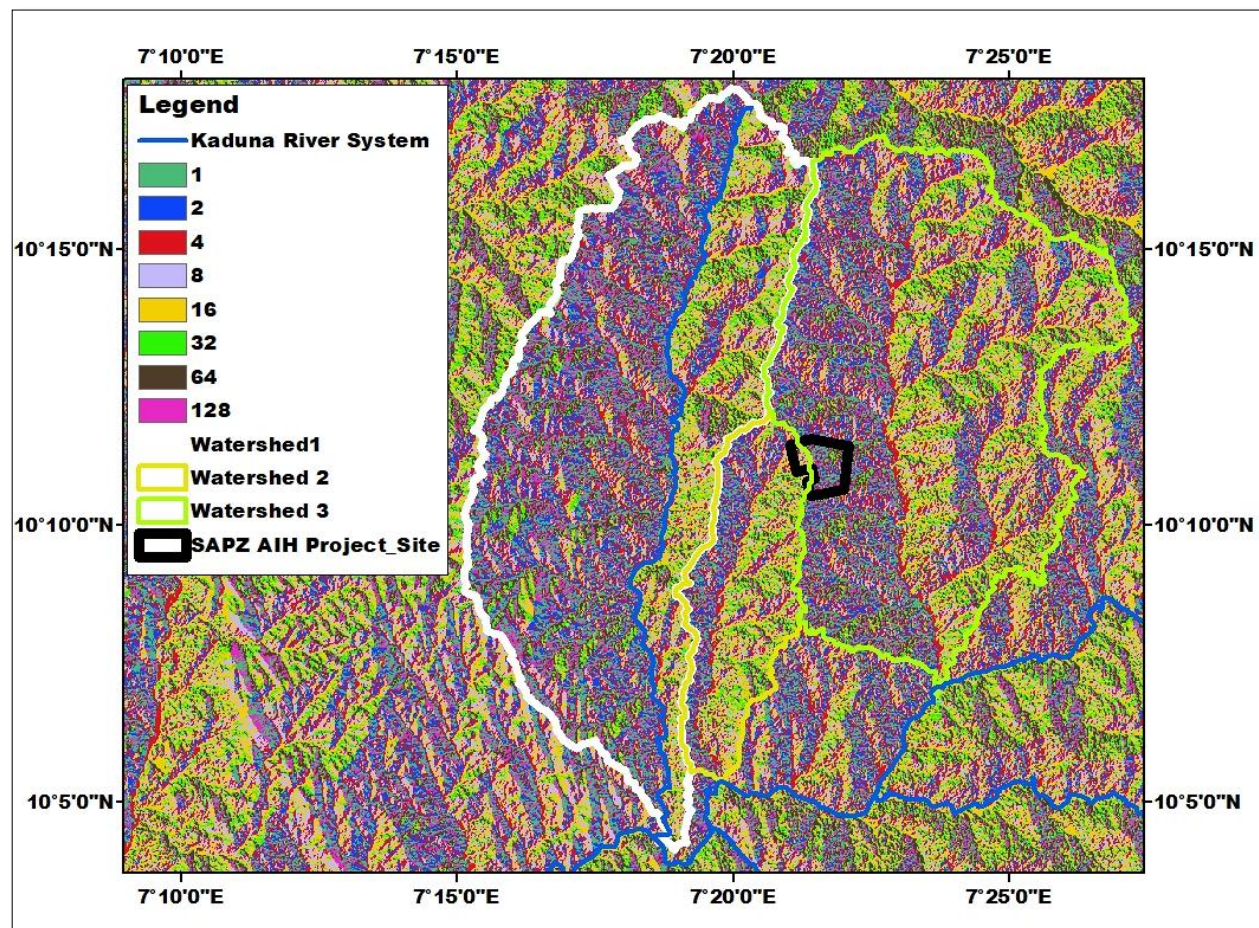


Figure 4.24: Map showing the flow direction analysis

The flow directions of stormwater over the slopy undulating terrain. of the flow direction, is described by an approach similar to a compass using the eight-point pour algorithm in Hydrologic Engineering Center's HEC-GeoHMS 10.1 as shown in Figure below: The possible eight possible directions are as follows:

- 1 = East;
- 2 = Southeast;



4 = South;

8 = Southwest;

16 = West;

32 = Northwest;

64 = North; and

128 = Northeast

A closer look at the flow direction map shows the red colour swatches indicating the flow of surface runoffs across the landscape towards the south with colour code 4 signifying red.. A look at the drainage channels shows mainly the red colour indicating flows towards the south into Kaduna River. A close examination of flows from the SAPZ AIH project site into watershed 3 shows significant flows towards the south along the rills and river channels in watershed 3 while, the portion of the AIH site in watershed 2 flows towards the west (with colour code 16) into the main drainage channel of watershed 2 before flowing southwards into Kaduan River. The nature of the topography of the SAPZ AIH project site which is rather complex with undulating and slopy terrain which could have the following hydrologic and drainage implications:

- **Development of Flashier Surface Runoffs along the steep gradients** with inherent shorten time of concentration, which results in **higher peak flows**, greater erosive power.
- **Channel design:** Natural drainage lines will be incised; unprotected outlets can head-cut. Use stepped drop structures, energy dissipation (aprons/riprap), and line steeper reaches where computed velocities exceed non-erosive limits (rule-of-thumb: bare fine soils ≤ 0.6 – 1.0 m/s; grassed swales up to ~ 1.5 – 2.0 m/s; riprap higher).
- **Erosion control:** Expect need for check dams in construction swales, slope blankets/matting on long faces, rapid revegetation. Sediment basins at low points sized from your hydrology model.
- **Platform grading:** Create **benches/terraces** at similar elevations; grade pads at **1–2%** (never dead-level) draining to controlled inlets. Avoid concentrating long slope lengths onto a single outfall.
- **Roads:** For heavy vehicles, target sustained grades **≤ 6 – 8%** ; use switchbacks and contour-following alignments.

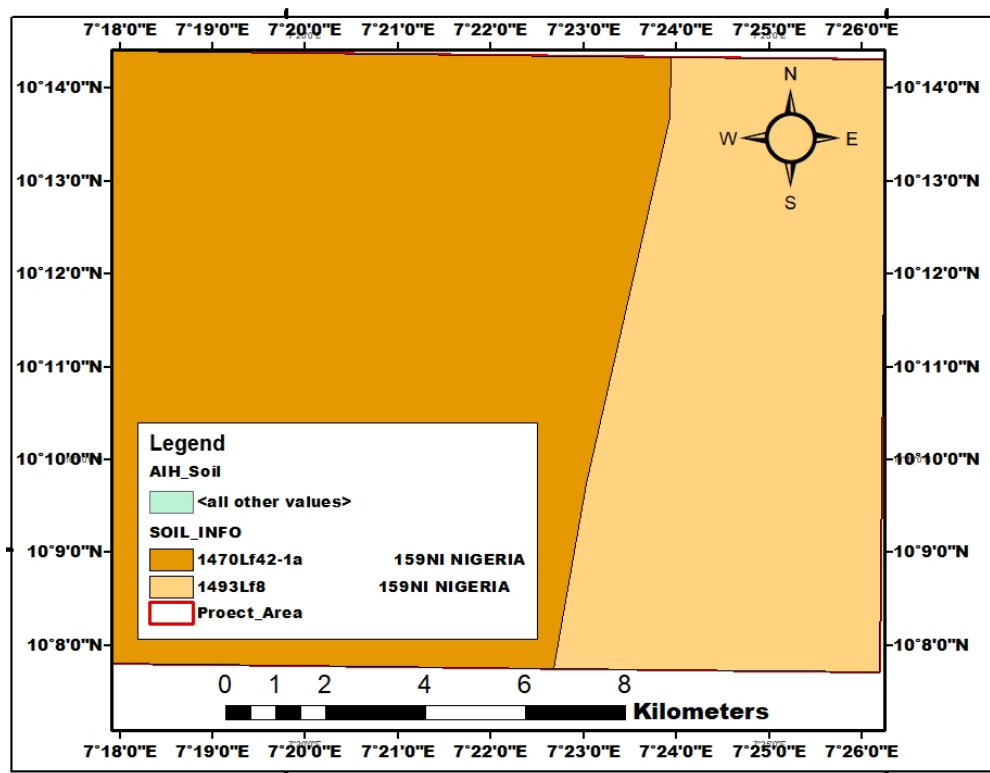


Figure 4.25: Soil map of SAPZ AIH project area

4.2.8 Soil Study

Soil Characteristics of SAPZ AIH Project Area

The dominant soils in the SAPZ AIH project environment is the dominant ferruginous tropical soils / Luvisols (Alfisols) typical of the Northern/ (transitional) Guinea Savanna on basement rocks; generally well-drained sandy loam topsoils, moderate natural fertility, low organic matter; alluvial/Fluvisols along the Kaduna/Romi floodplains. The soil map of the project area is as shown in Figure 4.25.

The soils in Chikun are generally deep to very deep, with substantial profiles stretching between 167–192 cm, and often characterized by a sandy loam to sandy clay loam texture. The surface coloration varies from yellowish-brown in well-drained upland areas and greyish-brown elsewhere, indicating hydrologic and drainage conditions. Geotechnically, these lateritic soils often exhibit low



to medium plasticity, low swelling potential, medium permeability (10^{-3} to 10^{-5} m/s), and high bearing capacity (>150 kN/m²) which are favorable traits for infrastructural development.

4.2.8.1 Soil Quality Studies

This report presents the baseline soil quality assessment for the proposed Daki Takwas Agro-Industrial Hub, Chikun Local Government Area, Kaduna State. The study was conducted as part of the Environmental and Social Impact Assessment (ESIA) to establish reference soil conditions prior to project implementation. The data provide a benchmark for evaluating future project-related impacts and for monitoring compliance with the Federal Ministry of Environment (FMEnv) standards.

4.2.8.2 Sampling a Laboratory Analysis Methodology

Soil samples were collected from thirty (30) locations within the project area (S1–S30), with two additional control samples. Sampling points were geo-referenced using handheld GPS devices (see Annex A). Samples were collected at depths of 0–15 cm, stored in clean polythene bags, labelled, and transported to the laboratory under appropriate preservation. Analytical methods followed APHA, ASTM, and FMEnv approved protocols. Parameters analysed included physical properties (pH, electrical conductivity, texture), chemical constituents (nitrates, sulphates, organic carbon), heavy metals (Pb, Cd, Cr, Ni, Zn, Fe, Cu, Mn), and microbiological indicators. The analysis was carried out at the KEPA laboratory Kaduna.

4.2.8.3 Kaduna SAPZ AIH Soil Baseline Condition

Table 4.16 presents a consolidated summary of soil quality results across the thirty sampling locations and two control sites. Results are compared against FMEnv permissible limits for soil quality.

Table 4.16: Soil Quality Results (Selected Parameters)

Parameter	Unit	S1	S2	S3	S4	S5	Control 1	Control 2	FMEnv Standard
pH	-	6.4	6.2	6.1	6.3	6.5	6.8	6.7	6.0–8.5
Electrical Conductivity	μS/cm	210	240	300	275	265	180	190	200
Organic Carbon	%	1.2	1.3	1.1	1.4	1.5	1.2	1.1	≥0.75
Nitrate	mg/kg	8.2	7.5	6.9	8.0	9.1	4.2	3.8	10



Parameter	Unit	S1	S2	S3	S4	S5	Control 1	Control 2	FMEnv Standard
Sulphate	mg/kg	45	51	39	62	59	28	30	100
Lead (Pb)	mg/kg	0.02	0.01	0.03	0.02	0.02	0.01	0.01	0.5
Cadmium (Cd)	mg/kg	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.01
Chromium (Cr)	mg/kg	0.04	0.05	0.03	0.06	0.04	0.02	0.03	0.1
Zinc (Zn)	mg/kg	2.1	2.4	2.0	2.3	2.2	1.9	1.8	50
Iron (Fe)	mg/kg	12.4	13.1	11.5	12.9	13.2	10.5	10.8	20
Total Coliform	Cfu/g	15	18	12	14	17	8	7	10

Soil pH values were moderately acidic to neutral (6.1–6.8), and the soil pH range fell within FMEnv permissible limits. Electrical conductivity levels were generally low to moderate, with some values exceeding the FMEnv limits, indicating potential low concentration of salt / ion concentration. Organic carbon levels were satisfactory across all sites, suggesting adequate soil fertility. Nitrate and sulphate concentrations were below FMEnv limits, though higher values near settlements suggest anthropogenic inputs. Heavy metals (Pb, Cd, Cr, Zn, Fe) were detected at trace levels and well below FMEnv thresholds, indicating no contamination concern. Microbial indicators exceeded FMEnv permissible levels at some locations, reflecting organic matter influence. Baseline soil quality in the project area is generally good, with fertility maintained through organic carbon content. However, slightly elevated conductivity in some locations indicates the potential for salt build-up, which could affect long-term soil productivity. Microbial contamination at some points reflects waste disposal and agricultural activity. The results provide a credible baseline for monitoring soil conditions throughout the project lifecycle.

4.2.8.4 Soil Impact Assessment

Project activities, particularly during construction, may disturb soil structure, increase erosion, and introduce pollutants. Improper handling of waste or agrochemicals during operation could affect soil chemistry and fertility. During construction, land clearing, grading, and foundation works could result in significant soil erosion. Leaks from heavy machinery and fuel storage could contaminate soils with hydrocarbons. During operation, improper infiltration of wastewater or effluent discharge could alter soil chemistry and increase salinity, while use of agrochemicals and improper waste disposal could lead to heavy metal accumulation. Leachates from agro-industrial solid waste storage



and by-products of processing activities also present risks. Without mitigation, impacts may be moderate to high, but reversible with proper management.

Table 4.17: Potential Impacts of Project Activities on Soil Quality

Project Phase	Potential Impact	Source/Activity	Receptor	Significance (Pre-Mitigation)	Mitigation
Construction	Soil erosion and loss of topsoil	Land clearing, grading, excavation	Soil resources, agriculture	Moderate–High	Erosion control, phased clearing, re-vegetation
Construction	Soil contamination by hydrocarbons	Leaks from machinery, fuel storage and handling	Soil, groundwater	Moderate	Secondary containment, spill kits, equipment maintenance
Operation	Soil salinisation	Improper wastewater infiltration or effluent discharge around utility areas	Soil fertility	Moderate	Wastewater treatment, lined infiltration ponds
Operation	Heavy metal accumulation	Agrochemical use, fertilisers, pesticides, waste disposal	Soil biota, crops	Low–Moderate	Controlled agrochemical use, safe disposal
Operation	Soil contamination from processing residues	Spilled processing chemicals, packaging residues	Soil and groundwater	Moderate	Good housekeeping, spill control, safe storage
Operation	Leachate seepage from solid waste storage	Improper storage of agro-industrial by-products and wastes	Soil, groundwater	Moderate	Lined storage, leachate collection systems



4.2.8.5 Mitigation Measures

The potential soil impacts identified in Section 6.0 require proactive mitigation to maintain soil fertility and prevent contamination during both construction and operational phases. Mitigation measures target erosion control, safe handling of hydrocarbons, prevention of soil salinisation, and controlled agrochemical use. These measures will be implemented as part of the project's Environmental Management Plan (EMP). Table 4.18 summarises the mitigation measures, the responsible parties, and the timelines for their implementation.

Table 4.18: Mitigation Measures for Identified Soil Impacts

Identified Impact	Mitigation Measure	Responsible Party	Timeline
Soil erosion and loss of topsoil	Use erosion control measures, phased land clearing, re-vegetation, and mulching	Contractor / Proponent	Construction phase
Soil contamination by hydrocarbons	Provide secondary containment for fuel storage, regular equipment maintenance, spill response kits	Contractor	Construction / Operation
Soil salinization	Ensure wastewater treatment prior to discharge, use lined infiltration ponds, monitor soil salinity	Proponent	Operation phase
Heavy metal accumulation	Promote controlled agrochemical use, integrated pest management, safe waste disposal	Proponent / Community	Operation phase
Soil contamination from processing residues	Adopt good housekeeping, safe storage of chemicals, spill control measures, proper packaging waste handling	Proponent	Operation phase
Leachate seepage from solid waste storage	Provide lined and covered waste storage areas, leachate collection and treatment systems, periodic monitoring	Proponent	Operation phase



4.2.8.6 Conclusion

The baseline assessment shows that soils in the project area are moderately fertile, with satisfactory organic carbon and low heavy metal concentrations. Some microbial contamination and slightly elevated conductivity were observed. These results serve as a valuable baseline for ESIA monitoring. Effective management will prevent erosion, contamination, and loss of fertility.

4.2.8.7 Recommendations

Adopt soil conservation practices during land preparation and construction. Ensure proper storage and handling of fuel and chemicals. Introduce wastewater management systems to prevent salinisation. Conduct periodic soil monitoring to track changes in fertility, salinity, and contamination levels in compliance with FMEnv requirements.

4.2.9 Groundwater Characteristics

Groundwater study was not performed in this ESIA Study as site does not include any underground water source.

4.2.10 Surface Water Characteristics

This report presents the baseline surface water quality assessment for the proposed Daki Takwas Agro-Industrial Hub, Chikun Local Government Area, Kaduna State. The study was conducted as part of ESIA to establish reference conditions of natural water bodies prior to project implementation. The proposed facility will process, package, and store agricultural products sourced from within Kaduna State and neighbouring regions. It will include processing halls, cold and dry storage warehouses, administrative offices, utility infrastructure, and support facilities. The project is strategically located within an agro-industrial zone, ensuring compatibility with designated land use and proximity to raw material sources, transport corridors, and target markets. Surface water monitoring was undertaken to provide baseline data and to assess potential implications of run-off, wastewater discharges, and other facility operations on surrounding water bodies. The coordinate and sampling point is presented on Figure 4.4.

All future water abstraction for process or utility purposes will require a Water Use Permit from the Kaduna State Water Resources Regulatory Commission, in accordance with the Water Resources Act (Cap W2 L.F.N. 2004). Similarly, prior to the commencement of operations, the project will obtain a Wastewater Discharge Permit from NESREA/FMEnv following the submission of detailed



effluent design data and environmental monitoring plans. At this stage of the ESIA, the necessary permit applications are pending and will be initiated during the detailed engineering design phase in collaboration with the Kaduna State Ministry of Environment and NESREA.

4.2.10.1 Methodology

Surface water samples were collected from six locations (W1–W6) to represent upstream, midstream, and downstream conditions of Rafin Sarki stream in the north-east of the project site; W6 served as a control point. Sampling locations were geo-referenced using handheld GPS; the coordinates are provided in Annex A. Samples were collected in sterilised containers, preserved under cooling, and transported to the laboratory for analysis. Analytical procedures followed APHA and ASTM methods recognised by FMEnv. Parameters analysed included physical (appearance, colour, turbidity, total suspended solids), chemical (pH, electrical conductivity, total dissolved solids, dissolved oxygen, nitrate, sulphate, chemical oxygen demand), organic (biochemical oxygen demand), trace metals (Ca, Mg, Pb, Cu, Cd, Fe, Zn, Cr, Ni) and bacteriological indicators (total coliform, faecal coliform). Results were compared to FMEnv surface water quality limits.

Table 4.19 provides a consolidated summary of all parameters measured across the six sampling locations with FMEnv surface water standards included for comparison.

Table 4.19: Consolidated Surface Water Quality Results

Parameter	Unit	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6 (Control)	FMEnv Surface Water Standard
pH	-	6.68	6.63	6.50	6.72	6.54	6.46	6.5–8.5
Turbidity	NTU	31	132	74	525	599	29	≤5
Colour	PtCo	449	648	808	2196	2288	118	15
TSS	mg/L	17	106	51	414	417	23	30
TDS	mg/L	740	800	264	600	360	600	1000
DO	mg/L	10.34	5.43	9.67	9.54	9.65	11.16	≥5
Nitrate	mg/L	6.0	11.5	12.3	35.1	35.4	2.5	10
Sulphate	mg/L	19	44	33	102	108	15	100
COD	mg/L	1	8	44	67	24	7	40
BOD ₅	mg/L	1.14	0.98	0.27	1.38	1.24	3.48	<6
Lead	mg/L	0.0011	0.0010	BDL	BDL	BDL	BDL	0.01
Cadmium	mg/L	0.0030	0.0012	0.0011	0.0012	0.0012	0.0012	0.003
Iron	mg/L	0.0270	0.0401	0.0201	0.0010	0.0201	0.1020	0.3
Zinc	mg/L	0.00210	0.0022	0.0031	0.0021	0.0100	0.0012	5.0
Total Coliform	MPN/100ml	12	14	17	22	14	31	10



Faecal Coliform	Cfu/ml	5	7	3	5	6	2	0

4.2.10.2 Baseline Surface Waater Quality in July 2025

The surface waters exhibited elevated turbidity and colour, far above FMEnv limits, which indicates high sediment load from erosion and catchment run-off. Total suspended solids were also elevated at midstream and downstream stations. pH values were slightly acidic but within the permissible range. Dissolved oxygen was favourable for aquatic life. Nitrate concentrations at W4 and W5 exceeded the FMEnv limit, consistent with agricultural or waste inputs. COD was elevated at some stations, while BOD₅ remained within guideline values, suggesting limited readily biodegradable organic load. Trace metals were found at low concentrations and below FMEnv limits. Total and faecal coliforms exceeded guideline values across all sites, indicating faecal infl

The dataset indicates moderate pressure on surface water quality arising from a mix of natural processes and human activities. Sediment mobilisation appears to be the principal driver of high turbidity and suspended solids. Nutrient enrichment and microbial indicators point to inputs from agriculture and settlements. Heavy metals are not a concern at present. Importantly, these baseline findings highlight the need for careful wastewater, stormwater, and sanitation management once the proposed agro-industrial facility becomes operational. Discharges from processing halls, storage facilities, utility infrastructure, and solid waste handling must be managed to ensure they do not exacerbate existing water quality challenges.

The results therefore provide a defensible baseline for impact prediction and compliance monitoring under the ESIA. The proposed SAPZ AIH project activities could intensify pressures on the soils of the project area. Land clearing and earthworks may raise turbidity and suspended solids. Run-off from work areas and worker facilities may increase nutrients and microbial loads. Hydrocarbons from equipment could raise COD and introduce oil and grease. Aquatic receptors are sensitive to reduced clarity and oxygen stress, while communities may be affected where surface waters are used without treatment. Without controls, impacts would be moderate to high in magnitude but reversible with appropriate management.

**Table 4.20: Potential Impacts of Project Activities on Surface Water Quality (Construction and Operation Phases)**

Project Phase	Potential Impact	Source/Activity	Receptor	Significance (Pre-Mitigation)	Mitigation (to be applied)
Construction	Increased turbidity and suspended solids	Land clearing, excavation, run-off	Surface waters, aquatic organisms	Moderate-High	Erosion control, silt traps, re-vegetation
Construction	Microbial contamination	Worker camps, sewage discharge	Surface waters, nearby communities	Moderate	Sanitation facilities, sewage management
Construction	Hydrocarbon contamination	Leaks from machinery and vehicles	Aquatic organisms, water users	Moderate	Equipment maintenance, spill control
Operation	Nutrient and organic enrichment	Run-off from processing halls and packaging facilities, wastewater discharges	Surface waters, aquatic life	Moderate-High	On-site wastewater treatment, controlled drainage systems
Operation	Chemical contamination	Leaks from refrigeration systems, utility water and chemical storage	Surface waters, aquatic organisms	Moderate	Spill containment, chemical handling procedures
Operation	Leachate contamination	Improper solid waste handling and storage	Surface waters, communities	Moderate	Lined storage, leachate collection and treatment systems

4.2.10.3 Mitigation Measures

The potential impacts identified in Section 6.0 require proactive mitigation to safeguard surface water resources during the construction and operational phases. Mitigation focuses on controlling erosion and sediment transport, preventing microbial and nutrient contamination, and avoiding hydrocarbon and chemical pollution. These measures will be implemented through the project's Environmental Management Plan (EMP). Table 4.21 summarises the measures, the responsible parties, and the timelines for implementation.

Table 4.21: Mitigation Measures for Identified Impacts on Surface Water Quality



Identified Impact	Mitigation Measure	Responsible Party	Timeline
High turbidity and suspended solids	Install erosion controls, stormwater drainage, sediment traps, and phased clearing with rapid re-vegetation	Contractor / Proponent	Construction phase
Microbial contamination	Provide adequate sanitation at camps, install septic systems, prohibit direct sewage discharge, community sanitation improvements	Contractor / Proponent	Construction and operation
Hydrocarbon contamination	Maintain machinery, provide oil-water separators, secondary containment for fuel storage, regular inspection	Contractor	Construction and operation
Nutrient and organic enrichment	Construct and operate wastewater treatment plant with sedimentation and biological treatment prior to discharge	Proponent	Operation phase
Chemical contamination	Ensure safe storage and handling of refrigerants and chemicals, emergency spill containment and clean-up procedures	Proponent	Operation phase
Leachate contamination	Provide lined and covered waste storage areas, collect and treat leachates, implement waste management plan	Proponent	Operation phase



4.2.10.4 Conclusion

Surface waters in the study area show moderate impairment from turbidity, suspended solids, nutrients, and microbiological indicators, while metals remain low. The baseline provides the benchmark for future monitoring and demonstrates the need for disciplined water management during project execution.

4.2.10.5 Recommendations

Incorporate erosion and sediment controls in design and method statements; provide sanitation facilities for workers; collect and treat wastewater prior to discharge; maintain equipment to prevent oil releases; and monitor surface water quality throughout construction and early operation to verify compliance with FMEnv limits and detect trends.

4.2.11 Hydrobiology of the project area

The un-availability of significantly sized waterbodies in the project area made the performance of hydrobiology studies not applicable in this ESIA study

4.2.12 Vegetation Studies

Vegetation ecology, which studies plant cover in relation to environmental factors, is an important indicator of biodiversity, ecosystem health, and sustainable land use (Van der Maarel & Franklin, 2013; Goudie, 2013). The AIH SAPZ project site at Daki – Takwas, Chikun LGA, falls within the Northern Guinea Savanna, a transitional belt between the southern forests and the northern Sudan–Sahel zone. The vegetation is characterized by open woodland with tall grasses, dominated by *Daniellia oliveri*, *Isobertinia doka*, *Vitellaria paradoxa* (shea butter), and *Parkia biglobosa* (locust bean), alongside grasses such as *Andropogon gayanus*, *Hyparrhenia* spp., and *Pennisetum purpureum*. Shrubs like *Combretum* and *Terminalia* spp. are also common.

The physiognomy consists of scattered medium-sized trees and extensive grass undergrowth, shaped by seasonal climate, soil conditions, and human activities including farming, grazing, fuelwood harvesting, and bush burning. These pressures have altered the natural structure, creating areas of secondary regrowth, fallows, and bare ground. According to Keay's (1953) classification, the project area belongs to the Northern Guinea Savanna subtype, which plays a vital role in biodiversity



support and local livelihoods by providing fodder, fuelwood, and non-timber forest products (Nwaogu et al., 2017). Understanding these vegetation dynamics is critical for the AIH SAPZ environmental assessment, ensuring that development balances resource use with biodiversity conservation.

4.2.12.1 Vegetation Types in the Project Area

The vegetation of the AIH SAPZ project area in Daki - Takwas, Chikun LGA, is typical of the Northern Guinea Savanna, shaped by climate, soil, and long-standing human activities. The main vegetation types observed include:

- **Guinea Savanna Woodland:** This is the dominant vegetation, featuring scattered medium to tall trees such as *Vitellaria paradoxa* (shea butter tree), *Parkia biglobosa* (locust bean), *Isobertlinia doka*, and *Daniellia oliveri*, interspersed with tall grasses like *Andropogon gayanus* and *Pennisetum purpureum*.
- **Derived Savanna/Secondary Vegetation:** Resulting from clearance for farming, grazing, and fuelwood collection, this zone is marked by grasses mixed with shrubs and scattered trees such as *Combretum* spp. and *Terminalia* spp.
- **Farmland Vegetation:** Extensive cultivation has introduced food and cash crops, particularly cassava, maize, sorghum, groundnut, and yam. These activities have fragmented the natural vegetation and created a patchwork of fallows and farm plots.

Human pressures—including agricultural expansion, fuelwood harvesting, bush burning, and grazing—have significantly altered the vegetation structure, reduced species diversity and encouraging the spread of secondary growth. Despite these pressures, the Guinea Savanna vegetation remains ecologically and economically important, supporting local livelihoods while providing fuelwood, fodder, and non-timber forest products as evident in the following pictures:

A total of 141 plant species from 44 families were recorded. None of the species was classified as endangered under IUCN standards.

Eight growth habits were identified:

- **Climbers (5 species):** e.g., *Dioscorea* spp. (yam), *Smilax anceps* (sarsaparilla).
- **Creepers (3 species):** e.g., *Cucumis melo* (melon).



- **Grasses (28 species):** dominated by *Andropogon gayanus*, *Panicum maximum* (Guinea grass), *Eleusine indica* (goosegrass), with cultivated species such as maize, and sorghum.
- **Herbs (53 species):** e.g., *Tridax procumbens*, *Cleome rutidosperma*, *Luffa cylindrica*.
- **Sedges (8 species):** e.g., *Scleria noumanniana*, *Rhynchospora corymbosa*.
- **Shrubs (23 species):** e.g., *Senna spp.*, *Sida acuta*, *Trema orientalis*.
- **Trees (21 species):** notable species include *Vitellaria paradoxa* (shea butter), *Parkia biglobosa* (locust bean), *Mangifera indica* (mango), and *Daniellia oliveri*.

Overall, the vegetation reflects a Guinea Savanna mosaic, significantly altered by human use but still ecologically important for fuelwood, fodder, food, and non-timber products. Its modification underscores the need for careful management to balance agricultural expansion with biodiversity conservation in the AIH SAPZ project area.

Several cultivated species were observed in the area, including *Terminalia catappa* (almond), *Ipomoea batatas* (potato), *Phaseolus vulgaris* (beans), *Arachis hypogaea* (peanut), *Abelmoschus esculentus* (okra), and *Dialium guineense* (tamarind). The vegetation was dominated by the family Poaceae (grasses) with 30 species (18.49%), followed by Leguminosae/Fabaceae with 18 species (11.69%) and Asteraceae with 10 species (6.49%). This indicates a landscape strongly influenced by grasses and legumes, typical of cultivated and semi-natural ecosystems. Plant species observed at the AIH SAPZ project site in Daki – Takwas, Chikun LGA, Kaduna is hereby summarized in Table 4.22 below.



Table 4.22: Plant Species Around the AIH SAPZ Project Area, Daki–Takwas (July 2025, Rainy Season)

S/N	Botanical Name	Family	Common Name	Local Name	Habit	Uses	Abundance	IUCN Status
A. Grasses								
1	<i>Andropogon gayanus</i>	Poaceae	Gamba Grass / Tambuki Grass	—	Grass	Fodder, thatching, soil stabilization, pasture improvement	Abundant	LC
2	<i>Hyparrhenia rufa</i>	Poaceae	Jaragua Grass / Thatching Grass	—	Grass	Thatching, fodder (young), erosion control	Moderate	LC
3	<i>Brachiaria deflexa</i>	Poaceae	Guinea Millet	Achara	Grass	Food, forage	Abundant	NE
4	<i>Zea mays</i>	Poaceae	Maize / Corn	Oka	Grass	Food crop	Abundant (farmland)	LC
5	<i>Cymbopogon citratus</i>	Poaceae	Lemon Grass	—	Grass	Food, medicine	Scanty	NE



B. Shrubs / Trees								
6	<i>Vitellaria paradoxa</i>	Sapotaceae	Shea Tree	Gwanna	Tree	Shea butter (food, cosmetics), medicine, timber	Moderate	VU
7	<i>Parkia biglobosa</i>	Fabaceae	African Locust Bean	Doruwa	Tree	Fermented condiment (iru/dawadawa), fodder, medicine	Abundant	LC
8	<i>Daniellia oliveri</i>	Fabaceae	African Copaiba Balsam	—	Tree	Timber, resin (medicine), fodder, shade	Moderate	LC
9	<i>Isobерlinia doka</i>	Fabaceae	Doka Tree	—	Tree	Timber, fuelwood, medicine	Moderate	LC



10	<i>Khaya senegalensis</i>	Meliaceae	African Mahogany	Madaci	Tree	Timber, medicine, ornamental	Scanty	VU
11	<i>Psidium guajava</i>	Myrtaceae	Guava	Goba	Tree	Food (fruit, juice), medicinal	Abundant	LC
12	<i>Mangifera indica</i>	Anacardiaceae	Mango	Mangwaro	Tree	Food, shade, timber	Moderate	DD
13	<i>Manihot esculenta</i>	Euphorbiaceae	Cassava	Rogo	Shrub	Food, economic	Abundant	LC
14	<i>Citrus sinensis</i>	Rutaceae	Orange	Lemun	Tree	Food, economic	Moderate	NE
C. Herbs / Creepers								
15	<i>Talinum triangulare</i>	Portulacaceae	Waterleaf	Mgbolodi	Herb	Vegetable, medicinal	Scanty	NE



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16	<i>Tridax procumbens</i>	Asteraceae	Tridax	—	Herb	Medicinal	Abundant	NE
17	<i>Cucumis melo</i>	Cucurbitaceae	Melon	—	Creeper	Food	Moderate	NE
18	<i>Dioscorea spp.</i>	Dioscoreaceae	Yam	Doya	Climber	Food	Abundant	NE



4.2.13 Wildlife Studies

Traditionally, wildlife refers to animals and other organisms that grow or live in the wild without direct human introduction. However, in the context of modern ecological studies, even wildlife in relatively remote areas such as Daki–Takwas is increasingly influenced by human activities. These include habitat disturbance from agriculture, fuelwood collection, grazing, hunting, and broader pressures such as climate variability and invasive species. Consequently, the interaction between humans and wildlife in the project area is complex, with implications for both ecological balance and community livelihoods.

While certain species pose risks to local communities such as crop-raiding mammals, reptiles, or vectors of zoonotic diseases wildlife also provides multiple benefits. These include ecological services (seed dispersal, pest control), cultural and educational values, and economic benefits (potential for eco-tourism and sustainable resource use). Conservation and management within the project area must therefore balance human needs with ecosystem integrity.

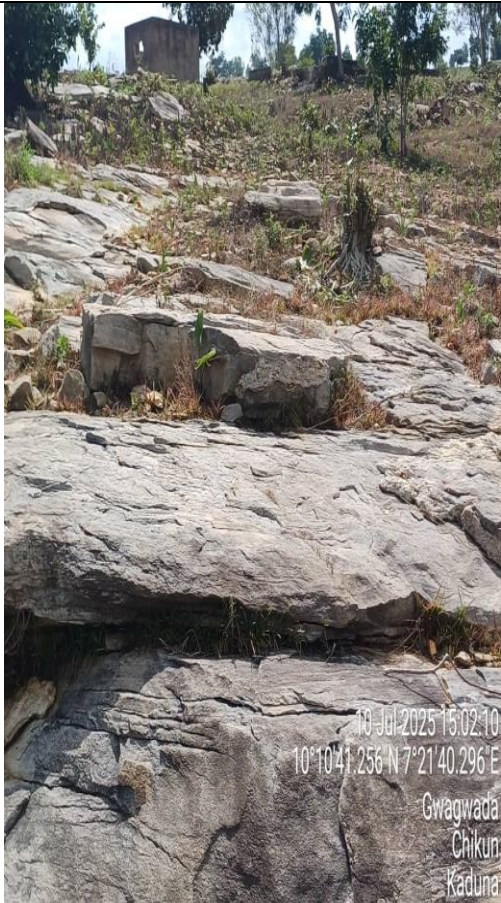


Wildlife/Geology of AIH	Overview
	Layered Rock Outcrop Chikun, Kaduna, Nigeria at coordinates N 10° 11' 41.022", E 7° 21' 42.012" on 10 July 2025 at 3:01 PM. Description & Context: • Prominent horizontally layered rock formation. • Sparse vegetation, mainly pioneer plants growing in rock crevices. • Surrounding landscape includes scattered trees and some cultivated land. Environmental Significance: • Natural erosion-resistant feature that influences local drainage. • Provides microhabitats for lichens, mosses, and small reptiles. • Acts as a natural barrier, reducing soil erosion in adjacent areas. Potential Concerns / Impacts: • Quarrying or rock removal could alter drainage and lead to soil loss. • Clearing surrounding vegetation may accelerate erosion around the outcrop. Recommendations / Mitigation Measures: • Protect rock formation from extraction activities. • Maintain vegetation around the outcrop to preserve soil stability.



	• Encourage natural regeneration of plant species in rock crevices to enhance biodiversity.
	Rocky Outcrop with Tree Cover Chikun, Kaduna, Nigeria at coordinates N 10° 14' 23", E 7° 25' 39", on 10 July 2025 at 3:02 PM Description & Context: • Rocky hill slope with exposed bedrock and thin soil layer. • A single large tree dominates the center, surrounded by scattered small shrubs and grasses. • Evidence of limited soil fertility and water retention due to rock exposure. Environmental Significance: • The tree may serve as a microhabitat, providing shade, organic matter, and soil stability. • Rock outcrops can act as refuges for reptiles, insects, and small mammals. Potential Concerns / Impacts: • Shallow soil layer prone to erosion if vegetation cover is lost. • Risk of overgrazing or deforestation reducing ecological resilience. Recommendations / Mitigation Measures: • Maintain existing tree cover to reduce erosion. • Avoid blasting or quarrying activities in this area.



	Promote planting of drought-tolerant vegetation in soil pockets to stabilize ground.
	Exposed Bedrock Area Chikun, Kaduna, Nigeria at coordinates N 10° 11' 25", E 7° 21' 40" on 10 July 2025 at 3:02 PM. Description & Context: - Dominant exposed granite bedrock with minimal soil cover. - Scattered small shrubs and grass tufts emerging from cracks in the rock. - Evidence of past vegetation clearing, including visible tree stumps. Environmental Significance: - Rocky surfaces limit agricultural potential but provide microhabitats for specialized plants and small fauna. - Cracks and crevices can trap water and organic matter, fostering niche biodiversity. Potential Concerns / Impacts: - Vegetation removal increases erosion risk and reduces carbon sequestration capacity. - Soil pockets may degrade further under overgrazing or human disturbance. Recommendations / Mitigation Measures: - Preserve existing vegetation to slow erosion. - Avoid land use changes that further strip remaining soil and plants.



	• Encourage natural regeneration by controlling grazing pressure.
	Termite Mound Description & Context: • Large, intact termite mound 4 meters tall. • Surrounding vegetation includes shrubs, grasses, and some broadleaf plants. • Location: Natural or semi-natural habitat, likely uncultivated land. Environmental Significance: • Termites play a key ecological role in soil aeration, nutrient recycling, and organic matter breakdown. • Mounds provide microhabitats for insects, reptiles, and small mammals. Potential Concerns / Impacts: • If land clearing or farming occurs, the termite mound could be destroyed, affecting local biodiversity. • Disturbance could lead to changes in soil structure and nutrient cycling. Recommendations / Mitigation Measures: • Avoid destruction during land-use changes; integrate mounds into agricultural landscapes where possible. • Educate locals on the ecological importance of termites and their mounds. • If relocation is required for development, use sustainable pest



	management to prevent unnecessary harm.
	Rocky Patch with Litter Description & Context: • Surface: Rocky and compact soil with some green groundcover. • Rocks: Mixed sizes, mostly weathered, possibly from natural erosion or land clearing. • Notable: Presence of plastic litter (blue) among rocks. Environmental Significance: • Rocks help reduce soil erosion in sloped terrain. • Early green sprouts indicate recovering vegetation after disturbance. • Litter introduces pollution risks to soil and nearby habitats. Potential Concerns / Impacts: • Plastic litter may degrade into microplastics, contaminating soil. • Rocks could be remnants of construction or quarrying, indicating past disturbance. Recommendations / Mitigation Measures: • Remove and properly dispose of plastic waste to prevent pollution. • Encourage community awareness campaigns on littering. • Protect regenerating vegetation to stabilize soil and restore habitat.



Butterfly on Vegetation

Description & Context:

- Subject: Medium-sized butterfly with orange-brown wings and black markings.
- Habitat: Mixed dry and green vegetation along farmland edge.
- **Coordinates:** N 10° 11' 30.59", E 7° 21' 6.42".
- **Location:** Chikun, Kaduna.
- **Date & Time:** 10 July 2025, 15:13 local time.

Environmental Significance:

- Presence of butterflies indicates a functioning pollinator network in the area.
- Butterflies are bioindicators for habitat quality and vegetation diversity.
- This species likely contributes to pollination of both wild plants and crops.

Potential Concerns / Impacts:

- Excessive pesticide use in nearby farmland could reduce pollinator populations.
- Habitat loss from land clearing could lower species diversity.

Recommendations / Mitigation Measures:

- Promote integrated pest management (IPM) to reduce harmful chemical use.
- Preserve flowering plants and native vegetation strips to support pollinators.



	• Raise community awareness about the importance of butterflies in ecosystems.
	Rock Outcrop in Cultivated Land Description & Context: • Feature: Large stacked rock slabs, naturally deposited. • Surroundings: Open farmland with young crop growth and scattered trees in the background. • Coordinates: N 10° 10' 40", E 7° 21' 41". • Location: Rumi Gidan Busa Dakwo Road, Gwosgawa, Chikun, Kaduna. • Date & Time: 10 July 2025, 14:58 local time. Environmental Significance: • Rock outcrops provide microhabitats for reptiles, small mammals, and insects. • Can help in soil moisture retention around the base and reduce localized erosion. • May hold cultural or traditional significance for local communities. Potential Concerns / Impacts: • Agricultural expansion could lead to removal or destruction of the rock habitat. • Soil disturbance from nearby cultivation may increase erosion risk. Recommendations / Mitigation Measures: • Preserve rock outcrops as biodiversity refuges within farmland.



	• Educate local farmers about the ecological importance of such features. • Implement contour farming or buffer planting to reduce erosion around the structure.
	Millipede on Bare Soil Description & Context: • Single millipede curled into a defensive spiral. • Located on bare, dry soil with some organic debris. Environmental Significance: • Millipedes are beneficial decomposers, aiding in the breakdown of leaf litter and plant material. • Contribute to soil formation and nutrient cycling. • Presence indicates relatively healthy soil microhabitat. Potential Concerns / Impacts: • Sensitive to habitat disturbance, chemical pollution, and prolonged drought. • Overuse of pesticides may reduce their population, affecting soil health. Recommendations / Mitigation Measures: • Avoid excessive pesticide and herbicide use in areas with beneficial invertebrates. • Maintain leaf litter or organic matter on soil surfaces to provide habitat.



	Promote soil moisture conservation practices to support decomposer communities.
	Ground Insect on Bare Soil Description & Context: - Single insect observed on dry, compacted soil surface. - Morphology: reddish-brown head/thorax and legs, dark oval abdomen. - Likely part of the local soil invertebrate community, important for nutrient cycling. Environmental Significance: - Soil invertebrates play a vital role in decomposition and soil aeration. - Can serve as bioindicators of soil health. - Presence suggests active micro-ecosystem. Potential Concerns / Impacts: - Agricultural pesticides may reduce beneficial insect populations. - Habitat loss from excessive tillage or soil compaction. Recommendations / Mitigation Measures: - Minimize pesticide use and promote integrated pest management (IPM). - Maintain patches of natural vegetation as insect refuges. - Educate local farmers on the role of beneficial insects in ecosystem functioning.



Small Termite/Ant Mound in Woodland Grassland

Description & Context:

- Low, circular mound of loose soil around an open cavity.
- Sparse dry-season grass cover with scattered small plants and leaf litter.
- GPS: N 10°10'44.453", E 7°21'40.727".
- Date/Time: 10 July 2025, 3:18 PM.

Environmental Significance:

- Indicates healthy soil biota activity, improving aeration and nutrient cycling.
- Acts as a microhabitat for insects, reptiles, and microorganisms.
- Soil turnover by termites contributes to organic matter incorporation.

Potential Concerns / Impacts:

- In high density, such mounds could interfere with certain farming activities.
- May attract predators that disturb soil around crops.

Recommendations / Mitigation Measures:

- Preserve mounds in non-cultivated or buffer zones.
- Control population in crop fields only if causing measurable yield loss.
- Educate local communities on ecological benefits.



Rocky Outcrop with Sparse Vegetation

Description & Context:

- Exposed bedrock with layered stone formations.
- Sparse grass and small shrubs growing in cracks and soil pockets.
- GPS: N 10°10'41.256", E 7°21'40.496".
- Date/Time: 10 July 2025, 3:02 PM.

Environmental Significance:

- Provides habitat for specialized plants and small fauna.
- Natural erosion control due to rock cover.
- May serve as a local stone resource for construction.

Potential Concerns / Impacts:

- Limited soil cover restricts vegetation growth.
- If quarried unsustainably, could lead to habitat loss.
- Runoff from bare rock surfaces may accelerate soil erosion downslope.

Recommendations / Mitigation Measures:

- Avoid extensive quarrying in ecologically sensitive areas.
- Promote vegetation growth in soil pockets to reduce runoff.
- Consider the site for eco-tourism or educational purposes if culturally/geologically significant.



Termite Mound in Grassland

Description & Context:

- Prominent termite mound composed of compacted soil, with multiple entry/exit holes.
- Located in open grassland with sparse herbaceous vegetation.
- GPS: N 10°11'26.998", E 7°21'17.798".
- Date/Time: 10 July 2025, 1:28 PM.

Environmental Significance:

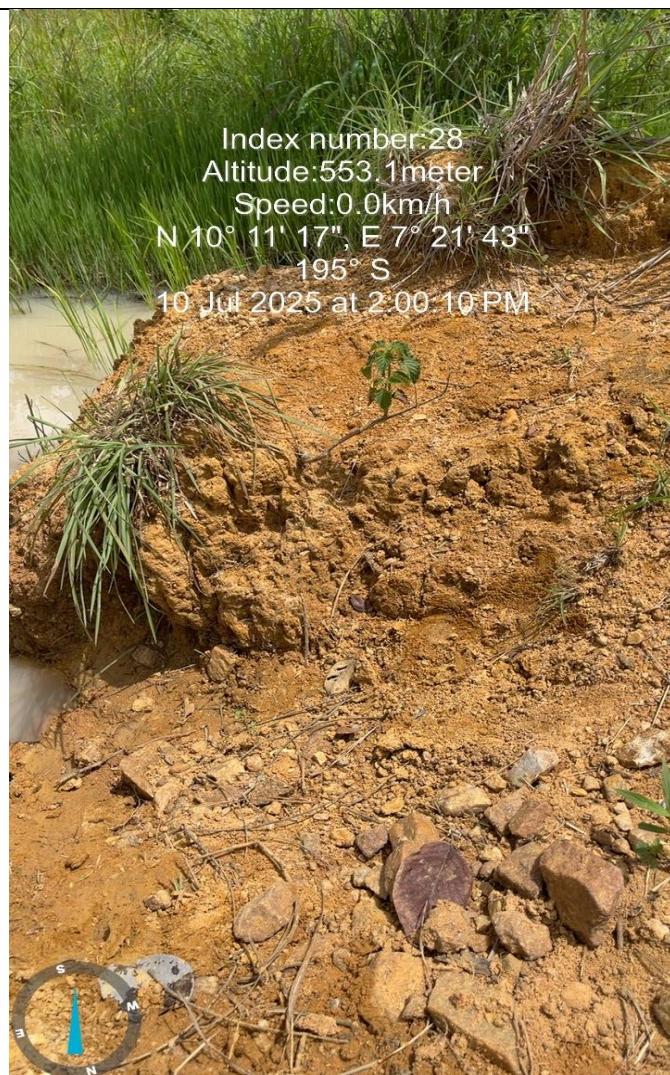
- Termite mounds improve soil aeration and water infiltration.
- Concentrated organic matter inside mound enhances soil fertility in surrounding areas.
- Serves as a microhabitat for other species (insects, reptiles, small mammals).

Potential Concerns / Impacts:

- Can hinder mechanical land preparation in cultivated fields.
- Large colonies may affect root crops if unmanaged.
- Over-abundance in agricultural fields could reduce usable land area.

Recommendations / Mitigation Measures:

- Preserve mounds in non-cultivated areas for ecological benefits.
- In agricultural zones, selectively remove only those obstructing operations.
- Educate local farmers on the ecological role of termites in soil health.



Gully/Erosion Bank Adjacent to Water Body

Description & Context:

- Steep eroded soil face with visible collapse of the bank.
- Water body nearby, a stream for irrigation channel.
- Sparse vegetation cover on eroded sections; grass present on top edges.
- GPS: N 10° 11' 17\", E 7° 21' 43\".
- Altitude: 553 m.

Environmental Significance:

- Indicates active soil erosion process.
- Connection to water body raises risk of sedimentation and water quality reduction.
- Some natural vegetation at edges helps stabilize topsoil.

Potential Concerns / Impacts:

- Bank collapse leading to loss of arable land.
- Sediment runoff into water, affecting aquatic life.
- Reduced water holding capacity of the water body over time.

Recommendations / Mitigation Measures:

- Install bioengineering solutions (vetiver grass, bamboo planting) along bank edges.
- Construct silt traps or small retaining structures upstream.
- Regular monitoring after rainy season for further bank retreat.



	Community awareness programs to prevent excessive disturbance near banks.
	Small Termite Mound Chikun, Kaduna, Nigeria at coordinates N 10° 11' 16\", E 7° 21' 45\", altitude 560.8 meters, recorded on 18 July 2025 at 2:09 PM. Description & Context: - Small, dome-shaped termite mound with visible entry/exit holes. - Located near bare, gravelly soil with sparse vegetation and small shrubs. - Close to a dirt track (presence of motorcycle in background). Environmental Significance: - Indicates active termite presence, important for ecosystem functioning (soil aeration, decomposition, nutrient cycling). - Mound may provide shelter for invertebrates and small vertebrates. Potential Concerns / Impacts: - Mound is at risk of disturbance from human traffic (motorcycles, footpaths). - Soil compaction from vehicles may reduce surrounding vegetation recovery. Recommendations / Mitigation Measures: - Avoid direct destruction during development or road expansion.



	• Mark and preserve for ecological monitoring where possible. • If in agricultural land, integrate termite activity into soil management strategies.

4.3 Socio-Economics Study

4.3.1 Study Approach and Methodology

The socio-economic baseline describes the existing social conditions essential to identifying and assessing the potential impacts of a proposed project. The baseline data for the proposed Kaduna Special Agro-processing Zone (SAPZ) project was collected through various methods, including a review of secondary data, primary data collection from key informant interviews, village-level surveys, focus group discussions (FGD), and household surveys. The data was used to assess potential impacts and generate mitigation measures for the ESIA study.

The primary objective of this study was to survey the baseline social and economic features of the host communities where the proposed Kaduna SAPZ project is located, although we observed that there are no sign of human habitation within the project site, it was purely farmland, but samples were taken from the neighbouring settlements farming with the proposed project area. The aim of the study was to ascertain the potential effects of the proposed Kaduna SAPZ project on the social and economic lives of the people of the communities including potentially positive effects.

This section therefore offers a detailed examination of the current social and economic conditions within the project areas, including demographic profiles, economic activities, education levels, healthcare access, and overall living standards. The comprehensive baseline data establishes a thorough understanding of the community's existing conditions, which is crucial for assessing the potential impacts of the project. This understanding also ensures that proposed interventions are effectively tailored to meet the specific needs and circumstances of the local population.

The study adopted a systematic approach to identify, analyze and evaluate the perceived and associated social impact of the proposed project on individuals or social groups within the host communities. The study consisted of two parts: a desktop part using secondary data to collate information on baseline socio-cultural, economic and infrastructure indices of the study area, and



direct studies via consultations (interviews and focus group discussions) Data was also collected with the use of an online data kit, Kobo Toolbox (www.kobotoolbox.org) to elicit information on resident views on their socioeconomic characteristics, concerns and expectations from the proposed project. For the purpose of this study, host communities were taken as those within the project site and/or those who had ownership rights to the land on which the Kaduna SAPZ project is to be sited. To elucidate the key socioeconomic parameters of interest in this study, the ESIA team conducted some qualitative data collection procedures. Typically, qualitative data is virtually any type of information that can be observed and recorded that is not numerical in nature. For this purpose, Key Informant interviews, meetings with informed stakeholders and various forms of in-field observation were all sources of qualitative data employed for the ESIA study.

The objectives of this study are to acquire and disseminate information, identify and address legislative, community and environmental concerns and proffer appropriate mitigation options for all identified negative impacts. The intention would be to: Avoid conflict by addressing issues promptly; Ensure that any fears or apprehensions about the nature, scale and impacts of the proposed project are fully addressed; and Avoid any misunderstanding about the project.

Others are to Increase understanding of the project's social, cultural, and economic implications for the proponent, community, and residents; Identify demographic, social, cultural, and economic aspects sensitive to project activities over short-, medium-, and long-term periods; establish baseline data and recommend measures; and to facilitate stakeholders' engagement.

4.3.2 Socio-Economic Baseline of the Project Area

Administratively, Kaduna State consists of twenty-three (23) local government areas, with the state capital at Kaduna. The AIH (Agro Industrial Hub) project is located in Daki-Takwas within Chikun LGA. The people are mostly Hausa and Fulani but with the presence of other ethnic groups like: Gwari Gbagyi); Adara; Ham; Atyap; Bajju; Kanuri; Nupe; Yoruba etc. The state has three senatorial districts, namely Kaduna Central, Kaduna North, and Kaduna South. The communities closely affected by the proposed SAPZ initiative are Daki- Takwas and the surrounding settlements like: Ungwan Dawaki; Ungwan Sarki; Sabon sara, all under Chikun Local Government Area, Central Kaduna District. The people are very resourceful and are known for their agricultural production like Rice, Maize, Sorghum, Millet, Cassava, Yam, Vegetables (tomatoes, cabbage,



pepper, okra, leafy greens) and fruits, not mentioning livestock rearing – especially poultry, goats, sheep, and cattle which are cultivated commercially in these agroecological zone.

The area largely benefits from fertile soils and seasonal rainfalls, enabling rain-fed crop production. The project area is therefore critical to achieving food security in Kaduna State and Beyond. However, agricultural activities are often constrained by inadequate access to modern farming inputs, limited mechanization, post - harvest losses, and fluctuating market prices.

In addition to farming, residents engage in petty trading, artisan mining (in nearby locations), and agro-processing on a small scale (rice and maize milling, groundnut oil extraction etc.) Women are active in crop production, vegetable gardening, food processing and trading, while men are predominantly into large-scale farming, livestock rearing, and transport of goods to urban markets like Abuja, Lagos, Port Harcourt etc. The project area has access to local markets where produce is sold, including Sarbon Tasha Market and Kaduna Central Market, and benefits from road linkages to Kaduna city and other LGAs around. However poor feeder road condition in the raining season can hinder produce transportation and thereby result in post - harvest losses.

4.3.2.1 Community Governance Arrangement

Traditional institutions in the project-affected communities of Chikun LGA, Kaduna State, play a central role in community leadership, conflict resolution, resource management, and cultural preservation. These institutions, while rooted in pre-colonial governance systems, are now integrated into the modern local government framework and continue to serve as a bridge between community members and government authorities.

The traditional governance system in the area is anchored by the District Head (Hakimi) and Village Heads (Mai Unguwa), supported by a Council of Elders, religious leaders, market women associations, youth groups, and other community-based organizations. These leaders are custodians of cultural norms, customary laws, and land tenure arrangements. They are entrusted with mediating disputes, safeguarding communal lands, overseeing local markets, and ensuring the fair and equitable use of natural resources. The governance structure is typically hierarchical, with the Hakimi serving as the overall custodian of traditions and community welfare, while Village Heads administer affairs at the grassroots level. Elders and respected family heads (often the most senior male in a compound) are consulted on key decisions, particularly those affecting



land allocation, agricultural activities, and family welfare. In polygamous and extended family settings, seniority is respected, and the eldest male is seen as the representative of the household in community matters.

Women hold an important role through organized market women associations and women development groups, which are influential in local economic activities such as crop marketing, small-scale processing, and cooperative savings. Youth groups are also active in mobilizing labour for farming seasons, community projects, and security watch activities.

Religious leaders (both Islamic clerics and Christian pastors) also play a significant role in shaping community values, resolving conflicts, and mobilizing support for development initiatives. In many cases, traditional and religious leadership work hand in hand to ensure peaceful coexistence in the multi-ethnic and multi-faith setting of Chikun LGA.

4.3.2.2 Cultural Heritage of the Project Host Communities.

Cultural heritage is a set of tangible and intangible items of cultural, archeological or spiritual significance to residents of an area. People identify with cultural heritage as a reflection and expression of their constantly evolving values, beliefs, knowledge, and traditions. Cultural heritage, in its many manifestations, is important as a source of valuable scientific and historical information, as an economic and social asset for development, and as an integral part of people's cultural identity and practice. ESS8 sets out measures designed to protect cultural heritage throughout the project life cycle. The host communities of the Agro-Industrial Hub (AIH) in Chikun LGA, Kaduna State, have a rich and diverse cultural heritage that reflects the multi-ethnic composition of the area. The predominant ethnic groups include Gwari (Gbagyi), Hausa, Fulani, and a mix of settlers from other parts of Nigeria. These groups have distinct yet interwoven cultural practices, festivals, dances, and music traditions that are important for social cohesion, identity, and community pride. The major cultural heritage items identified are as mentioned below:

a) Cultural Beliefs: The affected communities uphold certain cultural beliefs and taboos that influence daily life, social relations, and resource use. Among the **Gwari** and **Hausa/Fulani** communities, it is considered taboo to steal farm produce such as maize, yam, or groundnuts; offenders may face public shaming or community sanctions. Land is regarded as a communal heritage, and land disputes are settled through traditional arbitration by elders.



Marriage within close kin (same paternal lineage) is generally discouraged among Gwari and prohibited in many Hausa/Fulani families, while respect for elders is deeply ingrained across all ethnic groups. In some communities, widows observe mourning customs, which may restrict participation in certain public or economic activities for a defined period, though the severity of such customs is reducing with modernization;

b) Festivals: Among the **Gwari (Gbagyi)**, notable festivals include:

- **Zoza Festival** – Celebrated at the end of the harvest season, showcasing traditional dances, songs, and communal feasts.
- **Pasaka (Harvest Festival)** – Marks the beginning of the dry season and thanksgiving for a successful harvest, often held between October and November.

Among the **Hausa/Fulani** communities, important cultural and religious festivals include:

- **Eid al-Fitr (Sallah)** – Celebrated at the end of Ramadan with prayers, feasts, and visits to relatives.
- **Eid al-Adha (Babban Sallah)** – Commemorated with animal sacrifices, distribution of meat to the needy, and family gatherings.

Other settlers in the area bring their cultural heritage, including the Yam Festival celebrated by migrants from yam-producing regions and the New Year Festivals of southern ethnic groups. These events serve as a unifying platform for intercultural exchange and promote peaceful coexistence in the multi-ethnic setting of Chikun LGA.

- a) Sacred Places and Rituals:** In most of the communities, there are sacred places as well as ritual practices which are observed. However, some of the rituals that affect strangers have been eradicated by previous generations so as not to scare investors away from host communities.

4.3.2.3 Identification and Analysis of Stakeholders

A two-edged approach was used to identify project stakeholders following desktop reviews and a kick-off meeting with the client. Stakeholders were categorized based on an importance and influence matrix (Figure 4.26) to guide consultation efforts.



- b) Influence:** Reflects a stakeholder's ability to impact the project (e.g., through provision of Licenses, Approvals, Permits or Resources). Examples include government agencies and investors.
- c) Importance:** Reflects the project's impact on a stakeholder and their interest in its success (e.g., livelihoods, well-being). Examples include farmers, communities, and farmer associations.

Identified key stakeholders include Federal Government of Nigeria, Kaduna State Government (through its agencies), Africa Development Bank, community groups (women's groups, youths, traditional leaders), farmers' associations, residents, and transportation unions. This analysis, based on influence and importance, categorizes stakeholders for focused engagement strategies, promoting successful project management and communication (Kantamaturapoj et.al. 2023)

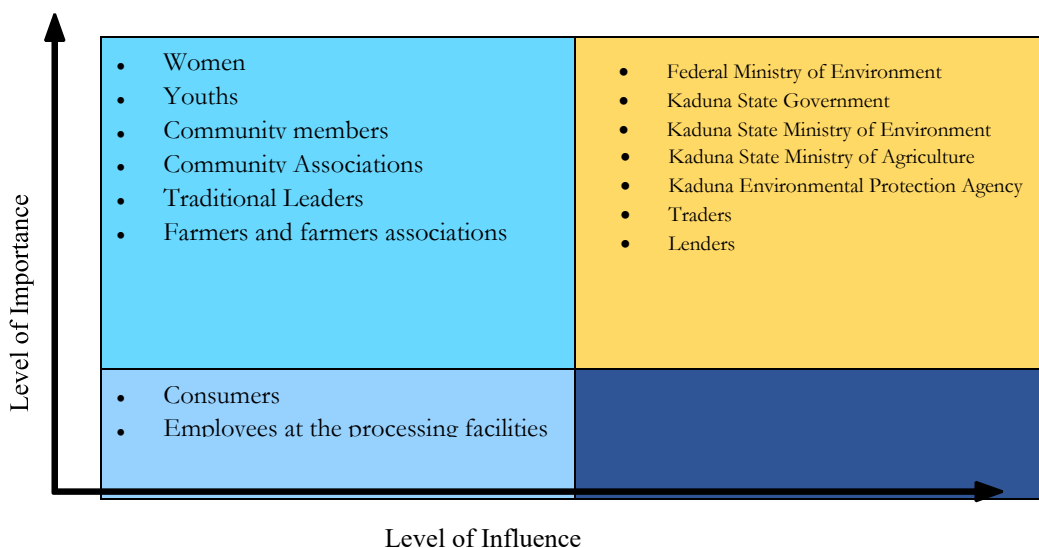


Figure 4.26: Stakeholders Identification and Analysis

In compliance with the AfDB's Integrated Safeguards System (ISS) (2023) and the Federal Ministry of Environment (FMEnv) EIA Procedural Guidelines (2017), stakeholder consultation aimed to ensure broad community support and gain their endorsement for proposed mitigation measures. This involved seeking and obtaining prior and informed consent through meaningful engagement with project host communities. Stakeholders were consulted for input on key documents.



4.3.2.4 Stakeholder Engagement for the ESIA

A dedicated stakeholder engagement exercise was undertaken specifically for this ESIA to ensure inclusive participation, transparency, and alignment with AfDB's Operational Safeguard 10 and FMEnv's EIA procedural guidelines. The engagement process involved early identification, mapping, and analysis of stakeholders through a two-stage approach — desktop review and field reconnaissance — followed by structured consultations across affected and interested parties. Stakeholders were categorized according to their interest (level of concern or benefit from the project) and influence (ability to affect decision-making or implementation outcomes). Table 4.6.1 presents the stakeholder analysis matrix summarizing key groups, their interests, level of influence, consultation methods used, and outstanding issues requiring follow-up.

Table 4.23: Stakeholder Analysis Matrix

Stakeholder Category	Specific Stakeholders	Interest / Expectation	Level of Influence	Consultation Method	Outstanding Issues / Follow-up
Federal Government Agencies	FMEnv, NESREA, Federal Ministry of Agriculture & Food Security	Environmental compliance, sustainable agro-industrial development	High	Official correspondence, virtual meetings, inception meeting	Continuous coordination for permit processing
State Government Agencies	Kaduna State Ministry of Environment, KADIPA, KADGIS, Ministry of Agriculture	Land allocation, ESIA approval, livelihood restoration, investment facilitation	High	Bilateral meetings, focus group discussions	Alignment of site plan and access routes
Local Government & Traditional Institutions	Chikun LGA, Village Heads (Daki Takwas, Sabon Gari)	Employment, compensation, social amenities, infrastructure	Moderate	Community meetings, key informant interviews	Clarification on employment priority and grievance channels



Community Groups	Youth and Women's Associations, Farmers' Cooperatives	Livelihood support, enterprise opportunities, social inclusion	Moderate	Community focus group discussions	Request for skill development and local hiring quotas
Private Sector / Business Groups	Transport Unions, Agro-processors, Traders	Access to market, logistics, local procurement	Low–Moderate	Stakeholder workshop, interviews	Desire for partnership in value chain operations
Vulnerable / Itinerant Users	Pastoralists, Seasonal Migrant Farmers	Access to grazing routes and water, security of movement	Low	Not directly engaged due to mobility; planned engagement through local leaders and extension services	Scheduled consultation during construction phase

Consultation Records

Field consultations were conducted between 10th–18th July 2025 across the project-affected and neighbouring communities, including Daki Takwas, Sabon Gari, Kuriga, and Kachia Road settlements. Meetings involved community heads, youth and women leaders, local farmers, and small business owners. Participants were informed about the project objectives, ESIA process, anticipated impacts, and proposed mitigation measures.

Table 4.24: Summary of Stakeholder Concerns and Responses

Stakeholder Group	Key Concerns / Questions	Responses Provided by ESIA Team
Community Leaders	How will land acquisition and compensation be handled?	Compensation will follow AfDB Resettlement Policy (OS2) and Kaduna State procedures; a RAP is under preparation.
Women's Groups	Will women be employed in processing activities?	Equal employment opportunities and skill development for women are incorporated in project planning.



Youth Representatives	What measures are in place to prevent external labour dominance?	Local hiring prioritization and contractor obligations to engage local labour.
Farmers' Cooperatives	How will runoff and waste from processing affect farmland?	Wastewater treatment and stormwater control included in design; effluent standards will comply with FMEEnv/NESREA limits.
Pastoralist Representatives	Concern about restricted grazing routes	Grazing corridors to be maintained in coordination with local authorities and extension agents.

In summary, all key stakeholder categories were consulted during ESIA preparation. Pastoralist and itinerant users, though identified, were not directly engaged due to their transient nature; however, targeted engagement is planned during construction and operation phases through the established Stakeholder Engagement Plan (SEP) and Grievance Redress Mechanism (GRM). Documentation of consultations (attendance sheets, photos, minutes) is included in Annex section.

4.3.2.5 Household Consultation and Questionnaire Administration

The population of project host communities were taken as the global/statistical population, while the corresponding total number of households in each of the host communities was considered as the total sampling population. The selection of sampling units and the sampling method were specific to each community. Each of the communities was taken as a sampling block. To select sampling units in each community, households were randomly selected as candidate-households for the survey. Residents within the project communities were surveyed using questionnaires and interviews. The questionnaires captured demographics, occupation, education, and healthcare perceptions etc. Responses were electronically transcribed and analyzed using Microsoft Excel. The Questionnaires were administered randomly based on population distribution within the study boundary. Where the population is densely distributed more questionnaires were administered and where sparsely distributed less were administered. They were verified for QA/QC. A total of 150 Questionnaires were administered to men, women, the elderly and youths of different age brackets. All the questionnaires were directly administered to respondents and were retrieved. Table 4.23 presents details of questionnaire distribution in the study locations.



Table 4.25: Numbers of Questionnaires Administered and Retrieved

S/N	Community	Local Government Area	No. of Questionnaires Administered	No. of Questionnaires Retrieved	No. of Households Surveyed	Average No. of Respondents per Household
01	Daki-Takwas	Chikun	60	60	20	3
02	Ungwan Dawaki	Chikun	45	45	15	3
03	Ungwa Sarki	Chikun	45	4	15	3
	TOTAL	3	150	150	50	

Source: Kaduna SAPZ ESIA Fieldwork 2025.

4.3.3 Demography

The Population sizes of the project was arrived at, using the following formulae

$$P_n = P_o (1 + r)^n$$

Where:

P_o = Population in the base year

r = Estimated annual growth rate of population

n = Time lapse in years

Chikun Local Government is in the central area of Kaduna State, it has an area of about 4,466km/sq with its headquarters at Kujama. As published by the National Population Commission, 2006 Census put her population at 372,272 people and a density of 291/sq mi (112.5/sqkm) with a population growth of about 3.4% annually (NBS 2016). The time elapsed between the base year and 2025 is 19years.

Table 4.26: Projected Population of Chikun LGA (2006 – 2025).

Year	Population Estimates	Source
2006	372,272	NPC
2016	502,500	NPC/NBS projection
2022	550,500	NPC/NBS Projection
2025	719,500	Projected using 3.4% growth rate

Table 4.27: Socio - Economic Attributes of Respondents in project Area.

		Daki - Takwas	Ungwan Dawaki	Ungwan Sarki	Sub Total	Daki - Takwas	Ungwan Dawaki	Ungwan Sarki	Sub Total
Gender	Female	60	40	27	127	33.00%	38.00%	33.00%	35.00%
	Male	120	65	56	241	67.00%	62.00%	67.00%	65.00%



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		Daki - Takwas	Ungwan Dawaki	Ungwan Sarki	Sub Total	Daki - Takwas	Ungwan Dawaki	Ungwan Sarki	Sub Total
	Total	180	105	83	368	100.00%	100.00%	100.00%	100.00%
Age Group	20-29 years	27	11	7	45	15.00%	10.00%	8.00%	11.00%
	30-39 years	44	30	22	96	24.00%	29.00%	27.00%	27.00%
	40-49 years	49	35	28	112	27.00%	33.00%	34.00%	31.00%
	50-59 years	48	20	18	86	27.00%	19.00%	22.00%	23.00%
	60-69 years	7	5	5	17	4.00%	5.00%	5.00%	5.00%
	70 Years and Above	5	4	3	12	3.00%	4.00%	4.00%	3.00%
	Total	180	105	83	368	100.00%	100.00%	100.00%	100.00%
Marital Status	Divorced	9	3	1	13	5.00%	3.00%	1.00%	5.00%
	Married	105	75	67	247	58.00%	71.00%	81.00%	60.00%
	Separated	14	9	3	26	8.00%	9.00%	4.00%	6.00%
	Single	40	15	10	65	22.00%	14.00%	12.00%	14.00%
	Widowed	12	3	2	17	7.00%	3.00%	2.00%	5.00%
	Total	180	105	83	368	100.00%	100.00%	100.00%	100.00%
Educational Status	No Formal Education	19	14	12	45	10.00%	14.00%	14.00%	13.00%
	Quranic Education	26	16	15	57	14.00%	15.00%	18.00%	16.00%
	Primary Education	57	32	30	119	32.00%	30.00%	36.00%	33.00%
	Secondary Education	41	22	11	74	23.00%	21.00%	13.00%	19.00%
	Vocational/Technical Education	19	11	8	38	11.00%	10.00%	10.00%	10.00%
	Tertiary Education	18	10	7	35	10.00%	10.00%	9.00%	9.00%
	Total	180	105	83	368	100%	100%	100.00%	100%
Ethnicity	Hausa	55	35	29	119	30.00%	33.00%	35.00%	33.00%
	Fulani	64	44	33	141	36.00%	41.00%	39.00%	39.00%
	Gbagyi	17	7	5	29	9.00%	7.00%	6.00%	7.00%
	Kanuri	14	7	3	24	7.00%	7.00%	4.00%	6.00%
	Nupe	14	8	5	27	7.00%	8.00%	6.00%	7.00%
	Yoruba	7	2	4	13	3.00%	2.00%	5.00%	3.00%
	Igbo	9	2	4	15	4.00%	2.00%	5.00%	4.00%
	Total	180	105	83	368	100.00%	100.00%	100.00%	100.00%
Status in the Household	Household Head	60	45	45	150	33.00%	43.00%	54.00%	43.00%
	Other Household Member	120	60	38	218	67.00%	57.00%	46.00%	57.00%
	Total	180	105	83	368	100.00%	100.00%	100.00%	100.00%
Religion	Islam	142	86	61	289	79.00%	82.00%	73.00%	78.00%
	Christianity	38	19	22	79	21.00%	18.00%	27.00%	22.00%
	Total	180	105	83	368	100.00%	100.00%	100.00%	100.00%



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		Daki - Takwas	Ungwan Dawaki	Ungwan Sarki	Sub Total	Daki - Takwas	Ungwan Dawaki	Ungwan Sarki	Sub Total
Sources of Income/ Occupation	Apprentice/ Business Learners	2	2	-	4	1.00%	2.00%	0.00%	3.00%
	Civil Servant	6	6	5	17	3.00%	6.00%	6.00%	5.00%
	Farming	103	74	57	234	57.00%	70.00%	69.00%	65.00%
	Industrial Work	15	4	4	23	8.00%	4.00%	5.00%	6.00%
	Technical work/Artisan	18	5	4	27	10.00%	5.00%	5.00%	6.00%
	Trading	36	14	13	63	21.00%	13.00%	15.00%	15.00%
	Total	180	105	83	368	100%	100%	100.00%	100%
Average Income per month	Below N10,000.00	9	3	2	14	6.00%	3.00%	2.00%	4.00%
	N10,001 – N20,000	19	9	7	35	11.00%	9.00%	8.00%	9.00%
	N20,001 – N30,000	46	22	19	87	25.00%	21.00%	24.00%	23.00%
	N30,001 – N40,000	58	45	34	137	32.00%	43.00%	41.00%	39.00%
	N40,001 – N50,000	37	19	14	70	20.00%	18.00%	17.00%	18.00%
	Above N50,000.00	11	7	7	25	6.00%	6.00%	8.00%	7.00%
	Total	180	105	83	368	100%	100%	100.00%	100%

Variables	Categories	Daki Takwas	Ungwan Dawaki	Ungwan Sarki	Sub- Total	Daki Takwas	Ungwan Dawaki	Ungwan Sarki	Sub - Total
Domestic Source of Water	Rain Water	19	13	12	44	11.00%	12.00%	13.00%	11.00%
	Private piped Borehole	7	6	3	16	4.00%	6.00%	4.00%	5.00%
	Public hand dug well	27	15	12	54	15.00%	14.00%	13.00%	14.00%
	Government piped water supply	0	0	0	00	0.00%	0.00%	0.00%	0.00%
	Community bore-hole	89	51	39	179	49.00%	49.00%	50.00%	50.00%
	Surface Water (Stream, Creek, Pond etc.)	38	20	17	75	21.00%	19.00%	20.00%	20.00%
	Total	180	105	83	368	100%	100%	100.00%	100%
Domestic source of power	Generator Alone	5	2	2	9	3.00%	2.00%	2.00%	2.00%
	National Grid Alone	101	52	45	198	56.00%	50.00%	54.00%	53.00%
	None	11	2	2	15	6.00%	2.00%	2.00%	3.00%
	National Grid + Generator	42	37	27	106	23.00%	35.00%	33.00%	31.00%
	Solar Powered Inverter Alone	4	0	0	4	2.00%	0.00%	0.00%	1.00%
	National Grid + Solar	17	12	7	36	10.00%	11.00%	9.00%	10.00%
	Total	180	105	83	368	100.00%	100.00%	100.00%	100.00%
Daily Duration of Availability of Power from National Grid	Above 12 Hours	2	2	-	4	1.00%	2.00%	0.00%	3.00%
	8 to 12 Hours	6	6	5	17	3.00%	6.00%	6.00%	5.00%
	6 to 8 Hours	103	74	57	234	57.00%	70.00%	69.00%	65.00%
	2 to 6 Hours	51	18	17	86	8.00%	4.00%	5.00%	21.00%



	Below 2 Hours	18	5	4	27	10.00%	5.00%	5.00%	6.00%
	Total	180	105	83	368	100%	100%	100.00%	100%
Access to Health Facility	Private Hospital	9	3	2	14	6.00%	3.00%	2.00%	4.00%
	Pharmacy	19	9	7	35	11.00%	9.00%	8.00%	9.00%
	Government General Hospital	46	22	19	87	25.00%	21.00%	24.00%	23.00%
	Primary Health center	58	45	34	137	32.00%	43.00%	41.00%	39.00%
	Patient Medicine Store	37	19	14	70	20.00%	18.00%	17.00%	18.00%
	Traditional Care	11	7	7	25	6.00%	6.00%	8.00%	7.00%
	Total	180	105	83	368	100%	100%	100.00%	100%

4.3.3.1 Gender and Marital Status

The proportion of male and female who participated in the survey shows that about 65% of the residents of the area are male while female is about 35%. This pattern is similar at the three communities hosting the SAPZ initiative.

4.3.3.2 Age, Marital Status, and Household Composition

The demographic survey of the project area shows that the majority of residents are middle-aged, with the 30–39 and 40–49-year age groups collectively accounting for 58% of respondents. In Daki-Takwas, 49% of the population falls within the 40–49-year bracket compared to 35% in Ungwan Dawaki, while the 50–59-year age group similarly shows 48% and 20% respectively. In contrast, younger age groups (20–29 and 30–39 years) are underrepresented relative to national trends, where approximately 65% of Nigerians are below 35 years, suggesting gradual population gentrification. This pattern is reinforced by insights from Key Informant Interviews and community engagement sessions, which highlight limited local employment and income-generating opportunities. Household structures are typical of Nigerian communities, with an average household size of three persons. Most respondents (60%) are married, while 14% are single, 5% widowed, 5% divorced, and 6% separated, reflecting a stable family composition within the project area.

4.3.4 Household Characteristics

The family size is moderate with an average of about 3 persons per household. The household structure in the communities around the project area is typical of most communities in Nigeria.



Greater percentage of the respondents are married (60%), 14% are single, 5% are widows/widowers, 5% are divorced, 6% are separated.

4.3.4.1 Ethnic Characteristics

Survey result revealed that the studied communities were dominated by Fulani with a record of 39% of the population while Hausas are 33%. Other ethnicities found in the areas include Gbagyi 7%, Kanuri 6%, Nupe 7%, Yoruba 3% and Ibo 4%.

4.3.4.2 Religious Characteristics

The study in terms of religious affiliation reveals that 78% of the respondents are Muslims while 22% practice Christianity. None of the respondents in the study area indicated that they were traditional worshipers. Plate 4.33 below are evidence of Church and Mosque as captured in the community.



Plate 4.8 Community Church at sabon birnin Kasarami



Plate



4.9: Community Mosque at sabon birnin Kasarami

4.3.5 Economics and Livelihoods of Households

In the study area, Crop farming, trading, artisanship, livestock rearing, processing of farm produce and self-employment are the major income generating activities of the people, also due to low level of urbanization and the primary nature of production, 65% (above half) of the respondents practice farming, though some of the respondents were equally employed as civil servants with 5% of respondents falling into that category. Another 6% were employed in industrial sector. 15% of respondents in the area are involved in Trading while 6% are either technicians or artisans. Students, apprentices and business learners account for the smallest proportion (3%) of the population.

In terms of monthly income generation, 39% earned between N30,000 and N40,000. The income bracket with the second highest proportion are those earning between N20,000 and N30,000 with 23%. Combining the values of these two income brackets reveals that over half (62%) fall between the N20,000 – N40,000 income bracket. Only 7% of the respondents earn above N50,000 while 18% of the respondent earn between N40,000 – N50,000. The implication of the foregoing is that income is generally low in the neighborhoods around the project corridor as none of the respondents earn up to the national minimum wage level.



4.3.5.1 Educational Level of Respondents

Thirty-three (33%) percent of the respondents have Primary School education, 19% had Secondary School while 13% had no formal education. Respondent who indicated that they are or have completed tertiary education were 9%, 10% had technical/ vocational training while 16% were product of Quranic educational institution.

4.3.6 Vulnerable Groups

The category and number of vulnerable groups in the project communities were identified and compiled with assistance from the village heads. Only one person was living with disability in the Ungwan- Sarki community. The other communities showed no persons living with a disability. Out of 368 respondents across the three communities, only one person indicated to be living with disability as a result of total blindness

4.3.7 Social Amenities and Infrastructure

Socio-cultural and economic activities as well as social infrastructures in the communities such as structural organization of the area, types of religion, private and government-owned institutions, level of income and expenditure, employment and dependency ratio, poverty profile etc. were discussed in this section of the study.

4.3.7.1 Government and Private Institutions Present in Project Host Communities

The presence of public and private institutions in the project host communities of Daki – Takwas, Chikun LGA is presented in Table 4.26 below. The availability of schools, health facilities, religious centers, recreational facilities, good roads and markets play a vital role in shaping the socio-economic development of the area

Table 4.26 Social Infrastructures in AIH SAPZ Host Communities

S/N	Category	Daki-Takwas	Ungwan Dawaki	Ungwan Sarki
01	No. of Primary Schools	01	01	01
02	No. of Secondary Schools	01	01	Nil



S/N	Category	Daki-Takwas	Ungwan Dawaki	Ungwan Sarki
03	No. of Tertiary/Higher Institutions	Nil	Nil	Nil
04	No. of Hotel/ Restaurant	01	Nil	Nil
05	No. of Hospitals/ Health Centers	01	Nil	01
06	No. of Markets	01	01	01
07	No. of Sporting Facilities	01	Nil	Nil

Source: AIH SAPZ ESIA Field Data 2025

The three communities hosting the AIH SAPZ have limited but functional presence of government and privately owned primary and secondary schools, though many of these are poorly maintained, leading some households to prefer private alternatives despite higher costs. There are no higher institutions in the immediate area, with tertiary education opportunities accessible mainly in urban centers such as Zaria and Kaduna town.

Health services are restricted to small clinics and primary health centers, which often struggle with shortages of qualified staff and medical supplies. Religious institutions are highly visible, with mosques outnumbering churches, reflecting the predominantly Muslim character of the population. Local markets in the three communities play a pivotal role in daily socio-economic activity, serving as hubs for trading agricultural produce and household goods. However, these markets face infrastructural challenges, including limited stalls, poor storage facilities, lack of decent toilets and inadequate access roads, which constrain their full potential as engines of local development.

4.3.7.2 Electricity

Abuja Electricity Distribution Company (AEDC) is responsible for the distribution of electricity to households and end users from the national power grid within the project area. It was gathered from the study that 53% of respondent rely on electricity available through national grid only, 31% make use of generator to compliment the electrical supply while 2% make use of home-sized



electricity generators only. A small fraction of the respondents 1%) obtain access to electricity through solar inverters, while 10% combines Solar inverter with national grid supply. A paltry 3% of the respondents do not have access to any of the available sources identified in the area.

Some of the residents interviewed are completely disconnected from the national grid as there are currently no operational distribution lines in the area. Residents disclosed during community-level consultations that there were also no enough numbers of transformers in the environment. The survey also revealed that the duration of availability of power from the national grid (for households with existing connections) was mostly around 6-8 hours. 27% of respondents with connections to the grid had power for about 5 hours daily while 5% were connected for about 8 hours and 3% for above 12hours daily. It is evident from the number of supply hours that there are considerable constraints in supply of electricity in the area.

4.3.7.3 Communication

Most of the inhabitants of the proposed project area have access to mobile phones with one or two national networks (such as MTN, Glo, 9Mobile and Airtel). It was reported that mobile communication is affordable to most residents. Television and radio signals are also very strong due to the proximity of area to available signals from Kaduna. Nonetheless the use of cable satellites from providers like DSTV (multi choice), StarTimes, GoTV was also observed in the area.



Plate 4.34: Telecoms Mast sighted in Daki Takwas



4.3.7.4 Transportation

According to the survey, Walking is the most prominent means of commuting to work place as indicated by 33% of the respondents. This was followed by 26% who use motorcycles. Also, 29% use commercial vehicles, 5% use private cars, 7% use private motorcycle and 2% use company/pool vehicles to work. The implication of the foregoing is that many of the respondents live close to their place of work and that commercial vehicles and motorcycles which account for 55% are the most used modes of transportation. Car ownership is low perhaps because of the prevailing socioeconomic status of the residents.

4.3.7.5 Road Network

The project area is along the linear path of the Abuja – Zaria – Kaduna Expressway which is a major road (Plate 4.35). The road plays a major role in conveying products and raw materials into and out of Kaduna and its environs. While the linear dual – carriage is smoothly tarred, the road network within the project site is narrow and untarred (Plate 4.36).



Plate 4.35: Abuja-Kaduna-Zaria Road



Plate 4.36: Roads within the Project site at Daki-Takwas



4.3.8 Housing and Living Conditions

In the project host communities of Daki-Takwas, housing is largely traditional, reflecting the rural character and income levels of the people. The majority of households live in mud houses roofed with zinc, which dominate the landscape as shown in Figure 4.27 below. These houses, although affordable, are poorly ventilated, prone to structural deterioration during heavy rainfall, and often lack proper flooring and sanitation facilities.

A smaller proportion of households occupy cement block houses with zinc roofing, which are more durable and provide relatively better living conditions. Very few houses were found to be constructed with cement blocks and asbestos roofing, and these are declining due to the health risks associated with asbestos. Overcrowding is common, with an average of three persons per room, raising public health concerns related to the spread of communicable and contagious diseases like cough, Tuberculosis etc.

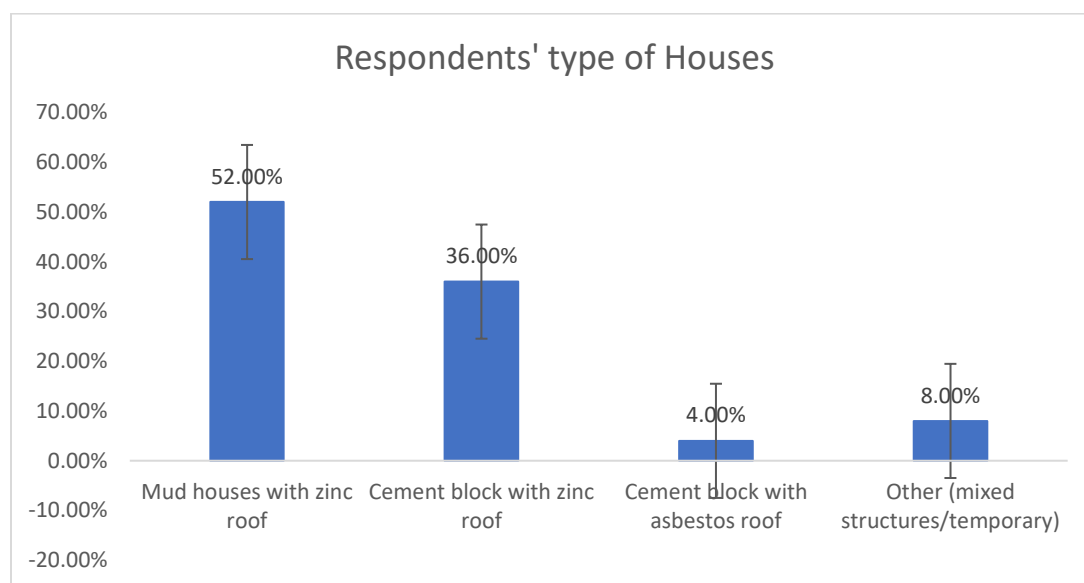


Figure 4.27: Types of Houses Found in Daki-Takwas

Source: AIH SAPZ ESIA Field Data 2025

4.3.9 Conflict Resolution Mechanism in the Project Host Communities

The project host community of Daki-Takwas, Chikun LGA have established traditional mechanisms for managing conflicts, which emphasize peacebuilding, mutual respect, and social



cohesion. Conflict resolution is primarily overseen by the council of elders and traditional rulers, who serve as custodians of community values and mediators in disputes.

The common forms of conflict in the project area include land disputes, family disagreements, value-based conflicts, and in some cases, gender-related issues. When conflicts arise, they are typically reported to the elders' council or the traditional ruler, who mediate through dialogue, negotiation, and reconciliation processes that are respected by community members.

This traditional conflict resolution system ensures timely settlement of disputes, reduces tensions, and promotes harmony within the project host communities, providing a culturally grounded mechanism for sustaining peace in the face of development activities such as the AIH SAPZ project.

4.3.9.1 Presence of Security Agencies in the Project Area

The Nigeria Police is responsible for the protection of lives and properties of the citizens as well as maintaining law and order in the country, including Daki- Takwas, community where this project is to be sited. Though the community has its local security, police stations and police posts are seen at strategic places to curb crime. Also, an Army Settlement was noticed close to the project site which suggest presence adequate security in the project site and its environ.

4.4 Perception about the Project

All of the 368 respondents that were surveyed across the project community (Daki-Takwas, Ungwan Sarki, and Ungwan Dawaki) area to assess perceptions about the proposed AIH SAPZ project expressed support for the project, citing anticipated benefits such as improved agricultural production, enhanced local economic activities, food security, employment opportunities, infrastructural and socio-economic development. These were seen as key drivers of community development and reasons for welcoming the project.

However, a segment of the population expressed negative perceptions and reservations. These concerns stem largely from fear of losing their farmlands without adequate resettlement and/or compensation and also, misconceptions linked to past experiences with private organizations, which had raised community expectations but failed to deliver tangible benefits. This history has created a degree of mistrust, leading some households to be cautious about fully endorsing the



SAPZ project. However, despite these concerns, the overall perception remains positive, with the community recognizing the potential of the AIH SAPZ project to improve livelihoods, stimulate the rural economy, and provide new opportunities for all and sundry if implemented transparently and inclusively. Figure 4.24 depicts respondents' reasons for supporting the project.

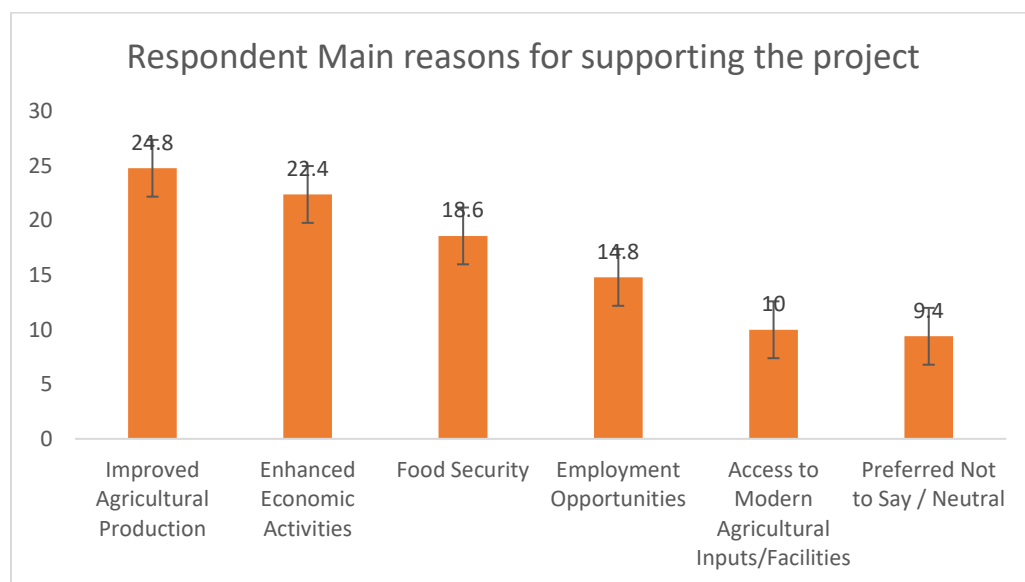


Figure 4.28: Respondents' reasons for supporting the AIH SAPZ Project

Source: AIH SAPZ ESIA Field Survey 2025

4.5 Health Study

4.5.1 Health Problems/Ailments and Cost Implications in Project Host Communities

Health challenges reported by households in the surveyed communities of Daki-Takwas, Ungwan Dawaki, and Ungwan Sarki were analyzed and summarized in Figure 4.29 and Table 4.27 below. The most common ailment is malaria, which remains the leading health issue across households, followed by typhoid, diarrhea, cough, and stomach-related problems such as ulcers. Chronic conditions like hypertension, stroke, diabetes and cholera were reported at very low levels. The high prevalence of malaria is linked to the abundance of mosquito breeding sites, poor drainage, and limited use or non-availability of household malaria prevention utensils like: insecticide, treated nets, malaria repellent cream etc. Similarly, the presence of typhoid and diarrhea indicates challenges with safe water supply and sanitation, reflecting inadequate access



to improved hygiene facilities. The results suggest that health problems in the project communities are largely preventable, as they are closely tied to environmental and sanitary conditions. However, it is hopeful that the implementation of the AIH SAPZ project, improvements in infrastructure, water, sanitation, and livelihoods would help reduce the spread of communicable diseases and improve community well-being.

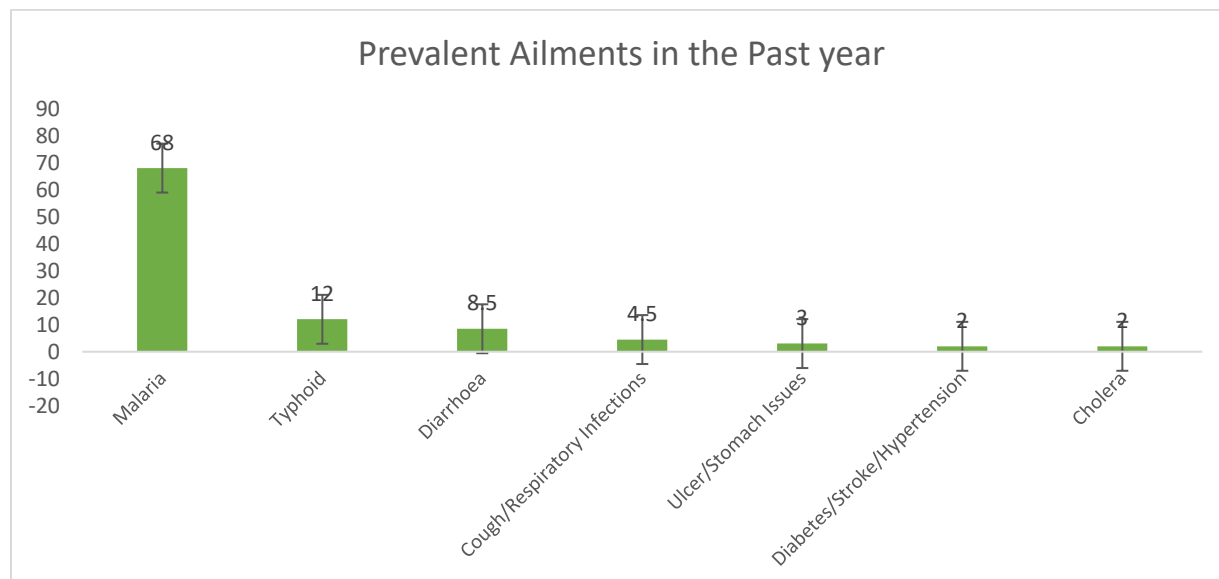


Figure 4.29 Prevalent Ailment in the Project Host Communities

Health facility records from the AIH SAPZ host communities of Daki Takwas, Ungwan Dawaki, and Ungwan Sarki reveal that malaria remains the most prevalent illness, followed by diarrhoea, gastrointestinal infections, and respiratory tract diseases. Other conditions such as pneumonia, tuberculosis, skin diseases, conjunctivitis, and urinary tract infections (UTIs) are also reported across all age groups. Chronic ailments such as HIV/AIDS and hypertension-related conditions occur at comparatively lower levels but remain of public health concern.

Table 4.27 shows the Occurrence of Common Diseases obtained from healthcare facilities in the project areas. Malaria is the most common illness treated at the facilities followed by diarrhoea and gastrointestinal problems.

Table 4.27: Occurrence of Common Diseases by Age and Sex



Disease	<5 years			5-14 years			15-49 years			50-64 years			≥64 years			Tot al
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
Malaria	3836	3101	6937	1369	2001	3370	2822	3107	5929	1152	2043	3195	102	291	3931	15264
Diarrhea	312	114	426	7	184	191	24	37	61	15	15	26	38	32	62	164
Gastroenteritis	335	264	599	37	264	301	122	165	287	23	29	64	45	32	167	523
Pneumonia	81	66	147	21	66	87	41	28	69	25	26	50	8	4	57	156
Tuberculosis	5	7	12	2	7	9	62	45	107	21	11	25	13	10	75	155
UTI	121	102	223	17	132	149	118	182	300	34	44	55	23	22	141	439
HIV/AIDS	2	5	7	7	5	12	11	24	35	4	5	6	9	8	21	39
Measles	141	116	257	23	216	239	7	17	24	4	4	31	4	4	11	89
URTI	1097	1532	2729	237	1115	1352	341	625	966	94	162	335	55	68	496	1876
Cellulites	85	63	148	65	60	125	84	115	199	37	46	106	21	33	105	446
Conjunctivitis	103	93	196	90	93	183	306	393	699	158	210	252	102	111	409	1464
Skin disease	105	110	215	141	230	371	170	242	412	63	95	208	40	33	210	912
Covid 19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Source: Secondary data obtained from health facilities in the project host communities.

4.5.2 Health Services Profile in the Project Host Communities

The host communities of Daki Takwas, Ungwan Dawaki, and Ungwan Sarki are served by a mix of government and private health facilities, though the services are limited compared to urban centres. The available facilities include primary health centres, dispensaries, and maternities, but most are poorly equipped, lacking adequate staff, essential drugs, and medical equipment.

The communities also rely on a dual system of healthcare delivery:

- Orthodox healthcare providers such as health posts, clinics, and government health centres provide first aid, immunisation services for children and women of reproductive age, and treatment of minor ailments.
- Non-orthodox providers, mainly traditional birth attendants (TBAs) and herbal practitioners, remain widely used, particularly for maternal and child health.



In addition, drug stores (chemists) and itinerant drug hawkers play a visible role in healthcare delivery, supplying malaria drugs, analgesics, antibiotics, and ointments, though often without proper regulation.

4.5.3 Accessibility and Affordability of Health Facilities and Services

Accessibility to healthcare in the project host communities remains a major challenge. While some households can reach nearby primary health centres, others depend on unregulated drug sellers due to distance, cost, and limited government facilities. Respondents during the survey noted that the nearest hospitals are located outside the communities, often in larger towns within Chikun LGA or Kaduna metropolis.

The affordability of healthcare is another limiting factor. Most respondents rely on out-of-pocket spending for treatment, with many opting for cheaper alternatives such as TBAs or drug hawkers. Overall, the survey revealed that the project host communities have moderate but inconsistent access to healthcare, underscoring the need for strengthened investment in affordable and well-equipped facilities to support the AIH SAPZ project's development goals.

4.5.4 Condition and Frequency of Use of Government Healthcare Services in the Project Host Communities

The condition of government healthcare services in the project host communities of Daki Takwas, Ungwan Dawaki, and Ungwan Sarki reflects significant challenges that limit accessibility and effectiveness. Despite national and state-level investments towards improving primary healthcare delivery, the utilization of these facilities remain low due to poor quality of service, inadequate infrastructure, and affordability concerns.

Under Nigeria's health policy framework, households are expected to first access primary healthcare centers (PHCs) before being referred to higher-level facilities. However, in practice, many residents of Daki Takwas, Ungwan Dawaki, and Ungwan Sarki bypass local PHCs because of their poor condition and limited functionality. These health centers lack sufficient qualified personnel—there are very few doctors, nurses, or midwives available on a regular basis. Essential



equipment such as diagnostic tools, functional laboratories, and maternity support facilities are either absent or in poor working condition.

As a result, community members rely more heavily on traditional birth attendants (TBAs), local chemists, or private clinics when seeking healthcare services. This reliance is driven by the perceived affordability and accessibility of these alternatives compared to government facilities. Nonetheless, such practices carry risks due to the absence of proper medical oversight, particularly for maternal and child health, infectious diseases, and emergency care.

The frequency of use of government PHCs is therefore low, with most respondents reporting that they only seek care at these centers during immunization campaigns, antenatal services, or when traditional options fail. The lack of consistent and quality government healthcare provision has created a gap in the delivery of effective and sustainable health services in the project area.

4.5.5 Sources of Potable Domestic Water

The leading source of water for domestic use in the area are community bore-holes which are quite common. 50% of respondents in the survey disclosed that they obtain water from boreholes. Another popular source of water for residents of the area is surface streams which serve about 20% of the residents of the area. 14% of the respondents rely on community hand dug well for their source of water while 11% depend on rain water. Pipe-borne or government water is scarcely available in the area. About 5% of the residents of the area draws from private boreholes. Plates 4.36, 4.37 and 4.38 shows the pictures of the types of water source available in the AIH SAPZ host communities.



Plate 4.36: Borehole as captured at sabon garin kasarami



Plate 4.37: Hand Dug Well as captured in Ungwan Dawaki

Source: AIH SAPZ ESIA Field Data 2025



Plate 4.38::Community Borehole as captured in Daki Takwas

Source: AIH SAPZ ESIA Field Data 2025



CHAPTER FIVE: ASSOCIATED AND POTENTIAL IMPACTS

This chapter discusses the associated and potential impacts of the Special Agro-Industrial Processing Zone (SAPZ) Agro-Industrial Hub (AIH) project described in Chapter 2 of this Report. The impact assessment methodology used to assess the potential project impacts on the baseline conditions will define the significance criteria used for this assessment. The impacts are discussed in relation to project interactions with the biophysical, social and health characteristics of the project environment. The chapter presents an overview of the impact assessment methodology and the results of impact screening. The associated impacts are those impacts that will occur while, the potential impacts are the impacts that could occur during the respective phases of the project. This EIA covers the analysis of the associated and potential impacts of all project activities in the pre-construction (site clearing and preparation); the construction; operation and maintenance; and the decommissioning phases of the project.

5.1 Impact Characteristics

A clear understanding and description of the characteristics of the associated and potential environmental and social impacts of the SAPZ AIH project is very important. Impact characteristics refer to the specific attributes or qualities of an identified project impact that describes, measure, and evaluate such project impact. Thus, impact characteristics represents the attributes utilized in the impact assessment process to enable the comparison of the dynamics of a project impact across project phases. Impact characteristics are the dimensions of project impacts that define the nature, intensity and importance of such project impact (Table 5.1). They constitute the attributes that are used for the assessment of the significance of the impacts of project activities throughout the lifecycle of a project. Tables 5.2 and 5.3 defines the designation and outlines the meaning of Impact Characteristics used in the ESIA. The characteristics and definitions in Tables 5.1 and 5.2 applies to both planned and unplanned project activities, however, an impact characteristics that applies only to unplanned events is the likelihood. The likelihood of occurrence of an unplanned event or incident is designated using a qualitative scale described in Table 5.3.

**Table 5.1: Impact Characteristics Definition and Designations and Meaning**

Characteristic	Definition	Designations
Type	A descriptor indicating the relationship of the impact to the Project (in terms of cause and effect).	Direct Indirect Induce
Extent	The “reach” of the impact (e.g., confined to a small area around the Project Footprint, projected for several kilometres, etc.).	Local Regional International
Duration	The period over which a resource / receptor is affected.	Temporary Short-term Longterm Permanent
Scale	The size of the impact (e.g., the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc.).	No fixed designations; intended to be a numerical value]
Frequency	A measure of the constancy or periodicity of the impact.	No fixed designations; intended to be a numerical value]

Table 5.2 Definition of Impact (Designation) Types

Designation (Type)	Definition
	Type
Direct	Impacts that result from a direct interaction between the Project and a resource/receptor (e.g., the impact of involuntary displacement from farmlands by the Project on the affected local persons.
Indirect	Impacts that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment (e.g., the reduction in water quality resulting from mobilization of surface runoffs contaminated with pesticides and fertilizer contaminants discharges into downstream water bodies leading to toxic effects in aquatic fauna).
Induced	Impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project (e.g., influx of camp followers resulting from the importation of a large Project workforce from other States in Nigeria or from West African Sub-region).
	Extent
Local	Impacts that affect an area in proximity to the development area within an area are defined on a resource/receptor-specific basis.



Designation (Type)	Definition
Regional	Impacts occurring at a regional scale as determined by administrative boundaries or which affect regionally important resources or ecosystems.
International	Impacts that extend across international boundaries or affect resources such as features, resources or areas protected by international conventions.
	Duration
Temporary	Impacts are predicted to be of short duration (in the order of days) and/or intermittent/occasional.
Short-term	Impacts that are predicted to last only for the duration of the construction period (i.e. – 8 years).
Medium-term	Impacts that will continue for a period of 5 to 10 years following the completion of the construction phase e.g., where the impact may reverse or affected resources or receptors recover within this period of time.
Long-term	Impacts that will continue for the life of the Project, but will either cease when the Project stops operating or is decommissioned, or where the impact may reverse or the affected resource/receptor recovers or reverts to a near-natural state after 10 or within 20 years following the completion of the construction phase.
Permanent	Impacts that cause a permanent change in the affected receptor or resource (e.g., removal or destruction of ecological habitat) that endures substantially beyond 20 years following the completion of the construction phase.

Table 5.3 Definition of Impact Likelihood Designations

Likelihood Level	Definition
Negligible or Unlikely	Occurrence of the effect is almost impossible (e.g., less than 1 or 2% likelihood of occurring, impact from risk unknown to have previously resulted in similar circumstances in the industry)
Possible or Low	Effect highly unlikely, given the controls in place (e.g., less than 2-20% likelihood of occurring, impact from risk has been known to result, but only very rarely, in similar circumstances.)
Medium or Likely	Effect could occur infrequently during normal operations, but given a breakdown of the safeguards and controls (i.e. lack of maintenance for a construction equipment, agro-industrial processing equipment or pollution control device) it could occur more readily (e.g., >20-70% likelihood of occurring, impact from risk has been known to result in many similar circumstances, but does not result routinely).
High	Given the controls in place, the effect is likely to occur during normal operations (e.g., over 70% likelihood of occurring, impact from risk has been known to result routinely, though not necessarily in all similar circumstances.)



Different impact assessment guidelines and methodologies have been developed hitherto, and new ones are still emerging however, in agreement with Canter (1996), there is no universal methodology that can be applied to all project types in all environmental settings hence, there is need for impact assessors to use tools from existing methodologies that best suit the specific project situation (UNEP, 1996). The concept of impact characteristics enables impact significance ranking methodology to adopt specific impact attributes that describes explicit qualities of a project impact based on the significance and likelihood criterias that forms the basis of the development of the Impact Significance Rankning in the impact prediction process. Consequently, the impact characteristics that shall be utilized in this SAPZ AIH impact analysis are presented hereafter.

5.2 Impact Prediction

Impact prediction is the process of forecasting the likely environmental and social changes (positive or negative) that will occur if a proposed project is implemented. Impact prediction will provide insight and understanding on the magnitude, extent, duration, and significance impact characteristics of the potential impacts before the project starts. The impact prediction process involves the identification of the key project activities (see Appendix X; and Section 3.6 in Chapter Three), and the environmental and social receptors they interact with using scoring results to determine which project activity (e.g., land clearing, involuntary displacement, waste disposal) would result in project impacts (see Leopold Matrix in Appendix X). The impact prediction process will also identify the environmental and social components or media (Appendix X) that could be affected (e.e., air, water, soil, vegetation, wildlife, project affected persons, noise environment).

The potential changes in indicators of impact receptors is determined with consideration of the the impact characteristics. Thus, impact prediction is evaluated based on the magnitude, extent, duration, significance of the impact, and the sensitivity of the environmental receptor receiving the impact, especially where the impact can be foreseen. In cases of unforeseen impacts, such as an chemical or oil spill, the dimension of probability of the occurrence of the impact must also be considered. The other pertinent steps in the impact prediction process include:



- ❑ Description of the environmental and social (E&S) baseline conditions;
- ❑ Explicit definition of the impact E&S impact indicators or monitoring parameters for the environmental and social media or components (e.g., **Air Quality:** PM_{2.5}, SO₂, NO_x levels; **Water Quality:** Turbidity, pH, BOD, heavy metals; and **Noise Emissions:** Decibel levels; and **Socio-economics:** employment, displacement, access to resources);
- ❑ Prediction of the magnitude and nature of the project impacts by evaluating how much change will occur and in what direction (positive or negative) using qualitative and quantitative methods;
- ❑ Evaluation of impact significance which involves the determination of how important or serious the predicted impacts are by considering the following impact characteristics Magnitude/intensity; Duration (short-, medium-, or long-term); Reversibility (reversible or permanent); Spatial extent (local, regional, global); Sensitivity of affected environment; and
- ❑ Assessment of the cumulative and indirect impacts. Cumulative impacts are the combined effects from other nearby projects, while the indirect impacts are secondary consequences (e.g., traffic congestions and bottlenecks; and increased emission of air pollutants).

5.2.1 Impact Magnitude

Impact Magnitude is defined as the quantitative intensity of the impact, and it can be measured as the percentage of a resource or a population within the area of influence that may be affected by an impact. The definitions of “high,” “medium” and “low” with respect to magnitude may vary depending upon the specific receptor. The magnitude of an impact is characterized as follows:

- High:** large amount of the resource or population is affected. The magnitude impact / effect characteristics is easily observable and measurable;
- Medium:** moderate amount of the resource or population is affected, and it is a generally measurable and observable effect;
- Low:** small amount of the resource or population is affected, and the low magnitude impact may be within the range of normal variation of background conditions;



Negligible: the amount of resource or population affected is unnoticeable or immeasurably small.

Impact Magnitude may also be defined with respect to quantitative or semi-quantitative criteria, if available and applicable, (e.g., level of noise as decibels). The magnitude of an impact is characterized as follows:

High: greater than the quantitative or semi-quantitative criteria;

Medium: at the quantitative or semi-quantitative criteria

Low: less than the quantitative or semi-quantitative criteria

Negligible: impact not detected or at background conditions

5.2.2 Impact Sensitivity

Impact Sensitivity refers to economic, social, and / or environmental / ecological relevance of the receptor, including the intrinsic sensitivity of the resource, reliance on the resource by people for sustenance, livelihood, cultural significance or economic activity, and to the importance of direct impacts to persons associated with the resource. The sensitivity criterion also refers to potential impacts to Environmentally Sensitive Areas (ESAs) and impacts on species, including loss of endangered species, effects of introduction of invasive species, and similar environmental/ecological impacts. The intrinsic sensitivities of a receptor species and actions that alter the function of the receptor are also considered. Sensitivity is characterized as follows:

High: receptor is of high economic, social, and/or environmental relevance and or has an intrinsic sensitivity (including vulnerability and exposure) to the specific impact (e.g., small holder farmers physically displaced from their farmlands and exposed to livelihood loss within the SAPZ AIH project site).

Medium: receptor is of moderate economic, social, and/or environmental relevance and is not particularly vulnerable and/or exposed to the impact.

Low: receptor is of low economic, social, and/or environmental relevance and is not vulnerable and/or exposed to the specific impact.

Negligible: receptor is not of economic, social, and/or environmental relevance or is not sensitive to impact.



5.2.3 Impact Probability

Impact probability refers to the likelihood that the impact will occur, with consideration for the issue of uncertainty and how to handle it. In this report, impact probability is ranked on three levels, consisting of high probability, medium probability and low probability, with their definitions shown in Table 5.4.

Table 5.4 Definitions of Probability Ranking

Ranking	Impact Probability	Frequency of Occurrence
High	A very probable impact	Occurs frequently
Medium	A probable impact	Occurs occasionally
Low	An improbable impact	Occurs rarely

5.2.4 Impact Evaluation

The criteria used for impact evaluation are described in Table 5.5.

Table 5.5 Impact Evaluation Criteria and Ratings

Consequence	Evacuation Criteria	
Environmental legislation and corporate Policy (A)	Is there any legislation affecting this aspect?	Score
	The impact is covered by legislation and policy	3
	The impact is covered by legislation	2
	The impact is covered by policy	1
	The impact is not covered by legislation or policy	0
Stakeholder concern/interest (B)	What stakeholder concern or interest does the stakeholder raise?	Score
	The impact raises considerable global, national and local interest or would have a serious detrimental effect on the reputation of the client	3
	The impact raises some interest and may have some detrimental effect on the reputation of the client	1
	The impact raises no interest and would have no effect on the reputation of the client	0



Consequence	Evacuation Criteria	
	The impact raises some interest and may have some positive effect on the reputation of the client	-1
	The impact raises global, national and local interest or would have a significant positive effect on the reputation of the client	-3
Severity of environmental impact (C)	What is the severity of the environmental impact?	score
	The impact has a moderate detrimental effect on the environment or a scarce, non-renewable resource. Longterm/ Irreversible Impact.	3
	The impact has a moderate detrimental effect on the environment or a scarce, non-renewable resource. Impact not reversible within a year. Year	2
	The impact has a minor detrimental effect on the environment and on scarce, non-renewable resources. Impact reversible within a month to a year.	1
	The impact has no known effect on the environment	0
	The impact has a minor positive effect on the environment and on scarce, non-renewable resources.	-1
	The impact has a moderate positive effect on the environment and on scarce, non-renewable resources.	-2
	The impact has a major positive effect on the environment or a scarce, non-renewable resource	-3
Scale of Impacts (D)	What is the scale of the impact?	Score
	The negative impact occurs in high or large quantities	3
	The negative impact occurs in medium quantities	2
	The negative impact occurs in low or small quantities	1
	The positive impact occurs in low or small quantities	-1
	The positive impact occurs in medium quantities	-2
	The positive impact occurs in high or large quantities	-3
Likelihood Frequency	How frequently does the impact occur	Score
	The impact occurs daily	5
	The impact occurs every week	4
	The impact occurs every month	3
	The impact occurs on an annual basis	2
	The impact is unlikely to occur	1



5.2.5 Impact Significance Ranking

The main goal of an ESIA is to predict whether the identified impacts of a proposed project are significant or not. This target impact significance rank can be calculated by multiplying the magnitude (consequence) and probability score for that impact. To calculate the magnitude of an impact, the sum of the magnitude scores scored during the impact magnitude evaluation for all components (A-D) are added together to obtain the magnitude score for that impact. This score is then multiplied by the probability score to arrive at the significance for that impact. Mathematically, the equation is as follows:

$$\text{Significance Evaluation Score} = \text{Magnitude } (A + B + C + D) \times \text{Probability } (Z)$$

Where A, B, C, D = Impact Characteristics and Z = Probability of Occurrence

This number is then compared against the Significance Categories shown in Table 5.6.

Table 5.6 Significance Level Categories

Impact Significance	Score
Low Negative Significance	1 – 25
Medium Negative Significance	26 – 50
High Negative Significance	> 50
Positive Significance	< -1

5.3 Impact Identification

Impact identification is a very important step in the ESIA process, to ensure that all potentially significant environmental and social impacts, both adverse and positive impacts, are thoroughly identified and considered. The impact identification process integrates project activities with baseline E&S conditions to assess how various project phases might affect both biophysical and socioeconomic receptors. This approach enables a comprehensive evaluation of the project impacts, and the identification of direct, indirect, and cumulative effects that may require mitigation or enhancement measures. All identified impact categories are described in the context of the affected biophysical or socio-receptors (Table 5.7).



This section presents the identification of potential environmental, social, health, and safety impacts associated with the SAPZ Agro-Industrial Hub project in Kaduna State. The impacts are structured by project phase and derived directly from the **Impact Register (Appendix 1)**. Each impact is summarized in terms of activity, aspect, receptor, direction (positive or negative), and significance category.

5.3.1 Pre-Construction Phase Impacts

During the pre-construction phase, impacts are primarily associated with land acquisition, site preparation, and workforce mobilization. Summary of Positive and Negative Impacts of the SAPZ AIH project.



Table 5.7 Pre-Construction Phase Project Impacts

Impact ID	Activity	Aspect/Pathway	Receptor	Impact Direction	Significance
LAID	Land Acquisition and Involuntary Displacement	Interaction affecting Physical and Economic Displacement	Physical and Economic Displacement	Negative	Very High
LAID	Land Acquisition and Involuntary Displacement	Interaction affecting Land use Conflict and Disturbance	Land use Conflict and Disturbance	Negative	Very High
LAID	Land Acquisition and Involuntary Displacement	Interaction affecting Population	Population	Negative	Medium
LAID	Land Acquisition and Involuntary Displacement	Interaction affecting Micro and Macro Economy	Micro and Macro Economy	Negative	Very High
LAID	Land Acquisition and Involuntary Displacement	Interaction affecting Social and Cultural Structure	Social and Cultural Structure	Negative	Very High
PPWE	Physical Presence of Workers, Equipment and Materials on Site (Pre-construction)	Interaction affecting Air Quality	Air Quality	TBD	Low
PPWE	Physical Presence of Workers, Equipment and Materials on Site (Pre-construction)	Interaction affecting Noise and Vibration	Noise and Vibration	Negative	Low
PPWE	Physical Presence of Workers, Equipment and Materials on Site (Pre-construction)	Interaction affecting Soil Quality	Soil Quality	Negative	Medium
PPWE	Physical Presence of Workers, Equipment and Materials on Site (Pre-construction)	Interaction affecting Aesthetics and Visual Aspect	Aesthetics and Visual Aspect	TBD	Low
PPWE	Physical Presence of Workers, Equipment and Materials on Site (Pre-construction)	Interaction affecting Population	Population	Negative	Medium
PPWE	Physical Presence of Workers, Equipment and Materials on Site (Pre-construction)	Interaction affecting Infrastructure	Infrastructure	Negative	Medium
PPWE	Physical Presence of Workers, Equipment and Materials on Site (Pre-construction)	Interaction affecting Transportation	Transportation	Negative	High
PPWE	Physical Presence of Workers, Equipment and Materials on Site (Pre-construction)	Interaction affecting Pollution Related Health Effects	Pollution Related Health Effects	Negative	High
PPWE	Physical Presence of Workers, Equipment and Materials on Site (Pre-construction)	Interaction affecting Accident – Fire – Explosion Incidence	Accident – Fire – Explosion Incidence	Negative	Medium
TRWM	Transportation of Workers and Materials (Pre-construction)	Interaction affecting Air Quality	Air Quality	Negative	Medium
TRWM	Transportation of Workers and Materials (Pre-construction)	Interaction affecting Noise and Vibration	Noise and Vibration	Negative	Medium



Impact ID	Activity	Aspect/Pathway	Receptor	Impact Direction	Significance
TRWM	Transportation of Workers and Materials (Pre-construction)	Interaction affecting Transportation	Transportation	Negative	High
TRWM	Transportation of Workers and Materials (Pre-construction)	Interaction affecting Accident – Fire – Explosion Incidence	Accident – Fire – Explosion Incidence	Negative	Medium
TRWM	Transportation of Workers and Materials (Pre-construction)	Interaction affecting Population	Population	Negative	High
PSUS	Project Site and Utility Route Survey Works	Interaction affecting Land use Conflict and Disturbance	Land use Conflict and Disturbance	Negative	Low
PSUS	Project Site and Utility Route Survey Works	Interaction affecting Transportation	Transportation	Negative	Low
SCPA	Site Clearing and Preparation; Temporary Facilities Setup	Interaction affecting Vegetation	Vegetation	Negative	High
SCPA	Site Clearing and Preparation; Temporary Facilities Setup	Interaction affecting Wildlife	Wildlife	Negative	High
SCPA	Site Clearing and Preparation; Temporary Facilities Setup	Interaction affecting Soil Quality	Soil Quality	Negative	High
SCPA	Site Clearing and Preparation; Temporary Facilities Setup	Interaction affecting Air Quality	Air Quality	Negative	Medium
SCPA	Site Clearing and Preparation; Temporary Facilities Setup	Interaction affecting Noise and Vibration	Noise and Vibration	Negative	Medium
SCPA	Site Clearing and Preparation; Temporary Facilities Setup	Interaction affecting Topography \Landscape Disturbance	Topography \Landscape Disturbance	Negative	Very High
SCPA	Site Clearing and Preparation; Temporary Facilities Setup	Interaction affecting Aesthetics and Visual Aspect	Aesthetics and Visual Aspect	Negative	Very High
SCPA	Site Clearing and Preparation; Temporary Facilities Setup	Interaction affecting Surface Water Quality	Surface Water Quality	Negative	Negligible
SCPA	Site Clearing and Preparation; Temporary Facilities Setup	Interaction affecting Groundwater Quality	Groundwater Quality	Negative	Medium
SCPA	Site Clearing and Preparation; Temporary Facilities Setup	Interaction affecting Transportation	Transportation	Negative	High
SCPA	Site Clearing and Preparation; Temporary Facilities Setup	Interaction affecting Population	Population	Negative	Medium
WEHD	Wastes and Emissions Handling and Disposal (Pre-construction)	Interaction affecting Surface Water Quality	Surface Water Quality	Negative	High
WEHD	Wastes and Emissions Handling and Disposal (Pre-construction)	Interaction affecting Groundwater Quality	Groundwater Quality	Negative	Medium
WEHD	Wastes and Emissions Handling and Disposal (Pre-construction)	Interaction affecting Soil Quality	Soil Quality	Negative	Medium
WEHD	Wastes and Emissions Handling and Disposal (Pre-construction)	Interaction affecting Air Quality	Air Quality	Negative	Medium
WEHD	Wastes and Emissions Handling and Disposal (Pre-construction)	Interaction affecting Pollution Related Health Effects	Pollution Related Health Effects	Negative	High



5.3.2 Construction Phase Impacts

The construction phase is expected to generate the most significant set of impacts, including environmental, social, and health/safety concerns (Table 5.8).

Table 5.8 Construction Phase Project Impacts

Impact ID	Activity	Aspect / Pathway	Receptor	Impact Direction	Significance
PPWE	Physical Presence of Workers, Equipment and Materials on Site (Construction)	Interaction affecting Air Quality	Air Quality	Negative	Medium
PPWE	Physical Presence of Workers, Equipment and Materials on Site (Construction)	Interaction affecting Noise and Vibration	Noise and Vibration	Negative	Medium
PPWE	Physical Presence of Workers, Equipment and Materials on Site (Construction)	Interaction affecting Soil Quality	Soil Quality	Negative	High
PPWE	Physical Presence of Workers, Equipment and Materials on Site (Construction)	Interaction affecting Aesthetics and Visual Aspect	Aesthetics and Visual Aspect	Negative	Medium
PPWE	Physical Presence of Workers, Equipment and Materials on Site (Construction)	Interaction affecting Population	Population	Negative	High
PPWE	Physical Presence of Workers, Equipment and Materials on Site (Construction)	Interaction affecting Infrastructure	Infrastructure	Negative	High
PPWE	Physical Presence of Workers, Equipment and Materials on Site (Construction)	Interaction affecting Transportation	Transportation	Negative	Very High
PPWE	Physical Presence of Workers, Equipment and Materials on Site (Construction)	Interaction affecting Pollution Related Health Effects	Pollution Related Health Effects	Negative	High
PPWE	Physical Presence of Workers, Equipment and Materials on Site (Construction)	Interaction affecting Accident – Fire – Explosion Incidence	Accident – Fire – Explosion Incidence	Negative	High
TRWM	Transportation of Workers and Materials (Construction)	Interaction affecting Air Quality	Air Quality	Negative	High
TRWM	Transportation of Workers and Materials (Construction)	Interaction affecting Noise and Vibration	Noise and Vibration	Negative	Medium
TRWM	Transportation of Workers and Materials (Construction)	Interaction affecting Transportation	Transportation	TBD	High
TRWM	Transportation of Workers and Materials (Construction)	Interaction affecting Accident – Fire – Explosion Incidence	Accident – Fire – Explosion Incidence	Negative	High



Impact ID	Activity	Aspect / Pathway	Receptor	Impact Direction	Significance
TRSP	Transportation of Raw Materials and Products	Heavy vehicle movement causing pavement damage, dust emissions, and increased accident risk	Transportation / Road Safety	Negative	High
TRWM	Transportation of Workers and Materials (Construction)	Interaction affecting Population	Population	Negative	High
CCPF	Core Factory, Civil and Support Infrastructure Construction	Interaction affecting Vegetation	Vegetation	Negative	High
CCPF	Core Factory, Civil and Support Infrastructure Construction	Interaction affecting Wildlife	Wildlife	Positive	High
CCPF	Core Factory, Civil and Support Infrastructure Construction	Interaction affecting Soil Quality	Soil Quality	Negative	High
CCPF	Core Factory, Civil and Support Infrastructure Construction	Interaction affecting Air Quality	Air Quality	Negative	Medium
CCPF	Core Factory, Civil and Support Infrastructure Construction	Interaction affecting Noise and Vibration	Noise and Vibration	Negative	Medium
CCPF	Core Factory, Civil and Support Infrastructure Construction	Interaction affecting Topography \Landscape Disturbance	Topography \Landscape Disturbance	Positive	Very High
CCPF	Core Factory, Civil and Support Infrastructure Construction	Interaction affecting Aesthetics and Visual Aspect	Aesthetics and Visual Aspect	Positive	Very High
CCPF	Core Factory, Civil and Support Infrastructure Construction	Interaction affecting Surface Water Quality	Surface Water Quality	Negative	High
CCPF	Core Factory, Civil and Support Infrastructure Construction	Interaction affecting Groundwater Quality	Groundwater Quality	Negative	High
CCPF	Core Factory, Civil and Support Infrastructure Construction	Interaction affecting Transportation	Transportation	Negative	High
IT-AIH	Installation and Testing of AIH Factory Equipment and Machinery	Interaction affecting Noise and Vibration	Noise and Vibration	Negative	Medium
IT-AIH	Installation and Testing of AIH Factory Equipment and Machinery	Interaction affecting Accident – Fire – Explosion Incidence	Accident – Fire – Explosion Incidence	Negative	High
IT-AIH	Installation and Testing of AIH Factory Equipment and Machinery	Interaction affecting Infrastructure	Infrastructure	Negative	High



Impact ID	Activity	Aspect / Pathway	Receptor	Impact Direction	Significance
LDGB	Landscaping and Development of Green Buffers	Interaction affecting Vegetation	Vegetation	Positive	Very High
LDGB	Landscaping and Development of Green Buffers	Interaction affecting Aesthetics and Visual Aspect	Aesthetics and Visual Aspect	Positive	Very High
LDGB	Landscaping and Development of Green Buffers	Interaction affecting Micro Climate	Micro Climate	Positive	Very High
LDGB	Landscaping and Development of Green Buffers	Interaction affecting Topography \Landscape Disturbance	Topography \Landscape Disturbance	Positive	Very High
WEHD	Wastes Disposal and Emissions Handling (Construction)	Wastewater generation and effluent discharge affecting surface and groundwater quality (BOD, COD, nutrients)	Surface Water Quality	Negative	High
WEHD	Wastes Disposal and Emissions Handling (Construction)	Odour emissions from wastewater treatment and organic waste handling	Groundwater Quality	Negative	High
WEHD	Wastes Disposal and Emissions Handling (Construction)	Improper management of solid waste (packaging, organic waste)	Soil Quality	Negative	High
WEHD	Wastes Disposal and Emissions Handling (Construction)	Interaction affecting Air Quality	Air Quality	Negative	Medium
WEHD	Wastes Disposal and Emissions Handling (Construction)	Interaction affecting Pollution Related Health Effects	Pollution Related Health Effects	Negative	High

5.3.3 Operation Phase Impacts

Operation phase impacts are linked to routine industrial processes, transport, and waste management, with both positive socio-economic benefits and negative environmental risks (Table 5.9).

Table 5.9 Operation Phase Project Impacts

Impact ID	Activity	Aspect / Pathway	Receptor	Impact Direction	Significance
FSC	SAPZ AIH Facility Start-up and Commissioning	Interaction affecting Air Quality	Air Quality	Negative	Medium
FSC	SAPZ AIH Facility Start-up and Commissioning	Interaction affecting Noise and Vibration	Noise and Vibration	Negative	Medium



Impact ID	Activity	Aspect / Pathway	Receptor	Impact Direction	Significance
FSC	SAPZ AIH Facility Start-up and Commissioning	Interaction affecting Population	Population	Positive	High
FSC	SAPZ AIH Facility Start-up and Commissioning	Interaction affecting Infrastructure	Infrastructure	Positive	High
FSC	SAPZ AIH Facility Start-up and Commissioning	Interaction affecting Accident – Fire – Explosion Incidence	Accident – Fire – Explosion Incidence	Negative	High
OAIH	Operation of the Agro-Industrial Processing Hub - Factories and Business Operations	Interaction affecting Surface Water Quality	Surface Water Quality	Negative	Very High
OAIH	Operation of the Agro-Industrial Processing Hub - Factories and Business Operations	Interaction affecting Groundwater Quality	Groundwater Quality	Negative	High
OAIH	Operation of the Agro-Industrial Processing Hub - Factories and Business Operations	Interaction affecting Soil Quality	Soil Quality	Negative	High
OAIH	Operation of the Agro-Industrial Processing Hub - Factories and Business Operations	Interaction affecting Air Quality	Air Quality	Negative	High
OAIH	Operation of the Agro-Industrial Processing Hub - Factories and Business Operations	Interaction affecting Noise and Vibration	Noise and Vibration	Negative	Medium
OAIH	Operation of the Agro-Industrial Processing Hub - Factories and Business Operations	Interaction affecting Population	Population	Positive	High
OAIH	Operation of the Agro-Industrial Processing Hub - Factories and Business Operations	Interaction affecting Pollution Related Health Effects	Pollution Related Health Effects	Negative	High
OAIH	Operation of the Agro-Industrial Processing Hub	Interaction affecting Micro Economy	Micro and Macro Economy	Negative	Very High



Impact ID	Activity	Aspect / Pathway	Receptor	Impact Direction	Significance
	- Factories and Business Operations	and Macro Economy			
OAIH	Operation of the Agro-Industrial Processing Hub - Factories and Business Operations	Interaction affecting Infrastructure	Infrastructure	Positive	Very High
PPFW	Physical Presence of AIH Factory Workers	Interaction affecting Population	Population	Negative	High
PPFW	Physical Presence of AIH Factory Workers	Interaction affecting Micro and Macro Economy	Micro and Macro Economy	Negative	Very High
PPFW	Physical Presence of AIH Factory Workers	Interaction affecting Education	Education	Negative	Very High
PPFW	Physical Presence of AIH Factory Workers	Interaction affecting Air Quality	Air Quality	Negative	High
PPFW	Physical Presence of AIH Factory Workers	Interaction affecting Noise and Vibration	Noise and Vibration	Negative	Medium
TW_VCC	Transportation of Workers and Value Chain Commodities	Interaction affecting Transportation	Transportation	Negative	Very High
TW_VCC	Transportation of Workers and Value Chain Commodities	Interaction affecting Air Quality	Air Quality	Negative	High
TW_VCC	Transportation of Workers and Value Chain Commodities	Interaction affecting Noise and Vibration	Noise and Vibration	Negative	Medium
TW_VCC	Transportation of Workers and Value Chain Commodities	Interaction affecting Accident – Fire – Explosion Incidence	Accident – Fire – Explosion Incidence	Negative	High
O&M	Operation & Maintenance of Water, Sewer and Power Infrastructure	Interaction affecting Surface Water Quality	Surface Water Quality	Negative	Very High
O&M	Operation & Maintenance of Water, Sewer and Power Infrastructure	Interaction affecting	Groundwater Quality	Negative	High



Impact ID	Activity	Aspect / Pathway	Receptor	Impact Direction	Significance
		Groundwater Quality			
O&M	Operation & Maintenance of Water, Sewer and Power Infrastructure	Interaction affecting Soil Quality	Soil Quality	Negative	High
O&M	Operation & Maintenance of Water, Sewer and Power Infrastructure	Interaction affecting Infrastructure	Infrastructure	Positive	Very High
O&M	Operation & Maintenance of Water, Sewer and Power Infrastructure	Interaction affecting Micro and Macro Economy	Micro and Macro Economy	Positive	Very High
O&M	Operation & Maintenance of Water, Sewer and Power Infrastructure	Interaction affecting Accident – Fire – Explosion Incidence	Accident – Fire – Explosion Incidence	Positive	High
WEHD	Wastes and Emissions Handling and Disposal (Operation)	Interaction affecting Surface Water Quality	Surface Water Quality	Negative	Very High
WEHD	Wastes and Emissions Handling and Disposal (Operation)	Interaction affecting Groundwater Quality	Groundwater Quality	Negative	High
WEHD	Wastes and Emissions Handling and Disposal (Operation)	Interaction affecting Soil Quality	Soil Quality	Negative	High
WEHD	Wastes and Emissions Handling and Disposal (Operation)	Interaction affecting Air Quality	Air Quality	Negative	High
WEHD	Wastes and Emissions Handling and Disposal (Operation)	Interaction affecting Pollution Related Health Effects	Pollution Related Health Effects	Negative	High

5.3.3.1 Operational Phase Impacts and Monitoring

During the operational phase of the SAPZ Agro-Industrial Hub (AIH), key environmental impacts are expected to arise from wastewater generation, odour emissions, solid waste management, transportation activities, and cumulative air emissions. This section provides a



detailed discussion of these impacts, expected emission/discharge points, and the proposed monitoring framework to ensure compliance with both national regulations and AfDB's Operational Safeguards (particularly OS1 and OS4).

1. Wastewater Management

Effluents from agro-processing units, equipment cleaning, and domestic sewage will contain organic matter, suspended solids, nutrients, and trace oil and grease. These effluents will be collected and treated in a dedicated Wastewater Treatment Plant (WWTP) to meet permissible discharge standards. Treated effluent will either be reused for irrigation or discharged into approved drainage systems.

Monitoring of influent and effluent quality will be undertaken monthly to track BOD, COD, TSS, nutrients, pH, and oil & grease levels in accordance with FMEnv and NESREA effluent discharge regulations.

2. Odour Control

Odour may emanate from processing activities, effluent treatment units, and organic waste storage areas. Control measures will include:

- Regular removal and proper storage of organic waste.
- Use of biofilters or activated carbon scrubbers at wastewater treatment facilities.
- Maintaining aerobic conditions in effluent ponds to reduce anaerobic odour formation.
- Routine olfactory inspections and quarterly air quality monitoring to assess odour intensity and effectiveness of control systems.

3. Solid Waste Management

Solid wastes generated during operation will consist of packaging materials (paper, plastic, metal), organic residues, and small quantities of hazardous wastes (e.g., spent oil, contaminated rags).

Waste will be segregated at source into recyclable, compostable, and hazardous categories.

Organic residues will be composted or converted to biogas, while recyclables will be transferred to licensed recycling contractors. A solid waste register will be maintained and monthly audits will be conducted to track waste volumes and disposal routes.

4. Transport Corridor Impacts



Increased vehicular movement from the transport of inputs and finished products will elevate risks of road surface deterioration, traffic congestion, and accidents.

Mitigation measures will include:

- Regular maintenance of internal access and feeder roads in collaboration with the Kaduna State Ministry of Works.
- Designation of loading and unloading zones within the Hub.
- Implementation of speed limits and traffic signage for road safety.
- Conducting quarterly road condition inspections and bi-annual safety audits.

Dust emissions from unpaved sections will be controlled through periodic watering and vegetation buffers.

5. Cumulative Air Emissions

Cumulative emissions during operation will arise from boilers, standby generators, and transport vehicles, comprising mainly PM₁₀, PM_{2.5}, NO_x, SO₂, and CO₂.

Mitigation measures will include:

- Installation of cyclone separators and particulate filters in boilers.
- Use of low-sulphur diesel or natural gas to minimize SO₂ emissions.
- Routine maintenance of combustion equipment and quarterly ambient air quality monitoring at designated receptor points (processing area, workers' quarters, and nearest communities).

Table 5.10: Emission/Discharge Points and Monitoring Plan

Source / Activity	Emission / Discharge Type	Key Parameters	Monitoring Frequency	Responsible Unit
Processing units / WWTP	Wastewater effluent	BOD, COD, TSS, Nutrients, pH, Oil & Grease	Monthly	ESMP / Facility Operator
Boilers / Generators	Stack emissions	PM ₁₀ , PM _{2.5} , NO _x , SO ₂ , CO	Quarterly	ESMP / Maintenance Unit
Organic waste handling	Odour	H ₂ S, NH ₃ , VOCs	Quarterly / Complaint-triggered	ESMP / Waste Management Unit



Solid waste storage	Leachate / litter	Visual inspection, waste volume	Monthly	ESMP / Sanitation Unit
Transport corridor	Air & Noise	Dust levels (TSP), Noise (dBA), Vehicle emissions	Quarterly	ESMP / Logistics Unit

Summary

Through the combination of engineering controls, best operational practices, and systematic monitoring, the operational impacts of the SAPZ AIH will be effectively managed. The mitigation and monitoring strategies outlined above align with national environmental standards and AfDB's sustainability safeguards to ensure that project operations remain environmentally sound, socially acceptable, and economically viable.

5.3.4 Decommissioning Phase Impacts

Decommissioning impacts relate to dismantling, disposal of wastes, and site rehabilitation, with potential temporary pollution but also opportunities for restoration (Table 5.10).

Table 5.11: Decommissioning Phase Impacts

Impact ID	Activity	Aspect / Pathway	Receptor	Impact Direction	Significance
CDR	AIH Closure, Decommissioning and Rehabilitation Plan (Preparation/Approval)	Interaction affecting Infrastructure	Infrastructure	Negative	Very High
CDR	AIH Closure, Decommissioning and Rehabilitation Plan (Preparation/Approval)	Interaction affecting Aesthetics and Visual Aspect	Aesthetics and Visual Aspect	Negative	Very High
PTWDE	Presence & Transportation of Workers and Demolition Equipment	Interaction affecting Air Quality	Air Quality	Negative	High
PTWDE	Presence & Transportation of Workers and Demolition Equipment	Interaction affecting Noise and Vibration	Noise and Vibration	Negative	Medium
PTWDE	Presence & Transportation of	Interaction affecting Transportation	Transportation	Negative	Very High



Impact ID	Activity	Aspect / Pathway	Receptor	Impact Direction	Significance
	Workers and Demolition Equipment				
PTWDE	Presence & Transportation of Workers and Demolition Equipment	Interaction affecting Accident – Fire – Explosion Incidence	Accident – Fire – Explosion Incidence	Negative	High
ED	AIH Equipment Dismantling	Interaction affecting Air Quality	Air Quality	Negative	High
ED	AIH Equipment Dismantling	Interaction affecting Noise and Vibration	Noise and Vibration	Negative	Medium
ED	AIH Equipment Dismantling	Interaction affecting Accident – Fire – Explosion Incidence	Accident – Fire – Explosion Incidence	Negative	High
ED	AIH Equipment Dismantling	Interaction affecting Infrastructure	Infrastructure	Negative	Very High
DS	Demolition of Structures	Interaction affecting Air Quality	Air Quality	Negative	High
DS	Demolition of Structures	Interaction affecting Noise and Vibration	Noise and Vibration	Negative	Medium
DS	Demolition of Structures	Interaction affecting Soil Quality	Soil Quality	Negative	Negligible
DS	Demolition of Structures	Interaction affecting Accident – Fire – Explosion Incidence	Accident – Fire – Explosion Incidence	Negative	High
RR	Restoration and Revegetation (Landscaping)	Interaction affecting Vegetation	Vegetation	Positive	Very High
RR	Restoration and Revegetation (Landscaping)	Interaction affecting Wildlife	Wildlife	Negative	Very High



Impact ID	Activity	Aspect / Pathway	Receptor	Impact Direction	Significance
RR	Restoration and Revegetation (Landscaping)	Interaction affecting Topography \Landscape Disturbance	Topography \Landscape Disturbance	Negative	Very High
RR	Restoration and Revegetation (Landscaping)	Interaction affecting Aesthetics and Visual Aspect	Aesthetics and Visual Aspect	Negative	Very High
RR	Restoration and Revegetation (Landscaping)	Interaction affecting Micro Climate	Micro Climate	Positive	Very High
SCWD	Site Cleanup, Wastes Disposal and Emissions Handling (Closure)	Interaction affecting Surface Water Quality	Surface Water Quality	Negative	Very High
SCWD	Site Cleanup, Wastes Disposal and Emissions Handling (Closure)	Interaction affecting Groundwater Quality	Groundwater Quality	Negative	High
SCWD	Site Cleanup, Wastes Disposal and Emissions Handling (Closure)	Interaction affecting Soil Quality	Soil Quality	Negative	High
SCWD	Site Cleanup, Wastes Disposal and Emissions Handling (Closure)	Interaction affecting Air Quality	Air Quality	Negative	High
SCWD	Site Cleanup, Wastes Disposal and Emissions Handling (Closure)	Interaction affecting Pollution Related Health Effects	Pollution Related Health Effects	Negative	High

5.3.4.1 Decommissioning Phase Impacts and Management

The eventual decommissioning of the SAPZ Agro-Industrial Hub (AIH) will involve the cessation of operations, dismantling of infrastructure, and site rehabilitation. Although this phase lies in the distant future, it is essential to define key measures early to ensure environmental protection, resource recovery, and socio-economic stability for affected workers and nearby communities.

1. Anticipated Decommissioning Activities

Decommissioning will cover the following broad activities:



- De-energizing and dismantling of processing lines, boilers, storage facilities, and utilities (water, power, and wastewater systems).
- Decontamination of surfaces, tanks, and equipment to eliminate residual pollutants.
- Recovery and salvage of reusable materials such as metal structures, piping, and electrical components.
- Demolition of non-reusable infrastructure, with controlled removal to prevent dust and debris impacts.
- Transportation and disposal of wastes to approved recycling or hazardous-waste treatment facilities.
- Rehabilitation of soil and vegetation to restore the site to a stable, non-polluting condition suitable for future land use.

2. Potential Environmental and Social Impacts

The main decommissioning impacts are expected to include:

- Air and noise emissions from dismantling and transport activities.
- Generation of solid and hazardous wastes (e.g., spent oil, chemical residues, construction debris).
- Soil contamination from leaks or spills during demolition or waste handling.
- Temporary livelihood disruption for employees and ancillary service providers.

These impacts will be temporary but require careful management to prevent residual contamination or social hardship.

3. Mitigation and Site Remediation Measures

To minimize decommissioning impacts, the following key measures will be implemented:

- **Site assessment:** Conduct a pre-decommissioning environmental audit to identify contaminated zones and equipment requiring special handling.
- **Hazardous-waste handling:** Collect and label all hazardous materials (oil, solvents, filters) for disposal through FMEnv/NESREA-approved facilities.
- **Material recovery:** Implement a Salvage and Reuse Plan prioritizing recycling of metal scrap, concrete rubble (for backfilling), and reusable mechanical parts.
- **Soil and groundwater remediation:** Excavate or stabilize any contaminated soils, followed by re-vegetation with native plant species.



- **Dust and noise suppression:** Use wetting during demolition and restrict activities to daylight hours.
- **Livelihood transition:** Develop a Decommissioning Transition Plan to provide severance, retraining, or redeployment support for affected workers in partnership with the State Ministry of Labour and the project proponent.

4. Monitoring and Post-Closure Verification

Environmental monitoring during decommissioning will focus on:

- **Air quality** (PM₁₀, PM_{2.5}, TSP) and **noise levels** at boundary points;
- **Soil and groundwater** quality (hydrocarbons, heavy metals) before and after decommissioning;
- **Waste tracking** to ensure all waste streams are properly documented and disposed of at approved sites;
- **Vegetation regrowth** and site stability post-remediation.

Monitoring will continue for at least **six months after closure** to verify successful restoration and absence of contamination.

Table 4.12: Indicative Decommissioning Schedule and Responsibilities

Decommissioning Activity	Indicative Timeline	Key Responsible Entity	Supervising Authority
Pre-closure environmental audit and plan preparation	3 months before closure	ESMP / Environmental Unit	FMEnv / Kaduna State MoE
Dismantling and salvage operations	Months 1–3	Engineering Unit / Contractors	Project Owner
Waste segregation and disposal	Months 1–4	Waste Management Unit	NESREA / Kaduna State EPA
Site remediation and re-vegetation	Months 3–6	Environmental Unit	Independent ESIA Auditor
Livelihood transition and staff support	Months 1–6	Human Resources / Labour Office	Kaduna State Ministry of Labour
Final site inspection and post-closure monitoring	Months 6–9	ESMP / Independent Auditor	FMEnv / AfDB

Summary



The decommissioning phase will be guided by sustainability principles emphasizing pollution prevention, material recovery, and social responsibility. Through structured planning, monitoring, and coordination with regulatory agencies, site remediation and closure activities will ensure that the SAPZ AIH area is left in a safe and environmentally stable condition, with minimal long-term impacts and fair transition support for the workforce.

5.3.5 Summary of Identified Impact Categories

The impacts identified across all phases can be grouped into four broad categories: environmental, social, health, and safety. This categorization facilitates targeted mitigation and management responses under the ESMP.

5.3.6 Positive Impacts

Positive impacts are mainly socio-economic, including job creation, livelihood improvement, market access, technology transfer, and infrastructure development. These benefits contribute to the economic upliftment of the local communities and align with the broader goals of the Special Agro-Industrial Processing Zone program.

5.3.7 Negative Impacts

Negative impacts are primarily environmental and health-related, such as soil erosion, land degradation, air quality impairment, water contamination, biodiversity loss, traffic accidents, and occupational health risks. These require robust mitigation measures to reduce their severity and likelihood.

5.3.8 Summary and Rating of Identified Impacts

The table 5.11 below summarizes the distribution of identified impacts according to their significance rating. This provides an overview of priority areas for mitigation and monitoring.

Table 5.13: Summary and Rating of Identified Impacts

Impact Direction	High	Low	Medium	Negligible	Very High
Negative	38	1	26	2	11
Positive	4	0	0	0	4
TBD	19	4	5	18	18



5.3.9 Cumulative Impacts

Cumulative impacts arise from the interaction of multiple project activities, or between project activities and existing environmental and socio-economic pressures. For the SAPZ Agro-Industrial Hub, key cumulative impacts include:

- Hydrology: Increased runoff and potential flooding due to slope and land cover change.
- Soil Stability: Higher erosion risks when combined with agricultural expansion.
- Traffic: Congestion Cumulative congestion and accident risks from project-related and existing road users.
- Biodiversity Loss: Habitat fragmentation when combined with ongoing land use pressures.
- Social Structure Changes: Community dynamics shifting due to in-migration, employment, and land acquisition pressures.

These cumulative effects require regional-level planning and integrated management responses, not just site-specific mitigation.



CHAPTER SIX: IMPACT MITIGATION

6.1 Methodology for Impact Mitigation

Mitigation measures are actions that are taken to enhance positive impact of a project and reduce or minimize impacts within a project site boundary such as making changes in engineering design of equipment to incorporate pollution prevention measures, or changes in the timing of a project activity to avoid or reduce the exacerbation of an impact if activity is carried out at the wrong time, or use of different technique etc. The primary aim of these measures is to improve the environmental sustainability of the project.

The implementation of the EIA process on the SAPZ AIH project has identified and predicted the beneficial and adverse significant biophysical, social and public health impacts of the proposed project. The primary focus of this chapter is to present the measures that are necessary to avoid, minimize or offset the identified adverse impacts and then incorporate these impact mitigation measures into an environmental management plan. To achieve this primary goal, the mitigation measure hierarchy approach was considered. This approach involves:

1. **Avoidance:** This is the first measure taken to avoid potential negative impacts by reevaluating and adjusting project components to prevent adverse outcomes.
2. **Minimisation:** When avoidance is not feasible, the focus shifts to minimising the extent or severity of impacts. This involves implementing best practices and technologies to reduce the consequences of any adverse effects. For instance, using silt fences and sediment control measures during construction can significantly reduce sediment entering nearby water bodies.
3. **Rectification:** If an impact occurs despite avoidance and minimisation efforts, rectification measures are essential. This involves actively repairing or restoring the affected environment. For example, if soil contamination occurs, techniques such as bioremediation or soil washing are used to cleanse the impacted areas and restore environmental health.
4. **Compensation:** In cases where full mitigation is not achievable through the above steps, compensation measures will be implemented. These measures involve providing



alternative benefits to offset adverse impacts. For example, resettlement plans will be developed for farmers displaced by the loss of agricultural land.

5. **Monitoring and Adaptive Management:** Effective mitigation requires ongoing oversight and adjustment. Continuous monitoring assesses the effectiveness of mitigation strategies and detects unforeseen impacts early. Adaptive management practices are then applied to make necessary adjustments and corrections, ensuring that mitigation efforts remain effective throughout the project's lifecycle. For instance, regular water quality assessments near construction sites will allow for prompt responses to any unexpected pollution issues.

This impact mitigation approach is first applied to avoid or reduce the magnitude of the impact from the associated project activity, and then to address the resultant effect on the resource/receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude.

6.2 Mitigation Pre-Construction Procurement Risks

To manage potential impacts relating to contractor procurement and ensure the effective implementation of mitigation measures as outlined in the ESIA and the Environmental and Social Management Plan (ESMP), the following Environmental, Social, Health, and Safety (ESHS) conditions will be integrated into the bidding documents, as described in Tables 6.1 and 6.2. The following elements are included:

- **Past Contractor Performance:** Evaluation of contractors' previous performance related to ESHS aspects, including records on sexual exploitation, abuse, and genderbased violence.
- **ESHS Staff:** Contractors must adhere to specified requirements for ESHS staffing.
- **Performance Security:** Compliance with performance-related security measures is required.
- **Mitigation Measures:** Contractors must implement mitigation measures throughout the project lifecycle.
- **Contractor's Code of Conduct:** Adherence to a specified code of conduct is mandatory for contractors.



- Management Strategies and Implementation Plans (MSIP): Contractors must comply with MSIP requirements.

By integrating these conditions, the project will ensure that contractors are selected based on their ability to adhere to high ESHS standards, thereby minimising potential adverse impacts and promoting the successful execution of the project in line with the established environmental and social safeguards.



Table 6.1 ESHS Management in the Bidding Documents

S/N	Condition	The rationale for the inclusion of this condition in the contract	Specifications to be included in the Bidding Documents	Responsibility	
				Bidders	KA-SAPZ-PIU
1	Past performance of the Contractor on ESHS is one of the eligibility criteria for the shortlisting process	The contractor's past performance on compliance with ESHS is an indicator of the contractor's commitment and capability for implementation of this ESMP	The Bidder shall "declare any civil work contracts that have been suspended or terminated and/or performance security called by an employer for reasons related to the non-compliance of any environmental, or social (including sexual exploitation and abuse (SEA) and gender-based violence (GBV) or health or safety requirements or safeguard in the past five years".	Bidder to make the Declaration	KA-SAPZ-PIU shall use the Bidder's Declaration information to seek further information or clarifications in carrying out its due diligence
2	The contractor shall propose and possess an ESHS	The Contractor's staff should include an ESHS specialist who is responsible for the implementation of all mitigation measures on ESHS risks and compliance with ESMP	The Bidder shall propose an Environmental, Social, Health and Safety (ESHS) Specialist as the Contractor's Key Personnel at the Site. The Bidder shall provide details of the proposed ESHS specialist including academic qualifications and work experience. The ESHS Specialist should have a minimum bachelor's degree in engineering or a master's degree in sciences related to environmental management. The Specialist should have 5 years of experience working on monitoring and managing ESHS risks related to airport projects or other similar infrastructure Projects	The Bidder shall propose an Environmental, Social, Health and Safety (ESHS) Specialist as the Contractor's Key Personnel at the Site. The Bidder shall provide details of the proposed ESHS specialist including academic qualifications and work experience. The ESHS Specialist should have a minimum bachelor's degree in engineering or a master's degree in sciences related to environmental management. The	The bidder shall submit the CV of the proposed ESHS Specialist



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S/N	Condition	The rationale for the inclusion of this condition in the contract	Specifications to be included in the Bidding Documents	Responsibility	
				Specialist should have 5 years of experience working on monitoring and managing ESHS risks related to airport projects or other similar infrastructure Projects	
3	The contractor shall submit ESHS Performance Security for compliance with ESHS obligations	The Contractor should have a financial implication if he could not comply with ESHS requirements. Hence performance security will be collected from the contractor	The Bidder shall submit the ESHS Performance Security in the form of a “demand guarantee” in the amount of one per cent (1 %) of the Contract Amount	The bidder will submit a Performance Security	
4	Implement Mitigation Measures to Address Construction-Related Impacts	The mitigation measures to address potential ESHS risks and impacts should be included in the bidding documents. The contractor shall be made responsible for the implementation of the mitigation measures through the necessary conditions in the contract	AMIC/SAPZ will include mitigation, monitory and implementation plan in the General Specifications of the Bidding Document and the reference to these tables will be provided in the Conditions of the Contract as follows: □ The Contractor shall implement the mitigation and monitoring measures given in provided in the ESMP to address ESHS risks associated with the construction works; □ The Contractor shall comply with the African Development Bank Group’s Environmental and Social Guidelines and Policies.		KA-SAPZ-PIU shall include this requirement in the bidding document



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S/N	Condition	The rationale for the inclusion of this condition in the contract	Specifications to be included in the Bidding Documents	Responsibility	
5	Payments for Implementation of ESHS Mitigation and Monitoring Measures	The proposed measures to address ESHS risks are mainly related to workplace safety. Hence the cost of implementing the ESHS requirements shall be covered by Bidder's rates for the relevant works, and no separate payment will be made.	The cost of delivering the ESHS requirements shall be a subsidiary obligation of the Contractor covered under the prices quoted for other Bill of Quantity items. No separate payments will be made for the implementation of ESHS requirements.		KA-SAPZ-PIU shall include this requirement in the bidding document
6	Code of Conduct for Contractor's Personnel	All workers hired by the Contractor should sign a code of conduct to ensure compliance with ESHS obligations of the Contract	The Bidder shall submit the Code of Conduct that will apply to the Contractor's employees and subcontractors. The Code of Conduct will state that the workers will comply with the following ESHS requirements: ☐ All workers hired by the Contractor should sign a code of conduct to ensure compliance with ESHS obligations of the Contract ☐ Wearing Personal Protective Equipment (PPE) in the workplace at all times - Non-discrimination in dealing with the local community by race, ethnicity, gender, religion, disability, sexual orientation, gender identity, social, or health status ☐ Respectful attitude while interacting with the local community	Bidder shall submit a code of Conduct with the bid documents	



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S/N	Condition	The rationale for the inclusion of this condition in the contract	Specifications to be included in the Bidding Documents	Responsibility	
			☐ Prohibit sexual harassment, particularly towards women and children ☐ Prohibit violence, including sexual and/ or genderbased violence		
7	Contractor's Management Strategies and Implementation Plan (MSIP) to manage the ESHS Risk	The Contractor proposal should include his understanding of the ESHS requirements of the project and the proposed strategies to manage the ESHS risks	The Bidder shall submit Management Strategies and Implementation Plans (MSIP) to manage the following key ESHS risks: ☐ Strategy for the protection of workers and community (airport staff, passengers and other users) from the construction related hazards inside the terminal ☐ Pollution prevention (wastewater, air and noise emissions) and management ☐ A waste management plan for proper collection and disposal of waste ☐ Traffic management plan to ensure the safety of local communities from traffic ☐ Hazardous material management plan safe storage and handling ☐ Strategy to address labour influx impacts on the local communities ☐ Gender-based violence and sexual exploitation and abuse prevention and response action plan ☐ Emergency response plan and early warning system	The bidder will submit MSIP along with the bid documents	



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S/N	Condition	The rationale for the inclusion of this condition in the contract	Specifications to be included in the Bidding Documents	Responsibility	
			☐ The Contractor shall be subsequently required to submit (before mobilisation) the Contractor's Environment and Social Management Plan (CESMP) in compliance with the strategies above, and Condition 4 of this Table.		

Table 6.2 ESHS Conditions in the Pre-Construction Phase

S/N	Condition	The rationale for the inclusion of this condition in the contract	Specifications to be included in the Bidding Documents	Responsibility
				Bidders
1	Preparation of Contractor's Environmental and Social Management Plan (C-ESMP)	The Contractor shall submit site-specific management plans to address ESHS risks following the ESMP requirements and MSIP proposed in the bid documents.	The Contractor to submit for approval and subsequently implement their Environment and Social Management Plan (CESMP). The C-ESMP should be submitted prior to the commencement of construction works and no construction activities will be carried out under the project until approval of the C-ESMP. The C-ESMP will include the following site-specific management plans on: ☐ Occupational health and safety management plan ☐ Community health and safety management plan; ☐ Waste management plan	Bidders; KA-SAPZ -PIU



S/N	Condition	The rationale for the inclusion of this condition in the contract	Specifications to be included in the Bidding Documents	Responsibility
			☐ Wastewater discharges management plan; ☐ Air and noise emissions management plan; ☐ Hazardous material management and spill control plan ☐ Water supply and sanitation management at the worksites and ☐ workers' accommodations ☐ Management of labour influx and facilities for foreign workers ☐ Labour recruitment procedures and labour management ☐ Traffic management plan ☐ Training plan for ESHS risks including HIV/AIDS, sexual exploitation and abuse, and gender-based violence ☐ Emergency Response Plan ☐ Grievance Redress Mechanism ☐ Demobilisation plan after completion of works	
2	Mobilisation of ESHS Specialist	The ESHS Specialist should be mobilised during preconstruction for the preparation of C-ESMP	The Contractor shall submit the CV of the ESHS Specialist for NIC/SAPZ review and approval. The ESHS Specialist should be present at the site throughout the construction period.	Contractor; KA-SAPZ -PIU Environmental Specialist



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S/N	Condition	The rationale for the inclusion of this condition in the contract	Specifications to be included in the Bidding Documents	Responsibility
3	Require Permits/ License for disposal of Commercial waste	Government permits/licenses are required for the disposal of commercial wastes generated from the construction activities at the governmentoperated landfill site.	The contractor shall obtain relevant permits and licenses from government authorities relating to waste disposal and construction authorisation	Contractor; KA-SAPZ -PIU and Environmental Specialist
4	The hiring of Construction Labour	OS 2: Labour and Working Condition – This safeguard establishes the Bank’s requirements for its borrowers or clients concerning workers’ conditions, rights and protection from abuse or exploitation. It covers working conditions, workers’ organisations, occupational health and safety, and avoidance of child or forced labour.	The contractor is to develop and implement labour management procedures following Operational Standard 2 for the hiring of construction workers. The procedures will include terms and conditions of employment including hours of work, wages, overtime, compensation and benefits, holidays, leaves, and so on. The procedures will set out measures to prevent and address harassment, intimidation and/or exploitation.	Contractor; KA-SAPZ -PIU Environmental Specialist
5	Temporary storage facilities and construction yard	The contractor will need areas for setting up temporary storage areas and construction yards.	The contractor shall set up temporary storage facilities and a construction yard within the AMIC/SAPZ facility boundary approved by the Master Plan	Contractor; KA-SAPZ -PIU



6.3 Mitigation Strategies for Negative Impact Categories

6.3.1 *Voluntary and Involuntary Displacement Mitigation Strategies:*

The indicators of this impacts are loss of livelihood, food security challenges and economic / social displacement. The option to embark on the development of the SAPZ AIH will definitely result in this impact. Hence, the project proponent must develop a detailed land acquisition and resettlement action plan at the pre-construction phase that involves a thorough socio-economic survey of affected communities to identify projected affected persons (PAP), including vulnerable groups, such as women, youths, those living with disability, and the elderly and their specific needs.

Mitigation Strategies:

- Contractor should develop a detailed land acquisition and resettlement action plan (RAP) in line with ESS5 that includes a thorough socio-economic survey of affected communities to identify projected affected persons (PAP), including vulnerable groups, such as women, youths, those living with disability, and the elderly and their specific needs.
- Provide livelihood restoration support and compensation packages.
- Ensure fair consultation and grievance redress mechanisms.
- Community Engagement: Establish continuous engagement channels with affected communities, ensuring transparent communication and incorporating their feedback into the resettlement planning process.
- Comprehensive Land Acquisition Planning: Develop a detailed land acquisition and resettlement plan that includes a thorough socio-economic survey of affected communities to identify vulnerable groups and their specific needs.
- Fair Compensation: Ensure that compensation for land and assets is fair, transparent, and provided promptly. Offer additional support such as relocation assistance, housing, and access to social services.
- Monitoring and Grievance Redress Mechanisms: Set up a robust monitoring system to track the resettlement process and a grievance redress mechanism to address concerns and complaints from affected individuals promptly.



6.3.2 *Livelihood Impact Mitigation Strategies:*

- **Livelihood Restoration Programmes:** Implement tailored livelihood restoration Programmes that provide alternative income sources, vocational training, and microfinance support for small businesses.
- **Local Hiring:** Prioritise hiring local labour for project activities, providing training to build their capacity and enhance employability.
- **Market Access Facilitation:** Facilitate access to new markets for local products by improving infrastructure and providing market linkages.
- **Community Support and Development:** Invest in comprehensive community support and development initiatives. This includes funding and implementing corporate and social responsibility (CSR) programmes that strengthen social cohesion and support education and healthcare needs, as well as collaborating with businesses and NGOs to improve infrastructure and access to quality services.
- **Ongoing Monitoring and Support:** Continuously monitor the effectiveness of livelihood Programmes and adjust strategies based on community feedback and changing circumstances. (Refer to Section 6.3.1 Monitoring and Grievance Redress Mechanisms).
- Support alternative livelihoods through vocational training programs.
- Facilitate linkages with small and medium enterprises (SMEs).

6.3.3 *Economic Impacts Mitigation Strategies:*

- **Economic Impact Assessments:** Conduct comprehensive economic impact assessments to understand potential positive and negative effects on local businesses and the regional economy.
- **Local Business Integration:** Create a database of local companies and foster partnerships by integrating them into the project supply chain through capacitybuilding initiatives and preferential procurement policies.
- **Community Development Programmes:** Implement community development programmes that diversify the local economy, such as supporting agribusinesses, tourism, and other sustainable enterprises.



- Capacity Building and Training: Offer capacity-building workshops and training sessions on market trends, business management, and sustainable practices to help local entrepreneurs and farmers capitalise on new market opportunities. This strengthens the local economic fabric and ensures sustainable development.
- Ongoing Economic Monitoring: Establish an economic monitoring system to track the project's impact on local businesses and the regional economy, making adjustments as necessary to mitigate adverse effects.
- Encourage local procurement of goods and services.
- Support microfinance initiatives for community enterprises.
- Provide market linkages for farmers and local producers.

6.3.4 Biodiversity Loss Mitigation Strategies:

- Avoidance and Minimisation: Prioritise project site selection and design to avoid areas of high ecological value and minimise habitat disturbance. Also, limit site clearance to the absolute minimum required for construction needs
- Develop and implement biodiversity management and monitoring plans that include alien invasive species control, faunal handling procedures, and guidelines for ecological landscaping.
- Conduct habitat restoration activities, such as reforestation to compensate for unavoidable habitat loss.
- Design: Incorporate pollution prevention measures into project design, such as impermeable liners for waste storage areas and runoff management systems, and minimising noise and light pollution to avoid disturbing wildlife.
- Establish protected areas and wildlife corridors in consultation with local communities and conservation experts. (Community Involvement: Engage local communities in biodiversity conservation efforts, providing education and incentives for sustainable practices. Monitoring and Adaptive Management: Regularly monitor biodiversity indicators and adapt management strategies based on monitoring results and scientific advancements.
- Restrict clearing of vegetation to the minimum area required.
- Create buffer zones and ecological corridors.



- Implement habitat restoration and tree planting programs.

6.3.5 *Soil Erosion / Land Degradation Mitigation Strategies:*

- Construction Contractor should implement erosion control measures such as silt fences, erosion control blankets, and terracing to prevent soil loss and sedimentation.
- Maintain natural vegetation cover where possible and restrict vegetation removal to necessary areas only, replanting promptly after disturbance.
- Schedule land clearance and construction activities to avoid the rainy season, minimising erosion risk.
- Contractor should use soil stabilisation techniques such as replanting native vegetation and applying mulches or geotextiles to protect exposed soils.
- Contractor should develop land management programmes that include measures for sustainable land use, soil conservation, and rehabilitation of degraded lands.
- Stabilize slopes using terracing, vegetation cover, and erosion mats.
- Apply phased earthworks to reduce exposed soils.
- Implement controlled excavation and backfilling practices.

6.3.6 *Soil Contamination*

- Contractor should develop and implement oil and chemical spill contingency plan
- Contractor should implement strict protocols for handling, storing, and disposing of hazardous materials, including regular inspections and maintenance of storage facilities
- Use of less toxic chemicals and safer alternatives wherever possible, minimising the risk of soil contamination
- Contractor should promptly excavate and rehabilitate contaminated soil areas, using appropriate remediation techniques such as bioremediation or soil washing.
- Continuously monitor soil quality and provide ongoing training for staff on best practices for hazardous material management
- Provide hazardous waste storage and handling facilities.
- Use spill kits and secondary containment for fuel storage.
- Train workers on soil contamination prevention practices.



6.3.7 *Impairment of Water Quality Mitigation Strategies:*

- Contractor should develop and implement Surface Water Quality Management Plan
- Contractor must implement erosion control measures: on the SAPZ AIH project site to mitigate the implications of the undulating and slopy terrain of the project on soil erosion and hydrology of the site
- Contractor should develop and implement Hazardous Material Management and Spill/Pollution Prevention Plan
- Contractor must ensure that wastewater generated by the project is treated and recycled. Where discharge into surface water is permitted, treated wastewater must meet regulatory standards before discharge.
- Contractor must establish and maintain buffer zones: of natural vegetation along water bodies especially along the riparian zone to filter pollutants and stabilise banks.
- The Contractor must regularly monitor water quality and establish corrective actions and response plans for addressing any detected contamination promptly.
- Install sediment traps and silt fences to reduce runoff.
- Treat effluents before discharge into surface water.
- Monitor water quality parameters regularly.

6.3.8 *Impairment of Air Quality Mitigation Strategies:*

- Contractor should use low-emission technologies and equipment, and enforce maintenance schedules to minimise emissions from construction and operational activities. Cover vehicles carrying dusty materials and switch off machinery and vehicles when not in use to reduce emissions.
- Contractor must put in place implement dust control measures such as water spraying, dust suppressants, and covering of stockpiles to reduce airborne particulate matter.
- Contractor must use high-quality diesel fuel to reduce emissions.
- Contractor must regularly monitor air quality in and around the project site and implement corrective actions if pollutant levels exceed acceptable limits.
- Contractor should as much as possible establish and incorporate green infrastructure, such as green roofs and walls, to absorb pollutants and improve air quality.



- Ensure equipment and machinery are well maintained as prescribed by the manufacturer
- Conduct regular water sprinkling to control dust emissions.
- Maintain construction machinery to reduce exhaust emissions.
- Provide PPE (masks, respirators) to workers in dusty areas.

6.3.9 Noise Pollution Mitigation Strategies:

- Noise Control Measures: Install noise barriers, mufflers, and silencers on equipment, and restrict noisy activities to daytime hours to minimise disturbances to local communities and wildlife.
- Machinery Maintenance: Ensure regular maintenance of machinery and vehicles to reduce noise emissions. (Refer to Section 6.3.8 Impairment of Air Quality)
- Community Engagement: Engage with local communities to inform them of potential noise impacts and involve them in developing noise management plans.
- Noise Monitoring: Regularly monitor noise levels and adjust operations as necessary to comply with noise regulations. (Refer to Section 6.3.6 Soil Contamination, 6.3.8 Impairment of Air Quality)
- Restrict high-noise activities to daytime working hours.
- Equip machinery with silencers and mufflers.
- Erect temporary noise barriers near sensitive receptors.

6.3.10 Traffic Impacts Mitigation Strategies:

- Contractor must develop and implement traffic management plans that include designated routes, schedules to avoid peak traffic times, and measures to enhance road safety.
- Contractor must work with local authorities to improve road infrastructure and signage to accommodate increased traffic.
- Contractor must conduct community awareness campaigns on traffic safety and project-related traffic changes.
- Contractor must continuously monitor traffic conditions and adjust plans as necessary to minimise congestion and safety risks.



- Implement a Traffic Management Plan with designated haul routes.
- Install road signage and enforce speed limits.
- Schedule deliveries to avoid peak traffic periods.

6.3.11 Visual Intrusion Mitigation Strategies:

- Contractor should incorporate aesthetic considerations into project design, such as landscaping and architectural features that blend with the natural environment.
- Contractor should use natural screening, such as tree planting, to reduce visual impacts on local communities.
- Contractor must regularly engage with local communities to understand their visual impact concerns and incorporate their input into the design process.
- Contractor should regularly maintain landscaping and visual mitigation measures to ensure their effectiveness.
- Design site layout to minimize visible disturbance.
- Plant vegetation screens and green buffers.
- Restore disturbed areas with landscaping post-construction.

6.3.12 Archaeological / Cultural Heritage Loss Mitigation Strategies:

- Heritage Assessments: Conduct comprehensive archaeological and cultural heritage assessments before starting construction activities.
- Site Avoidance: Design project activities to avoid known archaeological and cultural heritage sites.
- Monitoring and Contingency Plans: Implement monitoring and contingency plans to address any unexpected discoveries of archaeological or cultural heritage materials during construction.
- Community Consultation: Engage with local communities and cultural heritage experts to ensure that cultural heritage is respected and preserved.
- Implement a Chance-Find Procedure for archaeological resources.
- Consult with local heritage authorities and communities.
- Provide training to workers on cultural sensitivity.



6.3.13 Climate Change

- Contractor should integrate climate resilience considerations into project planning, design, and operations, ensuring that infrastructure and communities are prepared for potential climate impacts.
- Contractor should implement energy-efficient technologies and practices to reduce greenhouse gas emissions.
- Contractor should explore opportunities to integrate renewable energy sources, such as solar and wind, into project operations.
- Contractor should engage in carbon offsetting Programmes to mitigate the project's carbon footprint.
- Contractor must regularly monitor climate-related indicators and adapt strategies as necessary to address changing climate conditions.
- Promote energy efficiency in project design.
- Explore renewable energy integration where feasible.
- Adopt carbon offset measures such as reforestation.

6.3.14 Community Dynamics

- Community Engagement: Establish and maintain transparent and inclusive communication channels with local communities throughout the project lifecycle.
- Participatory Planning: Involve local communities in the planning and decision making processes to ensure their concerns and aspirations are addressed.
- Social Cohesion Programmes: Implement Programmes that promote social cohesion and cultural heritage preservation, fostering a sense of community ownership and pride.
- Community Investment: Invest in community development projects that improve local infrastructure, education, and healthcare, enhancing the overall well-being of the community.
- Establish a Community Liaison Committee.
- Promote gender inclusion in employment and consultation.
- Implement conflict resolution mechanisms.

6.3.15 Flood Risk Mitigation Strategies – AIH SAPZ Project, Daki-Takwas



Flood risk management is essential to safeguard project infrastructure and surrounding communities at Daki-Takwas, particularly given the area's topography and rainfall patterns. The following strategies are proposed to minimize potential flood impacts during both construction and operation phases of the AIH SAPZ Project:

- **Flood Risk Assessment:** Conduct a detailed flood risk assessment for the Daki-Takwas site and its immediate surroundings to identify areas susceptible to flooding and surface runoff. The assessment should inform site design, drainage layout, and emergency response planning.
- **Stormwater and Drainage Management:** Design and install a comprehensive stormwater drainage network, including lined channels, retention basins, culverts, and sediment traps, to manage runoff and prevent localized flooding. Silt fences and check dams should be used during construction to control erosion and sediment transport.
- **Green Infrastructure and Vegetation:** Integrate green infrastructure solutions—such as vegetated swales, buffer strips, and landscaped green belts—around facility perimeters to enhance water absorption, reduce surface runoff, and support habitat restoration objectives.
- **Permeable Surfaces:** Utilize permeable pavements and paving blocks in non-core operational areas (e.g., parking zones and internal roads) to promote groundwater recharge and minimize impermeable surface coverage.
- **Elevated Infrastructure Design:** Elevate critical structures, such as processing buildings, utility rooms, and electrical substations, above the predicted flood level to prevent water ingress and infrastructure damage.
- **Flood Protection Structures:** Where necessary, install low embankments, flood diversion channels, or perimeter bunds around the SAPZ platform to redirect runoff and protect vulnerable areas from inundation.
- **Routine Maintenance:** Establish and implement a periodic maintenance schedule for all drainage systems and flood control structures to prevent blockages and maintain optimal flow capacity, particularly before and during the rainy season.
- **Community Awareness and Preparedness:** Collaborate with local communities to raise awareness of flood risks, promote safety measures, and establish communication channels for early warning and emergency response.



- **Emergency Coordination:** Coordinate with relevant state emergency management agencies and local authorities to ensure the availability of response equipment, medical support, and logistics for effective disaster preparedness.

6.3.16 Health and Safety Risks

The Contractor must develop and implement the following:

- Spill/Pollution Prevention Plan
- Soil Contamination (Plan
- Impairment of Water Quality Control Measures
- Impairment of Air Quality Control Measures
- Increase Noise Levels Control Measures
- Traffic Congestion
- Implement a comprehensive HSE Plan.
- Conduct induction and routine HSE training.
- Ensure provision and use of PPE.
- Maintain emergency response systems and first aid facilities.

6.4 Residual Impact Assessment

Residual impacts are those remaining after mitigation measures are applied. For the SAPZ project, most significant impacts are expected to be reduced to low or medium significance. Residual monitoring will be conducted as per the Monitoring Plan (Annex 3b).

6.5 Mitigation During Decommissioning Phase

A strategic approach to mitigation measures during the decommissioning phase will focus on waste management, engineering practices, safety protocols, and mitigating socioeconomic impacts. The Contractor should must consider the following:

Issues to consider:

- Human health and safety
- Potential negative effects on the environment
- Compliance with all stated environmental laws and regulations



- Timely initiation of activities before the cessation of project activities
- Stakeholder engagement throughout the decommissioning process
- Community development and economic diversification in affected areas
- Legacy projects (if appropriate)
- Monitoring and evaluation of mitigation measures
- Contingency planning for unexpected challenges

The SAPZ SPIU will develop a Decommissioning Plan, which will be submitted to the FMEnv.

This plan will contain the following information:

- ✓ Affected Stakeholders
- ✓ Identification of the project components that will be removed
- ✓ Proposed methods for the removal, disposal, or reuse of any project equipment/material where applicable
- ✓ Mitigation plans for all foreseeable environmental and social impacts associated with the decommissioning process
- ✓ An appropriate site rehabilitation program developed in consultation with affected communities and other stakeholders
- ✓ Timeline for completion
- ✓ During decommissioning, mitigation will focus on safe dismantling, disposal of equipment, and site rehabilitation. Measures include controlled demolition, recycling of materials, soil and water quality monitoring, and replanting of native vegetation. Livelihood transition support will be provided for affected workers and communities.

The summary of mitigation measures for identified significant impacts are as shown in Table 6.3 for pre-construction, construction, operation and decommissioning project phases respectively.



Table 6.3 Pre-Constructino Phase

Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
LAID	Pre-Construction (Site Clearing and Preparation)	Land Acquisition and Involuntary Displacement	Conflict over loss of land and resettlement benefits	Kaduna SAPZ SPIU shall: - Consult extensively with the resident community PAPs on land acquisition and payment of benefits - Carry out adequate enumeration of project affected persons, economic trees within the land area to be acquired for the project - Develop a Resettle Action Plan and a Livelihood Restoration Plan for the Project	Very High	Kaduna SAPZ SPIU, RAP/LRP Consultant, Community Leaders	750,000
LAID	Pre-Construction (Site Clearing and Preparation)	Land Acquisition and Involuntary Displacement	<u>Impacts on Social and Cultural Structure</u> Cultural interference, disruption of the social and cultural structure of the community, complaints and conflicts between the Project and the community	Kaduna SAPZ SPIU shall: - Consult extensively with the PAPs on land acquisition and payment of benefits - Consult regularly with the communities (i.e. before, during and after site clearance) - Develop and implement Resettle Action Plan and a Livelihood Restoration Plan for the Project	Very High	SAPZ SPIU, Social Safeguards Officer	Included in RAP
LAID	Pre-Construction (Site Clearing and Preparation)	Land Acquisition and Involuntary Displacement	<u>Impact on Macro and Micro Economy:</u>	Design and implement location-specific Livelihood Restoration Plans (LRPs) in line with the RAP focusing on:	Very High	SAPZ SPIU, LRP	Included in RAP



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
	Clearing and Preparation		Loss of farmland and livelihood (An interaction affecting the micro and macro economy)	➤ Vocational training in areas such as agro-processing, tailoring, welding, ICT ➤ Support for petty traders, women cooperatives, and youth enterprise schemes ➤ Agricultural input subsidies and training in climate-smart farming for resettled farmers		Consultant, NGOs	
LAIID	Pre-Construction (Site Clearing and Preparation)	Land Acquisition and Involuntary Displacement	Voluntary / Involuntary Displacement and Resettlement (An interaction affecting the population)	Pre- Construction (Site Clearing and Preparation)	Medium	SAPZ SPIU	Included in RAP
PPWE	Pre-Construction (Site Clearing and Preparation)	Physical Presence of Workers, Equipment and Materials on Site (Pre-construction)	<u>Impact on Ambient Air Quality</u> Ambient air quality deterioration from fugitive dust releases and equipment/automobiles emissions	Not Applicable	Low	Contractor	20,000
PPWE	Pre-Construction (Site Clearing and Preparation)	Physical Presence of Workers, Equipment and Materials on	<u>Impact on Noise Emission Level</u>	Not Applicable	Low	Contractor	15,000



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
		Site (Pre-construction)	Increase in ambient noise levels and risk of ear impairment				
PPWE	Pre-Construction (Site Clearing and Preparation)	Physical Presence of Workers, Equipment and Materials on Site (Pre-construction)	<u>Impact on Soil Quality</u> Accidental release of oil, hazardous materials and chemicals on ground and potential contamination of soil and water quality	Kaduna SAPZ PIU and the Contractor shall: • Establish appropriate protocols for materials delivery and handling to ensure there are no spills; • Ensure that Contractor's HSE Plan address the prevention and containment of oil spills, chemicals and hazardous materials releases during all phases of the project; • Ensure that storage and handling of hazardous materials are in accordance with approved Hazardous Materials Management Plan • Develop and implement Hazardous Materials Management Plan • Maintain transportation vehicles, heavy civil engineering machinery and construction equipment in good working order so as to	Medium	Contractor, SAPZ SPIU, KEPA	60,000



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
				avoid exhaust emissions as well as oil and fuel leaks Any oil/chemical spill should be reported to FMEnv and Kaduna State Environmental Protection Agency			
PPWE	Pre-Construction (Site Clearing and Preparation)	Physical Presence of Workers, Equipment and Materials on Site (Pre-construction)	<u>Impact on Aesthetics and Visual Aspect</u> Aesthetics and visual impact on the landscape of SAPZ AIH project environment	Not Applicable	Low	Contractor	10,000
PPWE	Pre-Construction (Site Clearing and Preparation)	Physical Presence of Workers, Equipment and Materials on Site (Pre-construction)	<u>Worker's interaction affecting the local Population</u> Communicable and Non-Communicable Diseases	➤ Ensure the prevention of larval and adult propagation of vector-borne diseases through sanitary improvements and elimination of breeding habitats close to the project site or human settlements; ➤ Elimination of unusable impounded water in depression storage areas created as a result of topographic modifications in project area;	Medium	SAPZ SPIU, Ministry of Health	80,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
				➤ KA SAPZ PIU shall establish and implement integrated vector control programmes; ➤ KA SAPZ PIU shall educate project personnel and local residents on health risk they are exposed to and available treatment options; ➤ KA SAPZ SPIU shall periodically monitor resident communities during the life cycle of the project to detect and proactively treat emerging cases; ➤ KA SAPZ SPIU shall distribute appropriate health education materials to improve project workers and community awareness on potential and associated health risks of improper solid waste handling and management.			
PPWE	Pre-Construction (Site Clearing and Preparation)	Physical Presence of Workers, Equipment and Materials on	Impact on Infrastructure: In-migration of job seekers put pressure on existing infrastructure such as housing, restaurant and food eatery	➤ Employment of casual / unskilled labour shall be drawn from the members of the resident communities;	Medium	Contractor, SAPZ SPIU	25,000



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
		Site (Pre-construction)	services, transportation and health and security services.	➤ Priority consideration shall be given to qualified job seekers from local communities; ➤ Immigrant job seekers shall be hired and paid off-site, only after resident community workers has been primary consideration; ➤ Minimize pressure on existing infrastructure through control of population influx and utilization of resident members of communities living in close proximity to project site.			
PPWE	Pre-Construction (Site Clearing and Preparation)	Physical Presence of Workers, Equipment and Materials on Site (Pre-construction)	<u>Impact on Transportation:</u> ✓ Transportation of the estimated 20,000 directly and 80,000 indirectly employed workers to and fro the AIH project site would cause increased traffic congestion and bottleneck along alternative roads; ✓ Transportation of workers and materials during the construction phases of the project will lead to increased traffic activity along the main roads in the project	KA SAPZ SPIU and the Contractor shall avoid traffic congestion and disruptions around the project site by: • Implementation of Contractor's Traffic Management Plan • Putting in place temporary alternative access roads to reduce traffic bottlenecks • Repair alternative access roads if damaged and ensure minimal environmental and social impact liabilities	Medium	Contractor, SAPZ SPIU, FRSC	70,000



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
			area, and longer commuting time for existing road users	• Putting in place traffic control men to direct and coordinate traffic flows • Adjusting work schedules not to disturb traffic; • Establishing an adequate system of road signs and detour; • Notifying communities of pending work scope, duration and location			
PPWE	Pre-Construction (Site Clearing and Preparation)	Physical Presence of Workers, Equipment and Materials on Site (Pre-construction)	<u>Health Effects of Environmental Pollution Released from the Project:</u> • Dust (PM₁₀, PM_{2.5}, silica dust) emissions would cause respiratory irritation, chronic bronchitis, asthma, silicosis • Diesel exhaust from machinery could result in Lung cancer risk, headaches, eye and throat irritation • Cement and chemical additives would cause skin irritation, dermatitis, chemical burns	Contractor shall: • Use equipment with high combustion efficiency • Regularly service equipment and heavy machineries used on site; • PREMOB equipment and automobiles before usage; • Use dust suppressants on access roads to project site • Contrator should strictly implement and comply with the safety measures in the HSE Plan; • Sdevelop and implement pill Prevention and Containment	High	Contractor, SAPZ SPIU	120,000



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
			- Welding fumes and solvents would cause oxic metal exposure, neurological issues <u>Community Health Impacts</u> - Dust dispersion would exacerbates asthma, allergies, and respiratory illnesses in children and elderly - Contaminated runoff / wastewater would cause Pollutes local streams and wells; risk of gastrointestinal diseases - Increased noise and vibration emissions would cause sleep disturbance, anxiety, hypertension - Improper waste disposal would attract disease vectors (mosquitoes, rodents) leading to malaria, typhoid, etc.	Plan, and Hazardous Material Control Procedure to address the prevention and containment of oil spills, chemical and hazardous materials releases during the construction works; - Maintain construction machinery, vehicles and equipment in good working condition to prevent oil and fuel leaks during operation - Ensure adequate sanitary facilities are provided during the construction and operation phases of the project - Solid waste management should be addressed in Contractor HSE Plan and Waste Management Plan			
PPWE	Pre-Construction (Site	Physical Presence of Workers, Equipment and	Risk of accident, fire, explosion and injury	✓ Contrator shall strictly implement and comply with the safety measures in the HSE Plan;	Medium	Contractor	90,000



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
	Clearing and Preparation	Materials on Site (Pre-construction)		✓ Contractor employee should follow the safety procedures in the Contractor's Health and Safety Manual; ✓ Ensure appropriate PPEs are used during the Recce and Condition Surveys			
TRWM	Pre-Construction (Site Clearing and Preparation)	Transportation of Workers and Materials (Pre-construction)	<u>Impact on Ambient Air Quality</u> Ambient air quality deterioration from fugitive dust releases and equipment / automobiles exhaust emissions	Contractor shall: • use equipment with high combustion efficiency • regularly service equipment and heavy machineries used on site; • PREMOB equipment and automobiles before usage; • Use dust suppressants on access roads to project site	Medium	Contractor	40,000
TRWM	Pre-Construction (Site Clearing and Preparation)	Transportation of Workers and Materials (Pre-construction)	<u>Impact on Noise Emission Level</u> Increase in ambient noise levels and risk of ear impairment	• Ear protective device to be provided to workers; • Install acoustic mufflers on large equipment where necessary to limit ambient noise levels	Medium	Contractor	25,000
TRWM	Pre-Construction (Site Clearing and Preparation)	Transportation of Workers and Materials (Pre-construction)	<u>Impact on Transportation</u> Increased traffic congestion and bottleneck along alternative roads due to road closures	KA SAPZ SPIU and Contractor shall avoid traffic congestion and disruptions around the project site by:	High	Contractor, SAPZ SPIU	110,000



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
				• Implementation of the Contractor's Traffic Management Plan • Put in place temporary alternative access roads to reduce traffic bottlenecks • Repair alternative access roads if damaged and ensure minimal environmental and social impact liabilities • Put in place traffic control men to direct and coordinate traffic flows • Adjusting work schedules not to disturb traffic; • Establishing an adequate system of road signs and detour; • Notifying communities of pending work scope, duration and location			
TRWM	Pre-Construction (Site Clearing and Preparation)	Transportation of Workers and Materials (Pre-construction)	Risk of accident, fire, explosion and injury	✓ Contrator shall strictly implement and comply with the safety measures in the HSE Plan; ✓ Contractor employee should follow the safety procedures	Medium	Contractor	60,000



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
				in the Contractor's Health and Safety Manual; ✓ Ensure appropriate PPEs are used during the Recce and Condition Surveys			
TRWM	Pre-Construction (Site Clearing and Preparation)	Transportation of Workers and Materials (Pre-construction)	<u>Impact on Population</u> • Transportation of workers and equipment to the project site will put pressure on the existing transportation infrastructure, cause traffic congestions, increase travel time and cost of transportation • Pressure on healthcare facilities and public utilities;	KA SAPZ SPIU and Contractor shall avoid traffic congestion and disruptions around the project site by: • Implementation of the Contractor's Traffic Management Plan • Put in place temporary alternative access roads to reduce traffic bottlenecks • Repair alternative access roads if damaged and ensure minimal environmental and social impact liabilities • Put in place traffic control men to direct and coordinate traffic flows • Adjusting work schedules not to disturb traffic; • Establishing an adequate system of road signs and detour;	High	Contractor, SAPZ SPIU	75,000



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
				Notifying communities of pending work scope, duration and location			
SCPA	Pre-Construction (Site Clearing and Preparation)	Site Clearing and Preparation; Temporary Facilities Setup	<u>Impact on Vegetation</u> Loss of Vegetation and Agricultural lands Loss of Topsoil and potential incidence of soil erosion	- Limit site clearing to only the land take required by the construction works; - All riparian vegetation shall be designated as no-go areas for project construction works and development;	High	Contractor, SAPZ SPIU	45,000
SCPA	Pre-Construction (Site Clearing and Preparation)	Site Clearing and Preparation; Temporary Facilities Setup	<u>Impact on Wildlife</u> Loss of wildlife	(a) Clearing and stripping of the site to be carried out gradually and in phases to provide High opportunity for wildlife to migrate to unaffected areas; (b) Adjoining areas to be left un-cleared to serve as a buffer zone. (c) Site clearing should be done in sequence so as to allow easy movement of escaping wildlife to adjoining uncleared forests.	High	Contractor, SAPZ SPIU	30,000
SCPA	Pre-Construction (Site Clearing and Preparation)	Site Clearing and Preparation; Temporary Facilities Setup	<u>Impact on Soil Quality</u> Accidental release of oil, hazardous materials and chemicals on ground and potential	Contractor should develop and implement its: Spill Prevention and Containment Plan, and Hazardous Material Control Procedure to address the prevention and containment of	High	Contractor, SAPZ SPIU, KEPA	55,000



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
				oil spills, chemical and hazardous materials releases during the construction works; • Maintain construction machinery, vehicles and equipment in good working condition to prevent oil and fuel leaks during operation • Any oil or chemical spill should be reported to Contractor's Supervising Engineer; the Kaduna SAPZ SPIU, and the KEPA			
SCPA	Pre-Construction (Site Clearing and Preparation)	Site Clearing and Preparation; Temporary Facilities Setup	<u>Impact on Air Quality</u> Air quality deterioration from emissions during transportation / Climate Impact (GHG Emissions)	The Kaduna SAPZ SPIU shall: • Encourage contractors to opt for equipment and machinery with lower emissions, such as electric or hybrid-powered machinery. • Require contractors to ensure that all construction equipment and machinery are maintained per the manufacturer's instructions to minimise emissions from construction and operational activities. • Implement dust control measures such as water spraying, dust suppressants, and covering of stockpiles to reduce airborne particulate matter.	Medium	Contractor, SAPZ SPIU	65,000



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
				- Require contractors to use high-quality diesel fuel to reduce emissions. - Regularly monitor air quality in and around the project site and implement corrective actions if pollutant levels exceed acceptable limits.			
SCPA	Pre-Construction (Site Clearing and Preparation)	Site Clearing and Temporary Facilities Setup	Impact on Noise and Vibration	The Kaduna SAPZ SPIU shall: - Require contractors to install noise barriers, mufflers, and silencers on equipment, and restrict noisy activities to daytime hours to minimise disturbances to local communities and wildlife. - Require contractors to regularly maintain equipment and machinery to reduce noise emissions. - Engage with local communities to inform them of potential noise impacts and involve them in developing noise management plans. - Regularly monitor noise levels and adjust operations as necessary to comply with noise regulations.	Medium	Contractor	40,000



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
SCPA	Pre-Construction (Site Clearing and Preparation)	Site Clearing and Temporary Facilities Setup	<u>Impact on Topography \Landscape Disturbance</u> Risks of gully erosion, shallow slope failures, waterlogging, subgrade weakening, and downstream flooding associated with the sloping and undulating topography of the site if left unmanaged especially during the construction phase	Kaduna SAPZ SPIU shall implement the following Slope Stability Measures: ✓ Maintain cut and fill batters at no steeper than 1V:3H unless geotechnical checks justify otherwise. ✓ Compact fill materials to at least 95% Maximum Dry Density (MDD) with moisture control. ✓ Provide crest cut-off drains, lined toe drains, and stone-lined channels to manage runoff on slopes. ✓ Establish setbacks from slope crests and avoid locating heavy structures close to unstable slope edges.	Very High	SAPZ SPIU, Contractor, Geotechnical Eng.	180,000
SCPA	Pre-Construction (Site Clearing and Preparation)	Site Clearing and Temporary Facilities Setup	<u>Impact on Aesthetics and Visual Aspect of SAPZ AIH project landscape</u>	Pre-Construction Stage Landscape-Sensitive Site Design ✓ Align buildings and infrastructure with the natural	Very High	SAPZ SPIU, Contractor	75,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
	Clearing and Preparation	Temporary Facilities Setup	Site Clearing and Vegetation Removal - Removal of natural vegetation and topsoil will expose bare surfaces, producing visual scarring and loss of natural texture. - On slopy areas, cleared surfaces appear more pronounced due to high visibility and contrast with surrounding green areas. Topographic Alterations (Cut and Fill) - Grading and leveling on undulating terrain will modify the natural landform patterns, especially on hill toes and upper slopes. - Excessive cut or fill can create unnatural slopes and visual discontinuities, visible from surrounding viewpoints.	slope contours to minimize large cuts and fills. ✓ Avoid steep slope alteration; where unavoidable, use terracing and retaining structures with natural stone facing or vegetation cover. Vegetation Management ✓ Minimize clearing to only construction footprints. ✓ Preserve tree belts and natural buffers around the site periphery and along drainage channels. ✓ Mark out “No-Go Zones” before clearing. Visual Screening Planning ✓ Plan for vegetative buffers (rows of native trees and shrubs) around sensitive visual receptors such as nearby communities or roads.			



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
			Temporary Structures and Access Roads Installation of site offices, temporary camps, stockpiles, and access tracks introduces non-harmonious elements (metallic, reflective surfaces, dust trails) into the visual field.				
SCPA	Pre-Construction (Site Clearing and Preparation)	Site Clearing and Preparation; Temporary Facilities Setup	<u>Impact on Surface Water Quality</u> Loss of land cover and exposure of bare land surface resulting in: disturbed natural drainage, and introduction of contaminants into surface water pathways; increased sediment load and turbidity; Hydrocarbon and chemical contamination of surface water; Domestic wastewater and sewage pollution from temporary workers camp; solid	Kaduna SAPZ SPIU and Contractor shall adopt: A) Erosion And Sediment Control Measures such as: ✓ Minimize exposed land surfaces by clearing vegetation in phases; avoid stripping the entire site at once.; ✓ Retain buffer vegetation along drainage corridors and low-lying areas B. Construct Temporary Drainage Controls: ✓ Install silt fences, sediment basins, and check dams downstream of disturbed areas.		Contractor, SAPZ SPIU	95,000



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
			waste litter and runoff contamination of downstream water bodies	✓ Construct temporary diversion ditches to channel runoff away from cleared slopes. C. Stabilize Exposed Soils: ✓ Apply mulching, grass seeding, or hydroseeding on completed sections. ✓ Stockpiles should be covered or surrounded by silt traps. D. Schedule Earthworks in Dry Season to reduce erosion risk. E. Pollution Prevention for Fuel and Chemicals ✓ Designate bunded, impervious refueling and storage areas at least 50 m from watercourses. ✓ Keep spill response kits (absorbents, sand, drums) at all fuel handling points. ✓ Train workers in spill response and waste oil management. ✓ Collect used oil and lubricants for disposal through licensed waste handlers.			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
SCPA	Pre-Construction (Site Clearing and Preparation)	Site Clearing and Preparation; Temporary Facilities Setup	<u>Impact on Groundwater Quality</u>	Contractor should develop and implement its: • Spill Prevention and Containment Plan, and Hazardous Material Control Procedure to address the prevention and containment of oil spills, chemical and hazardous materials releases during the construction works; • Maintain construction machinery, vehicles and equipment in good working condition to prevent oil and fuel leaks during operation • Any oil or chemical spill should be reported to the Contractor's Supervising Engineer; the Kaduna SAPZ SPIU and the KEPA In Addition, Kaduna SAPZ SPIU and the Contractor shall ensure: A. Pollution Prevention from Fuel and Oil 1. Designate impervious, banded fuel storage and refueling areas located ≥ 50 m	Medium	Contractor, SAPZ SPIU	50,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
				away from boreholes, wells, or drainage lines. 2. Use drip trays and absorbent pads under stationary machinery and parked vehicles. 3. Provide spill kits and emergency response training for all equipment operators. 4. Collect and dispose of used oil, filters, and oily rags through licensed waste management contractors. 5. Maintain an inventory and inspection record of all fuel storage tanks and drums.			
SCPA	Pre-Construction (Site Clearing and Preparation)	Site Clearing and Preparation; Temporary Facilities Setup	<u>Impact on Transportation</u> Transportation of workers and materials for temporary facilities setup to the project site will put pressure on the existing transportation infrastructure, cause traffic congestions and bottleneck along alternative roads, increase travel time and cost of transportation	KA SAPZ SPIU and Contractor shall avoid traffic congestion and disruptions around the project site by: - Implementation of the Contractor's Traffic Management Plan - Put in place temporary alternative access roads to reduce traffic bottlenecks - Repair alternative access roads if damaged and ensure	High	Contractor, SAPZ SPIU, KEPA	70,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
				minimal environmental and social impact liabilities • Put in place traffic control men to direct and coordinate traffic flows • Adjusting work schedules not to disturb traffic; • Establishing an adequate system of road signs and detour; Notifying communities of pending work scope, duration and location			
SCPA	Pre-Construction (Site Clearing and Preparation)	Site Clearing and Preparation; Temporary Facilities Setup	<u>Impact on Population</u> • The influx of about 20,000 construction workers to the project areas will exert pressure on healthcare facilities and public utilities; cause price increase in commodities and cost of transportation, and traffic congestions	KA SAPZ SPIU and Contractor shall avoid traffic congestion and disruptions around the project site by: • Implementation of the Contractor's Traffic Management Plan • Put in place temporary alternative access roads to reduce traffic bottlenecks • Repair alternative access roads if damaged and ensure minimal environmental and social impact liabilities	Medium	Contractor, SAPZ SPIU	55,000



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
				- Put in place traffic control men to direct and coordinate traffic flows - Adjusting work schedules not to disturb traffic; - Establishing an adequate system of road signs and detour; Notifying communities of pending work scope, duration and location			
WEHD	Pre-Construction (Site Clearing and Preparation)	Wastes and Emissions Handling and Disposal (Pre-construction)	<u>Impact on Surface Water Quality</u> Deterioration in surface water quality due to accidental release of oil, hazardous materials and chemicals on ground and potential contamination of soil and water quality	Pollution Prevention for Fuel and Chemicals ✓ Designate bunded, impervious refueling and storage areas at least 50 m from watercourses. ✓ Keep spill response kits (absorbents, sand, drums) at all fuel handling points. ✓ Train workers in spill response and waste oil management. ✓ Collect used oil and lubricants for disposal through licensed waste handlers.	High	Contractor	45,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
WEHD	Pre-Construction (Site Clearing and Preparation)	Wastes and Emissions Handling and Disposal (Pre-construction)	<u>Impact on Groundwater Quality</u> Deterioration in Groundwater Quality	Contractor should develop and implement its: • Spill Prevention and Containment Plan, and Hazardous Material Control Procedure to address the prevention and containment of oil spills, chemical and hazardous materials releases during the construction works; • Maintain construction machinery, vehicles and equipment in good working condition to prevent oil and fuel leaks during operation • Any oil or chemical spill should be reported to the Contractor's Supervising Engineer; the Kaduna SAPZ SPIU and the KEPA In Addition, Kaduna SAPZ SPIU and the Contractor shall ensure: A. Pollution Prevention from Fuel and Oil 6. Designate impervious, bunded fuel storage and refueling areas located ≥ 50 m	Medium	Contractor	40,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
				away from boreholes, wells, or drainage lines. 7. Use drip trays and absorbent pads under stationary machinery and parked vehicles. 8. Provide spill kits and emergency response training for all equipment operators. 9. Collect and dispose of used oil, filters, and oily rags through licensed waste management contractors. Maintain an inventory and inspection record of all fuel storage tanks and drums.			
WEHD	Pre-Construction (Site Clearing and Preparation)	Wastes and Emissions Handling and Disposal (Pre-construction)	Impact on Soil Quality Accidental release of oil, hazardous materials and chemicals on ground and potential contamination of soil and water quality	Contractor should develop and implement its: • Spill Prevention and Containment Plan, and Hazardous Material Control Procedure to address the prevention and containment of oil spills, chemical and hazardous materials releases during the construction works	Medium	Contractor, SAPZ SPIU, Health Authorities	130,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
				For Waste Handling & Housekeeping, Contractor shall ensure: • Zero on-site burial; segregation at source; frequent evacuation via licensed carriers. • Spill prevention: drip trays at transfer points; quick-connect nozzles; small-volume containers where possible. • Concrete control: designated washout pits (lined); prohibit washout to bare ground; dry cleanup of cement dust. • Dust control: cover stockpiles, moistening during dry/windy conditions, truck tarping, on-site speed ≤ 20 km/h. • Material selection: low-VOC paints, sealed batteries handling, avoid chromate-rich additives unless justified.			
WEHD	Pre-Construction (Site	Wastes and Emissions Handling and	<u>Impact on Air Quality</u> Ambient air quality deterioration from waste generation, handling, and	A. Waste Handling and Disposal Controls 1. Prohibit Open Burning: ✓ Strictly forbid open-air burning of any waste,	Medium		



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
	Clearing and Preparation	Disposal (Pre-construction)	disposal as well as from process and equipment emissions.	including vegetation, plastic, or construction debris. ✓ Use approved off-site disposal or licensed waste contractors. 2. Segregation and Containment: ✓ Separate organic, recyclable, hazardous, and inert waste streams at source. ✓ Keep organic waste in covered, ventilated containers to prevent anaerobic decomposition odors. 3. Regular Evacuation: ✓ Remove waste frequently to avoid accumulation and decomposition. ✓ Cover waste during transport to prevent litter and dust escape. 4. Composting or Anaerobic Treatment (for organics): ✓ Compost biodegradable waste or use controlled digestion to minimize methane emissions. B. Dust and Particulate Matter Control			



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
				1. Regularly sprinkle or mist unpaved roads and work areas during dry, windy conditions. 2. Cover trucks and stockpiles with tarpaulins or netting. 3. Use wheel-washing bays at exit points to prevent mud tracking. 4. Limit vehicle speed on-site (max. 20 km/h). 5. Re-vegetate cleared or inactive areas promptly.			
WEHD	Pre-Construction (Site Clearing and Preparation)	Wastes and Emissions Handling and Disposal (Pre-construction)	<u>Pollution Related Health Effects:</u> Health risks from inhalation of dust/PM, fumes, VOCs, H₂S, NH₃, NO_x/SO₂/CO); dermal contact with oils, solvents, leachate; and ingestion (hand-to-mouth ingestion of contaminated food/water); and accidental blood contact with used injection (sharps needles) In solid waste streams	Mitigation & controls (hierarchy-based) A. Elimination / Substitution • No open burning under any circumstance. • Prefer low-VOC materials, water-based paints/cleaners; choose low-sulfur fuel where available. • Outsource special/hazardous waste to licensed facilities (no on-site treatment that generates harmful emissions).	High	Kaduna SAPZ SPIU, RAP/LRP Consultant, Community Leaders	50,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
				• Stormwater segregation (clean vs. contaminated); oil–water separators. • Fire & gas safety: fire-rated chemical stores; intrinsically safe equipment where needed; fixed gas detectors (H₂S/CH₄/CO) at risk locations; earthing/bonding for flammables. • Sharps & biohazards: puncture-proof containers; sealed, color-coded bins. • SOPs for: waste acceptance, loading/unloading, spill response, confined-space entry, hot work permit-to-work, sharps handling, and odor incident response. • Waste handling schedule to avoid accumulation; routing & timing to minimize			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
				community exposure (avoid school peak hours). • Community buffer & communication: fence-line green belt; prior notices for unusual odor/traffic events; grievance redress mechanism with response SLAs. • Training: induction + task-specific refreshers (spill/H₂S awareness/first aid/fire). • Medical fitness & restrictions for high-exposure tasks (e.g., pregnancy, severe asthma). • Contractor controls: EHS clauses, audits, KPIs, right-to-stop-work. Provide PPE (last line, but mandatory where relevant) • Respiratory protection: fit-tested particulate respirators			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
				for dust and appropriate cartridges for VOCs/H₂S where engineering controls can't fully contain. • Dermal/eye protection: Provide chemical-resistant gloves, coveralls, goggles/face shields for splashes; steel-toe, slip-resistant boots. • Hygiene: hand-wash stations, no eating/drinking in handling areas, dedicated lockers & laundry for workwear. 5) Monitoring, surveillance & assurance • Ambient & workplace air: periodic PM₁₀/PM_{2.5}, VOCs (as TVOC or targeted), H₂S at odor hotspots, CO/NO_x near generators; fence-line			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
				odor checks and complaint log review. • Instrument checks: calibration records for gas detectors; stack/vent performance where applicable. • Health surveillance: pre-placement + periodic respiratory symptom review; skin checks for frequent wet/chemical work; biological monitoring only if specific chemicals warrant. • Incident KPIs: TRIR, near-misses, spill numbers/volumes, sharps injuries, odor complaints response time (TTR). • Audits: monthly EHS walkthroughs; annual external compliance audits. 6) Emergency preparedness			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Parties	Estimated Cost (USD)
				• Spill response kits (pads, booms, neutralizers); roles & call tree posted. • Fire safety: extinguishers sized by hazard class; hydrants where required; drills (semi-annual). • Gas/H₂S protocol: alarm setpoints, muster points, evacuation routes, rescue plan; portable meters for entry. • First aid: trained first-aiders, eyewash/showers at chemical/acid/alkali use points; post-exposure protocols. • Traffic incidents: recovery plan, coordination with local authorities/clinics along routes.			



Table 6.4 Construction Phase

WEHD	Construction Phase	Wastes Disposal and Emissions Handling (Construction)	<u>Impact on Groundwater Quality</u>	Contractor should develop and implement its: • Spill Prevention and Containment Plan, and Hazardous Material Control Procedure to address the prevention and containment of oil spills, chemical and hazardous materials releases during the construction works; • Maintain construction machinery, vehicles and equipment in good working condition to prevent oil and fuel leaks during operation • Any oil or chemical spill should be reported to the Contractor's Supervising Engineer; the Kaduna SAPZ SPIU and the KEPA In Addition, Kaduna SAPZ SPIU and the Contractor shall ensure: A. Pollution Prevention from Fuel and Oil 10. Designate impervious, bunded fuel storage and refueling areas located ≥ 50 m away from boreholes, wells, or drainage lines.	High	Contractor; Landscape Specialist	33,333



				11. Use drip trays and absorbent pads under stationary machinery and parked vehicles. 12. Provide spill kits and emergency response training for all equipment operators. 13. Collect and dispose of used oil, filters, and oily rags through licensed waste management contractors. Maintain an inventory and inspection record of all fuel storage tanks and drums.			
WEHD	Construction Phase	Wastes Disposal and Emissions Handling (Construction)	<u>Impact on Soil Quality</u> Accidental release of oil, hazardous materials and chemicals on ground and potential	Contractor should develop and implement its: • Spill Prevention and Containment Plan, and Hazardous Material Control Procedure to address the prevention and containment of oil spills, chemical and hazardous materials releases during the construction works; • Maintain construction machinery, vehicles and equipment in good working condition to prevent oil and fuel leaks during operation Any oil or chemical spill should be reported to Contractor's Supervising	High	Contractor; KEPA; NESREA	16,667



				Engineer; the Kaduna SAPZ SPIU, and the KEPA			
WEHD	Construction Phase	Wastes Disposal and Emissions Handling (Construction)	<u>Impact on Air Quality</u> Air quality deterioration from emissions during transportation / Climate Impact (GHG Emissions)	The Kaduna SAPZ SPIU shall: • Encourage contractors to opt for equipment and machinery with lower emissions, such as electric or hybrid-powered machinery. • Require contractors to ensure that all construction equipment and machinery are maintained per the manufacturer's instructions to minimise emissions from construction and operational activities. • Implement dust control measures such as water spraying, dust suppressants, and covering of stockpiles to reduce airborne particulate matter. • Require contractors to use high-quality diesel fuel to reduce emissions. Regularly monitor air quality in and around the project site and implement corrective actions if pollutant levels exceed acceptable limits.	Medium	Contractor; SPIU	13,333
WEHD	Construction Phase	Wastes Disposal and Emissions	<u>Health Effects of Environmental</u>	Contractor shall: • Use equipment with high combustion efficiency	High	Contractor, SPIU	10,000



		Handling (Construction)	<u>Pollution Released from the Project:</u> • Dust (PM₁₀, PM_{2.5}, silica dust) emissions would cause respiratory irritation, chronic bronchitis, asthma, silicosis • Diesel exhaust from machinery could result in Lung cancer risk, headaches, eye and throat irritation • Cement and chemical additives would cause skin irritation, dermatitis, chemical burns • Welding fumes and solvents would cause oxalic metal exposure, neurological issues <u>Community Health Impacts</u> • Dust dispersion would exacerbate asthma, allergies, and	• Regularly service equipment and heavy machineries used on site; • PREMOB equipment and automobiles before usage; • Use dust suppressants on access roads to project site • Contractor should strictly implement and comply with the safety measures in the HSE Plan; • Develop and implement spill Prevention and Containment Plan, and Hazardous Material Control Procedure to address the prevention and containment of oil spills, chemical and hazardous materials releases during the construction works; • Maintain construction machinery, vehicles and equipment in good working condition to prevent oil and fuel leaks during operation • Ensure adequate sanitary facilities are provided during the construction and operation phases of the project • Solid waste management should be addressed in Contractor HSE Plan and Waste Management Plan		



			respiratory illnesses in children and elderly • Contaminated runoff / wastewater would cause Pollutes local streams and wells; risk of gastrointestinal diseases • Increased noise and vibration emissions would cause sleep disturbance, anxiety, hypertension • Improper waste disposal would attract disease vectors (mosquitoes, rodents) leading to malaria, typhoid, etc.			



Operation Phase

Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
FSC	Operation Phase	Interaction affecting Air Quality	<u>Impact on Ambient Air Quality</u> Ambient air quality deterioration from fugitive dust releases and equipment / automobiles exhaust emissions	Contractor shall: • use equipment with high combustion efficiency • regularly service equipment and heavy machineries used on site; • PREMOB equipment and automobiles before usage; Use dust suppressants on access roads to project site	Medium	EPC / O&M Contractor; SAPZ SPIU	28,000
FSC	Operation Phase	Interaction affecting Noise and Vibration	<u>Impact on Noise Emission Level</u> Increase in ambient noise levels and risk of ear impairment	• Ear protective device to be provided to workers; Install acoustic mufflers on large equipment where necessary to limit ambient noise levels	Medium	EPC / O&M Contractor	14,000
FSC	Operation Phase	Interaction affecting Population	<u>Impact on Population</u> • Transportation of average of 25,000 workers, private sector investors, agribusiness stakeholders, and equipment, during the operation phase, to the	KA SAPZ SPIU and Contractor shall avoid traffic congestion and disruptions around the project site by: • Implementation of the Contractor's Traffic Management Plan	High	EPC Contractor; SAPZ SPIU; Traffic Police	45,000



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
			AIH project site will put pressure on the existing transportation infrastructure, cause traffic congestions, increase travel time and cost of transportation • Pressure on healthcare facilities and public utilities; • Employment-seeking migrants will result in increased commercial activities in nearby communities around the SAPZ AIH project site. There will likely be further increase in the price of food, medicine, transportation and general goods and services in the project	• Put in place temporary alternative access roads to reduce traffic bottlenecks • Repair alternative access roads if damaged and ensure minimal environmental and social impact liabilities • Put in place traffic control men to direct and coordinate traffic flows • Adjusting work schedules not to disturb traffic; • Establishing an adequate system of road signs and detour; • The SAPZ AIH SPIU should encourage private investors to engage in residential and other ancillary recreation land use plot development within the Hub			



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
			area as a result of the influx for investment, agribusiness or employment opportunities. • Increased commerce is a positive impact, but price inflation is negative particularly if some sectors of the population do not benefit from the increased commerce within the AIH project area. • Based on experience gained from other projects in Nigeria, prices may not return to pre-construction levels, but rather the price could potentially be kept higher during the operation phase				



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
			•				
			<u>Personal Income (“Boom-Bust Effect”).</u> ✓ The use of local labour following the end of the pre-construction and construction activities will be drastically reduced. If workers are not employed for operation phase of the project, workers could potentially feel the effects of the unemployment and the rapid decrease in personal income (“boom-bust effect”). ✓ Locals engaged on the project would likely earn	KA SAPZ SPIU and Contractor shall design and implement Livelihood Restoration Plans (LRPs) for construction workers to mitigate the boom-burst-effect focusing on: ➤ Vocational training in areas such as agro-processing, tailoring, welding, ICT ➤ Support for petty traders, women cooperatives, and youth enterprise schemes ➤ Agricultural input subsidies and training in climate-smart farming for resettled farmers		SAPZ SPIU; Social Consultant	120,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
			significantly more than their pre-project income and than others not employed by the project. The increased earnings will lead to life-style changes including more expensive habits and in some cases, additional dependants, including wives, children, and other family members. Experience from similar developments elsewhere in Nigeria indicate that loss of this income can result in tension and conflicts between the people and the project. Assuming				



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
			that workers are not re-employed in the operation phase, the magnitude of the effects of the loss of employment will be high. ✓				
			<u>Communicable and Non-Communicable Disease</u> The anticipated in-migration and associated increase in close human interaction mostly during the pre-construction and construction phases of the Project have the potential to significantly add to the incidence of both communicable and non-communicable	Kaduna SAPZ SPIU shall: ➤ Ensure the prevention of larval and adult propagation of vector-borne diseases through sanitary improvements and elimination of breeding habitats close to the project site or human settlements; ➤ Elimination of unusable impounded water in depression storage areas created as a result of topographic modifications in project area; ➤ Kaduna SAPZ SPIU shall establish and implement		SAPZ SPIU; Ministry of Health	85,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
			diseases in nearby communities which could be exacerbated in the operation phase of the Project	integrated vector control programmes; ➤ Kaduna SAPZ SPIU shall educate project personnel and local residents on health risk they are exposed to and available treatment options; ➤ Kaduna SAPZ SPIU shall periodically monitor resident communities during the life cycle of the project to detect and proactively treat emerging cases; ➤ Kaduna SAPZ SPIU shall distribute appropriate health education materials to improve project workers and community awareness on potential and associated health risks of improper solid waste handling and management.			
FSC	Operation Phase	Interaction affecting Infrastructure	<u>Impact on Infrastructure:</u>	➤ Employment of casual / unskilled labour shall be drawn	High	SAPZ SPIU; Private Investors	40,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
			In-migration of job seekers put pressure on existing infrastructure in the SAPZ AIH project area. However, the development and operation of the AIH will positively increase and boost the construction of core and support agro-processing infrastructural in the area	- from the members of the resident communities; ➤ Priority consideration shall be given to qualified job seekers from local communities; ➤ Immigrant job seekers shall be hired and paid off-site, only after resident community workers has been primary consideration; ➤ Minimize pressure on existing infrastructure through control of population influx and utilization of resident members of communities living in close proximity to project site. ➤ Private sector property developers and agribusiness investors should be invited to invest in both the core and support infrastructure development within the Hub			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
FSC	Operation Phase	Interaction affecting Accident – Fire – Explosion Incidence	Risk of accident, fire, explosion and injury	✓ Contractor shall strictly implement and comply with the safety measures in the HSE Plan; ✓ Contractor employee should follow the safety procedures in the Contractor's Health and Safety Manual; ✓ Ensure appropriate PPEs are used during the Recce and Condition Surveys	High	EPC / O&M Contractor; KEPA	60,000
OAIH	Operation Phase	Interaction affecting Surface Water Quality	<u>Impact on Surface Water Quality</u> Loss of land cover and exposure of bare land surface resulting in: disturbed natural drainage, and introduction of contaminants into surface water pathways; increased sediment load and turbidity; Hydrocarbon and	Kaduna SAPZ SPIU and Contractor shall adopt: B) Erosion And Sediment Control Measures such as: ✓ Minimize exposed land surfaces by clearing vegetation in phases; avoid stripping the entire site at once.; ✓ Retain buffer vegetation along drainage corridors and low-lying areas	High	EPC Contractor; KEPA	35,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
			chemical contamination of surface water; Domestic wastewater and sewage pollution from temporary workers camp; solid waste litter and runoff contamination of downstream water bodies	F. Construct Temporary Drainage Controls: ✓ Install silt fences, sediment basins, and check dams downstream of disturbed areas. ✓ Construct temporary diversion ditches to channel runoff away from cleared slopes. G. Stabilize Exposed Soils: ✓ Apply mulching, grass seeding, or hydroseeding on completed sections. ✓ Stockpiles should be covered or surrounded by silt traps. H. Schedule Earthworks in Dry Season to reduce erosion risk. I. Pollution Prevention for Fuel and Chemicals ✓ Designate bunded, impervious refueling and			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				storage areas at least 50 m from watercourses. ✓ Keep spill response kits (absorbents, sand, drums) at all fuel handling points. ✓ Train workers in spill response and waste oil management. ✓ Collect used oil and lubricants for disposal through licensed waste handlers.			
OAIH	Operation Phase	Interaction affecting Groundwater Quality	<u>Impact on Groundwater Quality</u>	Contractor should develop and implement its: • Spill Prevention and Containment Plan, and Hazardous Material Control Procedure to address the prevention and containment of oil spills, chemical and hazardous materials releases during the construction works; • Maintain construction machinery, vehicles and	High	EPC Contractor; KEPA	22,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				equipment in good working condition to prevent oil and fuel leaks during operation - Any oil or chemical spill should be reported to the Contractor's Supervising Engineer; the Kaduna SAPZ SPIU and the KEPA In Addition, Kaduna SAPZ SPIU and the Contractor shall ensure: A. Pollution Prevention from Fuel and Oil ✓ Designate impervious, bunded fuel storage and refueling areas located ≥ 50 m away from boreholes, wells, or drainage lines. ✓ Use drip trays and absorbent pads under stationary machinery and parked vehicles.			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				✓ Provide spill kits and emergency response training for all equipment operators. ✓ Collect and dispose of used oil, filters, and oily rags through licensed waste management contractors. ✓ Maintain an inventory and inspection record of all fuel storage tanks and drums.			
OAIH	Operation Phase	Interaction affecting Soil Quality	<u>Impact on Soil Quality</u> Accidental release of oil, hazardous materials and chemicals on ground and potential	Contractor should develop and implement its: • Spill Prevention and Containment Plan, and Hazardous Material Control Procedure to address the prevention and containment of oil spills, chemical and hazardous materials releases during the construction works; • Maintain construction machinery, vehicles and equipment in good working	High	SAPZ SPIU	—



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				condition to prevent oil and fuel leaks during operation Any oil or chemical spill should be reported to Contractor's Supervising Engineer; the Kaduna SAPZ SPIU, and the KEPA			
OAIH	Operation Phase	Interaction affecting Air Quality	<u>Impact on Ambient Air Quality</u> Ambient air quality deterioration from fugitive dust releases and equipment / automobiles exhaust emissions	Contractor shall: • use equipment with high combustion efficiency • regularly service equipment and heavy machineries used on site; • PREMOB equipment and automobiles before usage; • Use dust suppressants on access roads to project site	High	EPC / O&M Contractor; SAPZ SPIU	110,000
OAIH	Operation Phase	Interaction affecting Noise and Vibration	<u>Impact on Noise Emission Level</u> Increase in ambient noise levels and risk of ear impairment	• Ear protective device to be provided to workers; • Install acoustic mufflers on large equipment where necessary to limit ambient noise levels	Medium	SAPZ SPIU; NGOs	95,000



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
OAIH	Operation Phase	Interaction affecting Population	<u>Impact on Population</u> • Increase in employment opportunities in the Agro-Industrial Hub; • Increased foreign investment opportunities; • Increased opportunities in Agribusiness for local community and all Nigerians at large	Kaduna SAPZ SPIU • Ensure all the core and support infrastructure as well as the associated Agricultural Transformation Centers are full developed and functional to provide the basis for the private sector and foreign investors wade ub ti druve the development and operation of the SAPZ AIH	High	SAPZ SPIU; EPC Contractor	25,000
OAIH	Operation Phase	Interaction affecting Pollution Related Health Effects	<u>Pollution Related Health Effects:</u> Health risks from inhalation of dust/PM, fumes, VOCs, H₂S, NH₃, NO_x/SO₂/CO); dermal contact with oils, solvents, leachate; and	Mitigation & controls (hierarchy-based) Elimination / Substitution • No open burning under any circumstance. • Prefer low-VOC materials, water-based paints/cleaners; choose low-sulfur fuel where available.	High	EPC Contractor; SAPZ SPIU	38,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
			ingestion (hand-to-mouth ingestion of contaminated food/water); and accidental blood contact with used injection (sharps needles) In solid waste streams	• Outsource special/hazardous waste to licensed facilities (no on-site treatment that generates harmful emissions). • Stormwater segregation (clean vs. contaminated); oil–water separators. • Fire & gas safety: fire-rated chemical stores; intrinsically safe equipment where needed; fixed gas detectors (H₂S/CH₄/CO) at risk locations; earthing/bonding for flammables. • Sharps & biohazards: puncture-proof containers; sealed, color-coded bins.			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				• SOPs for: waste acceptance, loading/unloading, spill response, confined-space entry, hot work permit-to-work, sharps handling, and odor incident response. • Waste handling schedule to avoid accumulation; routing & timing to minimize community exposure (avoid school peak hours). • Community buffer & communication: fence-line green belt; prior notices for unusual odor/traffic events; grievance redress mechanism with response SLAs. • Training: induction + task-specific refreshers			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				(spill/H₂S awareness/first aid/fire). • Medical fitness & restrictions for high-exposure tasks (e.g., pregnancy, severe asthma). • Contractor controls: EHS clauses, audits, KPIs, right-to-stop-work. Provide PPE (last line, but mandatory where relevant) • Respiratory protection: fit-tested particulate respirators for dust and appropriate cartridges for VOCs/H₂S where engineering controls can't fully contain. • Dermal/eye protection: Provide chemical-resistant gloves, coveralls, goggles/face shields for			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				splashes; steel-toe, slip-resistant boots. - Hygiene: hand-wash stations, no eating/drinking in handling areas, dedicated lockers & laundry for workwear. 5) Monitoring, surveillance & assurance - Ambient & workplace air: periodic PM₁₀/PM_{2.5}, VOCs (as TVOC or targeted), H₂S at odor hotspots, CO/NO_x near generators; fence-line odor checks and complaint log review. - Instrument checks: calibration records for gas detectors; stack/vent performance where applicable.			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				• Health surveillance: pre-placement + periodic respiratory symptom review; skin checks for frequent wet/chemical work; biological monitoring only if specific chemicals warrant. • Incident KPIs: TRIR, near-misses, spill numbers/volumes, sharps injuries, odor complaints response time (TTR). • Audits: monthly EHS walkthroughs; annual external compliance audits. 6) Emergency preparedness • Spill response kits (pads, booms, neutralizers); roles & call tree posted. • Fire safety: extinguishers sized by hazard class;			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				hydrants where required; drills (semi-annual). - Gas/H₂S protocol: alarm setpoints, muster points, evacuation routes, rescue plan; portable meters for entry. - First aid: trained first-aiders, eyewash/showers at chemical/acid/alkali use points; post-exposure protocols. - Traffic incidents: recovery plan, coordination with local authorities/clinics along routes.			
OAIH	Operation Phase	Interaction affecting Micro and Macro Economy	<u>Impact on Macro and Micro Economy:</u> 1. (Increase in the prices of food, goods and services)	Kaduna SAPZSPIU shall: ➤ Develop Influx Management Plan to control and manage population influx effect of the operation of the AIH ➤ Explore options to address anticipated increase in prices of food, medicine, transportation	Very High	EPC / O&M Contractor	50,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
			2. Unemployment boom-bust resulting in tension and conflicts	requirement, recruitment of workers, community expansion, housing demand, inflation, security risk and other general pressure on existing goods and services; ➤ Periodically conduct food basket survey to monitor the trend of the changes in prices of goods and services; ➤ Support micro credit schemes that equip the local communities with capital for trade expansion; ➤ Workers disengagement plans shall be put in place and adopted to address unemployment boom-bust; ➤ Existing cooperatives shall be strengthened together with the establishment of new ones to engage in various commercial activities that will reduce inflation;			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				➤ Employment of casual/unskilled labour shall be drawn primarily from the resident communities in close proximity to specific sub-project sites; ➤ Priority consideration shall be given to qualified job seekers from local communities; ➤ Immigrant job seekers shall be hired and paid off-site, only after resident community workers has been primary consideration; In situations where the human resource skills required for any Agro-Industry is not available locally, Kaduna SAPZ SPIU shall exhibit local cultural sensitivity in the importation of human resources into the project area to avoid the creation of cultural ghettos. All incoming personnel shall be			



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				integrated into the local community and given induction on the cultural antecedent of the specific sub-project area.			
OAIH	Operation Phase	Interaction affecting Infrastructure	<u>Impact on Infrastructure:</u> In-migration of job seekers put pressure on existing infrastructure in the SAPZ AIH project area. However, the development and operation of the AIH will positively increase and boost the construction of core and support agro-processing infrastructural in the area	➤ Employment of casual / unskilled labour shall be drawn from the members of the resident communities; ➤ Priority consideration shall be given to qualified job seekers from local communities; ➤ Immigrant job seekers shall be hired and paid off-site, only after resident community workers has been primary consideration; ➤ Minimize pressure on existing infrastructure through control of population influx and utilization of resident members of communities living in close proximity to project site.	Very High	EPC Contractor; KEPA; NESREA	55,000



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				➤ Private sector property developers and agribusiness investors should be invited to invest in both the core and support infrastructure development within the Hub			
PPFW	Operation Phase	Interaction affecting Population	<u>Impact on Population</u> • Increase in employment opportunities in the Agro-Industrial Hub; • Increased foreign investment opportunities; Increased opportunities in Agribusiness for local community and all Nigerians at large	Kaduna SAPZ SPIU • Ensure all the core and support infrastructure as well as the associated Agricultural Transformation Centers are full developed and functional to provide the basis for the private sector and foreign investors wade ub ti druve the development and operation of the SAPZ AIH	High		-
PPFW	Operation Phase	Interaction affecting Micro and Macro Economy	<u>Impact on Macro and Micro Economy:</u> Increase in the prices of food, goods and services	Kaduna SAPZSPIU shall: ➤ Develop Influx Management Plan to control and manage population influx effect of the operation of the AIH	Very High	EPC / O&M Contractor; SAPZ SPIU	28,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
			Unemployment boom-bust resulting in tension and conflicts	➤ Explore options to address anticipated increase in prices of food, medicine, transportation requirement, recruitment of workers, community expansion, housing demand, inflation, security risk and other general pressure on existing goods and services; ➤ Periodically conduct food basket survey to monitor the trend of the changes in prices of goods and services; ➤ Support micro credit schemes that equip the local communities with capital for trade expansion; ➤ Workers disengagement plans shall be put in place and adopted to address unemployment boom-bust; ➤ Existing cooperatives shall be strengthened together with the establishment of new ones to			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				engage in various commercial activities that will reduce inflation; ➤ Employment of casual/unskilled labour shall be drawn primarily from the resident communities in close proximity to specific sub-project sites; ➤ Priority consideration shall be given to qualified job seekers from local communities; ➤ Immigrant job seekers shall be hired and paid off-site, only after resident community workers has been primary consideration; In situations where the human resource skills required for any Agro-Industry is not available locally, Kaduna SAPZ SPIU shall exhibit local cultural sensitivity in the importation of human resources into the			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				project area to avoid the creation of cultural ghettos. All incoming personnel shall be integrated into the local community and given induction on the cultural antecedent of the specific sub-project area.			
PPFW	Operation Phase	Interaction affecting Education	<u>Impact on Education</u> Education in the context of the SAPZ AIH project implies change in primary, secondary and tertiary education school enrolment and attendance. During pre-construction, construction, operation, and decommissioning phases of the SAPZ AIH project,, direct and indirect work for semi-skilled and unskilled	Kaduna SAPZ SPIU must ensure that: ✓ No one under 15 may be employed in any role related to SAPZ AIH. ✓ No one under 18 may perform hazardous, night, or construction-site work, or be present in controlled work zones. ✓ Education must not be disrupted by the project; actions must support enrolment and attendance. Contractor shall:	Very High	EPC / O&M Contractor	14,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
			workers age 15 and older could become available. Young indigenes in the project area and its environs will be attracted to this opportunity especially because it will typically pay higher wages than other income generating activities available in the area. In addition, some of the young people may be attracted to illegal activities such as prostitution, fraud and stealing. The attraction to earn income could potentially, either directly for the project (for young adults), or through some other indirect income	Establish zero tolerance labour and procurement controls that: • AfDB-aligned Contract clauses: that affirms no-child-labour provisions for a child within age thresholds (≥ 15 / ≥ 18), and establish grounds for termination for breach. • Age verification protocol require original IDs (birth cert/NIN/passport), witness affidavits where needed; the information must be re-verify at gate passes and payroll onboarding.			



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
			generating enterprises, cause young people to abandon or suspend their education. Of particular concern are children in primary and secondary education. Baseline information indicates that the educational facilities and systems in the area are not adequate and this, together with a disruption in education, has the potential to seriously reduce the future potential for the area's young people.				
PPFW	Operation Phase	Interaction affecting Air Quality	<u>Impact on Ambient Air Quality</u> Ambient air quality deterioration from fugitive dust releases	Contractor shall: • use equipment with high combustion efficiency • regularly service equipment and heavy machineries used on site;	High	EPC Contractor; SAPZ SPIU; Traffic Police	45,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
			and equipment / automobiles exhaust emissions	- PREMOB equipment and automobiles before usage; - Use dust suppressants on access roads to project site			
PPFW	Operation Phase	Interaction affecting Noise and Vibration	<u>Impact on Noise Emission Level</u> Increase in ambient noise levels and risk of ear impairment	- Ear protective device to be provided to workers; - Install acoustic mufflers on large equipment where necessary to limit ambient noise levels	Medium	SAPZ SPIU; Social Consultant	120,000
TW_VCC	Operation Phase	Interaction affecting Transportation	<u>Impact on Transportation</u> Transportation of workers and materials for temporary facilities setup to the project site will put pressure on the existing transportation infrastructure, cause traffic congestions and bottleneck along alternative roads,	KA SAPZ SPIU and Contractor shall avoid traffic congestion and disruptions around the project site by: - Implementation of the Contractor's Traffic Management Plan - Put in place temporary alternative access roads to reduce traffic bottlenecks - Repair alternative access roads if damaged and ensure minimal environmental and social impact liabilities	Very High	SAPZ SPIU; Ministry of Health	85,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
			increase travel time and cost of transportation	• Put in place traffic control men to direct and coordinate traffic flows • Adjusting work schedules not to disturb traffic; • Establishing an adequate system of road signs and detour; • Notifying communities of pending work scope, duration and location			
TW_VCC	Operation Phase	Interaction affecting Air Quality	<u>Impact on Ambient Air Quality</u> Ambient air quality deterioration from fugitive dust releases and equipment / automobiles exhaust emissions	Contractor shall: • use equipment with high combustion efficiency • regularly service equipment and heavy machineries used on site; • PREMOB equipment and automobiles before usage; Use dust suppressants on access roads to project site	High	SAPZ SPIU; Private Investors	40,000
TW_VCC	Operation Phase	Interaction affecting Noise and Vibration	<u>Impact on Noise Emission Level</u>	• Ear protective device to be provided to workers;	Medium	EPC / O&M Contractor; KEPA	60,000



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
			Increase in ambient noise levels and risk of ear impairment	Install acoustic mufflers on large equipment where necessary to limit ambient noise levels			
TW_VCC	Operation Phase	Interaction affecting Accident – Fire – Explosion Incidence	Risk of accident, fire, explosion and injury	✓ Contrator shall strictly implement and comply with the safety measures in the HSE Plan; ✓ Contractor employee should follow the safety procedures in the Contractor's Health and Safety Manual; Ensure appropriate PPEs are used during the Recce and Condition Surveys	High	EPC Contractor; KEPA	35,000
O&M	Operation Phase	Interaction affecting Surface Water Quality	<u>Impact on Surface Water Quality</u> Loss of land cover and exposure of bare land surface resulting in: disturbed natural drainage, and introduction of contaminants into surface water pathways;	Kaduna SAPZ SPIU and Contracgtor shall adopt: C) Erosion And Sediment Control Measures such as: ✓ Minize exposed land surfaces by clearing vegetation in phases; avoid stripping the entire site at once.;	Very High	EPC Contractor; KEPA	22,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
			increased sediment load and turbidity; Hydrocarbon and chemical contamination of surface water; Domestic wastewater and sewage pollution from temporary worker's camp; solid waste litter and runoff contamination of downstream water bodies	✓ Retain buffer vegetation along drainage corridors and low-lying areas J. Construct Temporary Drainage Controls: ✓ Install silt fences, sediment basins, and check dams downstream of disturbed areas. ✓ Construct temporary diversion ditches to channel runoff away from cleared slopes. K. Stabilize Exposed Soils: ✓ Apply mulching, grass seeding, or hydroseeding on completed sections. ✓ Stockpiles should be covered or surrounded by silt traps. L. Schedule Earthworks in Dry Season to reduce erosion risk.			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				M.Pollution Prevention for Fuel and Chemicals ✓ Designate bunded, impervious refueling and storage areas at least 50 m from watercourses. ✓ Keep spill response kits (absorbents, sand, drums) at all fuel handling points. ✓ Train workers in spill response and waste oil management. ✓ Collect used oil and lubricants for disposal through licensed waste handlers.			
O&M	Operation Phase	Interaction affecting Groundwater Quality	<u>Impact on Groundwater Quality</u>	Contractor should develop and implement its: • Spill Prevention and Containment Plan, and Hazardous Material Control Procedure to address the prevention and containment of	High	SAPZ SPIU	—



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				oil spills, chemical and hazardous materials releases during the construction works; • Maintain construction machinery, vehicles and equipment in good working condition to prevent oil and fuel leaks during operation • Any oil or chemical spill should be reported to the Contractor's Supervising Engineer; the Kaduna SAPZ SPIU and the KEPA In Addition, Kaduna SAPZ SPIU and the Contractor shall ensure: A. Pollution Prevention from Fuel and Oil ✓ Designate impervious, banded fuel storage and refueling areas located ≥ 50 m away from boreholes, wells, or drainage lines.			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				✓ Use drip trays and absorbent pads under stationary machinery and parked vehicles. ✓ Provide spill kits and emergency response training for all equipment operators. ✓ Collect and dispose of used oil, filters, and oily rags through licensed waste management contractors. Maintain an inventory and inspection record of all fuel storage tanks and drums.			
O&M	Operation Phase	Interaction affecting Soil Quality	<u>Impact on Soil Quality</u> Accidental release of oil, hazardous materials and chemicals on ground and potential	Contractor should develop and implement its: • Spill Prevention and Containment Plan, and Hazardous Material Control Procedure to address the prevention and containment of oil spills, chemical and hazardous materials releases during the construction works;	High	EPC / O&M Contractor; SAPZ SPIU	110,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				• Maintain construction machinery, vehicles and equipment in good working condition to prevent oil and fuel leaks during operation Any oil or chemical spill should be reported to Contractor's Supervising Engineer; the Kaduna SAPZ SPIU, and the KEPA			
O&M	Operation Phase	Interaction affecting Infrastructure	<u>Impact on Infrastructure:</u> In-migration of job seekers put pressure on existing infrastructure in the SAPZ AIH project area. However, the development and operation of the AIH will positively increase and boost the construction of core and support agro-processing	➤ Employment of casual / unskilled labour shall be drawn from the members of the resident communities; ➤ Priority consideration shall be given to qualified job seekers from local communities; ➤ Immigrant job seekers shall be hired and paid off-site, only after resident community workers has been primary consideration; ➤ Minimize pressure on existing infrastructure through control	Very High	SAPZ SPIU; NGOs	95,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
			infrastructural in the area	of population influx and utilization of resident members of communities living in close proximity to project site. ➤ Private sector property developers and agribusiness investors should be invited to invest in both the core and support infrastructure development within the Hub			
O&M	Operation Phase	Interaction affecting Micro and Macro Economy	<u>Impact on Macro and Micro Economy:</u> Increase in the prices of food, goods and services Unemployment boom-bust resulting in tension and conflicts	Kaduna SAPZSPIU shall: ➤ Develop Influx Management Plan to control and manage population influx effect of the operation of the AIH ➤ Explore options to address anticipated increase in prices of food, medicine, transportation requirement, recruitment of workers, community expansion, housing demand, inflation, security risk and other general pressure on existing goods and services;	Very High	SAPZ SPIU; EPC Contractor	25,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				➤ Periodically conduct food basket survey to monitor the trend of the changes in prices of goods and services; ➤ Support micro credit schemes that equip the local communities with capital for trade expansion; ➤ Workers disengagement plans shall be put in place and adopted to address unemployment boom-bust; ➤ Existing cooperatives shall be strengthened together with the establishment of new ones to engage in various commercial activities that will reduce inflation; ➤ Employment of casual/unskilled labour shall be drawn primarily from the resident communities in close proximity to specific sub-project sites;			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				➤ Priority consideration shall be given to qualified job seekers from local communities; ➤ Immigrant job seekers shall be hired and paid off-site, only after resident community workers has been primary consideration; ➤ In situations where the human resource skills required for any Agro-Industry is not available locally, Kaduna SAPZ SPIU shall exhibit local cultural sensitivity in the importation of human resources into the project area to avoid the creation of cultural ghettos. All incoming personnel shall be integrated into the local community and given induction on the cultural antecedent of the specific sub-project area.			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
O&M	Operation Phase	Interaction affecting Accident – Fire – Explosion Incidence	Risk of accident, fire, explosion and injury	✓ Contrator shall strictly implement and comply with the safety measures in the HSE Plan; ✓ Contractor employee should follow the safety procedures in the Contractor's Health and Safety Manual; ✓ Ensure appropriate PPEs are used during the Recce and Condition Surveys	High	EPC Contractor; SAPZ SPIU	38,000
WEHD	Operation Phase	Interaction affecting Surface Water Quality	<u>Impact on Surface Water Quality</u> Loss of land cover and exposure of bare land surface resulting in: disturbed natural drainage, and introduction of contaminants into surface water pathways; increased sediment load and turbidity; Hydrocarbon and	Kaduna SAPZ SPIU and Contracgtor shall adopt: D) Erosion And Sediment Control Measures such as: ✓ Minize exposed land surfaces by clearing vegetation in phases; avoid stripping the entire site at once.; ✓ Retain buffer vegetation along drainage corridors and low-lying areas	Very High	EPC / O&M Contractor	50,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
			chemical contamination of surface water; Domestic wastewater and sewage pollution from temporary workers camp; solid waste litter and runoff contamination of downstream water bodies	N. Construct Temporary Drainage Controls: ✓ Install silt fences, sediment basins, and check dams downstream of disturbed areas. ✓ Construct temporary diversion ditches to channel runoff away from cleared slopes. O. Stabilize Exposed Soils: ✓ Apply mulching, grass seeding, or hydroseeding on completed sections. ✓ Stockpiles should be covered or surrounded by silt traps. P. Schedule Earthworks in Dry Season to reduce erosion risk. Q. Pollution Prevention for Fuel and Chemicals ✓ Designate bunded, impervious refueling and			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				storage areas at least 50 m from watercourses. ✓ Keep spill response kits (absorbents, sand, drums) at all fuel handling points. ✓ Train workers in spill response and waste oil management. ✓ Collect used oil and lubricants for disposal through licensed waste handlers.			
WEHD	Operation Phase	Interaction affecting Groundwater Quality	<u>Impact on Groundwater Quality</u>	Contractor should develop and implement its: • Spill Prevention and Containment Plan, and Hazardous Material Control Procedure to address the prevention and containment of oil spills, chemical and hazardous materials releases during the construction works;	High	EPC Contractor; KEPA; NESREA	55,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				• Maintain construction machinery, vehicles and equipment in good working condition to prevent oil and fuel leaks during operation • Any oil or chemical spill should be reported to the Contractor's Supervising Engineer; the Kaduna SAPZ SPIU and the KEPA In Addition, Kaduna SAPZ SPIU and the Contractor shall ensure: A. Pollution Prevention from Fuel and Oil ✓ Designate impervious, bunded fuel storage and refueling areas located ≥ 50 m away from boreholes, wells, or drainage lines. ✓ Use drip trays and absorbent pads under stationary machinery and parked vehicles.			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				✓ Provide spill kits and emergency response training for all equipment operators. ✓ Collect and dispose of used oil, filters, and oily rags through licensed waste management contractors. ✓ Maintain an inventory and inspection record of all fuel storage tanks and drums.			
WEHD	Operation Phase	Interaction affecting Soil Quality	<u>Impact on Soil Quality</u> Accidental release of oil, hazardous materials and chemicals on ground and potential	Contractor should develop and implement its: • Spill Prevention and Containment Plan, and Hazardous Material Control Procedure to address the prevention and containment of oil spills, chemical and hazardous materials releases during the construction works; • Maintain construction machinery, vehicles and equipment in good working	High	EPC / O&M Contractor;	12,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				condition to prevent oil and fuel leaks during operation • Any oil or chemical spill should be reported to Contractor's Supervising Engineer; the Kaduna SAPZ SPIU, and the KEPA			
WEHD	Operation Phase	Interaction affecting Air Quality	<u>Impact on Ambient Air Quality</u> Ambient air quality deterioration from fugitive dust releases and equipment / automobiles exhaust emissions	Contractor shall: • use equipment with high combustion efficiency • regularly service equipment and heavy machineries used on site; • PREMOB equipment and automobiles before usage; Use dust suppressants on access roads to project site	High	EPC / O&M Contractor; SAPZ SPIU	28,000
WEHD	Operation Phase	Interaction affecting Pollution Related Health Effects	<u>Pollution Related Health Effects:</u> Health risks from inhalation of dust/PM, fumes, VOCs, H ₂ S, NH ₃ , NO _x /SO ₂ /CO); dermal contact with	Mitigation & controls (hierarchy-based) A. Elimination / Substitution - No open burning under any circumstance. - Prefer low-VOC materials, water-based paints/cleaners; choose	High	EPC / O&M Contractor	14,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
			oils, solvents, leachate; and ingestion (hand-to-mouth ingestion of contaminated food/water); and accidental blood contact with used injection (sharps needles) In solid waste streams	• low-sulfur fuel where available. • Outsource special/hazardous waste to licensed facilities (no on-site treatment that generates harmful emissions). • Stormwater segregation (clean vs. contaminated); oil–water separators. • Fire & gas safety: fire-rated chemical stores; intrinsically safe equipment where needed; fixed gas detectors (H₂S/CH₄/CO) at risk locations; earthing/bonding for flammables. • Sharps & biohazards: puncture-proof			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				- containers; sealed, color-coded bins. - SOPs for: waste acceptance, loading/unloading, spill response, confined-space entry, hot work permit-to-work, sharps handling, and odor incident response. Waste handling schedule to avoid accumulation; routing & timing to minimize community exposure (avoid school peak hours). Community buffer & communication: fence-line green belt; prior notices for unusual odor/traffic events; grievance redress			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				mechanism with response SLAs. • Training: induction + task-specific refreshers (spill/H₂S awareness/first aid/fire). • Medical fitness & restrictions for high-exposure tasks (e.g., pregnancy, severe asthma). • Contractor controls: EHS clauses, audits, KPIs, right-to-stop-work. • Provide PPE (last line, but mandatory where relevant) • Respiratory protection: fit-tested particulate respirators for dust and appropriate cartridges for VOCs/H₂S where engineering controls can't fully contain.			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				• Dermal/eye protection: Provide chemical-resistant gloves, coveralls, goggles/face shields for splashes; steel-toe, slip-resistant boots. • Hygiene: hand-wash stations, no eating/drinking in handling areas, dedicated lockers & laundry for workwear. 5) Monitoring, surveillance & assurance • Ambient & workplace air: periodic PM₁₀/PM_{2.5}, VOCs (as TVOC or targeted), H₂S at odor hotspots, CO/NO_x near generators; fence-line odor checks and complaint log review.			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				• Instrument checks: calibration records for gas detectors; stack/vent performance where applicable. • Health surveillance: pre-placement + periodic respiratory symptom review; skin checks for frequent wet/chemical work; biological monitoring only if specific chemicals warrant. • Incident KPIs: TRIR, near-misses, spill numbers/volumes, sharps injuries, odor complaints response time (TTR). • Audits: monthly EHS walkthroughs; annual external compliance audits.			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Estimated Annual Cost (USD)
				6) Emergency preparedness • Spill response kits (pads, booms, neutralizers); roles & call tree posted. • Fire safety: extinguishers sized by hazard class; hydrants where required; drills (semi-annual). • Gas/H₂S protocol: alarm setpoints, muster points, evacuation routes, rescue plan; portable meters for entry. • First aid: trained first-aiders, eyewash/showers at chemical/acid/alkali use points; post-exposure protocols. Traffic incidents: recovery plan, coordination with local authorities/clinics along routes.			



Table 6.6: Decommissioning Phase

Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
CDR	Decommissioning Phase	Interaction affecting Infrastructure	Infrastructure Demolition Impacts Buildings and Structural Assets Impacts ✓ Demolition damage to adjacent assets (vibration, falling debris) ✓ Hidden hazardous materials (asbestos, lead paint) during strip-out ✓ Uncontrolled dust/PM and noise; structural instability mid-sequence	Contractor shall ensure: ✓ Pre-demolition structural survey and as-built utility mapping and determine the building and structures to be reserved for other uses and not to be demolished; ✓ Selective (soft-strip) demolition; engineered sequencing; exclusion zones ✓ Method statements with load paths, temporary bracing/shoring ✓ Hazardous materials survey & abatement plan (licensed contractors) ✓ Dust suppression (mist cannons), debris netting; noise windows ✓ Vibration monitoring for sensitive adjacent structures ✓ Contractor shall strictly implement and comply with the safety measures in the HSE Plan;	Very High	Contractor; SAPZ SPIU	45,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
				✓ Contractor employee should follow the safety procedures in the Contractor's Health and Safety Manual; ✓ Ensure appropriate PPEs are used during the Recce and Condition Surveys			
CDR	Decommissioning Phase	Interaction affecting Aesthetics and Visual Aspect	<u>Impact on Aesthetics and Visual Aspect (Negative)</u> Demolition of the buildings and structures will have negative aesthetics and visual impact.	Contractor shall ✓ Pre-demolition structural survey and as-built utility mapping and determine the building and structures to be reserved for other uses and not to be demolished; ✓ Identify buildings and structures that can be converted to other uses and cleared from demolition. ✓ The demolition should be done in phases in an orderly and organized manner ✓ Hazardous materials survey & abatement plan (licensed contractors)	Very High	Contractor; SAPZ SPIU	18,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
				✓ Dust suppression (mist cannons), debris netting; noise windows ✓ Vibration monitoring for sensitive adjacent structures ✓ Contractor shall strictly implement and comply with the safety measures in the HSE Plan; ✓ Contractor employee should follow the safety procedures in the Contractor's Health and Safety Manual; ✓ Ensure appropriate PPEs are used during the Recce and Condition Surveys			
PTWDE	Decommissioning Phase	Interaction affecting Air Quality	<u>Impact on Ambient Air Quality</u> Ambient air quality deterioration from fugitive dust releases and equipment / automobiles exhaust emissions	Contractor shall: • use equipment with high combustion efficiency • regularly service equipment and heavy machineries used on site; • PREMOB equipment and automobiles before usage; Use dust suppressants on access roads to project site	High	Contractor; SAPZ SPIU	12,000



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
PTWDE	Decommissioning Phase	Interaction affecting Noise and Vibration	<u>Impact on Noise Emission Level</u> Increase in ambient noise levels and risk of ear impairment	• Ear protective device to be provided to workers; - Install acoustic mufflers on large equipment where necessary to limit ambient noise levels	Medium	Contractor	8,000
PTWDE	Decommissioning Phase	Interaction affecting Transportation	<u>Impact on Transportation</u> • Transportation of workers and materials for temporary facilities setup to the project site will put pressure on the existing transportation infrastructure, cause traffic congestions and bottleneck along alternative roads, increase travel time and cost of transportation	KA SAPZ SPIU and Contractor shall avoid traffic congestion and disruptions around the project site by: • Implementation of the Contractor's Traffic Management Plan • Put in place temporary alternative access roads to reduce traffic bottlenecks • Repair alternative access roads if damaged and ensure minimal environmental and social impact liabilities • Put in place traffic control Very High men to direct and coordinate traffic flows • Adjusting work schedules not to disturb traffic; Very High	Very High	Contractor; SAPZ SPIU; Traffic Police	22,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
				Establishing an adequate system of road signs and detour; Notifying communities of pending work scope, duration and location			
PTWDE	Decommissioning Phase	Interaction affecting Accident – Fire – Explosion Incidence	Risk of accident, fire, explosion and injury	✓ Contrator shall strictly implement and comply with the safety measures in the HSE Plan; ✓ Contractor employee should follow the safety procedures in the Contractor's Health and Safety Manual; Ensure appropriate PPEs are used during the Recce and Condition Surveys	High	Contractor	15,000
ED	Decommissioning Phase	Interaction affecting Air Quality	<u>Impact on Ambient Air Quality</u> Ambient air quality deterioration from fugitive dust releases and equipment / automobiles exhaust emissions	Contractor shall: • use equipment with high combustion efficiency • regularly service equipment and heavy machineries used on site; • PREMOB equipment and automobiles before usage; Use dust suppressants on access roads to project site	High	Contractor; SAPZ SPIU	10,000



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
ED	Decommissioning Phase	Interaction affecting Noise and Vibration	<u>Impact on Noise Emission Level</u> Increase in ambient noise levels and risk of ear impairment	• Ear protective device to be provided to workers; Install acoustic mufflers on large equipment where necessary to limit ambient noise levels	Medium	Contractor	7,000
ED	Decommissioning Phase	Interaction affecting Accident – Fire – Explosion Incidence	Risk of accident, fire, explosion and injury	✓ Contrator shall strictly implement and comply with the safety measures in the HSE Plan; ✓ Contractor employee should follow the safety procedures in the Contractor's Health and Safety Manual; Ensure appropriate PPEs are used during the Recce and Condition Surveys	High	Contractor	12,000
ED	Decommissioning Phase	Interaction affecting Infrastructure	Infrastructure Demolition Impacts Buildings and Structural Assets Impacts ✓ Demolition damage to adjacent assets (vibration, falling debris)	Contractor shall ensure: ✓ Pre-demolition structural survey and as-built utility mapping and determine the building and structures to be reserved for other uses and not to be demolished;	Very High	Contractor; SAPZ SPIU	42,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
			✓ Hidden hazardous materials (asbestos, lead paint) during strip-out ✓ Uncontrolled dust/PM and noise; structural instability mid-sequence	✓ Selective (soft-strip) demolition; engineered sequencing; exclusion zones ✓ Method statements with load paths, temporary bracing/shoring ✓ Hazardous materials survey & abatement plan (licensed contractors) ✓ Dust suppression (mist cannons), debris netting; noise windows ✓ Vibration monitoring for sensitive adjacent structures ✓ Contractor shall strictly implement and comply with the safety measures in the HSE Plan; ✓ Contractor employee should follow the safety procedures in the Contractor's Health and Safety Manual; ✓ Ensure appropriate PPEs are used during the Recce and Condition Surveys			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
DS	Decommissioning Phase	Interaction affecting Air Quality	<u>Impact on Ambient Air Quality</u> Ambient air quality deterioration from fugitive dust releases and equipment / automobiles exhaust emissions	Contractor shall: • use equipment with high combustion efficiency • regularly service equipment and heavy machineries used on site; • PREMOB equipment and automobiles before usage; Use dust suppressants on access roads to project site	High	Contractor; SAPZ SPIU	9,000
DS	Decommissioning Phase	Interaction affecting Noise and Vibration	<u>Impact on Noise Emission Level</u> Increase in ambient noise levels and risk of ear impairment	• Ear protective device to be provided to workers; Install acoustic mufflers on large equipment where necessary to limit ambient noise levels	Medium	Contractor	6,500
DS	Decommissioning Phase	Interaction affecting Accident – Fire – Explosion Incidence	Risk of accident, fire, explosion and injury	✓ Contrator shall strictly implement and comply with the safety measures in the HSE Plan; ✓ Contractor employee should follow the safety procedures in the Contractor's Health and Safety Manual; Ensure appropriate PPEs are used during the Recce and Condition Surveys	High	Contractor	8,500



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
RR	Decommissioning Phase Restoration and Revegetation (Landscaping)	Interaction affecting Vegetation	<u>Impact on Vegetation (Positive)</u> Planting of trees/shrubs/groundcover increases canopy cover, stabilizes soil, increases vegetal cover, suppresses dust and mitigates soil erosion.	➤ Limit planting, where possible, to rainy-season to improve success, and use mulch 5–10 cm; stakes/guys only where needed; ➤ All riparian areas are still designated as no-go areas	Very High	Contractor; SAPZ SPIU	20,000
RR	Decommissioning Phase Restoration and Revegetation (Landscaping)	Interaction affecting Wildlife	<u>Impact on Wildlife</u> Loss of wildlife	(d) Clearing and stripping of the site to be carried out gradually and in phases to provide High opportunity for wildlife to migrate to unaffected areas; (e) Adjoining areas to be left uncleared to serve as a buffer zone. (f) Site clearing should be done in sequence so as to allow easy movement of escaping wildlife to adjoining uncleared forests.	Very High	Contractor; SAPZ SPIU	18,000
RR	Decommissioning Phase	Interaction affecting Topography	<u>Impact on Topography \ Landscape Disturbance (Positive)</u>	Kaduna SAPZ SPIU shall establish:	Very High	Contractor; SAPZ SPIU	25,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
	Restoration and Revegetation (Landscaping)	\Landscape Disturbance	Vegetated slopes stabilize cut/fill batters; root reinforcement reduces erosion; bioswales/raingardens reshape micro-topography to slow and filter runoff.	✓ Stabilization: geojute/coir + hydroseed on batters; edge control; install just before or during rainy-season window with protection. ✓ Watering plan with metered consumption; prioritize harvested or tanker supply during dry spells. ✓ Defect liability/establishment period of 12–24 months with mandatory replacements to maintain ≥85–90% survival.			
RR	Decommissioning Phase	Interaction affecting Aesthetics and Visual Aspect	<u>Impact on Aesthetics and Visual Aspect (Negative)</u> Demolition of the buildings and structures will have negative aesthetics and visual impact.	Contractor shall ✓ Pre-demolition structural survey and as-built utility mapping and determine the building and structures to be reserved for other uses and not to be demolished; ✓ Identify buildings and structures that can be converted to other uses and cleared from demolition.	Very High	Contractor; SAPZ SPIU	12,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
				✓ The demolition should be done in phases in an orderly and organized manner ✓ Hazardous materials survey & abatement plan (licensed contractors) ✓ Dust suppression (mist cannons), debris netting; noise windows ✓ Vibration monitoring for sensitive adjacent structures ✓ Contractor shall strictly implement and comply with the safety measures in the HSE Plan; ✓ Contractor employee should follow the safety procedures in the Contractor's Health and Safety Manual; Ensure appropriate PPEs are used during the Recce and Condition Surveys			
RR	Decommissioning Phase	Interaction affecting Micro Climate	<u>Micro Climate Impact of Site Restoration & Revegetation</u>	Design and Operations (Kaduna-specific recommendations)	Very High	Contractor; SAPZ SPIU	30,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
			<u>Microclimate (Kaduna SAPZ AIH)</u> Baseline microclimate context (Kaduna axis) • Tropical wet–dry (savanna): hot, dry season (dusty Harmattan NE winds), rainy season (SW monsoon), high insolation and strong diurnal heat swings. • Undulating terrain with exposed soils: high surface temperatures, dust resuspension, and rapid runoff where vegetation is sparse. Impacts ✓ Tree canopy and groundcover lower surface albedo contrasts and net	A. Canopy & Groundcover Targets • Aim for $\geq 20\text{--}30\%$ site canopy cover at maturity; continuous shade chains over walkways, bus/queue areas, and western façades/parking (PM sun). • Groundcover/mulch 5–10 cm to suppress dust and conserve moisture. B. Wind & Dust Management • Windbreaks perpendicular to NE Harmattan and to dominant SW monsoon where dust or wind-driven rain is problematic. • Keep shelterbelt porosity 40–50% (mix of trees + shrubs) to slow, not block, wind. C. Plant Palette (locally adapted examples) • Shade/structure: Vitellaria paradoxa (shea), Parkia biglobosa (African locust			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
			radiation absorbed by pavements/soils. ✓ Result: cooler ground and near-surface air (often 2–8 °C cooler at the surface in shade compared with full sun, depending on cover and materials). ✓ Lower ambient and surface temperatures in landscaped zones and along pedestrian routes/queues/parking. ✓ Lower dust levels and improved on-site comfort during the dry season and Harmattan. ✓ Reduced wind gusts in targeted areas (loading bays, pedestrian edges), while keeping ventilation corridors open. ✓ Shelterbelts/windbreaks (porosity ~40–50%)	bean), <i>Faidherbia albida</i>, <i>Albizia</i> spp., <i>Khaya senegalensis</i>. • Wind/dust edges: <i>Acacia</i> (<i>Senegalia/Vachellia</i>) spp., <i>Azadirachta indica</i> (neem) where locally accepted; manage for spread. • Shrubs/groundcovers: drought-tolerant natives; avoid known invasives. D. Green-Infrastructure Hydrology • Bioswales/raingardens sized for first flush; overflow weirs armored; connect to planted level spreaders. • Drip irrigation (construction/establishment phase) with metered use; no standing water.			



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Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
			reduce wind speed on the leeward side up to 10–15× tree height, cutting dust entrainment and improving outdoor comfort. ✓ Leaves and roughness elements capture PM/dust, reducing airborne particulates during construction and early operations. ✓ Root networks and mulched groundcover increase infiltration and soil moisture, moderating soil temperature swings and supporting ET cooling. ✓ etc				
SCWD	Decommissioning Phase	Interaction affecting	<u>Impact on Surface Water Quality</u>	Kaduna SAPZ SPIU and Contractor shall adopt:	Very High	Contractor; SAPZ	28,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
		Surface Water Quality	Loss of land cover and exposure of bare land surface resulting in: disturbed natural drainage, and introduction of contaminants into surface water pathways; increased sediment load and turbidity; Hydrocarbon and chemical contamination of surface water; Domestic wastewater and sewage pollution from temporary worker's camp; solid waste litter and runoff contamination of downstream water bodies	E) Erosion And Sediment Control Measures such as: ✓ Minimize exposed land surfaces by clearing vegetation in phases; avoid stripping the entire site at once.; ✓ Retain buffer vegetation along drainage corridors and low-lying areas R. Construct Temporary Drainage Controls: ✓ Install silt fences, sediment basins, and check dams downstream of disturbed areas. ✓ Construct temporary diversion ditches to channel runoff away from cleared slopes. S. Stabilize Exposed Soils: ✓ Apply mulching, grass seeding, or hydroseeding on completed sections. ✓ Stockpiles should be covered or surrounded by silt traps.		SPIU; KEPA	



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
				T. Schedule Earthworks in Dry Season to reduce erosion risk. U. Pollution Prevention for Fuel and Chemicals ✓ Designate bunded, impervious refueling and storage areas at least 50 m from watercourses. ✓ Keep spill response kits (absorbents, sand, drums) at all fuel handling points. ✓ Train workers in spill response and waste oil management. ✓ Collect used oil and lubricants for disposal through licensed waste handlers.			
SCWD	Decommissioning Phase	Interaction affecting Groundwater Quality	<u>Impact on Groundwater Quality</u>	Contractor should develop and implement its: • Spill Prevention and Containment Plan, and Hazardous Material Control Procedure to address the	High	Contractor; SAPZ SPIU; KEPA	22,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
				prevention and containment of oil spills, chemical and hazardous materials releases during the construction works; • Maintain construction machinery, vehicles and equipment in good working condition to prevent oil and fuel leaks during operation • Any oil or chemical spill should be reported to the Contractor's Supervising Engineer; the Kaduna SAPZ SPIU and the KEPA In Addition, Kaduna SAPZ SPIU and the Contractor shall ensure: A. Pollution Prevention from Fuel and Oil ✓ Designate impervious, bunded fuel storage and refueling areas located ≥ 50 m away from boreholes, wells, or drainage lines.			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
				✓ Use drip trays and absorbent pads under stationary machinery and parked vehicles. ✓ Provide spill kits and emergency response training for all equipment operators. ✓ Collect and dispose of used oil, filters, and oily rags through licensed waste management contractors. Maintain an inventory and inspection record of all fuel storage tanks and drums.			
SCWD	Decommissioning Phase	Interaction affecting Soil Quality	<u>Impact on Soil Quality</u> Accidental release of oil, hazardous materials and chemicals on ground and potential	Contractor should develop and implement its: • Spill Prevention and Containment Plan, and Hazardous Material Control Procedure to address the prevention and containment of oil spills, chemical and hazardous materials releases during the construction works; • Maintain construction machinery, vehicles and equipment in good working	High	Contractor; SAPZ SPIU; KEPA	18,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
				condition to prevent oil and fuel leaks during operation Any oil or chemical spill should be reported to Contractor's Supervising Engineer; the Kaduna SAPZ SPIU, and the KEPA			
SCWD	Decommissioning Phase	Interaction affecting Air Quality	<u>Impact on Ambient Air Quality</u> Ambient air quality deterioration from fugitive dust releases and equipment / automobiles exhaust emissions	Contractor shall: • use equipment with high combustion efficiency • regularly service equipment and heavy machineries used on site; • PREMOB equipment and automobiles before usage; Use dust suppressants on access roads to project site	High	Contractor; SAPZ SPIU	10,500
SCWD	Decommissioning Phase	Interaction affecting Pollution Related Health Effects	<u>Pollution Related Health Effects:</u> Health risks from inhalation of dust/PM, fumes, VOCs, H ₂ S, NH ₃ , NO _x /SO ₂ /CO); dermal contact with oils, solvents, leachate; and ingestion (hand-to-mouth ingestion of	Mitigation & controls (hierarchy-based) A. Elimination / Substitution • No open burning under any circumstance. • Prefer low-VOC materials, water-based paints/cleaners; choose low-sulfur fuel where available.	High	Contractor; SAPZ SPIU; Ministry of Health	40,000



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
			contaminated food/water); and accidental blood contact with used injection (sharps needles) In solid waste streams	• Outsource special/hazardous waste to licensed facilities (no on-site treatment that generates harmful emissions). • Stormwater segregation (clean vs. contaminated); oil–water separators. • Fire & gas safety: fire-rated chemical stores; intrinsically safe equipment where needed; fixed gas detectors (H₂S/CH₄/CO) at risk locations; earthing/bonding for flammables. • Sharps & biohazards: puncture-proof containers; sealed, color-coded bins. • SOPs for: waste acceptance, loading/unloading, spill response, confined-space			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
				entry, hot work permit-to-work, sharps handling, and odor incident response. • Waste handling schedule to avoid accumulation; routing & timing to minimize community exposure (avoid school peak hours). • Community buffer & communication: fence-line green belt; prior notices for unusual odor/traffic events; grievance redress mechanism with response SLAs. • Training: induction + task-specific refreshers (spill/H₂S awareness/first aid/fire). • Medical fitness & restrictions for high-exposure tasks (e.g.,			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
				pregnancy, severe asthma). • Contractor controls: EHS clauses, audits, KPIs, right-to-stop-work. • Provide PPE (last line, but mandatory where relevant) • Respiratory protection: fit-tested particulate respirators for dust and appropriate cartridges for VOCs/H₂S where engineering controls can't fully contain. • Dermal/eye protection: Provide chemical-resistant gloves, coveralls, goggles/face shields for splashes; steel-toe, slip-resistant boots. • Hygiene: hand-wash stations, no eating/drinking in handling areas, dedicated			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
				lockers & laundry for workwear. 5) Monitoring, surveillance & assurance Ambient & workplace air: periodic PM₁₀/PM_{2.5}, VOCs (as TVOC or targeted), H₂S at odor hotspots, CO/NO_x near generators; fence-line odor checks and complaint log review. Instrument checks: calibration records for gas detectors; stack/vent performance where applicable. Health surveillance: pre-placement + periodic respiratory symptom review; skin checks for frequent wet/chemical work; biological monitoring only if			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
				specific chemicals warrant. • Incident KPIs: TRIR, near-misses, spill numbers/volumes, sharps injuries, odor complaints response time (TTR). • Audits: monthly EHS walkthroughs; annual external compliance audits. 6) Emergency preparedness • Spill response kits (pads, booms, neutralizers); roles & call tree posted. • Fire safety: extinguishers sized by hazard class; hydrants where required; drills (semi-annual). • Gas/H₂S protocol: alarm setpoints, muster points, evacuation routes, rescue plan; portable meters for entry.			



Impact ID	Impact Category (Phase)	Project Activity	Project Impact	Mitigation Measures	Impact Significance	Responsible Party	Est. Cost (USD)
				First aid: trained first-aiders, eyewash/showers at chemical/acid/alkali use points; post-exposure protocols. Traffic incidents: recovery plan, coordination with local authorities/clinics along routes.			

Project Phase	Estimated Cost (USD)
Pre-Construction	2,575,000
Construction	73,333
Operation	1,678,000
Decommissioning	438,500
Total Estimated ESMP Cost	4,764,833



Conclusion

Mitigation measures have been developed to address the full range of environmental, social, and health impacts identified in Chapter 5. These strategies are aligned with the AfDB Operational Safeguards consisting of: OS 1 (Assessment and Management of Environmental and Social Risks and Impacts); OS 2 (Labour and Working Condition); OS 3 (Resources Efficiency and Pollution, Prevention and Management); OS 4 (Community Health, Safety, and Security); OS 5 (Land Acquisition, Restrictions on Access to Land and Land Use, and Involuntary Resettlement); OS 6 (Habitat and Biodiversity Conservation, and Sustainable Management of Living Natural Resources); OS 7 (Vulnerable Groups); and OS 10 (Stakeholder Engagement and Information Disclosure) respectively.



CHAPTER SEVEN: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

7.1 Introduction

This chapter presents the Environmental and Social Management Plan (ESMP) developed for the SAPZ Agro-Industrial Hub project. The ESMP provides a framework for identifying, mitigating, monitoring, and managing potential environmental, social, and health impacts during the pre-construction, construction, operation, and decommissioning phases of the project. This ESMP integrates and fully align the AfDB's Operational Safeguards (OS) requirements and Nigerian regulatory provisions.

7.2 Scope of the ESMP

The ESMP covers the provisions for the implementation and compliance with the mitigation and safeguard measures recommended for the amelioration of the environmental social, health and safety impacts of the SAPZ AIH project from the pre-construction, through the construction, operation, and decommissioning phases. It identifies mitigation measures, monitoring indicators, cost requirements, and institutional responsibilities to ensure compliance with AfDB's Operational Safeguards (OS1, OS2, OS3, OS4, OS5, OS6, OS7, and OS10) applicable to SAPZ projects in general, with specific focus on the Agro-Industrial Hub (AIH) development project at, Km26, Abuja-Kaduna-Zaria Expressway, Daki-Takwas, Chikun LGA, Kaduna State.

7.3 Objectives of the ESMP

The main objectives of the ESMP are to provide a structured framework for implementation and compliance with all recommended impact mitigation measures identified in the ESIA to avoid, mitigate, or offset the adverse environmental and social impacts, The ESMP is designed to achieve the following specific objectives:

- Ensure environmental and social impacts / risks identified in the ESIA Report are implemented and complied with throughout the project lifecycle;
- Provide a framework for ESMP implementation and compliance monitoring and reporting especially during the construction phase of the SAPZ AIH project;



- Strengthen institutional capacity for ESMP implementation.
- Ensure compliance with national legislation, the National Investment HSE Policy and AfDB Environmental and Social Guidelines to achieve the highest environmental protection standards.
 Ensure contractors comply with safeguard requirements.
- Support sustainable and inclusive project delivery.
- Maintain high standards in working conditions throughout the project lifecycle and, ensure health, safety, and well-being of both the construction workers and the resident communities;
- Clearly define the roles and responsibilities of contractors.
- Establish a robust monitoring and supervision framework for SPIU to oversee contractors' performance;
- Provide contractors with the necessary support to effectively implement the project impact mitigation measures.
- Establish a monitoring program to track the effectiveness of impact / risk mitigation measures implementation, and ensure ongoing compliance with environmental and social standards

7.4 Responsibilities and Accountability

ESMP implementation is the exclusive responsibility of the Construction Contractor. The Contractor must act to ensure that a high level of ESHS performance and impact mitigation measure compliance is achieved during the pre-construction and construction phases of the project. However, there are other stakeholders with explicit roles and responsibilities and accountability requirements in the ESMP implementation process. Table 7.1 shows the relevant stakeholders in the ESMP implementation, their roles and responsibilities.



Table 7.1 Stakeholders' roles and responsibilities

S/No	Stakeholder Category	Roles & Responsibilities
	Federal Ministry of Environment (FMEnv)	* Lead role in screening, scoping, and review of ESMP reports (in collaboration with Kaduna State Ministry of Environment and KEPA). * Receive stakeholder comments and oversee public disclosure and hearing. * Undertake social liability investigations and M&E.
	Kaduna State Agricultural Development Agency (KADA) / SPIU (Kaduna State)	* Oversee compliance of contractors and service providers with ESMP requirements. * Monitor environmental and social performance across project lifecycle. * Coordinate with regulatory bodies and provide periodic updates to the Steering Committee.
	Kaduna State Ministry of Agriculture (KSMA)	* Provide overall project oversight for SAPZ investments in alignment with state agricultural policies. * Ensure investor and contractor compliance with environmental safeguards through coordination with FMEnv and FMAFS.
	Federal Ministry of Agriculture and Food Security (FMAFS)	* Provide strategic direction and policy guidance to SAPZ implementation. * Support ESMP compliance through its Safeguard Desk and coordinate with FMEnv and SPIU.
	Kaduna State Ministry of Environment (KSME)	* Conduct environmental monitoring and due diligence at the state level. * Review and monitor ESMP and subproject compliance within its jurisdiction.
	Kaduna State Environmental Protection Authority (KEPA)	* Lead environmental audits and site inspections to ensure compliance with ESMP provisions. * Collaborate with KSME and FMEnv on enforcement and pollution control mechanisms.
	SPIU Safeguard Unit (Environmental & Social)	* Environmental Safeguards: Collect environmental baseline data, screen activities, liaise with stakeholders, and monitor mitigation effectiveness. * Social Safeguards: Implement livelihood restoration plans, conduct stakeholder consultations, oversee GRM effectiveness, and manage community engagement.
	Other Relevant MDAs (e.g., Ministry of Women Affairs & Social Development, Ministry of Health)	* Monitor gender-related safeguards, community health, and labor risks. * Liaise with CSOs, CBOs, and NGOs for implementation support.



S/No	Stakeholder Category	Roles & Responsibilities
	Environmental and Social Consultant	* Prepare and update the ESMP and related instruments (e.g., C-ESMP, RAP, LRP, SEP). * Conduct trainings for contractors, SPIU, and regulators on safeguard requirements. * Monitor safeguard performance and report to SPIU and AfDB.
	Contractors & Subcontractors	* Integrate ESMP into construction activities through C-ESMP. * Train workers on OHS, Code of Conduct, and safeguard compliance. * Provide and enforce PPE use; prepare OHS Manual. * Maintain records and submit ESHS performance data.
	Chikun LGA (Local Government Authority)	* Provide local oversight of ESMP implementation in Daki-Takwas. * Support sanitation, waste control, and public health enforcement. * Participate in grievance redress and awareness creation.
	Daki - Takwas Host Community (including Traditional Institutions)	* Participate in stakeholder consultations and feedback sessions. * Promote environmental and social awareness. * Review reports and provide local insight on risks or concerns. * Actively engage in the grievance redress process.
	NGOs / CSOs / CBOs	* Support public awareness campaigns and community monitoring. * Collaborate with government and SPIU to ensure inclusive engagement. * Conduct research and propose adaptive measures for improved ESMP performance.
	African Development Bank (AfDB)	* Conduct safeguard compliance reviews and implementation support missions. * Provide technical support and capacity building to SPIU and implementing partners. * Enforce adherence to AfDB Operational Safeguards (OS 1–10).
	General Public	* Support implementation through local knowledge and participation. * Report violations or incidents and contribute to grievance redress. * Participate in awareness campaigns and project consultations.



7.5 Institutional Capacities

7.5.1 *Kaduna State Programme Implementation Unit (SPIU)*

The State Programme Implementation Unit (SPIU) for the SAPZ project in Kaduna State was established by the Kaduna State Government (KDSG) in collaboration with the African Development Bank (AfDB) to oversee and coordinate the implementation of the Special Agro-Industrial Processing Zone (SAPZ) programme. The Project Coordinator is the head and coordinator of the SPIU. The SPIU is made up of a team of technical experts which include, Environmental and Social Safeguards Officers, Procurement Specialists, M&E Officers, and Liaison Officers seconded from relevant Ministries, Departments, and Agencies (MDAs) such as the Kaduna State Ministry of Agriculture, Ministry of Environment, and KEPA.

The primary responsibilities of the Kaduna SPIU include:

- Strategic planning and execution of project components;
- Preparation of bidding and contract documents;
- Procurement and supervision of contractors and project management consultants;
- Integration of environmental and social safeguard requirements into all project phases, including the Environmental and Social Management Plan (ESMP), Livelihood Restoration Plan (LRP), and Resettlement Action Plan (RAP);
- Monitoring of contractors' compliance and performance reporting to AfDB and FMEnv.
- Strengthen the safeguard compliance and ensure effective implementation of mitigation measures, the SPIU has established an internal Environmental and Social (E&S) Unit. This unit is tasked with:
 - Oversee the day-to-day implementation of the ESMP and RAP/LRP;
 - Manage stakeholder engagement, grievance redress, and compensation disbursement;
 - Ensure safeguard documentation aligns with the final detailed engineering design and that all environmental measures and technical specifications are embedded in the bidding documents and contractor obligations.



- Enhance technical capacity and impartiality, the SPIU may engage independent Environmental and Social Consultants to provide external support, conduct audits, and offer advisory services. In addition, relevant local NGOs or CBOs may be contracted to monitor RAP/LRP implementation, support community engagement, and ensure transparency in social safeguard delivery.

7.5.2 Contractual Management:

ESMP implementation and achievement of high level of ESHS performance and impact mitigation measure compliance are mandatory. Thus. This requirement must be incorporated and integrated in the contract document to be signed by the Contractor at the commencement of the pre-construction phase. In alignment with this requirement

- Contractors are required to integrate all applicable environmental, social, health, and safety (ESHS) measures into their Construction-ESMP (C-ESMP) submissions and work plans;
- The SPIU will ensure that bidding documents and contract agreements contain enforceable clauses mandating compliance with the ESMP, RAP, and AfDB OS standards;
- The contractors and subcontractors shall be trained on their ESHS obligations and will be monitored regularly for compliance;
- Non-compliance or negligence in safeguard implementation may attract sanctions or contract suspension, in line with the SPIU's Environmental and Social Management Framework.

7.5.3 Contractual Obligations for ESMP Compliance

The Construction Contractor is solely responsible for the implementation of the ESMP especially during the pre-construction and the construction phases of the SAPZ AIH project. The Contractor shall be fully responsible to ensure full compliance with all the ESMP impact mitigation measures and be accountable to prepare and submit weekly and monthly ESMP implementation report to the SPIU. Therefore, contractors will need to incorporate these measures into their proposals as outlined in Table 7.2.

Table 7.2 Contractual Obligations for ESMP Compliance

S/Mo	Action	Remarks
	The Contractor shall include all the impact mitigation measures outlined in this ESMP in the Tender Document with commitment to adjust to w=site-specific circumstances	Non-inclusion of these measures in the proposal will result in disqualification of the proponent



	The contract with the successful bidder should incorporate these environmental and social management measures as firm conditions. These measures should be detailed in environmental specifications that align with the language and format of the rest of the contract document.	This approach ensures that environmental and social controls are integrated seamlessly into the tender document and presented in a familiar format to the Contractor
	The cost of implementing mitigation measures must be included in the overall cost of the contractual document.	Contractors must account for and incorporate the costs associated with environmental and social requirements specified in the ESMP.
	Contractor ESMP (C-ESMP)	The contractor is required to prepare a Contractor ESMP (CESMP) detailing how they will implement the ESMP measures onsite.

7.5.4 Organizational Capacity and Competency:

Contractors must demonstrate adequate HSE staffing, monitoring skills, and compliance experience. The implementation of the Agro-Industrial Hub (AIH) project ESMP at Km26, Abuja-Kaduna-Zaria Expressway, at Daki-Takwas, Chikun LGA, Kaduna State. requires a well-trained institutional framework with sound organizational capacity and competence. It is imperative that the Kaduna State SAPZ State Project Implementation Unit (SPIU) and its supporting institutions have the required capacity and further develop the required competence, either through formal education, prior experience, or targeted on the job professional training.

Engagement with the Kaduna Investment Promotion Agency (KADIPA), Kaduna State Environmental Protection Authority (KEPA), and relevant Ministries (e.g., Environment; Agriculture; Women and Social Development) revealed the absence of dedicated Environmental and Social (E&S) safeguard staff. In effort to correct this E&S safeguard capacity, the following actions are recommended for prompt implementation:

- Recruitment of 3–4 competent E&S Safeguard Officers (Environmental and Social) under the SPIU to specifically oversee ESMP and RAP implementation.
- Alternatively, secondment of qualified staff from relevant state institutions (such as KEPA, Ministry of Environment, Ministry of Women Affairs and Social Development) who will be formally trained and capacitated to execute these responsibilities in alignment with AfDB ISS (2023) and FMEnv guidelines.



An initial capacity assessment indicated that key stakeholders and implementing institutions currently lack full familiarity with the AfDB's Integrated Safeguard System (ISS), as well as critical ESMP areas, such as:

- Gender-based violence (GBV) prevention, including Sexual Exploitation and Abuse (SEA)
- Labour influx management
- Grievance Redress Mechanism (GRM)
- Climate risk integration and resilience measures
- Stakeholder engagement and community consultations

To bridge this knowledge and capacity gap, a structured training programme (Table 7.3) is recommended for implementation as part of the project's capacity development strategy. This will include:

- Orientation workshops on AfDB ISS and ESMP principles;
- Practical sessions on RAP implementation, GRM operation, and community engagement;
- Refresher training at key project milestones (e.g., pre-construction, mid-term, and post-construction).

This capacity-building plan is critical to ensure ESMP impact mitigation implementation compliance, project environmental and social sustainability, and community trust in the environmental and social performance of the SAPZ AIH development project.



Table 7.3 Capacity Building Plan for E&S Competency Development

Module ID	Capacity Building Activity	Proposed Topics	Objectives	Target Audience	Duration	Estimated Budget (NGN)
Module 1	AfDB ISS and Nigerian Environmental Regulatory Framework	* Overview of national environmental and social laws (e.g., FMEnv, NESREA, KEPA) * AfDB's Integrated Safeguards System (ISS) * Operational Safeguards (OS) triggered by SAPZ activities * Roles of implementing agencies and AfDB during project execution	To enhance understanding of AfDB safeguards and applicable national laws among project implementers	SPIU, KADIPA, KADSWA C, KEPA, MoE, MoA, contractors, NESREA, Local Government Officers, project GRM committee, and E&S/OHS officers	1 Day	3,500,000.00
Module 2	Training on ESMP Implementation	* Introduction to the project-specific ESMP * Anticipated environmental and social impacts * Pollution prevention, mitigation measures- Labour influx, GBV, Code of Conduct * Environmental monitoring and compliance reporting	To strengthen institutional capacity for implementing mitigation measures and monitoring compliance	Same as above	1 Day	3,500,000.00
Module 3	Climate-Smart Agriculture and	* Climate change impacts on agriculture- Climate	To integrate resilience and sustainability	Same as above, with particular	1 Day	3,500,000.00



Module ID	Capacity Building Activity	Proposed Topics	Objectives	Target Audience	Duration	Estimated Budget (NGN)
	Environmental Resilience	* smart crop production strategies * Building enabling environment for climate adaptation in farming systems	principles into agricultural practices	emphasis on Ministry of Agriculture, LGA Agric officers, and farmer cooperative representatives		
Module 4	Waste Management in Agro-industrial Zones	* Agricultural and agro-processing waste types * Modern waste management: composting, recycling, biogas production * Circular economy principles in agro-waste	To promote environmentally sustainable waste management practices within the agro-processing facility	Same as above, with addition of AIH operators, facility engineers, and community waste management cooperatives	1 Day	3,000,000.00
Module 5	Occupational Health, Safety, and Environmental (HSE) Management	* Construction and operational HSE hazards * Risk assessment and mitigation-Emergency preparedness and response * Site safety inspections, use of PPE, incident reporting	To ensure zero harm and compliance with health and safety standards during all project phases	Contractors, project engineers, safety officers, supervisors, SPIU and monitoring teams	1 Day	3,000,000.00



Module ID	Capacity Building Activity	Proposed Topics	Objectives	Target Audience	Duration	Estimated Budget (NGN)
		* Defensive driving and first aid				
GRAND TOTAL						16,500,000.00

Total Estimated Budget (NGN): Sixteen Thousand Five Hundred Naira Only (₦16,500,000.00) .

7.6 Management Plans

This ESMP has 13 thematic management plans integrated within it. Each management plan describes risks, mitigation measures, compliance checklists, strategies and procedures designed to ensure compliance with specific environmental and social safeguard requirements of the project. They outline the processes required for carrying out necessary activities and are integral to managing the environmental and social impacts identified in the ESIA report.

7.6.1 Occupational Health and Safety Management Plan (OHSP)

The Kaduna SAPZ State Project Implementation Unit (SPIU), Kaduna Environmental Protection Authority (KEPA) and relevant state institutions, are responsibility for ensuring that a comprehensive Occupational Health and Safety Plan (OHSP) is developed, implemented, and monitored throughout all phases of the SAPZ AIH project—from pre-construction through commissioning. The OHSP shall comply with: AfDB Operational Safeguard 5 (OS5); Labour Conditions, Health and Safety; National and Kaduna State OHS regulatory frameworks; International Best Practices and ILO standards, The Construction Contractors shall be directly responsible for the on-site daily implementation of the OHSP. The OHS Manager and the Environmental and Social (E&S) Safeguards Unit shall oversee the plan's adherence and integration with the project's broader ESMP. The SPIU-appointed OHS Manager will coordinate the preparation, periodic review, and implementation monitoring of the safety program.

The management measures to safeguard workers' health and safety on the SAPZ AIH project site include:

- Provision of appropriate Personal Protective Equipment (PPE) and mandatory usage.
- Ensuring access to potable water for all workers on-site.



- Provision of immunization services based on health risk assessments (e.g., tetanus, hepatitis).
- Designated hygienic eating areas with proper sanitation.
- Establishment of well-equipped First Aid stations with trained and present First Aiders.
- Maintenance of high hygiene standards in work areas, restrooms, and facilities.
- Safe and environmentally-sound disposal systems for all sanitary and hazardous waste.
- Installation of clearly marked safety signs across project sites and facilities.
- Implementation of fire prevention and emergency response training, including fire extinguishers and fire exits.
- Display of emergency contact numbers and evacuation routes in strategic locations.

Roles and Responsibilities

The OHS Manager shall:

- Develop the detailed site-specific OHSP
- Conduct regular safety trainings and toolbox talks
- Perform routine safety audits and inspections
- Oversee storage and handling of hazardous substances
- Investigate all incidents and near misses, ensuring corrective action
- Coordinate fire drills and emergency simulations

A Safety Committee shall be established comprising representatives from the:

- ✓ Kaduna SAPZ SPIU
- ✓ Kaduna State Ministry of Environment
- ✓ KEPA
- ✓ Local Government Health Office
- ✓ Contractor and workers' representatives

The committee shall meet regularly to assess and improve site safety performance and compliance with OHS standards.



7.6.1.1 Estimated Budget for Implementing OHS Mitigations

Table 7.4 presents the updated estimated cost of implementing key Occupational Health and Safety (OHS) mitigation strategies for the first year of the project. This excludes costs related to ongoing monitoring programmes, personnel remuneration, and contractor-embedded items, which are detailed separately in Section 7.9 of the ESIA.

Table 7.4 Estimated Cost of Implementing OHS Management Plan (2025 Values)

OHS Mitigation Strategy	Estimated Cost (NGN)
Provision of safety devices, first aid kits, fire extinguishers, and safety signage	<i>Captured in Contractors' Cost</i>
Training and awareness programmes for site staff and supervisors (including fire drills, hazard awareness, safe handling procedures)	₦6,500,000.00
Immunisation services (e.g., Hepatitis B, tetanus, COVID-19 boosters)	₦3,500,000.00
Hygiene and sanitation maintenance (handwashing stations, disinfection, waste management for hygiene areas)	₦1,800,000.00
Personal Protective Equipment (PPE) (helmets, gloves, masks, boots, goggles, vests)	<i>Captured in Contractors' Cost</i>
Total Estimated Cost (Year 1)	₦11,800,000.00

Note: These figures reflect prevailing market prices as of mid-2025 and may be subject to periodic review based on inflation trends, procurement volumes, and updated safety requirements during implementation.

7.6.2 Development of an Emergency Preparedness and Response Plan (EPRP)

Responsibility

The Kaduna SAPZ State Project Implementation Unit (SPIU), in collaboration with the Kaduna Investment Promotion Agency (KADIPA) and the Kaduna Emergency Management Agency (KADSEMA), will be responsible for the development, coordination, and oversight of the Emergency Preparedness and Response Plan (EPRP) for the AIH at Daki – Takwas, Chikun LGA. The contractor(s) and site operators will be responsible for implementing the EPRP on-site, while the appointed Occupational Health and Safety (OHS) Manager will monitor compliance. The



Supervising Engineer will provide technical guidance, particularly in the design and installation of alarm systems, emergency signage, and evacuation protocols.

Management Measures

The EPRP will incorporate the following strategic components:

- Clearly defined roles for emergency personnel, including site managers, emergency coordinators, and response teams.
- Communication protocols and coordination procedures with local emergency services (e.g., Fire Service, NSCDC, Primary Healthcare Centers, Local Police, and KADSEMA).
- Scenario-specific emergency procedures, such as those for chemical spills, fire outbreaks, gas leaks, medical emergencies, equipment failure, and extreme weather events.
- Installation of emergency alarms and alert systems that are audible throughout the facility, especially near fuel depots, substations, and processing lines.
- Comprehensive evacuation plan with clearly mapped escape routes, assembly points, and post-evacuation accounting procedures.
- Inventory and maintenance schedule of all emergency response equipment, including stretchers, fire extinguishers, spill kits, oxygen masks, and megaphones.
- Training and capacity building programmes, including regular emergency drills, fire safety training, first aid simulations, and rescue operations tailored to local and site-specific hazards.

During emergencies, all on-site personnel will be promptly alerted via alarm systems and/or public address systems. The OHS Manager will lead evacuation coordination, and community liaison protocols will be activated to notify surrounding settlements (e.g., Ungwan Sarki, Daki-Takwas). For slow-onset hazards or early warning indicators, the SPIU, contractor, KADSEMA, and relevant stakeholders (e.g., KEPA, LGA Health and Works Departments) will convene to initiate preventive actions.

The SPIU will also be responsible for maintaining an up-to-date EPRP and logistical readiness through the availability of emergency supplies and scheduled reviews.



Evacuation Procedures

- Immediately mobilize emergency response teams.
- Activate alarms, sirens, loudspeakers, or mobile notification systems.
- Issue clear and concise instructions, e.g., “We have a fire emergency. Evacuate to the main assembly point near the northern gate.”
- Where feasible, safely shut down equipment prior to evacuation.
- Ensure full headcounts at designated assembly areas.
- Instruct personnel to remain in place until an all-clear signal is given or further instruction provided.

The EPRP will include detailed fire safety protocols, including:

- Fire containment strategies, use of extinguishers, hydrants, and water curtains;
- Explosion response measures, including shockwave safety zones and PPE protocols;
- Coordination with local fire services and KADSEMA for post-incident response.

The EPRP will be reviewed annually or following any incident, and updates will be made to reflect new risks, technologies, or operational changes at the AIH.

7.6.3 Estimated Budget for Implementing Emergency Preparedness and Response Plan (EPRP) Mitigations

Table 7.5 presents the estimated cost for implementing the identified Emergency Preparedness and Response Plan (EPRP) mitigations for the first year of the AIH SAPZ project at Daki– Takwas. The cost excludes monitoring programs and staff remunerations, which are addressed under Section 7.9 of this report. The values reflect current (2025) market realities in Northern Nigeria, particularly for safety-critical infrastructure and logistics.

**Table 7.5 Estimated Cost of Implementing Emergency Preparedness and Response Plan (EPRP)**

EPRP Mitigation Strategy	Cost Estimate (NGN)
Salaries for ERP development team, OHS Manager, engineers, and site operators	<i>Captured in Staff Remuneration</i>
Expenses for emergency response drills, training sessions, and educational materials	3,500,000.00
Procurement and installation of emergency alarms, communication tools, and evacuation kits	<i>Captured under OHS Management Plan Budget</i>
Regular updates, servicing, and replacement of emergency equipment and communication systems	2,000,000.00
Total Estimated Cost	5,500,000.00

***Note:** The implementation of the EPRP is critical to mitigating site-specific occupational and environmental risks such as fire, chemical spills, and natural disasters. The costs above ensure adequate training, preparedness infrastructure, and response capability to meet AfDB OS5/OS1 and FMEnv/KEPA emergency planning requirements.*

7.6.4 Contractor Management

For the AIH SAPZ project in Daki–Takwas, the Kaduna State SAPZ Project Implementation Unit (SPIU) and the Kaduna State Ministry of Agriculture (KDMA), as project proponents, bear full responsibility for ensuring that all engaged contractors comply with applicable Environmental, Social, Health, and Safety (ESHS) obligations throughout the project lifecycle. The project’s Occupational Health and Safety (OHS) Manager and Environmental & Social Safeguards (E&S) Unit shall supervise contractor compliance and monitor adherence to all relevant provisions, including national regulations and AfDB safeguard policies.

All contractors are obligated to implement required risk mitigation measures in line with the Environmental and Social Management Plan (ESMP) and to maintain continuous compliance with standards and protocols outlined in project documents. The SPIU shall conduct periodic inspections and audits to verify compliance, address gaps, and enforce corrective actions where needed.



Management Measures

To ensure effective contractor performance in relation to OHS and EPRP standards, the SPIU will institute a Contractor Environmental and Social Management Framework (CESMF), containing the following key requirements:

- **Establishment of EHSMS:** All contractors must develop and maintain a robust Environmental, Health, and Safety Management System (EHSMS) that aligns with AfDB Operational Safeguard 5 (Labour Conditions and OHS). The EHSMS must include:
 - Task-based and site-specific risk assessments
 - Emergency preparedness and response protocols
 - Measures for hazard prevention and mitigation
 - Procedures for ongoing ESHS monitoring, reporting, and performance review
- **Adherence to ESHS Requirements:** Contractors are mandated to comply with ESHS specifications provided in the C-ESMP, including:
 - Proper handling, storage, and disposal of hazardous materials
 - Solid and liquid waste management procedures
 - Noise, air quality, and vibration control
 - Spill and accident prevention and response

These requirements must comply with:

- Nigerian environmental, labor, and safety laws (e.g., FMEnv guidelines, Labour Act, Factories Act)
- International Good Industry Practice (e.g., IFC EHS Guidelines)
- **Training and Capacity Building:** Contractors must ensure that all personnel receive comprehensive training on ESHS matters. This includes:
 - Induction and refresher courses on PPE usage
 - Fire safety and first aid procedures
 - Incident reporting and communication systems
 - Waste segregation and disposal methods

The SPIU and supervising consultants will monitor the effectiveness of these programs through field verifications and feedback mechanisms.



- **ESHS Record-Keeping:** Contractors are required to maintain proper documentation of:
 - Safety drills and incident reports
 - Training records and attendance
 - Environmental monitoring data (e.g., air, noise, soil)
 - Waste manifests and disposal receipts

These records must be submitted monthly to the SPIU for review and will form part of the project's safeguard compliance reporting.

- **Regular Audits and Inspections:** The SPIU, with support from the Environmental and Social Consultant, will carry out unannounced and scheduled audits of contractor activities. Observed non-compliance will attract sanctions, including warnings, suspension of work, or financial penalties, in accordance with contract terms.

Note: These contractor management measures are critical to ensuring that the ATC SAPZ project does not create or exacerbate occupational hazards, environmental degradation, or social risks. They reflect the project's commitment to sustainable development and compliance with the African Development Bank's ISS, Nigerian laws, and Kaduna State environmental and labor standards.

7.6.4.1 Estimated Budget for Implementing Contract Management Mitigations

Table 7.6 presents the revised estimated cost for implementing the identified Contract Management mitigation strategies in the first year. The budget reflects current market realities and includes provisions for effective contractor training and addressing non-compliance. Costs related to ongoing monitoring and staff remuneration remain captured under Section 7.9 of the report.

Table 7.6 Estimated Cost of Implementing Contract Management Mitigations

Contract Management Mitigation Strategy	Cost Estimate (NGN)
Training sessions for contractors on ESHS standards and procedures	Captured in Organisational Capacity and Competency
Expenses related to addressing non-compliance issues	Captured in Contractor's Cost
Total	₦0.00

Source: SAPZ AIH Daki-Takwas ESIA (2025)



7.6.5 Noise Management Plan

Table 7.7 Noise management activity, responsibility and costs

Noise Management Activity	Responsibility	Cost Estimate (NGN)
Equipment and machinery noise mitigation (maintenance, silencers, etc.)	Contractor	Captured in Contractor's Cost
Site planning (barriers, traffic scheduling, time restrictions)	Contractor / Engineer	Captured in Contractor's Cost
Community engagement (consultation and notification)	SAPZ SPIU / E&S Safeguard Unit	Captured in Organizational Capacity and Competency
Noise monitoring and compliance enforcement	E&S Safeguard Unit / Engineer	Captured in Monitoring and Reporting
Provision of PPE and installation of warning signs	Contractor / E&S Safeguard Unit	Captured in OHS Management

Narrative Summary

The SAPZ SPIU and Kaduna State Ministry of Agriculture, as project owners, will retain overall responsibility for effective noise management throughout all project phases. During construction and operations, the contractor and facility operators will be primarily responsible for executing noise control measures. The Environmental and Social (E&S) Safeguard Unit will oversee compliance monitoring, while the project engineer will ensure technical integration of noise mitigation in design and planning.

All noise-related expenditures, including contractor-driven mitigations, PPE, monitoring, and community liaison efforts, are embedded within the broader cost categories of the ESMP — such as Contractor's Cost, Organizational Capacity and Competency, and Monitoring and Reporting, per the integrated budget framework.

Noise Management Plan

The SAPZ State Project Implementation Unit (SPIU) and Kaduna State Agricultural Development Agency (KADA) as project owners will assume overall responsibility for ensuring effective noise management throughout the project life cycle. During the construction and operational phases, the contractor and facility operators will be responsible for the implementation and execution of noise control measures. The Environmental and Social (E&S) Safeguard Unit will oversee monitoring



and ensure compliance with the noise management plan, while the supervising engineer will provide technical oversight and ensure that noise mitigation measures are integrated into project planning and design.

Management Measures

Mitigation measures to be enforced during construction to minimize noise levels include:

- **Equipment and Machinery Management:**
 - Select inherently quiet equipment to reduce noise at the source.
 - Ensure that all mechanical equipment is properly maintained and efficiently operated.
 - Minimize equipment speed to reduce noise output.
 - Shut down or throttle intermittent-use equipment during non-operational periods.
 - Utilize and maintain silencers/mufflers to control vibration and noise on construction equipment.
- **Site Logistics and Planning:**
 - Use material stockpiles, barriers, and structures as noise buffers where feasible.
 - Restrict site access for truck traffic outside regular working hours to minimize disturbance.
 - Limit noisy work to morning hours and avoid extended periods of high-noise activities.
 - Employ acoustic insulation, noise source isolation, and other engineering controls.
- **Community Engagement:**
 - Conduct consultations with affected communities to inform them of upcoming noisy activities and address concerns.
 - Issue timely notifications before the commencement of significant noise-generating operations.
- **Noise Monitoring and Compliance:**
 - Implement regular noise monitoring to ensure adherence to set noise thresholds.
 - Place visible warning signs in high-noise areas.
 - Enforce hearing protection when:



- Equivalent sound level over 8 hours reaches 85 dB(A),
- Peak sound level hits 140 dB(C),
- Or average maximum sound level exceeds 110 dB(A).

Compliance and Enforcement

Noise control measures will be embedded in all construction contracts as mandatory requirements. The E&S Safeguard Unit will ensure enforcement and compliance, with regular monitoring reports submitted to the SPIU and relevant state environmental authorities (e.g., KEPA) for review and oversight.

7.6.5.1 Estimated Budget for Noise Management Mitigations

Table 7.8 presents the estimated cost of implementing the identified noise mitigation strategies during the first year of the project. The budget excludes the cost of ongoing monitoring programmes and staff remuneration, which are addressed under Section 7.9 (Environmental and Social Management Budget). The amounts reflect updated 2025 price estimates for procurement, logistics, and engagement in Northern Nigeria.

Table 7.8 Estimated Cost of Implementing Noise Mitigations (Year 1)

Noise Mitigation Strategy	Cost Estimate (NGN)	Notes
Purchase and maintenance of noise control equipment (e.g., silencers, mufflers)	10,000,000.00	Captured in Contractor's Cost
Procurement and installation of temporary noise barriers (where feasible)	5,000,000.00	Captured in Contractor's Cost
Community consultations and early warning systems for noisy activities	2,000,000.00	Captured in Stakeholder Engagement Budget
Provision of personal protective equipment (PPE) for noise exposure (earplugs, earmuffs)	Captured in OHS Budget	See Section 7.9
Regular noise monitoring and compliance enforcement	Captured in Environmental Monitoring Budget	See Section 7.9
Total Direct Mitigation Estimate	₦17,000,000.00	Year 1 only



7.6.6 Air Quality Management Plan

The Kaduna SAPZ State Project Implementation Unit (SPIU) in collaboration with the Kaduna State Environmental Protection Authority (KEPA) shall be responsible for overseeing air quality management throughout the lifespan of the Agricultural Industrial Hub (AIH) project in Daki–Takwas. During the construction and operational phases, the contractors and facility operators will be responsible for implementing the prescribed air quality mitigation measures.

The Environmental and Social Safeguards Unit under the SPIU shall monitor and ensure full compliance with the air quality management plan, while the resident engineer/environmental specialist will provide technical oversight and ensure that air quality considerations are fully integrated into project planning, design, and execution.

7.6.6.1 Control of Air Emissions

To minimize air pollution and emissions during construction activities at the AIH site, the following control measures shall be implemented:

- **Particulate Matter (PM) Management:**
 - Employ surface stabilization techniques such as:
 - ✓ Water spraying on exposed surfaces.
 - ✓ Chemical stabilization where necessary.
 - ✓ Installation of temporary windbreaks.
 - For long-term dust control:
 - Improve unpaved roads by applying gravel or slag.
 - Maintain road surfaces regularly through grading to increase aggregate size and reduce dust.

Good Housekeeping Practices: These low-cost operational practices shall be enforced on-site:

- Proper enclosure of active construction zones using screening or hoarding.
- Controlled on-site concrete mixing, unloading, and cement handling to minimize dust.
- Maintain site vehicle speed limits and monitor movement along access roads.
- Ensure trucks transporting loose materials are covered.
- Enforce routine maintenance of construction machinery and vehicles.



- Prohibit the open burning of vegetation or other waste materials.
- Stockpiled excavated or dusty materials shall be covered using impervious sheeting.
- Apply water spraying in dry and windy conditions to suppress airborne dust.

7.6.6.2 Emissions from Vehicles and Construction Equipment

Construction activities at the AIH site will lead to emissions from diesel-powered machinery and vehicles, including carbon monoxide (CO), carbon dioxide (CO₂), nitrogen dioxide (NO₂), sulphur oxides (SO_x), and hydrocarbons. The following strategies shall be used to mitigate emissions:

- Conduct regular preventive maintenance and servicing of construction trucks, engines, and heavy-duty equipment.
- Develop and implement a site-specific Traffic Management Plan to prevent congestion on local and access roads.
- Ensure the use of low-sulphur diesel or high-quality fuels to reduce emissions from machinery.
- Instruct operators to turn off idle equipment to reduce unnecessary fuel consumption and air emissions.
- Schedule construction activities to avoid peak traffic hours and minimize cumulative impacts on air quality.

7.6.6.3 Estimated Budget for Implementing Air Quality Mitigations

Table 7.9 presents the estimated cost of implementing the proposed air quality mitigation measures during the first year of the AIH SAPZ project at Daki–Takwas. The cost estimates provided here are exclusive of expenses related to environmental sample monitoring and remuneration of staff, which are detailed in Section 7.9 of this report.

The mitigation measures aim to reduce fugitive dust emissions, manage pollutant emissions from vehicles and machinery, and ensure overall ambient air quality is maintained throughout the project lifecycle—especially during the construction and early operational phases.

Table 7.9 Estimated Cost of Implementing Air Quality Mitigation Measures

Air Quality Mitigation Strategy	Cost Estimate (NGN)



Watering, chemical stabilization, and use of dust suppression materials	Captured under Environmental Sample Monitoring
Regular maintenance of equipment to reduce vehicular and machinery emissions	Captured in Contractors' Construction Budget
Implementation of traffic control and site traffic management plans	NA (Captured in Traffic Mitigation Costs – Section 7.6.3)
Provision of site enclosures and controls for on-site material handling and mixing	Captured in Contractors' Construction Budget
Routine ambient air quality monitoring and compliance audits	Captured under Environmental Sample Monitoring
Total Estimated Budget (First Year)	NA (Captured in multiple related line items)

Note:

- “NA” indicates that specific costs are not independently itemized but are included under other related mitigation or contractor provisions.
- All mitigation strategies will be implemented in compliance with the applicable environmental standards of the Federal Ministry of Environment (FMEEnv), Kaduna State Environmental Protection Authority (KEPA), and the African Development Bank (AfDB) Integrated Safeguards System (ISS, 2023).

7.6.7 Water Quality Management Plan

The Kaduna SAPZ SPIU and Kaduna State Ministry of Agriculture (KDSMA), in collaboration with the Kaduna State Environmental Protection Authority (KEPA), shall assume overall responsibility for ensuring the implementation of the Water Quality Management Plan throughout the life cycle of the Agricultural Industrial Hub (AIH) project at Daki–Takwas.

During the construction and operational phases, the EPC contractor and AIH facility operators will be responsible for the practical execution of water pollution control measures. The Environmental and Social (E&S) Safeguards Unit of the SAPZ SPIU will oversee monitoring and ensure compliance with water quality requirements, while the supervising engineer shall provide technical oversight and ensure all water-related mitigation measures are incorporated into engineering design and site operations.

7.6.7.1 Degradation of Water Quality Due to Stormwater Runoff

Construction activities—including vegetation clearing, excavation, and soil exposure—pose risks of erosion, sedimentation, and increased turbidity in nearby watercourses such as the Kuzuntu Stream, and ephemeral wetland zones in the project area. Furthermore, pollutants from



construction material yards, vehicle wash areas, and accidental leaks may contaminate surface waters, especially during the rainy season.

To mitigate these risks, the Kaduna SAPZ SPIU shall require contractors to prepare and implement a site-specific Erosion and Sediment Control Plan (ESCP) prior to commencing site works. The ESCP will outline Best Management Practices (BMPs) tailored to local hydro-geological and seasonal rainfall patterns in Northern Kaduna.

Key Measures:

- Restricting vegetation clearing to designated work zones, access roads, and material laydown areas.
- Avoiding soil disturbance during peak rainy periods and scheduling major earthworks during dry seasons.
- Establishing and maintaining a minimum 15-metre Riparian Buffer Zone between construction footprints and all-natural watercourses to intercept sediment-laden runoff.
- Using tarpaulin or geotextile covers on exposed stockpiles during rainfall events.
- Prompt soil compaction and slope stabilization immediately after foundation works or excavation.
- Re-vegetating or resurfacing cleared areas promptly after construction to stabilize soil and reduce erosion.

7.6.7.2 Degradation of Water Quality Due to Accidental Spills and Leaks

To prevent contamination of surface and groundwater by hazardous substances, the SPIU shall develop a Spill Prevention and Contingency Plan (SPCP) aligned with AfDB OS1 and national environmental regulations.

Key Provisions:

- Prohibiting storage of diesel, lubricants, and other hazardous materials within 30 metres of surface water bodies or wetlands.
- Ensuring all fueling operations near sensitive habitats use secondary containment (e.g., drip trays or berms).
- Immediate containment and clean-up of any spills using oil-absorbent materials and trained spill response personnel.



- Collection and secure storage of used oil, chemicals, and lubricants in labeled, leak-proof containers for recycling or safe disposal by KEPA-licensed waste handlers.
- Installing secondary containment (e.g., bund walls) around all above-ground fuel tanks and hazardous material stores.
- Integrating oil-water separators into stormwater drains in areas with high risk of hydrocarbon pollution (e.g., machinery maintenance yards).

7.6.7.3 Estimated Budget for Implementing Water Quality Mitigations

Table 7.10 presents the estimated cost allocations for implementing the identified water quality mitigation strategies in the first year of the AIH SAPZ project. The cost structure aligns with the integrated budgeting model used in the overall Environmental and Social Management Plan (ESMP). It excludes costs for staff remunerations and routine monitoring, which are detailed in Section 7.9 of this report.



Table 7.10 Estimated Cost of Implementing Water Quality Mitigation Strategies

Water Quality Mitigation Strategy	Cost Estimate (NGN)
Implementation of erosion and sediment control measures (e.g., silt fences, runoff channels)	Captured in Contractor's Cost
Equipment and materials for spill containment and cleanup (e.g., absorbents, drip trays, spill kits)	Captured under Spill Management Plan
Construction and provision of secure storage facilities for fuel and hazardous materials	Captured in Environmental Sample Monitoring
Regular monitoring and laboratory analysis of water quality (surface and groundwater sampling)	Captured in Environmental Sample Monitoring
Site restoration and riparian buffer zone management (post-construction rehabilitation)	Captured in Contractor's Cost
Total	-

Source: ESIA for the AIH SAPZ Project – Kaduna SPIU, 2025

7.6.8 Soil and Erosion Management Plan

The Kaduna SAPZ SPIU and Kaduna State Agricultural Development Agency (KADA) through the Kaduna State Ministry of Agriculture shall assume overall responsibility for managing soil degradation and erosion prevention throughout the project lifecycle at the AIH in Daki–Takwas. During the construction and operational phases, contractors and facility operators will be responsible for executing the required soil and erosion control measures. The Environmental & Social (E&S) Safeguard Unit will be tasked with ensuring compliance through regular monitoring and reporting. The project engineer will provide technical oversight to ensure all design and implementation strategies incorporate erosion mitigation.

Management Measures

Before the commencement of physical works, the Kaduna SAPZ SPIU will develop and implement a Soil and Erosion Control Plan, ensuring that no substantial risk of sediment discharge arises from the site. Key mitigation measures include:

- **Limited Vegetation Clearing:** Minimize clearing only to necessary access, storage, and work zones. A 15-meter Riparian Management Zone (RMZ) will be maintained near surface water bodies like the nearby stream, filtering sediment and protecting aquatic life.
- **Grading of Unpaved Roads:** Roads within and near the AIH site will be graded to reduce runoff impacts during the rainy season and prevent erosion.



- **Reuse and Protection of Excavated Soil:** Soil from excavations (e.g., for foundations and drainage works) will be reused promptly to avoid exposure to runoff or wind erosion.
- **Use of Alternative Transport Routes:** Movement of construction materials will avoid steep terrain or heavily vegetated areas, using alternative routes where feasible to reduce soil compaction and disturbance.
- **Minimised Machinery Footprint:** Movement of heavy machinery will be limited to designated work areas to reduce topsoil disturbance.
- **Protection of Vegetation Near Water Bodies:** Riverbank and wetland-adjacent vegetation will be minimally disturbed to reduce erosion risk and protect biodiversity.

Revegetation with Native Species: Cleared or disturbed sites will be replanted with **indigenous plant species** to aid natural regeneration and improve vegetation cover.

Sediment Binding Vegetation: In erosion-prone areas, sediment-binding grasses will be established to stabilize the soil structure and prevent degradation.

7.6.8.1 Estimated Budget for Soil and Erosion Control Mitigations

Table 7.11 outlines the estimated cost of implementing the above-listed soil and erosion control measures in the first year of the AIH SAPZ project. These costs are integrated into contractor responsibilities and captured under relevant mitigation budget lines. Monitoring costs and staff remunerations are excluded here and addressed in Section 7.9.

Table 7.11 Estimated Cost of Implementing Soil and Erosion Control Mitigation Strategies

Soil and Erosion Mitigation Strategy	Cost Estimate (NGN)
Limited vegetation clearing and revegetation with local/native species	Captured in Contractor's Cost
Grading of unpaved internal roads	Captured in Contractor's Cost
Implementation of sediment-binding grasses	Captured in Contractor's Cost
Soil reuse and compaction protection	Captured in Contractor's Cost
Use of alternative low-impact transport routes	Not Applicable (see traffic plan)
Total	-

7.6.9 Spill Contingency Management Plan

The Kaduna SAPZ SPIU and the Kaduna State Agricultural Development Agency (KADA) shall assume overall responsibility for developing and maintaining an effective Spill Contingency



Management Plan throughout the lifecycle of the Agricultural Industrial Hub (AIH) project in Daki–Takwas.

During the construction and operational phases, contractors and facility operators will be responsible for implementing the spill management procedures, while the Environmental & Social (E&S) Safeguard Unit and the Occupational Health and Safety (OHS) Manager will be responsible for monitoring compliance. This plan will be developed to prevent, contain, clean up, and report any spills or releases of fuel oil, lubricants, and other hazardous substances, thereby protecting nearby surface and groundwater bodies and the surrounding environment.

Key Management Measures:

- **Routine maintenance and inspection** of equipment and storage containers to detect and address leaks, corrosion, or damage.
- **Construction of containment bunds** around fuel and chemical storage areas to limit the spread of potential spills.
- **Positioning of spill kits** near chemical storage zones and within mobile machinery and vehicles.
- **Comprehensive training** for staff and contractors on the safe handling, transfer, and storage of hazardous materials, including spill response and incident reporting protocols.
- **Immediate response** to oil or chemical spills by isolating the affected area, switching off ignition sources, and containing the spill using spill kits and absorbents.
- **Safe disposal of contaminated soil**, following Kaduna State environmental guidelines and AfDB standards.
- **Construction of berms** around major spills to prevent runoff to nearby water bodies and adjacent farmlands.

7.6.9.1 Estimated Budget for Implementing Spill Mitigations

Table 7.12 presents the estimated cost of implementing the identified spill mitigation strategies for the first year. As per the integrated financial structure adopted for the AIH SAPZ project, many of the mitigation costs are captured in other sections, such as the Contractor’s Bill of Quantities or environmental sample monitoring costs. Salaries and monitoring programmes are reflected in Section 7.9 of the ESIA.

Table 7.12 Estimated Cost of Implementing Spill Mitigation Strategies



Spill Contingency Mitigation Strategy	Cost Estimate (NGN)
Staff and contractor training on spill response and reporting procedures	Captured in Contractor's Cost
Procurement and maintenance of spill kits (for site and mobile equipment)	Captured in Contractor's Cost
Excavation and safe disposal of contaminated soil	Captured in Contractor's Cost
Construction of containment bunds around storage facilities	Captured in Contractor's Cost
Construction of berms around affected zones for large spills	Captured in Contractor's Cost
Total	-

Source: ESIA Report for the AIH SAPZ Project, Kaduna SPIU (2025)

7.6.10 Hazardous Materials Management Plan

The Kaduna SAPZ SPIU will hold overall responsibility for ensuring the effective development and implementation of the Hazardous Materials Management Plan (HMMP) throughout the life of the Agricultural Industrial Hub (AIH) project in Daki–Takwas. The contractor will be responsible for the preparation and execution of the plan, including the safe storage, handling, and disposal of hazardous materials, and must ensure full compliance with relevant Nigerian environmental regulations, Kaduna State laws, and AfDB's Integrated Safeguards System (ISS).

The SPIU, supported by the Environmental and Social Safeguard Unit, will supervise, inspect, and verify compliance with all hazardous materials management protocols during pre-construction, construction, and operational phases.

Implementation and Key Management Measures:

The contractor shall prepare and implement a Spill Contingency and Hazardous Materials Management Plan which includes the following mitigation strategies:

- **Secure Storage:** All oil, fuel, chemicals, and hazardous materials shall be stored within **secondary containment structures (bunds)** located in designated and secured areas.
- **Operational Spill Protection:** Use of portable oil collection trays or drip pans during fuel transfers and re-fueling operations.
- **Pesticide and Herbicide Management:** Pesticides/herbicides used for land clearing or pest control shall comply with FAO Guidelines, especially in packaging, storage, labelling, handling, application, and disposal.



- **Buffer Zones:** No storage of hazardous materials shall occur within 30 metres of surface water bodies, such as streams or wetlands within the Daki-Takwas landscape.
- **Equipment Integrity:** Regular maintenance and inspection of machinery, equipment, and containers to detect and prevent leaks, spills, corrosion, or deterioration.
- **Spill Response Readiness:** Spill containment kits and absorbents shall be readily available at chemical storage points and within heavy-duty vehicles and equipment.
- **Training and Capacity Building:** All site personnel handling hazardous materials will undergo comprehensive training on:
 - Material handling and transfer procedures
 - Transport safety
 - Spill response and reporting mechanisms
 - Occupational and environmental health risks
- **Inventory and Documentation:** Maintain an up-to-date inventory of all hazardous substances and wastes stored or used on-site. Material Safety Data Sheets (MSDS) shall be available for all chemicals in use.

Monitoring and Enforcement

The E&S Safeguard Unit and the OHS Manager will carry out routine inspections and submit monthly reports to the SPIU. Any identified non-compliance or incident must be rectified immediately with corrective and preventive actions.

7.6.10.1 Estimated Budget for Implementing Hazardous Materials Mitigations

Table 7.13 below presents the estimated cost of implementing the identified hazardous materials mitigation measures in the first year of the project. These costs are captured under relevant thematic and contractor budget lines, and therefore, no direct financial allocation is provided here. The cost of monitoring programs and staff remunerations is presented separately in Section 7.9 of the report.

Table 7.13 Estimated Cost of Implementing Hazardous Materials Mitigation Strategies

Hazardous Materials Mitigation Strategy	Cost Estimate (NGN)
Construction of secondary containment structures for oils and hazardous materials	Captured in Contractor's Cost
Designated pesticide/herbicide storage facilities per FAO standards	Captured in Contractor's Cost



Maintenance of equipment to prevent leaks or spills	Captured in Spill Contingency Management Plan
Routine inspection of containers and machinery for signs of corrosion, leaks, or deterioration	N/A
Provision and maintenance of spill response equipment	Captured in Spill Contingency Management Plan
Training and capacity building for workers handling hazardous substances	Captured in Contractor's Cost
Construction of bunds for containment of hazardous materials	Captured in Contractor's Cost
Inventory management and MSDS recordkeeping	N/A

Total: Captured under related budget categories

Note: NA = Not Applicable. Some items are not budgeted separately as they are subsumed under broader project implementation or contingency plans.

Source: AIH SAPZ ESIA – Daki–Takwas, Kaduna (2025)

7.6.11 Waste Management Plan

The Kaduna State Government through the SAPZ SPIU and Kaduna Investment Promotion Agency (KADIPA), in collaboration with the Kaduna State Ministry of Environment (KSMEnv) and Kaduna State Environmental Protection Authority (KEPA), shall ensure the development and implementation of a comprehensive Waste Management Plan (WMP). This plan will align with Nigerian environmental regulations, AfDB OS5 and OS3, and international good practice.

During the construction phase, the contractor will be responsible for the on-site implementation, segregation, temporary storage, and safe disposal of construction and domestic waste. During the operational phase, agro-industrial hub operators, AIH users, and service providers will be required to comply with the WMP as a condition of engagement.

The SAPZ SPIU will prepare a project-specific WMP that addresses all phases of the project lifecycle and includes the following elements:

- Classification of waste types (hazardous, non-hazardous, liquid, e-waste, etc.)
- Waste minimization strategies and circular economy principles.
- Procedures for segregation, storage, transport, and final disposal.
- Provision of labelled waste bins and temporary holding stations.



- Institutional responsibilities and training requirements.
- Documentation and tracking of waste generation and disposal using manifest systems.

Potential Waste Categories

- **Hazardous Waste:** Unused paints, spent oils, batteries, pesticides, chemical containers, etc.
- **Non-Hazardous Waste:** Organic food waste (e.g., cassava peels), packaging materials.
- **Liquid Waste:** Grey water, sanitary wastewater.
- **E-waste:** Phones, laptops, printers with lead, mercury, or cadmium—managed by licensed recyclers.
- **Special Waste:** Used oil, fluorescent bulbs, plastics, and other recyclables.
- **Domestic Waste:** Food wrappers, tissue paper, general refuse.

Storage, Handling, and Disposal Procedures

Each waste category will be managed according to its risk profile. For instance:

- **Hazardous materials** will be stored in bunded areas with containment controls.
- **Non-hazardous and recyclables** will be stored separately to encourage reuse and recycling.
- **Electronic and special wastes** will be routed to KEPA-certified handlers for environmentally sound disposal.

7.6.11.1 Estimated Budget for Implementing Waste Mitigation Strategies

Table 7.14 below presents the estimated cost of implementing the identified waste mitigation strategies in Year 1. This does not include costs associated with staff salaries or sample-based monitoring, which are addressed in Section 7.9 of this ESIA report.

Table 7.14 Estimated Cost of Implementing Waste Mitigation Strategies

Waste Mitigation Strategy	Cost Estimate (NGN)
Development and operationalization of the WMP	Captured in Contractor's Cost
Provision and labelling of waste receptacles and bins	Captured in Contractor's Cost
Training of staff and contractors on waste handling protocol	Captured in Contractor's Cost



Waste disposal logistics and contracting certified haulers	Captured in Contractor's Cost
Maintenance of waste segregation stations	Captured in Contractor's Cost

Total Budget: *Captured in Contractor's Cost*

Note: Cost components are integrated within the broader contractor implementation budget to avoid duplication and enhance financial coherence across ESHS thematic areas.

Source: AIH SAPZ ESIA – Daki–Takwas (2025)

7.6.11 Pest Management Plan

Given that the Agro-Industrial Hub (AIH) will involve agricultural processing, storage, and potential pest-attracting activities, there is a clear need to establish a Pest Management Plan (PMP) to guide safe, efficient, and environmentally sound pest control practices. The PMP will be developed to ensure that pest management within the hub and associated value chain operations aligns with national environmental and agricultural regulations as well as AfDB's Integrated Safeguards System (ISS). Its development is essential to minimize the risks of pesticide misuse, protect human health, prevent contamination of soil and water resources, and promote the adoption of Integrated Pest Management (IPM) approaches that emphasize biological and cultural control over chemical dependence.

7.6.13 Traffic Management Plan

Responsibility

The Kaduna State SAPZ SPIU, in partnership with the Kaduna State Ministry of Works and Transport (KSMWT), KADIPA, and KEPA, will oversee the development and implementation of the Traffic Management Plan (TMP) throughout the pre-construction, construction, and operational phases.

- A dedicated Traffic Manager, to be appointed by the Contractor, will handle daily implementation, liaise with local traffic enforcement units, and coordinate with communities.
- The E&S Safeguard Unit will monitor compliance, while site engineers will integrate traffic controls into logistics planning.



- Community engagement will be critical to ensuring acceptance of detours, route adjustments, and public safety protocols.

Management Measures

1. Traffic Management Actions

- Prepare and implement a site-specific TMP with designated access routes and avoidance of peak hour mobilization.
- Install road signs, speed bumps, reflectors, and safety barriers around active construction zones.
- Train all drivers and equipment operators on site-specific traffic safety protocols.
- Coordinate with local government authorities (LGA Works Dept., NSCDC, FRSC) to align with municipal regulations.
- Improve existing feeder roads, shoulders, and turning points where necessary.

2. Community Engagement Actions

- Launch a public awareness campaign (radio, town hall meetings, social media) to notify the community about:
 - New traffic patterns
 - Temporary closures
 - Safety tips for pedestrians and road users
- Use community liaison officers (CLOs) to handle feedback and complaints.

3. Monitoring and Adjustment Actions

- Monitor traffic conditions using field observation and mobile camera units at entry/exit points.
- Maintain a Traffic Logbook and monthly reporting on:
 - Near misses
 - Obstructions
 - Travel delays
- Review the TMP quarterly and update in response to community feedback and traffic impact monitoring.



7.6.13.1 Estimated Budget for Implementing Traffic Mitigation Strategies

Table 7.15 below shows the revised budget estimate for implementing the traffic management mitigation measures in the first year. This excludes the cost of long-term monitoring and staff remuneration, which are presented separately under Section 7.9.

Table 7.15 Estimated Cost of Implementing Traffic Mitigation Strategies

Traffic Mitigation Strategy	Cost Estimate (NGN)
Development and implementation of TMP (planning, route mapping, logistics)	Captured in Contractor's Cost
Installation of road signage, reflectors, barriers, speed calming devices	3,500,000.00
Training for drivers, traffic safety briefings, and route familiarization	2,000,000.00
Community awareness campaigns and public safety announcements (media, flyers, CLOs)	2,500,000.00
Manual and digital traffic monitoring systems (e.g., mobile camera setup, logs)	3,000,000.00
Periodic reporting on TMP implementation and effectiveness	Captured in Management Reporting Cost

Total Nudget: ₦11,000,000.00

Source: AIH SAPZ ESIA Report – Daki–Takwas (2025)

7.6.14 Biodiversity Management Plan

The clearing of vegetation in designated construction work areas within the AIH project footprint may significantly affect terrestrial and aquatic habitats—especially in forest patches, farmland–wetland mosaics, and riparian buffers, which are home to endemic and migratory species.

To ensure sustainable development, a comprehensive Biodiversity Management Plan (BMP) will be implemented to prevent, mitigate, and offset biodiversity loss, while promoting ecological balance and community engagement.

Mitigation Measures

Key strategies to manage biodiversity risks and impacts include:

- **Vegetation Management:** Limit vegetation clearing to only where necessary; avoid clearing in ecologically sensitive areas or critical habitats.



- **Seasonal Sensitivity:** Schedule construction activities to avoid key breeding or migratory periods for wildlife.
- **Rehabilitation & Restoration:** Rehabilitate disturbed areas through revegetation with native species, and conduct habitat restoration (e.g., agroforestry plots and riparian tree belts).
- **BMP Development & Implementation:** Develop a site-specific BMP incorporating:
 - Alien invasive species control
 - Faunal relocation and handling protocols
 - Ecological landscaping guidelines
- **Wildlife Corridors & Protected Zones:** Identify and preserve natural corridors and buffer zones, and consult local communities and ecologists on the establishment of protected areas.
- **Riparian Protection:** Maintain a 15-meter Riparian Management Zone (RMZ) along Eso Stream and its tributaries, avoiding direct impacts on aquatic life.
- **Community Engagement:** Involve local communities in biodiversity conservation, offering training, awareness sessions, and incentives for sustainable forest and land use.
- **Pollution Control:** Integrate erosion control, spill prevention, and impermeable storage liners to prevent ecological degradation.
- **Monitoring & Adaptive Management:** Conduct baseline and follow-up biodiversity monitoring, and revise strategies based on field evidence and scientific input.
- **Equitable Resource Use:** Allow community access to non-critical cleared vegetation for fuelwood or economic purposes to discourage illegal logging elsewhere.

7.6.14.1 Estimated Budget for Implementing Biodiversity Loss Mitigation Strategies

The table 7.16 below presents the updated cost estimate for implementing biodiversity mitigation measures in the first year of project execution. Costs related to long-term monitoring and staff salaries are covered under Section 7.9.

Table 7.16 Estimated Cost of Implementing Biodiversity Mitigation Strategies

Biodiversity Mitigation Strategy	Cost Estimate (NGN)
Limiting vegetation clearing and avoiding critical habitats	Captured in Contractor's Cost
Timing construction activities to avoid sensitive periods	Captured in Contractor's Cost



Revegetation with native plant species and habitat restoration	Captured in Contractor's Cost
Development of site-specific Biodiversity Management Plan	2,000,000.00
Establishment of protected areas and wildlife corridors	6,500,000.00
Riparian Management Zone establishment and maintenance	3,000,000.00
Community education, training, and incentives on biodiversity conservation	3,000,000.00
Pollution prevention measures (e.g., runoff barriers, soil protection infrastructure)	1,500,000.00
Regular biodiversity monitoring and adaptive strategy revision	Captured in Monitoring Cost

Total Estimated Cost: ₦16,000,000.00

7.6.15 Climate Change Mitigation Plan

To enhance the project's resilience and reduce its environmental footprint, the AIH SAPZ SPIU, in collaboration with Kaduna State Ministry of Agriculture and Kaduna Investment Promotion Agency (KADIPA), will oversee the design and execution of a Climate Change Mitigation Plan (CCMP) across all project phases. The CCMP will guide risk reduction, infrastructure adaptation, and climate-smart agricultural processing. The Project Manager and Resident Engineer will ensure climate resilience is integrated into infrastructure and operational planning. The Environmental and Social Safeguard Unit, in conjunction with the Energy and OHS Managers, will implement climate mitigation actions and monitor performance.

Management Measures

1. Climate Resilience Planning Measures

- Conduct a climate risk and vulnerability assessment to identify flooding, drought, and heatwave exposure across project components.
- Integrate structural and non-structural climate resilience features (e.g., drainage upgrades, shaded facilities, stormwater capture).
- Develop and implement adaptation plans to respond to climate-related threats in both construction and operational phases.

2. Energy Efficiency and Renewable Integration

- Adopt energy-efficient lighting, pumps, and cooling systems for agro-processing facilities and AIH buildings.
- Conduct baseline energy audits and develop a roadmap for reducing energy use intensity.



- Promote clean cooking solutions and solar-powered equipment in field operations, including solar dryers and irrigation pumps.
- Assess and integrate solar mini-grids or hybrid renewable systems to support off-grid or backup energy needs.
- Monitor and report energy use and system performance quarterly.

3. Carbon Offset and GHG Tracking

- Partner with credible programs to implement carbon offsetting via agroforestry and wetland protection within and around the AIH.
- Track and report carbon offset gains through quarterly carbon accounting reports using accepted methodologies (e.g., IPCC or Verified Carbon Standard).
- Incorporate reforestation, sustainable biomass, and low-emission technologies as part of offset and mitigation efforts.

7.6.15.1 Estimated Budget for Implementing Climate Change Mitigation Strategies

Below in table 7.17 is the estimated cost of implementing climate mitigation measures for the first year of the AIH SAPZ project. Costs related to continuous monitoring and staff salaries are reflected in Section 7.9.

**Table 7.17 Estimated Cost of Implementing Climate Change Mitigation Strategies**

Climate Change Mitigation Strategy	Cost Estimate (NGN)
Climate risk and vulnerability assessment	4,500,000.00
Integration of resilience measures into infrastructure planning	Captured in Contractor's Cost
Energy audits and baseline studies	3,500,000.00
Procurement and installation of energy-efficient equipment	Captured in Contractor's Cost
Feasibility and partial installation of solar PV / hybrid energy systems	10,500,000.00
Development of carbon offset plan and partnerships	5,000,000.00
Quarterly carbon offset monitoring and reporting	2,500,000.00
Training of staff and partners on climate-smart technologies	2,500,000.00

Total Estimated Cost: ₦28,500,000.00**Source:** AIH SAPZ ESIA Report – Daki–Takwas (2025)

7.6.16 Social Management Plan

The key stakeholders with responsibilities for the implementation of the Social Management Plan are:

- The Kaduna SAPZ SPIU, in collaboration with the Kaduna State Ministry of Agriculture (KSMA), Kaduna State Ministry of Human Services and Social Development (KSMHSSD), and Kaduna State Environmental Protection Authority (KEPA), will oversee the development, implementation, and monitoring of the Social Management Plan (SMP) throughout all project phases.
- The Community Liaison Officer (CLO) will coordinate community engagement, local grievance resolution, and implementation of social programmes.
- The Grievance Officer (GO) will manage grievance redress mechanisms (GRM), track resolution, and liaise with the Grievance Redress Committee (GRC).
- The Environmental and Social Safeguard Unit (E&SSU) will support CLO and GO in monitoring compliance with social safeguards, particularly related to resettlement, livelihood impacts, and cultural heritage.
- Non-Governmental Organisations (NGOs), Community-Based Organisations (CBOs), and Civil Society Organisations (CSOs) will play advocacy, monitoring, and community



empowerment roles. Their involvement will ensure the inclusion of vulnerable groups, transparency, and local ownership.

7.6.16.1 Voluntary/Involuntary Displacement

Responsibility

Kaduna SAPZ SPIU, KSMA, KSMHSSD, CLO, GO, E&SSU, NGOs, CSOs, CBOs

Management Measures

- Prepare and implement a Resettlement Action Plan (RAP) in line with AfDB's Operational Safeguards (OS2) and Nigerian Land Use Act.
- Conduct socio-economic baseline studies to identify vulnerable populations and inform compensation planning.
- Ensure fair, transparent, and timely compensation, including land-for-land or cash compensation, and livelihood restoration support.
- Maintain continuous engagement with Project-Affected Persons (PAPs), including disclosure of entitlements and consultations on resettlement options.
- Establish and operationalize the GRM with representation from local community leaders, women's groups, youth representatives, and other stakeholders.

7.6.16.2 Livelihood Impacts Management

The key stakeholders with roles and responsibilities in the mitigation and management of livelihood impacts are the Kaduna SAPZ SPIU, KSMA, KSMHSSD, CLO, GO, E&SSU, NGOs, CSOs, CBOs

Management Measures:

- Implement livelihood support programs such as vocational training (e.g., agro-processing, tailoring, ICT).
- Promote local employment through job reservation policies, inclusive recruitment, and on-the-job training.
- Improve access to market linkages, including aggregation centres and storage infrastructure for smallholder farmers and traders.
- Promote community social investment initiatives in health, education, and water supply through SAPZ-funded CSR projects.



- Periodically review and adapt livelihood programs based on feedback from stakeholders and evolving community needs.

7.6.16.3 Economic Impacts Management Plan

The stakeholders responsible for the management and mitigation of the economic impacts of the SAPZ AIH are:

Kaduna SAPZ SPIU, KSMA, KSMHSSD, CLO, E&SSU

Management Measures

- Conduct economic baseline assessments to identify potential impacts on existing enterprises and informal traders.
- Support local enterprise development by integrating local contractors and suppliers into the SAPZ procurement chain.
- Facilitate partnerships with microfinance institutions and state-led entrepreneurship support programs (e.g., Kaduna Agribusiness Incubation Centres).
- Build entrepreneurial capacity through business development training and support for youth-led agribusiness start-ups.
- Develop and maintain an enterprise impact monitoring system.

7.6.16.4 Archaeological / Cultural Heritage Loss

Community Labour Organization (CLO) and E&SSU are responsible for the management of the Archaeological and cultural heritage losses from the SAPZ AIH project.

Management Measures

- Conduct archaeological screening and cultural heritage assessments before excavation or construction begins.
- Establish a chance finds procedure in line with Nigerian heritage laws and AfDB OS1, to guide construction contractors on steps to take if artifacts are found.
- Avoid interference with identified sacred sites, shrines, or historical features through project redesign where feasible.
- Engage local elders, traditional rulers, and cultural experts to ensure culturally sensitive development.



- Preserve community cultural assets where possible and promote inclusive cultural dialogue.

7.6.16.5 Community Dynamics and Inclusivity Management

The stakeholders responsible for the management and implementation of all community dynamics and inclusivity management in the SAPZ AIH Project are:

Kaduna SAPZ SPIU, KSMA, KSMHSSD, CLO, E&SSU, NGOs, CSOs, CBOs

Management Measures

- Maintain inclusive communication strategies, including community meetings in local languages, town hall sessions, and gender-specific engagement platforms.
- Ensure equal participation of youth, women, persons with disabilities, and minority groups in consultation and decision-making processes.
- Train contractors, project staff, and community representatives on non-discrimination, GBV prevention, and inclusion protocols.
- Promote social cohesion through youth empowerment, conflict-sensitive programming, and community-driven development (CDD) models.
- Implement community development projects that directly benefit vulnerable groups and promote shared prosperity across gender and class lines.

7.6.16.6 Reporting – Social Management Plan

- The Community Liaison Officer (CLO) and E&S Safeguard Unit of the Kaduna SAPZ SPIU will provide regular updates to the Kaduna State Ministry of Agriculture (KSMA), Ministry of Human Services and Social Development (KSMHSSD), and Kaduna State Environmental Protection Authority (KEPA) on the effectiveness of social management measures, community feedback, and ongoing social risks.
- An annual review of the Social Management Plan (SMP) will be conducted to assess performance, compliance, and impact, and to inform strategic adjustments in line with emerging realities on the ground.



7.6.16.7 Estimated Budget for Implementing Social Impact Mitigation Strategies

The table 7.18 below presents the estimated budget for implementing the identified social mitigation measures for the first year of the project. This budget aligns with the realities of 2025 pricing in Kaduna State and excludes the cost of routine monitoring, staff remuneration, and overhead, which are covered under Section 7.9.

Table 7.18 Estimated Cost of Implementing Social Impact Mitigation Strategies

Social Mitigation Strategy	Cost Estimate (NGN)
Livelihood impact mitigation measures (vocational skills, start-up kits, cooperatives)	30,000,000.00
Economic impact assessments & local business integration strategy	12,000,000.00
Archaeological and cultural heritage assessments & protection measures	7,000,000.00
Stakeholder training (GBV prevention, disability inclusion, youth/women empowerment)	8,000,000.00
Annual reporting , social audit and performance review of SMP	3,000,000.00
Total	

7.7 Grievance Redress Mechanism (GRM)

The African Development Bank (AfDB) defines a Grievance Redress Mechanism (GRM) as a structured and transparent process for receiving, assessing, and resolving concerns or complaints related to a project's social or environmental performance. This is in accordance with AfDB's Operational Safeguards (OS1, OS5 and OS10), which require that compensation, resettlement, and livelihood restoration issues are addressed proactively, early in the project lifecycle.

A functional GRM ensures stakeholders have culturally appropriate, non-retaliatory channels to voice concerns and receive timely, clear responses. All grievances shall be acknowledged, documented, tracked, and resolved within an agreed timeframe, and stakeholders shall be informed of what to expect in terms of process and response.

7.7.1 Nature of Grievances

Grievances may arise from:

- Property damage or injuries.
- Compensation, resettlement, and land acquisition disputes.
- Environmental and health impacts.



- Livelihood disruption.
- Concerns or requests for project-related information.

The GRM allows stakeholders—including Project-Affected Persons (PAPs)—to submit grievances at **no cost**, without fear of retribution, and with assurance of fair and transparent resolution.

7.7.2 Importance of GRM for the AIH SAPZ Project

For the SAPZ Agricultural Transformation Centre (AIH) in Daki–Takwas, a robust GRM is critical for:

- Fostering trust and maintaining strong community relationships.
- Preventing escalation of issues that could delay or disrupt project implementation.
- Safeguarding vulnerable groups, including women, the elderly, youth, and persons with disabilities.
- Improving accountability, by resolving conflicts early and transparently.

7.7.3 GRM Structure and Functionality

The GRM structure for the AIH SAPZ Project will be non-hierarchical and inclusive, enabling affected stakeholders to resolve complaints at the local level or escalate to higher levels where necessary. It includes:

A. Project-Level Grievance Mechanism

This is the first line of redress, overseen by the State Project Implementation Unit (SPIU) and implemented through:

- **Community Liaison Officer (CLO):** First point of contact for community complaints.
- **Grievance Officer (GO):** Responsible for registering and tracking grievances.
- **Community Resettlement Committee (CRC):** Mediates and investigates unresolved complaints.
- **Resettlement Steering Committee (RSC):** Final arbiter for unresolved issues.

Stakeholders may lodge complaints via:

- Verbal submissions during community meetings.
- Written forms submitted to designated complaint boxes or SPIU offices.
- Confidential SMS/WhatsApp to designated project hotlines.



A grievance logbook will be maintained at the project office and monitored regularly.

B. Independent Recourse Mechanism (IRM)

For grievances concerning non-compliance with AfDB policy requirements, stakeholders can approach the IRM independently of the project mechanism. This ensures:

- Impartiality and objectivity.
- Access to redress for unresolved or escalated grievances.
- Reinforcement of trust and accountability in the project.

7.7.4 Key Attributes of the GRM

Table 7.19 GRM key attributes

Principle	Description
Culturally Appropriate	Communicated in local languages and sensitive to social norms.
Accessible	Available across all project communities, including remote areas.
Inclusive	Ensures participation of women, youth, elderly, people with disabilities, and marginalised groups.
Transparent	Provides clarity on procedures, response timelines, and resolution steps.
Reliable	Grievances are responded to within 15 working days , with feedback loops built into each stage.
Publicised	Awareness is raised through community meetings, radio announcements, posters, and outreach by the CLO and NGOs.
Logged and tracked	All grievances are recorded, classified, and tracked from submission to resolution using a grievance database.
Free and non-retaliatory	Complainants are not charged fees or punished for submitting a grievance.

7.7.5 Framework for Grievance Redress Mechanism (GRM)

The Grievance Redress Mechanism (GRM) framework for the AIH SAPZ Project provides a structured, culturally grounded, and multi-level process to address project-related complaints transparently and efficiently. At the heart of the GRM is the Grievance Redress Committee (GRC) system, which functions across three levels—community, ministry, and independent review—to ensure fair and timely resolution of grievances.

Members of the GRC at all levels are selected based on their integrity, community standing, and ability to engage inclusively and respectfully with Project-Affected Persons (PAPs). The GRM



ensures that all complaints are handled with dignity, accountability, and transparency, while also aligning with local customs and conflict resolution traditions.

Core Objectives of the GRM Framework

- **Responsive Grievance Handling:** Define roles and procedures for efficient intake, assessment, resolution, and documentation of complaints.
- **Cultural Integration:** Ensure the process is grounded in community customs to build trust and participation.
- **Structured Escalation:** Provide clear grievance resolution pathways—starting at the Community Resettlement Committee (CRC) level, escalating to the Resettlement Steering Committee (RSC), and ultimately to the Independent Recourse Mechanism (IRM) if needed.
- **Continuous Accountability:** Implement feedback loops and monitoring tools to strengthen transparency and improve grievance resolution over time.

7.7.5.1 Project-Level Grievance Mechanism

The project-level GRM is the primary avenue for community members to lodge complaints and seek redress.

1. Community Liaison Officer (CLO)

- First point of contact for complaints related to resettlement, property damage, or community engagement.
- Responsible for logging and acknowledging complaints and forwarding them to the Grievance Officer (GO) and Resettlement Coordinator (RC) for processing.

2. Grievance Officer (GO)

- Coordinates grievance resolution, working with relevant departments or project teams depending on the issue (e.g., land, compensation, resettlement).
- Ensures timely updates and response to complainants and forwards unresolved matters to the CRC.

3. Community Resettlement Committee (CRC) – Community-Level GRC

Acts as the local grievance committee and is made up of trusted representatives selected for their familiarity with local dispute resolution norms.



Typical CRC Composition:

- **Village Union Chairman or CBO Rep:** First recipient of community complaints.
- **Town Union President General (PG):** Facilitates escalation or forms sub-committees as needed.
- **Traditional Ruler or Designate:** Resolves culturally sensitive or high-level community grievances.
- **Additional Members:**
 - One member from the town union.
 - One representative from the complainant's village.
 - One-woman representative.
 - One youth representative.
 - One representative from the SPIU.

This structure promotes inclusivity and ensures fair representation across demographics.

7.7.5.2 Resettlement Steering Committee (RSC) – Ministry-Level GRC

The RSC addresses grievances that could not be resolved by the CRC. It provides state-level oversight and is chaired by the Commissioner for Agriculture, with the SAPZ Project Coordinator as Secretary.

Membership of the Resettlement Steering Committee (RSC include:

- Representatives from the State Ministries of:
 - ✓ Agriculture
 - ✓ Environment
 - ✓ Women and Social Welfare

The RSC has the mandate to mediate, resolve complex complaints, and provide strategic oversight and policy guidance.

7.7.5.3 Cultural Appropriateness of the CRC

The design and operation of the CRC is modeled after traditional grievance resolution systems familiar in project communities. These systems:

- Begin with the village union or CBO,
- Escalate to the Town Union or Traditional Ruler, and



- Form ad hoc investigative committees including respected members from youth, women, and the affected village.

This culturally embedded structure builds trust, ensures social legitimacy, and reduces the potential for conflict.

7.7.5.4 Grievance Escalation Process

If a complainant remains dissatisfied after CRC intervention, the case must be:

- Escalated to the Resettlement Steering Committee (RSC) by the CRC.
- The SPIU must be informed and kept in copy.
- The complainant must be informed of their right to access the IRM at any stage.

This escalation path reinforces procedural fairness, ensures resolution at appropriate levels, and strengthens community confidence in the grievance system.

Support Provided: The CRC will assist vulnerable complainants—including illiterate or marginalised individuals—through:

- Translation or interpretation support,
- Guidance in submitting complaints,
- Accompaniment to meetings with higher-level committees if required.

7.7.5.5 Independent Recourse Mechanism (IRM)

If the project-level grievance process does not resolve an issue or the complainant prefers an independent review, they may submit a complaint to the AfDB's Independent Recourse Mechanism (IRM).

IRM Key Features of the Independent Recourse Mechanism (IRM).:

- **Unbiased Oversight:** Conducts impartial investigations for grievances related to policy non-compliance.
- **Corrective Action:** May recommend project revisions, compensation, or further monitoring.
- **Transparent Communication:** Final outcomes and decisions are shared with both the complainant and project management to ensure closure and learning.



7.7.5.6 Grievance Redress Process Procedure

The Grievance Redress Process (GRP) provides a clear, step-by-step procedure for receiving, processing, and resolving grievances under the Grievance Redress Mechanism (GRM) of the ATC SAPZ Project. It is designed to ensure timely response, transparent communication, cultural appropriateness, and accountability to Project-Affected Persons (PAPs) and other stakeholders.

Step 1: Grievance Submission

- **Modes of Submission:** Grievances may be submitted:
 - Verbally
 - In writing (physical or electronic)
 - Through designated digital platforms (SMS, WhatsApp, grievance hotline, or email)
 - At community meetings or via authorised community representatives.
- **Submission Channels:** Grievances can be lodged directly with the Community Liaison Officer (CLO) or the Grievance Officer (GO).
- **Required Details:** Complainants are encouraged to include:
 - Name and contact information (can remain anonymous if preferred)
 - Description of the grievance
 - Supporting documents (if any)
 - Suggested remedy (if applicable)

Step 2: Acknowledgement and Logging

- **Logging Process:** Each grievance is entered into the Grievance Register maintained by the GO. A unique identification number is assigned, and the issue is classified based on category (e.g., compensation, resettlement, environment).
- **Acknowledgement Timeline:** An acknowledgment letter or verbal confirmation is provided by the CLO within five (5) working days, outlining:
 - Confirmation of receipt
 - Summary of the issue
 - Proposed resolution timeline (target: within **28 calendar days**)

Step 3: Screening and Categorisation



- **Screening:**

The GO, with support from the CLO, verifies if the complaint is within the scope of project-related concerns.

- **Categorisation:**

Grievances are classified by:

- **Type** (e.g., environmental, economic, resettlement)
- **Urgency** (e.g., safety-related, routine)
- **Complexity** (e.g., minor vs. cross-agency grievance)

Priority is given to grievances with immediate impact on safety, livelihood, or vulnerable groups.

Step 4: Resolution Process

- **Investigation:** The GO coordinates with relevant project departments (e.g., Land, Environment, Livelihoods) for fact-finding and root cause analysis.
- **CRC Involvement:** The Community Resettlement Committee (CRC) provides cultural insight, mediates resolution discussions, and may investigate grievances requiring community-based responses.
- **Decision-Making:** A proposed resolution is developed by the GO, in consultation with the CRC and Resettlement Manager (RM), and then communicated to the complainant.

Step 5: Escalation Pathways

- **CRC to RSC:** If unresolved at the community level, the grievance is escalated to the Resettlement Steering Committee (RSC) at the state level. The SPIU is notified and copied for transparency.
- **Independent Recourse Mechanism (IRM):** If dissatisfaction persists after RSC intervention, the complainant may approach the AfDB's IRM. The CRC or SPIU will assist in preparing the referral, if necessary.

Step 6: Communication and Feedback

- **Resolution Communication:** Upon resolution, the GO formally communicates:
 - The outcome
 - Actions taken
 - Further options for escalation, including IRM if unsatisfied.



- **Follow-Up:** The GO and CRC periodically check with the complainant to confirm satisfaction and address any residual or follow-up concerns.

Step 7: Documentation and Monitoring

- **Record-Keeping:**

All grievances, including actions, communications, and resolutions, are stored in the project's GRM database. This ensures transparency and auditability.

- **Monitoring & Continuous Improvement:** The GRM is reviewed quarterly or bi-annually:
 - To assess responsiveness and fairness
 - To incorporate community feedback
 - To ensure alignment with evolving project dynamics and local customs

This grievance redress process ensures that the rights and voices of community members are respected, while also providing a fair, timely, and culturally appropriate system for conflict prevention and resolution. *A detailed Grievance Redress Framework, including flowchart, contact list, and reporting templates, is provided in Appendix 13 of this ESIA Report.*

To prevent and address risks of Gender-Based Violence (GBV), Sexual Exploitation and Abuse (SEA), and the risk of Sexually Transmitted Infections (STIs) associated with labor influx and project activities at the proposed Agro-Industrial Hub (AIH) in Daki-Takwas, the Kaduna SAPZ Project will enforce a zero-tolerance policy for all forms of sexual exploitation, harassment and abuse. This will be operationalized through mandatory Codes of Conduct for all workers, routine GBV/SEA and sexual health awareness training, and targeted sensitization on HIV/AIDS and other STIs for the workforce and surrounding communities. A confidential, survivor-centred Grievance Redress Mechanism (GRM) with clear referral pathways to medical, psychosocial, and legal support services will be established.

7.7.6 Grievance Redress Mechanism (GRM) Budget

To ensure the effective implementation of the Grievance Redress Mechanism (GRM), a dedicated budget of NGN 35,000,000.00 has been proposed. This budget will support all GRM-related activities across the community, project, and state levels, including training, community engagement, documentation, and grievance resolution processes.



The GRM budget covers operational, logistical, and institutional needs in line with AfDB's OS1 and OS10 requirements and is summarized in Table 7.20 below.

Table 7.20 Updated GRM Budget Estimate (2025)

Budget Category	Description	Revised Estimated Cost (NGN)
CLO and GO Compensation	Salaries/stipends for Community Liaison Officer and Grievance Officer, covering grievance tracking and field resolution.	<i>Captured in Personnel Remuneration (See Table 7.24)</i>
CRC and RSC Member Stipends	Monthly stipends and transport reimbursements for 20–25 committee members across CRCs and RSC.	7,500,000.00
Training Sessions	Initial and quarterly refresher training for GRM stakeholders, including community reps and SPIU staff.	4,000,000.00
Awareness Campaigns	Radio jingles, community townhall engagements, flyers, and translations into local languages.	5,000,000.00
Communication Costs	Call cards, internet bundles, printing grievance forms, logbooks, and radio announcements.	2,000,000.00
Meeting Expenses	Quarterly CRC and biannual RSC meetings – venue, logistics, refreshments, and facilitation.	3,500,000.00
Field Visits	Routine transportation and accommodation for GRM officers visiting rural/remote areas.	6,500,000.00
Reporting & Documentation	Printing, compilation, and submission of monthly and quarterly GRM reports.	1,500,000.00
Feedback Mechanism	Community scorecards, surveys, analysis software, and participatory workshops.	1,500,000.00
Escalation & Legal Support	External mediation costs, legal support for IRM, grievance arbitration.	1,500,000.00
Independent Review Costs	Third-party auditing, social safeguard consultants for unresolved or sensitive cases.	2,000,000.00
Total		₦35,000,000.00



This budget will enable the project to:

- Build trust with stakeholders, especially Project-Affected Persons (PAPs),
- Prevent escalation of conflicts, and
- Ensure compliance with international standards and national grievance procedures.

This allocation reflects the project's commitment to social accountability, transparency, and community-centered development.

7.8 Environmental and Social Management Plan (ESMP) Implementation

This section presents the Environmental and Social Management Plan (ESMP) proposed for implementation during the pre-construction and construction phase of the SAPZ AIH Project. This ESMP articulates the environmental and social management requirements and mitigation commitments that has to be incorporated in the Contract obligation the Construction Contractor must sign before the commencement of this project, and it specifies the strategies to adopt to ensure full compliance with all the safeguard requirements of the SAPZ AIH project. The proposed ESMP is as shown in Table 7.21, with details on the project activities, the ESHS impacts, the mitigation measures recommended for the amelioration of the adverse environmental and social impacts of specific project activities; the impact monitoring indicators or parameters the be measured, the frequency of monitoring, the stakeholders responsible for monitoring and implementation; the type of monitoring that shall be performed, and the cost implication of the implementation and monitoring of the impact mitigation measures.

The ESMP is made up of a number of management plans that details the specifications required for compliance with specific ESHS risk / impact mitigation and they describe the plans and processes required for performing the specific and necessary mitigation implementation actions. The management plans required for the SAPZ project constitutes an integral part of this ESMP and they consist of the following:

- ✓ Occupational Health Safety Management Plan;
- ✓ Emergency Preparedness and Response Plan;
- ✓ Contractor Management Plan;



- ✓ Noise Management Plan;
- ✓ Air Quality Management Plan;
- ✓ Waste Management Plan;
- ✓ Water Quality Management Plan;
- ✓ Soil and Erosion Management Plan;
- ✓ Spill Contingency Management Plan;
- ✓ Hazardous Materials Management Plan;
- ✓ Waste Management Plan;
- ✓ Traffic Management Plan; ;
- ✓ Biodiversity Management Plan;
- ✓ Climate Change Mitigation Plan;
- ✓ Social Management Plan;
- ✓ Emergency Preparedness and Response Plan; and
- ✓ Labour Influx Management Plan;

7.9 Environmental and Social Management and Monitoring Plan (ESMMP) and Reporting

The Environmental and Social Management and Monitoring Plan (ESMMP) provides a structured and detailed framework within the overall ESMP for the SAPZ Agro-Industrial Hub (AIH) at Daki-Takwas, Chikun LGA, ensuring that all environmental and social mitigation measures are effectively implemented, monitored, and reported throughout the project lifecycle. It outlines specific actions, responsibilities, timelines, and procedures to guide both internal and external monitoring efforts. The purpose of the ESMMP is to promote compliance with national regulatory requirements, AfDB's Integrated Safeguards System (ISS, 2023), and international good practices, especially those aligned with the International Finance Corporation (IFC) Performance Standards (2015). The ESMMP clearly defines the roles and responsibilities of key actors, including the State Programme Implementation Unit (SPIU), Contractors, Consultants, NESREA, FMEnv, KEPA, and other stakeholders, to ensure that all identified mitigation measures are executed effectively. Implementation will rely on a combination of internal (project-driven) and external (independent) monitoring mechanisms to uphold continuous oversight and institutional accountability.



7.9.1 Internal Monitoring

Internal monitoring will be carried out routinely by the Kaduna State SPIU, in collaboration with the Environmental, Health, and Safety (EHS) units of Contractors and Supervising Consultants. These internal mechanisms will focus on day-to-day oversight and compliance with environmental, social, health, and safety (ESHS) obligations during all phases of project implementation—especially construction and operations.

Key objectives of internal monitoring include:

- Verifying adherence to ESMMP mitigation measures;
- Identifying deviations or emerging E&S risks;
- Promptly initiating corrective or preventive actions;
- Reporting regularly to the SPIU and the AfDB.

This approach aligns with the IFC’s Environmental and Social Monitoring Guidance (2015), which underscores the necessity of embedded internal performance checks to ensure adaptive environmental and social management. Internal monitoring tools include inspection checklists, EHS audit forms, weekly/monthly reports, photographic evidence, incident registers, and non-compliance logs. These will be integrated into the contractors’ Environmental and Social Management Systems (ESMS) and supervised by SPIU’s safeguards team.

7.9.2 External Monitoring

External monitoring will be undertaken by regulatory authorities and independent entities, including the Federal Ministry of Environment (FMEEnv), National Environmental Standards and Regulations Enforcement Agency (NESREA), Kaduna State Environmental Protection Authority (KEPA). This independent oversight will involve:

- Periodic field visits and audits;
- Review and validation of internal monitoring reports;
- Independent verification of environmental and social performance;
- Assessment of compliance with Nigerian laws, AfDB safeguards, and other international benchmarks.



To further enhance accountability and transparency, the participation of civil society organisations (CSOs), non-governmental organisations (NGOs), traditional institutions, and local community representatives will be encouraged. Their engagement in third-party monitoring ensures broader social legitimacy and provides local perspectives on the project's impac



Documentation and Reporting

All internal and external monitoring results shall be thoroughly documented using structured templates and databases. These records will include:

- Monitoring schedules and checklists;
- Observed non-conformances and their resolution status;
- Records of training and capacity building activities;
- Corrective action plans (CAPs) and implementation tracking.

Quarterly and annual monitoring reports will be prepared and submitted to SPIU, the African Development Bank (AfDB), and regulatory authorities as required. These reports will serve as evidence of ESMMP compliance and will contribute to the adaptive management of environmental and social risks. Reports may also be disclosed to communities and stakeholders to maintain transparency and build trust throughout the project. Table 7.22 will present the monitoring programme framework, including monitoring parameters, frequency, responsibility, and reporting channels for each identified Environmental and Social impact under the SAPZ AIH Project at Daki-Takwas, Chikun LGA, Kaduna State.



Table 7.21 Monitoring Programme for Kaduna SAPZ ESMP

Monitoring Aspect	Action / Parameters to Monitor	Responsibility	When	Deliverables	Indicative Unit Budget (NGN)
Preconstruction Phase					
Environmental	Review approved ESMP and mitigation plans for AIH management	E&S Safeguard Unit, SPIU Kaduna State Ministry of Agriculture (KSMoA), Kaduna State Environmental Protection Authority (KEPA)	Before the start of site preparation activities	Review report; Compliance checklists	Included in Personnel Remuneration (Table 7.24)
	Ensure waste management plans are developed and aligned with FMEnv and KEPA regulations	E&S Safeguard Unit, SPIU – KSMoA, KEPA	Before the start of site preparation activities	Approved Waste Management Plans	Included in Personnel Remuneration (Table 7.24)
	Confirm that waste management strategies are communicated to all contractors and stakeholders	E&S Safeguard Unit, SPIU KSMoA, KEPA, KAD-WAMA	Before the start of site preparation activities	Communication records, Stakeholder acknowledgements	Included in Personnel Remuneration (Table 7.24)
	Ensure mitigation measures (air, water, noise, biodiversity) are	E&S Safeguard Unit	Weekly	Compliance monitoring	Included in Personnel



Monitoring Aspect	Action / Parameters to Monitor	Responsibility	When	Deliverables	Indicative Unit Budget (NGN)
	applied effectively onsite			reports, corrective action plans	Remuneration (Table 7.24)
	Conduct regular site inspections to verify waste segregation, storage, and disposal at the AIH	E&S Safeguard Unit, KEPA, KAD-WAMA	Monthly	Site inspection reports, Waste management documentation	Included in Personnel Remuneration (Table 7.24)
	Conduct air quality measurements at project boundary	OHS Manager, E&S Safeguard Unit	Quarterly	Reports of air quality monitoring	500,000.00
	Conduct ambient noise level measurements during equipment deployment	OHS Manager, E&S Safeguard Unit	Quarterly	Noise level reports	500,000.00
Social	Verify that RAP for AIH and ATC are developed and implemented as planned	E&S Safeguard Unit, SPIU, Ministry of Lands, NGOs, CBOs, CLO	Throughout the preconstruction phase	RAP implementation reports, Engagement summaries	Included in Personnel Remuneration (Table 7.24)
	Verify that fair compensation mechanisms are in place and are transparently executed	CLO, E&S Safeguard Unit, NGOs, CSOs, Ministry of Lands	Throughout the preconstruction phase	Compensation records, Transparency audit reports	Included in Personnel Remuneration (Table 7.24)



Monitoring Aspect	Action / Parameters to Monitor	Responsibility	When	Deliverables	Indicative Unit Budget (NGN)
	Monitor establishment and functioning of Grievance Redress Mechanism (GRM)	CLO, E&S Safeguard Unit, NGOs, CBOs	Throughout the preconstruction phase	GRM logs and resolution reports	Included in Personnel Remuneration (Table 7.24)
	Assess community support programmes in relation to community needs (especially in Kuzuntu and Daki-Takwas)	E&S Safeguard Unit – KSMoA, CLO	Ongoing	Impact reports, Community feedback and action plans	Included in Personnel Remuneration (Table 7.24)
Social / GBV/SEA	Verify inclusion of GBV/SEA awareness, reporting mechanisms, and staff/contractor training	E&S Safeguard Unit; CLO; NGOs	Before site mobilization	Training attendance logs; GBV/SEA risk assessment reports; GRM updates	500,000
OHS	Verify that Occupational Health and Safety (OHS) plans are fully implemented at both project sites	OHS Manager, E&S Safeguard Unit	Throughout the preconstruction phase	OHS Reports (incident logs, compliance, trainings)	Included in Personnel Remuneration (Table 7.24)



Construction Phase

Monitoring Aspect	Action/Parameters to Monitor	Responsibility	Frequency/Timing	Deliverables	Indicative Unit Budget (NGN)
Air Quality Monitoring	Conduct air quality measurements (PM ₁₀ , PM _{2.5} , NO _x , SO ₂) in and around construction areas	Independent Consultant OHS Manager, E&S Safeguard Unit (SPIU), KEPA	Quarterly	Air quality compliance monitoring reports	6,400,000 per Annum
Ambient Noise Monitoring	Conduct ambient noise level measurements (day/night) to ensure compliance with FMEnv standards	Independent Consultant OHS Manager, E&S Safeguard Unit, KEPA	Quarterly	Noise monitoring reports	6,400,000 per Annum
Site Inspections	Site inspections to ensure effective implementation of environmental and social mitigation measures (dust, erosion, drainage, runoff, etc.)	E&S Safeguard Unit, SPIU, KEPA, Local Govt. Rep	Weekly	Field compliance monitoring reports	Included in Personnel Remuneration (Table 7.24)
Waste Management	Verify contractor compliance with the approved Waste Management Plan (WMP), including segregation, reuse, and disposal	E&S Safeguard Unit, SPIU, KEPA	Monthly	Contractor waste logs, site waste management records	Included in Personnel Remuneration
Hazardous Waste Handling	Monitor hazardous waste generation, ensure safe storage and disposal with tracking documentation	E&S Safeguard Unit, KEPA	Monthly	Hazardous waste manifests and disposal records	Included in Personnel Remuneration
Impact Mitigation Monitoring	Independent verification of environmental and social mitigation implementation by regulators and SPIU	FMEnv, KEPA, NESREA, E&S Safeguard Unit (SPIU)	Once during construction phase	IMM report	Covered under regulatory monitoring and reporting



Monitoring Aspect	Action/Parameters to Monitor	Responsibility	Frequency/ Timing	Deliverables	Indicative Unit Budget (NGN)
Livelihood and Community Support	Monitor and support ongoing livelihood restoration activities and community engagement programs (where triggered)	Independent Consultant E&S Safeguard Unit, CLO, SPIU, NGOs, CSOs, Community Leaders	Ongoing	Progress reports, community feedback summaries	Included in Personnel Remuneration (Table 7.24)
OHS Monitoring	Weekly monitoring of occupational health and safety compliance: use of PPE, safety signage, incident logs	OHS Manager, E&S Safeguard Unit	Weekly	Safety inspection reports, incident and accident records	Included in Personnel Remuneration (Table 7.24)
GBV/SEA Monitoring	Enforce prohibition of GBV/SEA; monitor and report incidents; Conduct awareness campaigns, and capacity building for workers & communities	E&S Safeguard Unit; CLO; NGOs; CSOs	Monthly	GBV/SEA incident logs; Training reports; GRM updates	1,000,000 per Annum

Operational/Maintenance Phase

Monitoring Aspect	Action/Parameters to Monitor	Responsibility	Frequency	Deliverables	Adjusted Unit Budget (NGN)
Ambient Noise	Conduct ambient noise level measurements using calibrated meters	E&S Safeguard Unit, KEPA	Quarterly	Noise monitoring reports	6,400,000 per Annum
Air Quality	Measure PM _{2.5} , PM ₁₀ , NO _x , SO ₂ , VOCs at sensitive receptor points	E&S Safeguard Unit, KEPA	Quarterly	Air quality compliance reports	6,400,000 per Annum



Monitoring Aspect	Action/Parameters to Monitor	Responsibility	Frequency	Deliverables	Adjusted Unit Budget (NGN)
Groundwater Quality	Test borehole samples for pH, TDS, heavy metals, bacteria, nitrates, etc.	E&S Safeguard Unit, certified lab	Biannually	Groundwater quality reports	6,400,000 per Annum
Surface Water Quality	Assess nearby stream for pollutants – BOD, COD, heavy metals, turbidity, etc.	E&S Safeguard Unit, certified lab	Biannually	Surface water quality reports	6,400,000 per Annum
Soil Quality	Analyze soil samples for pH, nutrient levels, contamination (heavy metals, oil)	E&S Safeguard Unit	Biannually	Soil monitoring reports	6,400,000 per Annum
Environmental Audits	Conduct statutory environmental audits per NESREA (air, water, waste, records)	External Consultant, SPIU, NESREA	Every 3 years	Environmental Audit Report	~~₦~~ 25,000,000 per audit
Waste Generation & Disposal	Track and analyze solid waste trends, segregation efficiency, and disposal route	E&S Safeguard Unit, KEPA	Quarterly	Waste management reports	Included in staff remuneration
Hazardous Waste Disposal	Verify safe disposal and tracking of hazardous waste like agrochemicals, oils	E&S Safeguard Unit, KEPA	Monthly	Hazardous waste tracking logs	Included in staff remuneration
Waste Plan Updates	Review and revise waste plan based on performance feedback and regulation	SPIU, E&S Unit, NESREA	As needed	Updated Waste Management Plan	Included in staff remuneration
Community & Livelihood Monitoring	Monitor social issues: grievances, economic impact, stakeholder cohesion	SPIU, CLO, NGOs, CBOs	Ongoing	Social monitoring reports	Included in staff remuneration



Monitoring Aspect	Action/Parameters to Monitor	Responsibility	Frequency	Deliverables	Adjusted Unit Budget (NGN)
Occupational Health & Safety (OHS)	Safety audits, health impact assessments, PPE compliance, accident logs	OHS Manager, SPIU	Ongoing	HSE records and reports	Included in staff remuneration
GBV/SEA Monitoring	Track GBV/SEA incidents, awareness campaigns, response, and referral mechanisms	E&S Safeguard Unit; CLO; NGOs; CSOs	Monthly	GBV/SEA logs, training reports, GRM updates	1,000,000 per Annum



7.9.3 Estimated Cost of Environmental Monitoring Programme

The estimated costs of conducting environmental sampling and analysis during the monitoring programme are presented in Table 7.23, while Table 7.24 presents the remuneration of staff responsible for conducting the monitoring programmes. These costs are exclusive of mitigation strategy costs, which are detailed in Section 7.6 of this report.

Table 7.22 Updated Cost of Environmental Monitoring Programme (Per Annum)

S/N	Environmental Aspect	Monitoring Frequency (Times/Year)	Estimated Number of Samples	Unit Cost (NGN)	Total Estimated Cost (NGN)
1	Air Quality (PM2.5, PM10, NOx, SO ₂ , VOCs)	4	32	200,000	6,400,000
2	Noise Quality (Leq, dB(A))	4	32	200,000	6,400,000
3	Soil Quality (Topsoil & Subsoil – 2 depths)	4	64	200,000	12,800,000
4	Surface Water Quality (BOD, COD, metals, nutrients)	4	32	200,000	6,400,000
5	Groundwater Quality (Physico-chemical & microbial)	4	32	200,000	6,400,000
6	Biodiversity Monitoring (Habitat health & indicator species)	1	-	Lump Sum	7,299,123
	Total Estimated Annual Cost				₦45,699,123

**Table 7.23 Remuneration of Staff for Environmental Monitoring**

Role / Position	Scope of Responsibility	Monthly Rate (NGN)	Annual Cost (NGN)
Environmental Field Technician (x2)	Field sampling (air, noise, water, soil); equipment set-up; QA/QC of samples; site logistics	₦600,000	₦7,200,000
Senior Environmental Analyst (Lab-based, x1)	Sample review, data validation, lab coordination, quality assurance	₦450,000	₦5,400,000
Environmental Monitoring Supervisor (SPIU E&S)	Oversight of overall monitoring schedules; coordination with KEPA & NESREA	₦750,000	₦9,000,000
Occupational Health & Safety (OHS) Officer	On-site safety assurance, PPE checks, incident reporting, safety audits	₦500,000	₦6,000,000
Community Liaison Officer (CLO)	Liaison for community feedback; manage GRM report inputs for monitoring	₦400,000	₦4,800,000
Environmental Consultant (Quarterly review)	Quality assurance of monitoring reports; compliance review coordination with regulatory bodies	₦1,500,000 (per visit)	₦6,000,000 (4 visits)
Total Annual Team Remuneration	-	-	₦38,400,000

Notes:

- **Field Technician:** Covers two technicians rotating weekly coverage; includes field allowances and logistics.
- **Quarterly Environmental Consultant Engagements:** Ensures third-party oversight and alignment with AfDB, NESREA, and FMEnv standards.
- **Supervisor and CLO Roles:** Based in SPIU with occasional field coverage and community interaction duties, supported by retainer and travel allowance budget.



7.10 ESMP Disclosures

Following the review and approval of the ESMP by the FMEnv and the AfDB, the ESMP will be disclosed at both national and local levels by KADIPA/KADSME/SPIU, in accordance with the Nigerian EIA Act and AfDB Integrated Safeguards System (ISS, 2023). The disclosure process will ensure transparency and public access to project environmental and social information (Table 7.25).

Table 7.24 Disclosure Procedure to Comply with Nigerian Regulations

Action	Remarks	Cost (NGN)
Disclosure in 2 national newspapers	KADIPA/KADSME/SPIU will publish the approved ESIA/ESMP in one national and one Kaduna-based newspaper for public access and comments.	₦1,200,000
Disclosure at KADSME	Hard and soft copies of the ESMP will be made available for public review at the Kaduna State Ministry of Business, Innovation, and Technology.	₦0
Disclosure at KADIPA	Copies will be displayed at the Kaduna Investment Promotion Agency (KADIPA) for public access.	₦0
Disclosure at Chikun LGA Secretariat	To engage local stakeholders, the ESMP will be displayed at the Chikun LGA Council Secretariat.	₦0
Total		₦1,200,000

7.10.1 Indicative Budget Estimation for ESMP Implementation

The updated indicative ESMP implementation budget for the SAPZ AIH site at Daki-Takwas, Chikun LGA reflects 2025 pricing benchmarks and revised cost components (Table 7.26). The total budget is estimated at ₦224,099,123 (Two Hundred and Twenty-Four Million, and Ninety – Nine Thousand One Hundred and Twenty- Three Naira Only), excluding land acquisition and resettlement costs.

Table 7.25 Summary of Updated Total Budget for ESMP Implementation (2025)



S/N	Cost Component	Description	Updated Estimate (NGN)
1	Mitigation Strategies	Cost of implementing all project-phase mitigation measures (contractor responsibility)	₦67,000,000
2	Environmental Sampling & Monitoring	Annual cost for air, noise, soil, water, biodiversity monitoring (Table 7.23A)	₦45,699,123
3	Staff Remuneration	Environmental team salaries including technicians, analysts, OHS officer, CLO, and consultants (2025)	₦38,400,000
4	Capacity and Competency Development	Training workshops, PPE, safety drills, compliance refreshers for SPIU and contractor staff	₦36,800,000
5	ESMP Disclosure	Public disclosures in national and local media, as well as at designated offices (Table 7.25)	₦1,200,000
6	Grievance Redress Mechanism (GRM)	Setup, operations, and training for GRM committees, community GRM hotline, documentation and outreach	₦35,000,000
	Total		₦224,099,123

7.11 Implementation Schedule

Table 7.27 presents the proposed implementation schedule for the Environmental and Social Management Plan (ESMP) for the AIH SAPZ Project in Daki – Takwas, Chikun LGA. Kaduna State. The timeline reflects phased actions across Pre-construction, Construction, and Operation stages. While actual start dates may vary depending on final procurement timelines, site readiness, and approvals, the table outlines the expected sequencing and responsibilities for key ESMP actions.

**Table 7.26 Proposed ESMP Implementation Schedule for AIH SAPZ, Kaduna State**

S/N	Activity	Responsible Party(ies)	Preconstruction (0–3 months)	Construction (4–18 months)	Operation (post-18 months)
1	Clearance and Approval of ESIA by FMEnv and AfDB	SPIU, KADIPA, KADSME	✓		
2	Inclusion of E&S Requirements in Bid Documents	SPIU, Procurement Team	✓		
3	Inclusion of ESMP in Contractor Agreements	SPIU, Legal Advisor, Procurement	✓		
4	Review and Approval of Contractor's CESMP	SPIU, AfDB Safeguards Team, FMEnv	✓		
5	Finalisation of Engineering Designs (including safeguards)	SPIU, Design Consultant	✓		
6	Implementation of Environmental & Social Mitigation Measures	Contractor, SPIU, E&S Safeguards Unit, OHS Manager, CLO, Relevant MDAs		✓	✓
7	Supervision of ESMP Implementation	SPIU, E&S Safeguards Unit, CLO, OHS Manager, MDAs (KEPA, Ministry of Environment)		✓	✓



8	Monitoring and Reporting of ESMP Implementation	SPIU, Independent E&S Consultants, KEPA, M&E Unit, CLO, Local Stakeholders		✓	✓
9	Environmental and Social Auditing (Annual or Bi-annual)	SPIU, External Auditors, AfDB, FMEnv			✓

7.12 Environmental and Social Management System (ESMS)

In alignment with the Environmental and Social Management System (ESMS) framework developed for the Special Agro-Industrial Processing Zones (SAPZ) Programme in Nigeria, the AIH at Daki Takwas, Chikun LGA shall operate under a structured and integrated ESMS during its operational phase. The ESMS will serve as a comprehensive management framework designed to ensure that all environmental, social, health, and safety (ESHS) risks associated with the hub's activities are effectively identified, assessed, monitored, and managed throughout the project lifecycle.

The Facility Manager shall establish, implement, and maintain this ESMS in accordance with relevant national environmental and social policies, laws, and regulations, as well as the African Development Bank's Integrated Safeguards System (ISS) and its applicable Operational Safeguards (OS 1–10). The ESMS will outline procedures for compliance monitoring, environmental performance evaluation, occupational health and safety management, pollution prevention, waste and resource efficiency, stakeholder engagement, and grievance redress.

The system will also define clear institutional responsibilities, communication and reporting mechanisms, capacity-building plans, and documentation protocols to ensure consistency and accountability in environmental and social performance. Regular audits and management reviews will be conducted to evaluate system effectiveness and ensure continuous improvement.



The ESMS will therefore provide the operational foundation for the AIH's sustainable management, ensuring that all hub activities contribute positively to environmental protection, social inclusion, and economic resilience in line with the broader SAPZ sustainability objectives. The ESMS implementation is fully budgeted at an estimated USD 30,000, covering monitoring, training, community engagement, and mitigation measures. A phased approach ensures that pre-construction, construction, operation, and eventual decommissioning activities are appropriately managed, with mitigation measures and monitoring integrated throughout the project lifecycle to ensure sustainable and socially responsible operations at the AIH.



CHAPTER EIGHT: STAKEHOLDER ENGAGEMENT AND CONSULTATION

8.1 Stakeholders Consultations

Stakeholders' participation during project planning, design, and implementation is widely recognized as an integral component of the Environmental and Social Impact Assessment (ESIA) process. It facilitates a two-way flow of information and dialogue between the project proponent and identified stakeholders, aimed at shaping project design, resolving potential conflicts at an early stage, supporting the implementation of agreed solutions, and monitoring ongoing project activities.

To ensure a structured, transparent, and inclusive engagement process, a Stakeholder Engagement Plan (SEP) will be developed for the SAPZ project in Kaduna which include AIH Project in Daki Takwas, Chikun LGA. The SEP will define the framework, methods, and frequency of consultations with various stakeholder groups—including host communities, local government authorities, women, youth, and vulnerable persons—and establish mechanisms for grievance redress and continuous feedback.

The development of the SEP is necessary to promote accountability, build trust, and secure broad community support for the project. It will also guide the project team in meeting AfDB's Operational Safeguard requirements and national environmental regulations on disclosure, consultation, and participatory monitoring throughout the project lifecycle.

8.1.1 Objectives of Stakeholder Consultations

The main objective of the consultations with stakeholders was to discuss the proposed Kaduna AIH SAPZ projects' environmental and social implications with a view to jointly proffer appropriate mitigations for consideration. Specifically, the consultations sought to achieve the following objectives:

- to provide information about the proposed SAPZ project;
- to provide opportunities for stakeholders to discuss their opinions and concerns;
- to effectively communicate key project information such as construction timelines and work schedules to stakeholders, particularly project affected communities and persons;



- to provide and discuss with stakeholders, the alternatives considered to reduce anticipated impacts;
- to identify and verify significance of environmental, social and health impacts;
- to establish a mechanism for receiving and addressing grievances in a timely manner; and to inform the process of developing appropriate mitigation and management options.
- Establish stakeholders' perceptions, and solicit their participation for achieved benefits from the AfDB supported SAPZ project

8.1.2 Stakeholder Identification

Preliminary site visits were carried out in May 2025 to identify key stakeholders, this was successfully carried out with the assistance of the youth leader, Local Government Chairman, Director of Agriculture of the LGA and the Councilor representing Dutse ward at the LGA. At this time, information was also gathered on the spatial boundaries of the Project and any likely key issues associated with land ownership. During this visit, the following group of stakeholders were identified for consultation.

- Key Administrative Stakeholders (Federal Government Agencies, Kaduna State Government Agencies, Chikun Local Government Authority and Traditional Leaders);
- Project Affected Persons (PAPs);
- Vulnerable Groups; and
- Host Community;

8.2 Engagement Methodology

A participatory and inclusive approach was adopted for the stakeholder's engagement activities. Conscious efforts were made to minimize interruption to stakeholders' daily activities, with careful selection of meeting times and locations. Meetings were conducted in Hausa and English, depending on the ethnicity and first language of the participants. English was used during engagements with the state government as it is the official language in Kaduna State, though Hausa is also accepted for the purpose of effective communication in the House of Assemblies and other jurisdictional platforms like courts for interpretations among other. All



meetings were recorded; with meeting notes, lists of comments, concerns and feedback all captured in the process, and the right to stakeholders' confidentiality fully observed.

8.2.1 List of Stakeholders Consulted

Host Communities, Project Proponent/Relevant MDAs:

- Kaduna State Ministry of Agriculture;
- Kaduna State Ministry of Environment and Natural Resources;
- Kaduna State Environmental Protection Agency;
- Hakimi, Sarki and Mai-Angwan of Daki-Takwas Community;
- All farmers across Chikun LGA, Kaduna State;
- Communities around the Proposed project area

The ESIA team visited the SAPZ office several times, followed by a meeting with Ministry of Agriculture, Ministry of Environment Forestry Department and several visits was made to the District Head of Dutse and Maiunguwa of Daki-Takwas all of Gbagyi Emirates of Chikun Local Government of Kaduna State. The visit was to support our efforts to collect official information and establish link to respective leaders of the communities ahead of the community engagement, communications was sent to all community leaders, elders, youth leaders and women leaders. Various meetings were held with these groups on the proposed project and with the district head of Kasarami/Dutse of Chikun LGA on the requirement and the need for the information for our team to start the ESIA study and capture all their needs and challenges that are associated or may be associated directly or indirectly with SAPZ projects.

8.2.2 Outcome of Stakeholder Consultations

The minutes of the technical session with the stakeholders from the Host Communities, Ministry of Agriculture and other relevant ministries and parastatals (see list of attendance) is summarized in Table 8.1 below. The list of stakeholders across the value chain consulted and the nature/topic of discussions is presented in Table 8.2. Photos taken during and after consultations with the various stakeholders/institutions are outlined in Plate 8.1, while the attendance list can be found in Table 8.3.

**Table 8.1 Minutes of the technical session**

Date	19/07/2025
Venue	
In attendance	• Reps. Kaduna State Ministry of Agriculture • Reps. Forestry Dept. Kaduna State Ministry of Agriculture • Reps. Kaduna State Ministry of Env. and Nat. Resources • Reps. Kaduna State Environmental Protection Agency; • Reps. Chairman, Chikun LGA; • Reps. Federal Ministry of Environment, Kaduna State office; • Hakimi Daki-Takwas Community; • Sarki Daki-Takwas Community, • Mi-angwan Daki-Takwas Community, • District head, Kasarami Gbagyi, • Management Team, Kaduna SAPZ office, • ESIA Consultancy Team
Language of Communication	English /Hausa
Meeting in Session	Opening prayer was led from among the community members followed by introduction of participants. An introductory remark was given by the representative of the Commissioner, Ministry of Agriculture. (forestry dept) He introduced the ESIA Consultant team and gave an overview of the proposed SAPZ project.
Consultant's presentation	The ESIA Lead Consultant, after welcoming everybody expressed his joy and satisfaction at the large turnout which he called a sign of community support for the project. He further gave an overview of the purpose of the ESIA study. by informing the participants that his team was at the meeting to consult with the community on their willingness to host the SAPZ project or not, to find out their concerns about the SAPZ project and to educate them on potential positive and negative environmental and social externalities associated with the project. He further explained that the meeting was aimed at ascertaining the public approval of the community to host the project and also to find out their concerns about the project with a view to discussing and arriving at a mutually beneficial solution. The meeting also aimed at ensuring that there is no conflict of interest on the land designated for the SAPZ project.



Date	19/07/2025
Venue	
	Lastly, he inquired from the community and the people in attendance at the meeting if there are concerns about implementation of the proposed SAPZ project in their area.
Response from the Community	At this point, The Miangwa of Daki – Takwas introduced himself as the representative of the Sarki and the entire farmers on the proposed project site at Daki – Takwas, after thanking all for the initiative of coming to meet with them, went to state the following as their concern and prayers with respect to the proposed Kaduna SAPZ project: ○ The government should do well in fulfilling the promise of compensating them for their farmland and crops as it is their only source of livelihood ○ That government should employ them both during construction and operational cycle of the SAPZ project ○ That government should not forget them in the areas of infrastructural development like Pipe -borne water, Electricity, Health facilities, schools etc. ○ He ended by requesting for continuous relationship between them and the government throughout the life cycle of the project.
Consultant's Response	After thanking the Miangwa and the communities for their openness and sincerity as evident in their submission through the Miangwa, he assured them as follows: ▪ That there is adequate provision for compensation, at this juncture he informed them of the RAP and LRP studies which are not only to take care of compensation for their farmlands and crops but also to enhance their livelihoods positively



Date	19/07/2025
Venue	▪ Regarding employment and infrastructures, he promised there shall be a recommendation in that regard in our report to the client as we are merely consultants to the project, our job is to give the best advise to the project proponent based on our findings on the field. ▪ Lastly, and on the issue of continuous consultations, he assured them them that there is provision for continuous interaction and consultation with them as the host community. He went further to explain the scoping activities that will be carried out in the period of the field study. The scoping activities involves focus group discussions with various stakeholders, collection of water and soil samples at strategic locations for environmental parameter analysis and description of the bio-physical features that borders the project area. The study would be useful in addressing the adverse impact of the project. He also informed the gathering about the grievance redress mechanism, which will be established for the project, with the aim to provide a platform for complains and settlement of grievances which may affect the project. He further stated that the operational guideline for the Grievance Redress Mechanism (GRM) will be distributed since it exists in Kaduna State under Kaduna Geographic Information System (KADGIS) at the end of the preparation of the ESIA and that the Ministry of Agriculture will also sensitize the stakeholders further about it. After all the explanation, the ESIA Team Lead asked if they were satisfied with his explanation or Not? In response to the consultant's question, the Miangwa, again on behalf of the Sarki and the entire communities expressed their satisfaction with the handling



Date	19/07/2025
Venue	
Community's Response to Consultant's Question	of the meeting and also pledged their total support for the project which they have seen as one that will bring tremendous development to their community.
And the Meeting came to a Close	After the Miangwa's positive response and words of support to the Kaduna SAPZ project, the ESIA Team Lead thanked the Sarkis, Miangwas and other members of the communities for their patience, support and maturity throughout the meeting. After this, the Imam of Daki – Takwas mosque said the closing prayer, committing the proposed Kaduna SAPZ project and the host communities in the hands Allah. After this, a group photograph was taken for the records.

Table 8.2 Summary of Stakeholders Engagement Meeting

Stakeholder/Institution/Location	Contact Person	Role	No of Representatives	Date	Line of Discussions
Project Implementers					
Kaduna State Ministry of Agriculture			2	July 2024	Discussion was about: Provision of relevant information on Project site potentials; livelihood impact; proposed mitigation plans and support required towards implementation.



Kaduna State Environmental Protection Agency (KEPA)			2	July2025	Our discussion centers on managing the project impacts, ESIA procedure and updates on project concession agreement. Land acquisition and compensation process in line with state standards and discussions around top up mechanism to comply with international best practices. We Discussed: Livelihood improvement strategy at the LGA and exploring livelihoods service providers for collaboration on implementation. Discussion of entitlement matrix and compensation.
Kaduna State Ministry of Environment & Nat. Res.			2	July2025	
Local Government Chairman.			3	July2025	



Traditional Rulers:				JulyA2025	Discuss livelihood improvement strategy and exploring livelihoods service providers for collaboration on implementation. Discussion of entitlement matrix and Compensation and positive impacts of the project on the communities.
Mai-Anguwa Daki Takwas;			17		
Hakimi Ungwan-Dawaki;			11		
Ugwan Sarki;			6		
District head, Kasarami (Gbagyi) etc.			9		



8.3 Photographs and attendance list from various consultations

8.3.1 Consultation Photograph



Plate 8-1: ESIA Team Meeting with SAPZ leadership and the DBO consultants

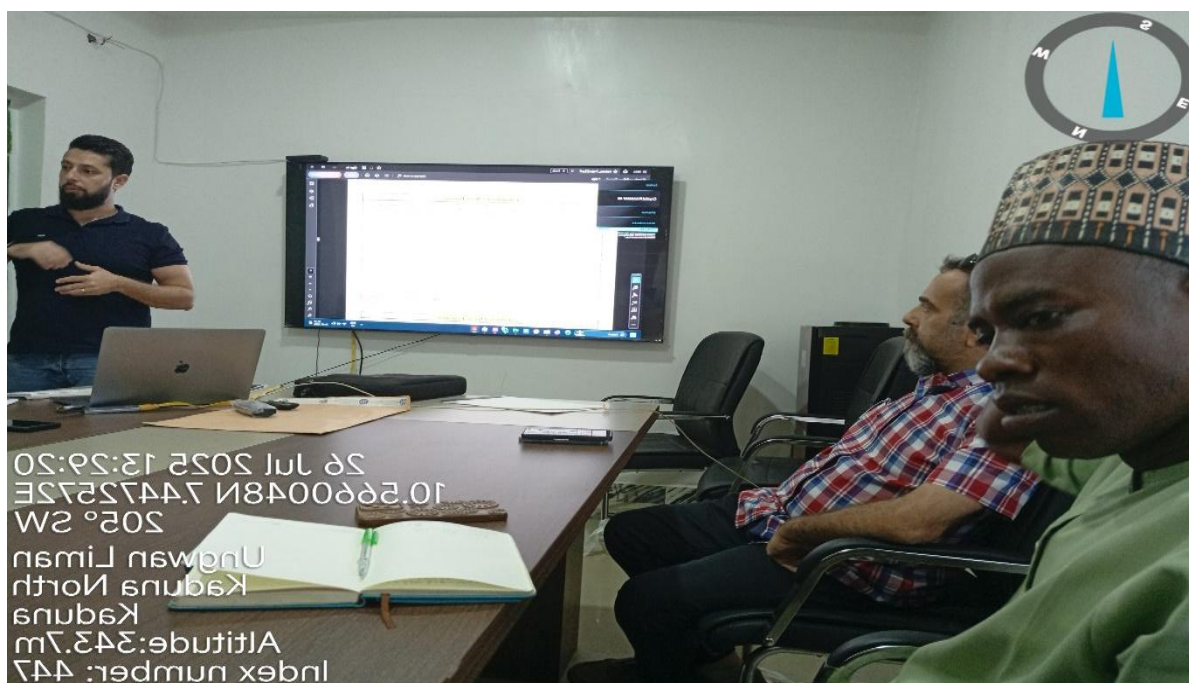




Plate 8-2: ESIA Team Meeting with SAPZ Leadership and the DBO Consultants

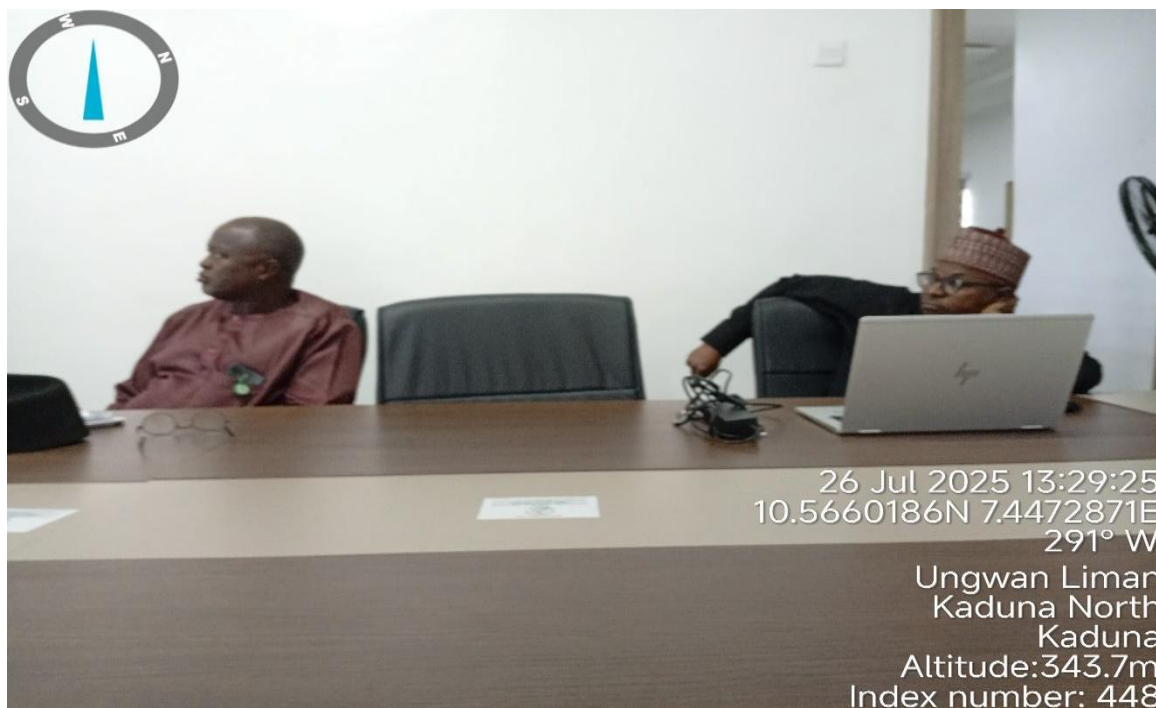


Plate 8-3: ESIA Team Meeting with SAPZ Leadership and the DBO Consultants



Plate 8-4: ESIA Team at the palace of District Head, Dutse, Gbagyi, Chikun LGA



Plate 8-5: ESIA Team with some community members at Daki-Takwas



Plate 8-6: Group picture, ESIA Team, District Head and Community members



Plate 8-7 :ESIA Team with some of the stakeholders



Plate 8-8 :ESIA Team with Stakeholders



8.3.2 Attendance List at Stakeholder's Meeting

VILLAGE HEAD OFFICE, S/GARI KASARAMI GWAGWADA DISTRICT Gbagyi Chiefdom, Kaduna State			
Our Ref: _____		Date: _____	
S/N	NAME	PHONE	SIGNATURE
1. ^{Sark}	Christopher Habila	09056050222	
2.	BOO Garba Galadima	08052658250	
3.	Sunday Sami	08029798170	
4.	Adamu Tuma	08057200267	
5.	Elsha Rawa	09058912323	
6.	Danladi Toma	09043982534	
7.	Ishaya Sarki	09025354570	
8.	Elsha Toma	08087812205	
9.	LECAS S ALAPITU	08059450931	
10.	Godfrey Attah	08138199055	
12.	Sunday Habila Sarki	08030616893	
13.	Alh. Garba Galadima	08032470188	
14.	Thing Markes	07035818181	
15.	Sylvester Samalla Garo	08130315246	
16.	ENGR. BATO OKEDIRAN	08030435411	
17.	YANGA BITRUS (ROW)	08022322855	
18.	YASHIM LUKA (REPS. ATUBATUKA)	08067651667	
19.	Isah Dogara Agwara	08029641990	
20.	Samuel Meisango	09070707072	
21.	Solomon Dabo Sodangi	08033143645	

ATTENDANCE 19/07/2025
Stakeholders Engagement

S/N	NAME	phone no.	Signature
①	Chief Solomon Dabò Sadrige	08033143645	
(2)	YASHIM LUKA	08067651667	
3.	Isah Dogara Agwar	08029641990	
4	Engr. BAYO OKEDIRAN	08030435411	
5	Aph. Garba Gelaadima (CP REP)	08032470188	
6	YANGA BITRUS (Rep)	08022322855	
7	Godfrey Attah	08138199055	
8.	LUCAS SARAHI ALAPHU	08059450931	
9.	EMMANUEL SARKI HABILA	08072996787	
10	Sunday Habila Sarki	08030616893	
11	Iliso Markue	07035818181	
12	Samuel Maisango	09070707072	

**Table 8.3: Stakeholder Engagement Monitoring Framework**

Objective	Indicator	Means of Verification	Frequency	Responsible Institution
Ensure continuous and inclusive stakeholder engagement throughout project phases	Number of stakeholder consultations held (by type and category)	Attendance sheets, meeting minutes, photos	Quarterly	PIU Environmental & Social Specialists / Consultant
Promote awareness of project activities, potential impacts, and mitigation measures	Number of information materials distributed (flyers, posters, radio broadcasts)	Copies of IEC materials, media logs	Quarterly	PIU / Communication Officer
Strengthen participation of vulnerable groups (women, youth, farmers, pastoralists)	% of vulnerable group representation in consultations	Attendance disaggregated by gender and category	Quarterly	PIU Social Specialist / CBO representatives
Address and track stakeholder grievances effectively	Number of grievances received, resolved, and pending	Grievance Log, GRM database	Monthly	PIU / Grievance Redress Committee
Ensure transparency and accountability in project implementation	Disclosure of key ESIA and ESMP documents	Disclosure records, AfDB website confirmation	Annual	AfDB / PIU / Kaduna State Ministry of Environment
Assess community perception and satisfaction	Level of stakeholder satisfaction (survey or interviews)	Survey reports, focus group notes	Bi-annually	PIU / Independent Monitor
Maintain institutional collaboration	Number of coordination meetings with LGA, MDAs, and	Meeting minutes and attendance lists	Quarterly	PIU / Kaduna State Ministries / Local Government



	traditional councils			

Table 8.4: Summary of Stakeholder Concerns and Responses

Stakeholder Group / Community	Key Concerns Raised	Responses / Commitments Provided	Status / Follow-up Plan
Daki-Takwas Community	Fear of land take and loss of farmland	Only pre-approved land allocated for AIH will be used; compensation and livelihood restoration plan under development	Addressed; continuous monitoring through RAP implementation
Ungwan Dawaki Community	Need for employment opportunities for youth	Priority for local employment in construction and operation phases; local labour registry to be maintained	Ongoing; contractor to report on employment statistics
Traditional Rulers and Elders	Cultural heritage protection and community benefits	Chance Find Procedure to be implemented; local leadership to be consulted before excavation or site clearing	Integrated into ESMP and site induction
Women's Groups	Access to livelihood support and inclusion in decision-making	Women to be represented in GRM Committee and trained on agro-processing and cooperative management	Ongoing through PIU gender mainstreaming program
Farmers' Associations	Concerns on water use and irrigation access	Water abstraction to be managed through Kaduna State Water Board permits; downstream users will not be deprived	Addressed through hydrological monitoring plan
Youth Associations	Requests for vocational training and skill acquisition	Technical training to be provided through partner institutions during hub development	Included in community development plan



Transport Union / Local Drivers	Road safety and damage to local roads during construction	Contractor to implement Traffic Management Plan; damaged sections to be rehabilitated post-construction	To be monitored quarterly
Kaduna State Ministry of Environment	Compliance with state EIA regulations and reporting	ESIA and ESMP submitted for review; monitoring and reporting framework established	Ongoing regulatory liaison
AfDB and PIU	Compliance with AfDB operational safeguards	SEP to align with AfDB Integrated Safeguards System (ISS); special outreach for vulnerable persons added	Periodic monitoring and reporting of all environmental and social management action plan for Kaduna

Table 8.5: Budget Summary (Indicative)

Item	Estimated Cost (USD)	Estimated Cost (₦)	Responsible Institution
Stakeholder consultations & logistics (travel, venues, refreshments)	8,000	₦12,800,000	PIU / Consultant
Communication materials (posters, flyers, community radio)	2,500	₦4,000,000	PIU
Grievance Redress Mechanism implementation	4,000	₦6,400,000	PIU / Community GRM Committee
Training and capacity building (small workshops, materials)	5,000	₦8,000,000	PIU / AfDB / LGA
Monitoring & evaluation (annual surveys, reporting)	6,000	₦9,600,000	PIU / Independent Monitor
Total Estimated Cost	25,500	₦40,800,000	

Institutional Roles and Responsibilities

- **PIU (Project Implementation Unit):** Lead coordination of all stakeholder engagement, reporting, and grievance management.
- **AfDB:** Oversight and compliance monitoring with ISS standards.



- **Kaduna State Ministry of Environment:** Regulatory oversight and participation in joint monitoring.
- **Chikun LGA & Traditional Institutions:** Facilitate community participation and conflict resolution.
- **Contractors:** Implement site-level engagement and safety communications.
- **Community-Based Organizations (CBOs):** Support dissemination and feedback at grassroots level.



CHAPTER NINE: CONCLUSIONS

9.1 Conclusions

The Environmental and Social Impact Assessment (ESIA) for the Special Agro-Industrial Processing Zone (SAPZ) Agro-Industrial Hub in Kaduna State demonstrates that the project presents both significant opportunities and challenges. The positive impacts include job creation, strengthened agricultural value chains, increased agro-industrial productivity, and socio-economic development for surrounding communities. Negative impacts, however, include land acquisition and resettlement risks, potential livelihood disruptions, air and noise pollution during construction, biodiversity disturbance, community health and safety risks, and, most critically, risks associated with the sloping and undulating topography of the site. The terrain influences surface hydrology, slope stability, runoff, drainage patterns, and flooding potential, creating unique environmental and engineering challenges. If unmanaged, these could result in gully erosion, shallow slope failures, waterlogging, subgrade weakening, and downstream flooding.

The ESIA concludes that with appropriate design adaptations, slope stabilization measures, hydrological management, and strict implementation of the Environmental and Social Management Plan (ESMP), these risks can be managed to acceptable levels. Residual impacts after mitigation are expected to be minor to moderate, provided adequate resources and oversight are committed.

9.2 Recommendations

The following recommendations are made to ensure project sustainability, safeguard community welfare, and meet World Bank Environmental and Social Framework (ESF) requirements:

- Slope Stability:
 - Maintain cut and fill batters at no steeper than 1V:3H unless geotechnical checks justify otherwise.
 - Compact fill materials to at least 95% Maximum Dry Density (MDD) with moisture control.
 - Provide crest cut-off drains, lined toe drains, and stone-lined channels to manage runoff on slopes.



- Establish setbacks from slope crests and avoid locating heavy structures close to unstable slope edges.
- Hydrology and Drainage:
 - Grade all platforms with at least 1–2% slope away from built structures to avoid ponding.
 - Construct grass swales, lined ditches, and outfalls with energy dissipators (riprap, aprons).
 - Design detention/retention basins at low points, sized for 1-in-25-year internal and 1-in-100-year external storm events.
 - Preserve natural drainage paths and provide culverts/weirs where embankments intercept flow.
- Flood and Erosion Risk Management:
 - Install temporary erosion and sediment controls during construction (silt fences, check dams, rapid revegetation).
 - Undertake stormwater modeling (e.g., HEC-HMS, SWMM) to simulate and design for peak flow conditions.
- Practical Checks for Design and Construction:
 - Prepare a slope classification map (0–2%, 2–5%, 5–10%, >10%) to identify high-risk areas needing reinforcement.
 - Carry out flow-accumulation mapping to detect ponding zones and micro-channels requiring drainage design.
 - Conduct geotechnical investigations (shear strength, Atterberg limits, groundwater depth) to guide slope and foundation designs.
- Institutional and Contractor Capacity:
 - SPIU should conduct periodic geotechnical and hydrological audits of construction works.
 - Contractors must integrate slope stabilization, drainage, and erosion control measures into method statements.
 - Provide regular training for contractor staff on environmental, health, and safety measures.
- Stakeholder Engagement and GRM:
 - Continue structured consultations with communities, especially regarding flood and erosion risks.
 - Maintain the functional, transparent, and accessible Grievance Redress Mechanism (GRM) established in Section 7.7.
- Climate Resilience:
 - Integrate climate adaptation measures such as improved drainage systems, vegetative buffer zones, and flood mitigation structures.
- Go-Ahead Recommendation:
 - The project is considered environmentally and socially feasible provided that slope stabilization, drainage, flood risk management, and ESMP measures are implemented in full. Strong contractor adherence and SPIU oversight are essential for project success.



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LIST OF APPENDICES

Appendix 1: Impact Scoring Rubric

This rubric provides the standardized scoring framework for assessing environmental, social, and health impacts during the ESIA.

Criteria	Score 1	Score 2	Score 3	Score 4	Score 5
Magnitude	Negligible change, barely discernible	Minor change within baseline variability	Moderate change, noticeable but manageable	Major change, significant deviation from baseline	Severe change, irreversible damage
Extent	Impact limited to project site	Impact extends to immediate surroundings	Impact at community/LGA level	Impact at regional/state level	Impact at national/international scale
Duration	Very short-term (days)	Short-term (weeks to months)	Medium-term (several years)	Long-term (project lifespan)	Permanent or irreversible
Reversibility	Fully reversible, recovery immediate	Reversible within short period (months)	Reversible in medium-term (years)	Partially reversible, difficult recovery	Irreversible change, no recovery possible
Sensitivity	Low sensitivity (robust environment/community)	Moderate sensitivity (some resilience)	Sensitive receptor (ecosystem or vulnerable group)	High sensitivity (critical resource or group)	Very high sensitivity (protected area, highly vulnerable)
Overall Significance Interpretation	1–2 = Low significance	3 = Medium significance	4–5 = High significance		



Appendix 2: Impact Register

<i>This sheet contains lookup tables (5.8–5.12) used for calculating significance.</i>				
Table 5.8: Spatial Effect				
Magnitude	Extent	Spatial Score		
1	1	2		
3	2	5		
5	5	10		
Table 5.9: Temporal Effect				
Duration	Frequency	Temporal Score		
1	1	2		
3	3	6		
5	5	10		
Table 5.10: Combined Spatial + Temporal				
Spatial	Temporal	Combined Score		
2	2	4		
5	6	11		
10	10	20		
Table 5.11: Impact Severity with Sensitivity				
Combined	Sensitivity	Severity Score		
4	1	5		
10	3	13		
20	5	25		
Table 5.12: Overall Impact Significance (Severity + Likelihood)				
Severity	Likelihood	Significance		
5	1	Low		
13	3	Moderate		
25	5	High		

**Appendix 3: General project activities of the SAPZ AIH development project**

Project Phase	General Project Activities
Pre-Construction and Site Preparation	Land acquisition and compensation of PAPs
	Project site survey works: (mapping, demarcation and beaconing) of plots in the layout plan for either commercial, industrial, or construction of roads
	Stakeholder engagement: consultation
	Site clearing and preparation: Setting up of temporary facilities on the construction site: (e.g., temporary contractor camps, storage areas, equipment laydown areas, and sanitary facilities.)
	Site grading, excavation earthworks, backfilling, and leveling of land to prepare for construction works
	Perimeter fencing for security
	Utility route planning works: (design, surveying and mapping to align on ground the ROW routes designated for of the power lines, water pipes, ICT cables, etc.
	Mobilisation of equipment and materials to the project site: (Transportation of construction machinery and materials to the project site)
Construction	Mobilization of equipment and construction workers to the AIH project site
	Civil construction works: Construction of buildings, onstruction of roads, side drains, culverts, retaining walls, and site grading
	Utility infrastructure construction works: Construction and installation of electricity infrastructure, water supply systems, sewer lines, ICT infrastructure, waste management facility
	Construction of core processing facilities: Building of rice mills, tomato processing factory, feed mills, ginger drying and processing factory, soy oil manufacturing factory
	Construction of support service infrastructure: Construction of storage warehouses, cold chain rooms, silos, and packaging units
	Construction of Administrative and Training Blocks: Construction of Offices, Staff Quarters, Meeting / Training Halls, Laboratories, and ICT / Data Centers
	Construction of Social Infrastructure: Construction of Clinics, Recreation Areas, Canteens, Restrooms, and Community Facilities
	Installation of AIH Machineries: Placement and testing of AIH Production Machinery and Processing Lines



Project Phase	General Project Activities
	Landscaping and Development of Green Buffers: Planting of Vegetation to control dust, enhance aesthetics and act as environmental buffers Waste Management Systems: Construction of solid waste and liquid waste collection, treatment, and recycling systems
Operation and Maintenance	AIH Facility Commissioning: Testing and validation of processing units, utilities, and safety systems before operation Recruitment and Training of Personnel: Hiring of skilled / unskilled labor, including operators, technicians, administrative staff, and security staffs Agricultural Coordination: Linking with outgrowers and suppliers of tomatoes, maize, soybeans and ginger Agro-Processing Operations: Full-scale operation of value chain processing / facilities and related logistics Maintenance and Repairs Operations: Routine and preventive maintenance of machinery, roads, and utilities Quality Control, Research and Development Operations: Monitoring of AIH product standards, and implementation of continuous improvements Agro-Industrial Hub Business Operations: Product Packaging, Branding, Marketing, Sales, and Distribution Waste Generation, Storage, Collection, Treatment and Disposal: Daily management of solid, liquid, and hazardous wastes in line with regulations Community Engagement and Consultations: Sustained consultation and grievance redress mechanisms with host communities
Decommissioning and Closure	AIH Closure Planning: Preparation of a decommissioning and site rehabilitation plan Stakeholder Consultation: Engagement with communities and regulators on closure intent and procedures AIH Equipment Dismantling: Safe removal and recycling / disposal of machinery, piping, tanks and other materials Demolition of Structure: Demolition of non-reusable buildings, followed by debris clearance AIH Site Cleanup:



Project Phase	General Project Activities
	Removal of contaminants, residual waste, and reinstatement of topsoil
	Waste Disposal: Environmentally compliant disposal of hazardous or non-recyclable waste materials
	Restoration and Revegetation of the AIH: Replanting and greening of the site for ecological recovery or alternative land use

Appendix 4 Table 5.3e: Initial Screening List of Affected Media

Impact Category	Specific Medium
Environmental	Land Use
	Natural Habitat and Biological Resources
	Topography, Geology and Soils
	Water Resources
	Ambient Air Quality
	Noise and Vibration
	Solid and Hazardous Waste
	Energy Resources
Socioeconomic	Socioeconomics and Social Aspects
	Transportation
	Cultural Resources
Health and Safety	Occupational and Public Health
	Occupational and Community Safety and Security

**Appendix 5: Environmental, Social and Health Components and Impact Indicators**

Components	Impact Indicators
Biophysical	
Geology	Changes to geology, geomorphology, topography
Soil	Changes to physical and chemical properties and soil ecology
Surface Water	Changes to water quality indices, (physicochemical properties, hydrocarbons, metals and hydrobiology); Introduction of exotic species, changes in habitat quality, abundance, diversity; Effluent discharge
Hydrobiology and Fisheries	Changes in water quality, changes in fisheries productivity
Vegetation	Changes to vegetation population, health, species abundance and diversity and impact on endangered and economic species, food chain effects
Wildlife	Changes to wildlife assemblages, impact on endangered and economic species, food chain effects
Air	Emissions of NO _x , SO _x , PM, CO, VOC, greenhouse gases (CO ₂ , CH ₄ , and N ₂ O), ozone and changes to ground level concentrations of pollutants
Vibration and Noise	Change in noise or vibration levels at sensitive receptors
Aesthetics	Physical presence of facilities, increased night time light
Groundwater	Contamination of shallow or deep groundwater resources, change in ground water resources
Sediments	River/waterbed morphology, physical and chemical properties, benthic organisms.
Social	
Population	Changes in population indices, total population, gender ratio, age distribution
Infrastructure	Improvement or pressure on existing urban/rural infrastructure including waste handling facilities
Macro and Micro economy	Change in macro and micro economy, employment, standard of living, occupation
Social and Cultural Structure	Disruption in local authority and governance structure; change in social behaviours; intra and inter ethnic clashes;
Physical and Economic Displacement	Permanent physical displacement from residence as a result of project land take, or activities; permanent or temporary displacement from land or water based livelihood activities; partial or whole severance from social and cultural networks
Cultural and Archaeological resources	Physical disturbance of shrines, burial grounds, archaeological resources or other desecration
Transportation	Alteration in means of transportation or ability to move efficiently



Components	Impact Indicators
Education	Change in primary, secondary and tertiary education school enrolment and attendance
Health Determinants	
Pollution Related Health Effects	Increase in concentration of, and exposure to non ionizing radiation, air pollutants of concern (NO _x , SO _x , VOC, CO, PM), contamination of surface waters and potable ground water, increased vibration and noise beyond regulatory limits, increased night time light beyond acceptable limits.
Communicable and Non Communicable Diseases	Change in incidence of communicable and non-communicable diseases or disease causing factors
Morbidity and Mortality	Change in health of workers and of general public, change in security of the area
Nutritional status	Changes to nutritional status
Health Care/Recreational Facilities	Changes in availability of and access to health care and recreational facilities
Psychosocial factors	Drug use/abuse, communal violence, crime, suicide, depression and prostitution; changing expectations of quality of life
Fertility	Changes to fertility levels, changes in birth rates
Accidents/Fires/Explosions	Changes to rate of occurrence and severity of accidents/fires/explosions



Appendix 6: Screening Matrix for Potential Impacts (Biophysical and Social Impacts)

PROJECT PHASES AND ACTIVITIES	Biophysical Impact Indicators												Social Impact Indicators									
	Surface Water Quality	Groundwater Quality	Soil Quality	Vegetation	Wildlife	Air Quality	Noise and Vibration	Micro Climate	Topography /Landscape Disturbance	Geology	Aesthetics and Visual Aspect	Land use Conflict and Disturbance	Population	Infrastructure	Micro and Macro Economy	Social and Cultural Structure	Physical and Economic Displacement	Transportation	Education	Pollution Related Health Effects	Health Care and Recreation Facilities	Accident – Fire – Explosion Incidence
PRE-CONSTRUCTION AND SITE PREPARATION																						
Land Acquisition and Involuntary Displacement	-	-	-	-	-	-	-	-	-	-	-	2	-	-	2	2	2	-	-	-	-	-
Physical Presence of Workers, Equipment and Materials on Site	1	1	1	-	-	1	1	-	-	-	1	1	1	2	1 +	2 +	+	1	-	2	1	1
Transportation of Workers and Materials	-	-	-	-	-	2	1	-	-	-	1	1	-	2	1 +	2	1	2	-	2	1	1
Project Site and Utility Route Survey Works	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Contractor's Site Clearing and Preparation Operations and Logistics: (Setting up of Temporary Facilities on the Construction Site)	1	-	1	1	1	1	1	-	2	-	2	1	1	2	2 +	2	1	2	-	2	1	1
Wastes and Emissions Handling and Disposal	1	1	1	-	-	1	-	-	-	-	2	-	-	1	+	-	2	1	-	2	1	2



PROJECT PHASES AND ACTIVITIES	Biophysical Impact Indicators												Social Impact Indicators									
	Surface Water Quality	Groundwater Quality	Soil Quality	Vegetation	Wildlife	Air Quality	Noise and Vibration	Micro Climate	Topography /Landscape Disturbance	Geology	Aesthetics and Visual Aspect	Land use Conflict and Disturbance	Population	Infrastructure	Micro and Macro Economy	Social and Cultural Structure	Physical and Economic Displacement	Transportation	Education	Pollution Related Health Effects	Health Care and Recreation Facilities	Accident – Fire – Explosion Incidence
CONSTRUCTION																						
Physical Presence of Workers, Equipment and Materials on Site	1	1	1	-	-	1	1	-	-	-	1	1	1	2	1 +	2 +	+	1	-	2	1	1
Transportation of Workers and Materials (Project Site Personnel's Logistics Issues)	-	-	-	-	-	2	1	-	-	-	1	1	-	2	1 +	2	1	2	-	2	1	1
Civil, Buodling, Social and Surport Services Infrastructure and Core Processing Factory Construction Works	1	-	1	1	1	1	1	-	2	-	2	1	1	2	2 +	2	1	2	-	2	1	1
Installation and Testing of AIH Factory Equipments and Machineries	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	1	2
Landscaping and Development of Green Buffers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Wastes Disposal and Emissions Handling	1	1	1	-	-	1	-	-	-	-	2	-	-	1	+	-	-	1	-	2	1	2
OPERATION AND MAINTENANCE																						



PROJECT PHASES AND ACTIVITIES	Biophysical Impact Indicators												Social Impact Indicators									
	Surface Water Quality	Groundwater Quality	Soil Quality	Vegetation	Wildlife	Air Quality	Noise and Vibration	Micro Climate	Topography /Landscape Disturbance	Geology	Aesthetics and Visual Aspect	Land use Conflict and Disturbance	Population	Infrastructure	Micro and Macro Economy	Social and Cultural Structure	Physical and Economic Displacement	Transportation	Education	Pollution Related Health Effects	Health Care and Recreation Facilities	Accident – Fire – Explosion Incidence
SAPZZ AIH Facility Start-up and Commissioning	-	-	-	-	-	1	1	-	-	-	-	-	1	1	1	1	-	1	-	1	1	2
Operation of the Agro-Industrial Processing Hub Factories and Business Operations	1	1	1	-	-	1	1	-	-			-	1	1	2 +	2 +	-	1	-	1	1	2
Physical Presence of AIH Factory Workers	1	1	1	-	-	1	1	-	-	-	1	1	1	2	1 +	2 +	+	1	-	2	1	1
Transportation of Workers and Value Chain Commodities, Raw Materials etc., to the Hub	-	-	-	-	-	2	1	-	-	-	1	1	-	2	1 +	2	1	2	-	2	1	1
Operation and Maintenance of Water Supply Systems, Sewer Lines, and Electric Power Infrastructure	1	1	1	-	-	1	1	-	-	-	-	-	1	2	1 +	2 +	-	1	-	2	1	2
Wastes and Emissions Handling and Disposal	1	1	1	-	-	1	-	-	-	-	2	-	-	1	+	-	-	1	-	2	1	2
DECOMMISSIONING AND CLOSURE																						
AIH Closure, Decommissioning and Site Rehabilitation Plan Preparation and Approval	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1



PROJECT PHASES AND ACTIVITIES	Biophysical Impact Indicators												Social Impact Indicators									
	Surface Water Quality	Groundwater Quality	Soil Quality	Vegetation	Wildlife	Air Quality	Noise and Vibration	Micro Climate	Topography /Landscape Disturbance	Geology	Aesthetics and Visual Aspect	Land use Conflict and Disturbance	Population	Infrastructure	Micro and Macro Economy	Social and Cultural Structure	Physical and Economic Displacement	Transportation	Education	Pollution Related Health Effects	Health Care and Recreation Facilities	Accident – Fire – Explosion Incidence
Physical Presence and Transportation of Workers and Demolition Equipment on Site	1	-	1	-	-	1	1	-	-	-	1	1	1	2	1 +	2 +	-	1	-	2	1	1
AIH Equipment Dismantling:	1	1	1	-	-	1	1	-	1	-	2	-	1	1	-	1	-	1	-	2	1	2
Demolition of Structure	1	1	1	-	-	1	1	-	1	-	2	-	1	1	-	1	-	1	-	2	1	2
Restoration and Revegetation (Landscaping) of the SAPZ AIH	-	-	-	1 +	1 +	-	-	1 +	1 +	-	2 +	-	1	-	-	-	-	-	-	-	1	1
AIH Site Cleanup , Wastes Disposal, and Emissions Handling	1	1	1	-	-	1	-	-	-	-	2	-	-	1	+	-	-	1	-	2	1	2

[illegible]



Appendix 8: Field Reference Tools (Rubric Cards & Posters)

Quick Reference Card – Impact Assessment Rubric

Criteria	1 (Lowest)	2	3	4	5 (Highest)
Magnitude	Negligible	Minor	Moderate	Major	Severe
Extent	Site-specific	Local (<5km)	District-wide	Regional	National/Transboundary
Duration	Days	Weeks	Months	Years	Permanent
Reversibility	Fully reversible	Mostly reversible	Partially reversible	Difficult to reverse	Irreversible
Sensitivity	Very low	Low	Medium	High	Very high
Likelihood	Rare	Unlikely	Possible	Likely	Almost certain
Overall Significance	1–2 = Low		3 = Medium		4–5 = High

Refer to ESIA Annex 1 for detailed rubric definitions



Appendix 9.1: ESMP Detailed Tables & Monitoring Plan

Note: USD equivalents auto-calculated at fixed exchange rate (1 USD = 1500 NGN). Update in 'Settings' sheet if needed.

Project Phase	Project Activity	Potential Impact	Mitigation Measures	Responsibility (Implementation)	Responsibility (Monitoring)	Cost Estimate (NGN)	Cost Estimate (USD)
Construction	Site clearing & excavation	Loss of vegetation, soil erosion	Restrict clearing to designated areas; re-vegetate cleared zones promptly	Contractor	Supervising Consultant	1500000	
Construction	Civil works & equipment operation	Dust emissions, air quality deterioration	Regular water sprinkling; cover stockpiles; enforce speed limits on site roads	Contractor	HSE Officer	1000000	
Construction	Worker presence on site	Occupational health & safety risks	Provide PPE; conduct HSE induction & weekly toolbox meetings; enforce safety signage	Contractor HSE Unit	Independent Safety Auditor	2000000	
Construction	Construction traffic & haulage	Traffic congestion, road accidents	Prepare and enforce Traffic Management Plan; use flagmen; schedule off-peak deliveries	Contractor	Road Safety Authority	1200000	
Operation	Facility operation	Solid & liquid waste generation	Implement Waste Management Plan; provide segregation bins; licensed disposal contractors	Facility Operator	State Environmental Agency	1800000	
Operation	Production activities	Water pollution from effluents	Construct effluent treatment plant; monitor discharge quality; comply with NESREA standards	Facility Operator	NESREA / FMEnv	3000000	



Appendix 9.2: Monitoring indicators with frequency

Note: Monitoring indicators and frequency aligned with ESIA requirements; see 'Settings' sheet for standard references.

Project Phase	Project Activity	Impact/Aspect to Monitor	Monitoring Indicator(s)	Frequency of Monitoring	Means of Verification	Responsibility (Implementation)	Responsibility (Monitoring)
Construction	Civil works & equipment operation	Air quality (dust emissions)	PM10/PM2.5 levels ($\mu\text{g}/\text{m}^3$)	Weekly	Field air quality measurement logs	Contractor	HSE Officer
Construction	Construction traffic & haulage	Traffic safety	Number of traffic incidents / near misses	Monthly	Incident and accident reports	Contractor	Road Safety Authority
Construction	Worker presence on site	Occupational health & safety	Accident & injury records	Monthly	HSE reports; medical logs	Contractor HSE Unit	Independent Safety Auditor
Operation	Facility operation	Water quality (effluent discharge)	BOD, COD, TSS levels	Quarterly	Laboratory test results; discharge logs	Facility Operator	NESREA / FMEnv
Operation	Facility operation	Waste management	Volume of waste generated & disposed via licensed contractors	Monthly	Waste manifests; contractor receipts	Facility Operator	State Environmental Agency



Appendix 9.3: ESMP Costing at Fixed Rates

Mitigation Item	Unit	Quantity	Unit Cost (NGN)	Total Cost (NGN)	Total Cost (USD @1500)
Provision of PPE (helmets, boots, gloves)	set	100	15000	1500000	1000
Dust suppression (water sprinkling)	day	60	20000	1200000	800
Effluent monitoring (BOD, COD, TSS tests)	test	12	50000	600000	400
Waste segregation bins	bin	50	25000	1250000	833.3333333
HSE induction and training sessions	session	10	100000	1000000	666.6666667
Traffic management measures (flagmen, signage)	month	6	300000	1800000	1200

ESMP Costing at Flexible Rate

Mitigation Item	Unit	Quantity	Unit Cost (NGN)	Total Cost (NGN)	Total Cost (USD)
Provision of PPE (helmets, boots, gloves)	set	100	15000	1500000	1000
Dust suppression (water sprinkling)	day	60	20000	1200000	800
Effluent monitoring (BOD, COD, TSS tests)	test	12	50000	600000	400
Waste segregation bins	bin	50	25000	1250000	833.3333333
HSE induction and training sessions	session	10	100000	1000000	666.6666667
Traffic management measures (flagmen, signage)	month	6	300000	1800000	1200



Appendix 10: Stakeholder Engagement Records

Photographs on Various Consultations



Plate8.1.1: ESIA Team Meeting with SAPZ leadership and the DBO consultants

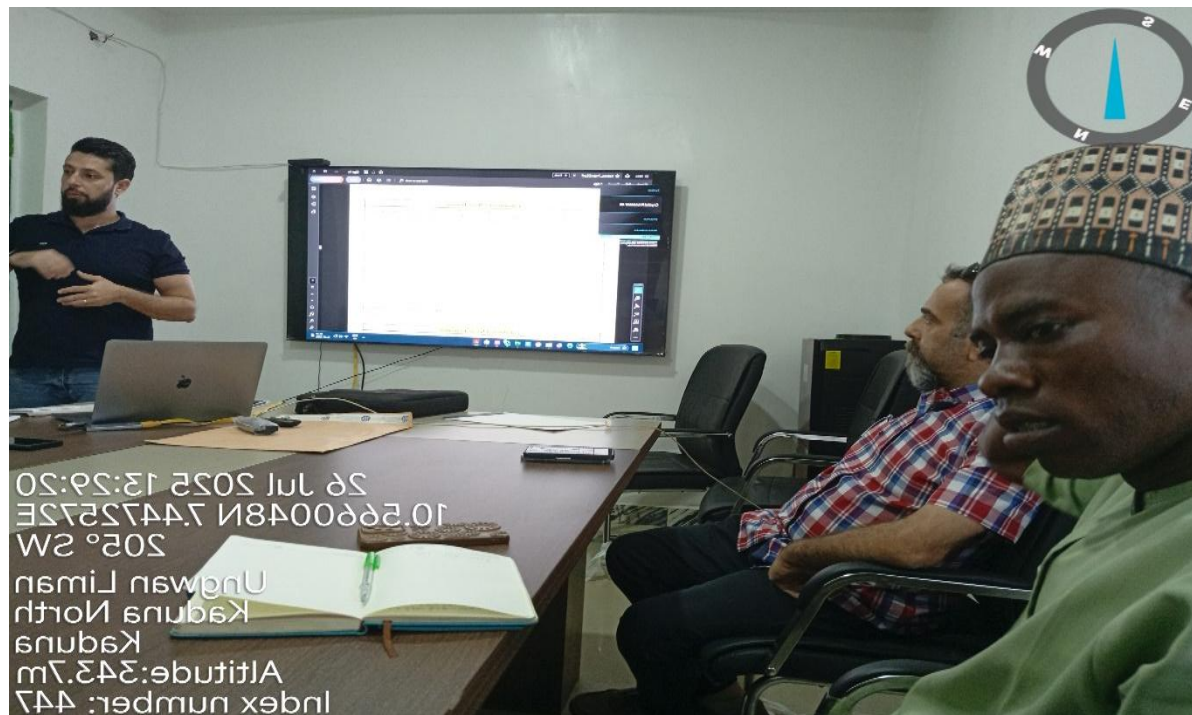


Plate8.1.2: ESIA Team Meeting with SAPZ Leadership and the DBO Consultants

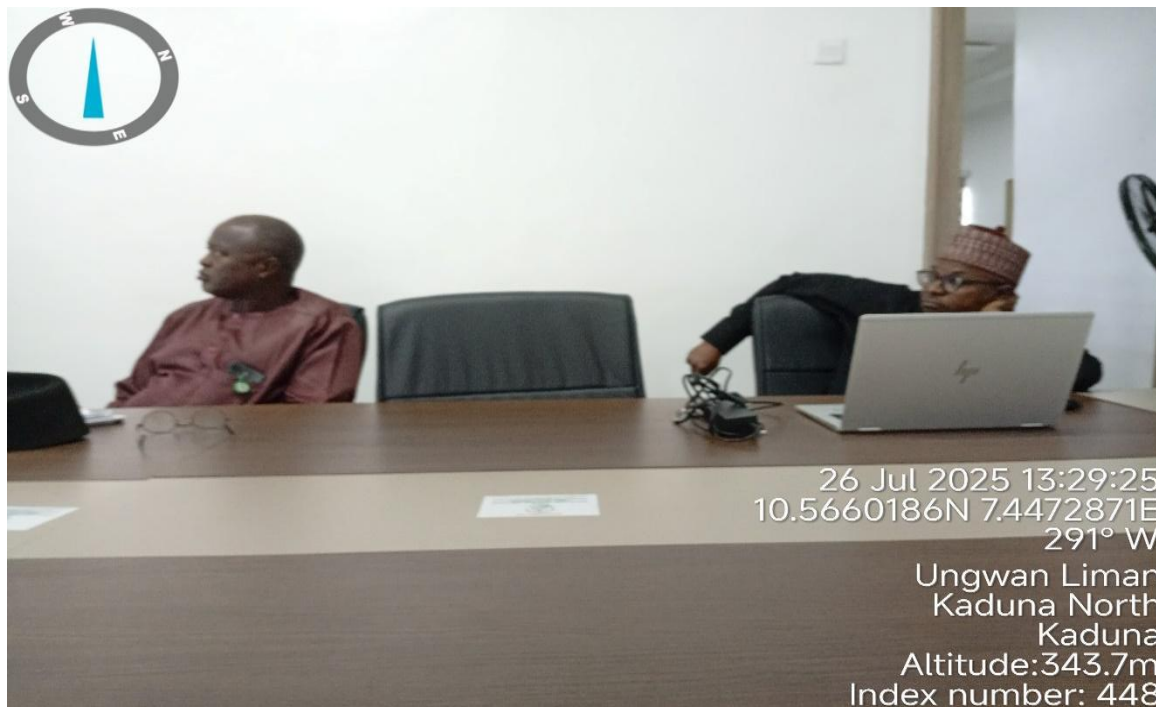


Plate 8.1.3: ESIA Team Meeting with SAPZ Leadership and the DBO Consultants



ESIA Team at *the palace of District Head, Dutse, Gbagyi, Chikun LGA*



ESIA Team with some community members at Daki-Takwas



Group picture, ESIA Team, District Head and Community members



ESIA Team with some of the stakeholders



ESIA Team with Stakeholders



Appendice 11: Attendance List at the Stakeholders Meeting

ATTENDANCE 19/07/2025
Stakeholders Engagement

S/N	NAME	PHONE NO.	SIGNATURE
①	Chief Solomon Babo Sodangi	08033143645	<i>[Signature]</i>
(2)	TASHIM LUKE	08067651667	<i>[Signature]</i>
3.	Isah Dogara Agwax	08029641990	<i>[Signature]</i>
4	Engr. BATO OKEDIRAN	08030435411	<i>[Signature]</i>
5	Ath. Garba Galadima (CP RTR)	08032470188	<i>[Signature]</i>
6	YANGA BITRUS (ROR)	08022322855	<i>[Signature]</i>
7	Godfrey Attah	08138199055	<i>[Signature]</i>
8.	LUCAS SARAKI ALAPHU	08059450931	<i>[Signature]</i>
9.	EMMANUEL SARKI HABILA	08072776787	<i>[Signature]</i>
10	Sunday Habila Sarki	08030616893	<i>[Signature]</i>
11	Ilings Markues	07035818181	<i>[Signature]</i>
12	Samuel Maisango	09070707072	<i>[Signature]</i>

VILLAGE HEAD OFFICE, S/GARI KASARAMI
GWAGWADA DISTRICT
Gbagyi Chiefdom, Kaduna State

Our Ref: _____ Date: _____

S/N	NAME	PHONE	SIGNATURE
1.	Christopher Habila	09056050222	<i>[Signature]</i>
2.	Isah Dogara	08052658250	<i>[Signature]</i>
3.	Sunday Sarki	08029798170	<i>[Signature]</i>
4.	Adanmi Tuma	08057200267	<i>[Signature]</i>
5.	El. Sha Rawa	09058912323	<i>[Signature]</i>
6.	Danladi Tuma	09043982534	<i>[Signature]</i>
7.	Isah Sarki	09025354570	<i>[Signature]</i>
8.	El. Sha Tuma	08087812205	<i>[Signature]</i>
9.	LUCAS S ALAPHU	08059450931	<i>[Signature]</i>
10.	Godfrey Attah	08138199055	<i>[Signature]</i>
12	Sunday Habila Sarki	08030616893	<i>[Signature]</i>
13	Ath. Garba Galadima	08032470188	<i>[Signature]</i>
14	Ilings Markues	07035818181	<i>[Signature]</i>
15	Sylvester Camalla Goro	08130315246	<i>[Signature]</i>
16	ENGR. BATO OKEDIRAN	08030435411	<i>[Signature]</i>
17	YANGA BITRUS (ROR)	08022322855	<i>[Signature]</i>
18	TASHIM LUKE (ROR, ATUENTUKA)	08067651667	<i>[Signature]</i>
19	Isah Dogara Agwax	08029641990	<i>[Signature]</i>
20	Samuel Maisango	09070707072	<i>[Signature]</i>
21	Solomon Babo Sodangi	08033143645	<i>[Signature]</i>



Appendix 12 Letter of Laboratory Accreditation



NIGERIAN MIDSTREAM AND DOWNSTREAM PETROLEUM REGULATORY AUTHORITY

Plot 1012, Cadastral Zone AOO, Central Business District, P.M.B.609, Garki GPO, Abuja, Nigeria.
Tel: +234(0) 9-460-5033. Email: authority@nmdpra.gov.ng www.nmdpra.gov.ng

Ref: NMDPRA/HQ/HSEC/04/2025/009

Date: 22nd January 2025

The Managing Director

Kaduna State Environmental Protection Authority (KEPA)
L10 link Road
Ungwan Television
Kaduna State.

Dear Sir,

LETTER OF LABORATORY ACCREDITATION

Reference is made to the inspection exercise carried out on your laboratory facility by officers of the Authority on 5th November 2024.

2. Report of the inspection revealed that your laboratory has met the minimum requirements to render a third-party Environmental Quality Monitoring Services in the Midstream and Downstream oil and gas industry.

3. Consequently, the accreditation of your laboratory is hereby revalidated to render these services for a period of one (1) year from the date on this letter.

4. Please note this accreditation is one of the pre-requisites for the issuance of Authority service permit, you are therefore expected to fulfil other requirements and apply online at www.mdogisp.gov.ng to obtain the relevant Oil & Gas Industry Service Permit.

5. Furthermore, you are required to submit an electronic copy of your activity report in a Microsoft Excel format on quarterly basis to hsec@nmdpra.gov.ng alongside the hard copies. The activity report as a minimum should contain:

- I. Status of your laboratory equipment
- II. Types of analysis conducted
- III. Number of samples analyzed

Kindly note that without prejudice to the above, the Authority reserves the right to an appraisal of your analysis results where necessary.

6. Finally, any changes in ownership, facility location, personnel, or test methodology should be reported to the Authority in writing within a period of four (4) weeks before the date of such changes.

Yours faithfully,

Engr. Amos Oliver Piribu

For: Executive Director, Health Safety Environmental & Community



Appendix 13: Grievance Redress Mechanism (GRM) Framework Document

A. Objective

The Grievance Redress Mechanism (GRM) provides a structured process for receiving, assessing, and resolving complaints from individuals, groups, or institutions affected by the AIH SAPZ Project in Dakiu–Takwas, Chikun LGA, Kaduna State.

Its primary objectives are to:

- Promote accountability and transparency in project implementation;
- Provide accessible and timely resolution of environmental and social grievances;
- Prevent escalation of conflicts and maintain good community relations;
- Support compliance with AfDB, FMEnv, and KEPA safeguard requirements.

B. Guiding Principles

The GRM shall operate on the following principles:

1. **Accessibility:** All stakeholders, including vulnerable groups, can submit grievances free of charge.
2. **Transparency:** The process and outcomes will be publicly disclosed at community and SPIU levels.
3. **Fairness and Confidentiality:** All complaints will be handled objectively and confidentially, ensuring non-retaliation.
4. **Timeliness:** Every complaint will be acknowledged within 5 working days and resolved within 30 working days where possible.
5. **Feedback and Documentation:** Complainants will be informed of outcomes in writing, and all grievances logged in a database.

C. Institutional Structure of the GRM

The GRM operates on **four tiers**, each responsible for escalating unresolved cases upward.

Tier	Level	Responsible Unit / Actors	Function



Tier 1	Community Level	Community Liaison Office (CLO), Ward Development Committee (WDC), Traditional Leaders	Receive and log grievances through community channels; attempt early resolution via dialogue.
Tier 2	Project Level	SPIU Grievance Redress Committee (GRC) composed of SPIU Safeguard Officers, Contractor Representative, CLO, and LGA official	Review unresolved community-level cases, investigate, and decide within 30 days.
Tier 3	State / Regulatory Level	Kaduna State Ministry of Environment, KEPA, and FMEnv Safeguard Units	Handle escalated cases involving regulatory breaches or unresolved compensation disputes.
Tier 4	Judicial / External Review	Courts of competent jurisdiction, AfDB Independent Review Mechanism (IRM)	Serve as the final appeal stage when administrative resolution fails.

D. Grievance Submission Channels

Multiple accessible channels will be available for lodging complaints, including:

- Verbal reports through community meetings or field officers;
- Written submissions to the **CLO Office** or **SPIU Environmental & Social Unit**;
- Dedicated **telephone hotline** and **WhatsApp channel**;
- Email submission via the SPIU project address;
- Suggestion/complaint boxes at project sites and LGA offices.

The SPIU will publicize all contact details through community noticeboards, radio, and local announcements in Hausa and English.

E. Grievance Resolution Process

Step 1: Receipt and Registration



- Grievance received via any channel is logged by the CLO within **48 hours**.
- A unique reference number is assigned, and acknowledgment is issued to the complainant.

Step 2: Screening and Categorization

- The GRC screens the complaint to determine type (environmental, social, labour, GBV/SEA, etc.) and urgency.
- Cases involving **GBV/SEA** are handled under a **confidential survivor-centred protocol** and referred to a trained focal person.

Step 3: Investigation and Resolution

- The GRC investigates the case, consulting relevant parties and site records.
- Corrective action or compensation measures are determined and implemented.

Step 4: Feedback and Closure

- Complainant is informed of the decision in writing or verbally (for illiterate persons).
- The case is marked “**closed**” only after the complainant acknowledges satisfaction.

Step 5: Escalation

- If unresolved, the complaint is referred to the next tier within **10 working days**.

F. GRM Flowchart

Grievance Submission → Registration & Acknowledgment → Screening → Investigation → Resolution → Feedback & Closure → Escalation (if unresolved)

Each step is tracked in the GRM database with timestamps and responsible persons.

G. GRM Record-Keeping and Reporting

The **SPIU Safeguard Unit** will maintain a digital and physical grievance logbook containing:

- Date and nature of grievance;
- Complainant details (if not anonymous);



- Category (environmental, social, labour, GBV/SEA);
- Actions taken and dates;
- Status (open/resolved);
- Feedback provided.

Quarterly GRM performance summaries will be included in SPIU's ESMP monitoring reports to FMEnv, KEPA, and AfDB.

Actor / Institution	Responsibilities
Community Liaison Officer (CLO)	First point of contact for complaints, ensures registration, acknowledgment, and timely forwarding.
SPIU Environmental & Social Safeguard Unit	Coordinates all grievance handling, ensures fair investigation, documentation, and timely feedback.
Grievance Redress Committee (GRC)	Reviews cases monthly; approves corrective measures; recommends escalation where necessary.
Contractor / Subcontractors	Maintain worker grievance log; cooperate with SPIU in investigations.
KEPA / FMEnv	Oversight, audits, and participation in escalated grievance resolution.
AfDB	Monitors compliance through supervision missions and may refer cases to the IRM if necessary.

H. Roles and Responsibilities

J. Monitoring Indicators for GRM Effectiveness

Indicator	Unit of Measure / Target
No. of grievances received per quarter	≥ 20% reduction after one year



Indicator	Unit of Measure / Target
% of grievances resolved within 30 days	≥ 80%
% of complainants satisfied with outcomes	≥ 90%
No. of GBV/SEA cases handled confidentially	100% compliance
Frequency of GRC meetings held	Quarterly
GRM summary reports submitted to FMEnv, KEPA, AfDB	100% compliance

K. Sustainability Measures

- Integrate GRM costs into **SPIU's operational budget** beyond construction.
- Maintain **active CLO office** during project operation and early decommissioning.
- Periodically review the mechanism based on community feedback.
- Include GRM performance in **annual environmental and social audits**.



Appendix 14: ESMP Matrix Tables (a – d)

A) Pre- Construction Phase

Project Activity/ Impact Source	Potential Environment and Social Impact	Mitigation/Enhancement Measures	Monitoring Indicators	Frequency	Responsible Institutions	Reference Standards	Estimated Cost (Naira)
Land acquisition and site preparation	Displacement, livelihood disruption	Implement RAP and LRP; compensate PAPs prior to displacement	No. of PAPs compensated; Percentage of RAP completion	Once, before construction	SPIU, FMEnv, AfDB, LGA	AfDB OS2; Nigerian Resettlement Guidelines	16,000,000
Stakeholder engagement and disclosure	Community tension, misinformation	Conduct FPIC; establish CLO; maintain feedback register	No. of meetings; attendance records	Monthly	SPIU, CLO	AfDB OS1	8,000,000
Clearing of Vegetation	Habitat disturbance	Implement Biodiversity Management Plan (BMP); define buffer zones	Area cleared vs buffer maintained	During Cleaning	Contractor, SPIU, KEPA	AfDB OS3	7,000,000
Soil exposure from grading	Sedimentation of Erosion	Install silt fences, diversion drains before clearing	Evidence of Erosion Control Structure	Weekly	Contractor, SPIU	FMEnv. Erosion Guidelines	8,500,000
Chance finds during excavation	Loss of Cultural Heritage	Apply Chance-Find Procedure; notify NCMM	Apply Chance-Find Procedure; notify NCMM	Continuous	Contractor, SPIU, NCMM	NCMM Act	4,000,000
						SUB TOTAL	43,500,000



B) Construction Phase

Project Activity	Potential Environmental and Social Impact	Mitigation/Enhancement Measures	Monitoring Indicators	Frequency	Responsible Institutions	Reference Standards	Estimated Cost (Naira)
Earthworks and excavation	Soil Erosion	Gabions, check dams, vegetation cover, limit rainy-season works	Erosion extent reports	Monthly	Contractor, SPIU	FMEnvt.	21,000,000
Machinery operation	Dust Emission	Maintain equipment, water sprinkling, cover haul trucks	PM ₁₀ , PM _{2.5} levels	Bi - Weekly	Contractor, SPIU	NESREA Air Quality Reg.	6,500,000
Equipment noise	Distance to Residence	Use silencers, restrict to daytime	Noise Level Readings	Weekly	Contractor, SPIU	FMEnv Noise Standards	4,300,000
Labour Influx	GBV, social tension	Local hiring, GBV/SEA training, worker code of conduct	Percentage of local workforce; GBV training logs	Monthly	SPIU, Contractor, CLO	AfDB OS2	7,800,000
Fuel and material handling	Soil and water contamination	Bunded storage; spill kits; proper waste disposal	Spill log records	Weekly	Contractor, SPIU, KEPA	FMEnv Waste Reg.	6,600,000
Waste generation	Pollution	Segregation, storage, and licensed disposal	Waste volumes; disposal receipts	Weekly	Contractor, SPIU	FMEnv Waste Reg.	7,000,000
Traffic Management	Congestion, accidents	Implement TMP; signage near schools	No. of accidents reported	Weekly	Contractor, LGA, SPIU	FRSC Standards	5,500,000



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Worker health and safety	Accidents, Injuries	Enforce PPE use, OHS Plan, safety drills	PPE compliance; incident logs	Weekly	Contractor, SPIU	ILO OHS	15,000,000
Community Health	Exposure to dust/noise	Awareness campaigns, periodic health checks	Awareness sessions held	Quarterly	SPIU, CLO	AfDB OS1	3,400,000
						SUB TOTAL	77,600,000

C) Operation Phase

Project Activity	Potential Environmental and Social Impact	Mitigation/Enhancement Measures	Monitoring Indicators	Frequency	Responsible Institutions	Reference Standards	Estimated Cost (Naira)
Plant operation and effluent discharge	Air, noise, water pollution	Operate treatment systems; monitor emissions	Air/water quality results	Monthly	Operator, SPIU, KEPA	FMEnv Standard	14,150,000
Agro – input Storage	Soil/groundwater contamination	Secondary containment; monitoring wells	Soil/water test results	Quarterly	Operator, KEPA	AfDB OS3	6,375,000
Worker and plant safety	Injuries, Exposure	Implement OHS policy, drills, audits	Safety reports	Quarterly	Operator, SPIU	ILO Standards	5,790,000
Biodiversity management	Habitat Degradation	Maintain reforestation buffers, annual species count	Vegetation cover index	Annually	SPIU, KEPA	AfDB OS3	6,000,000
Community engagement	Poor Relations	Conduct forums, maintain grievance database	Forum records	Quarterly	FPIU, CLO	AfDB OS1	8,750,000
						SUB TOTAL	41,065,000

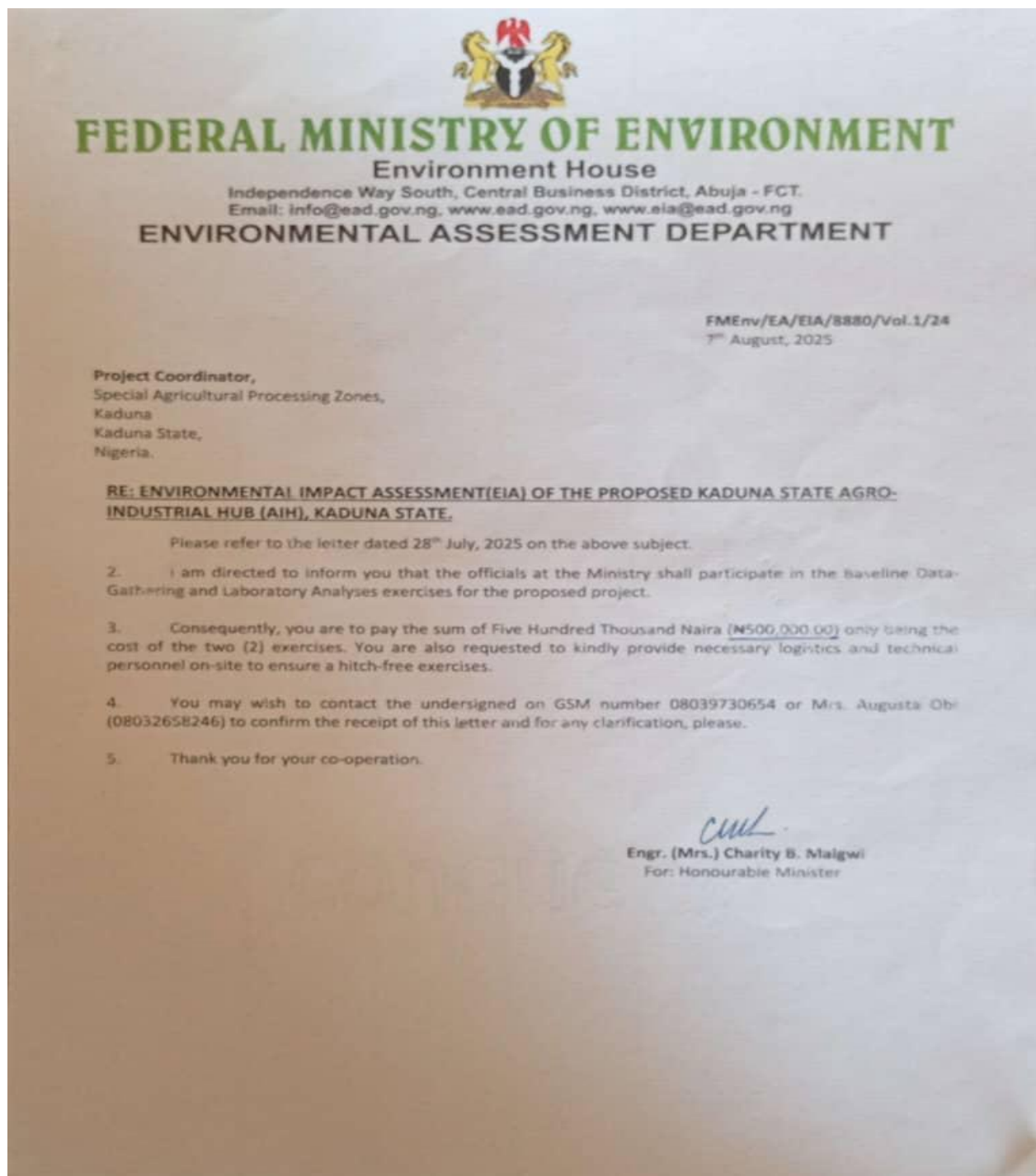


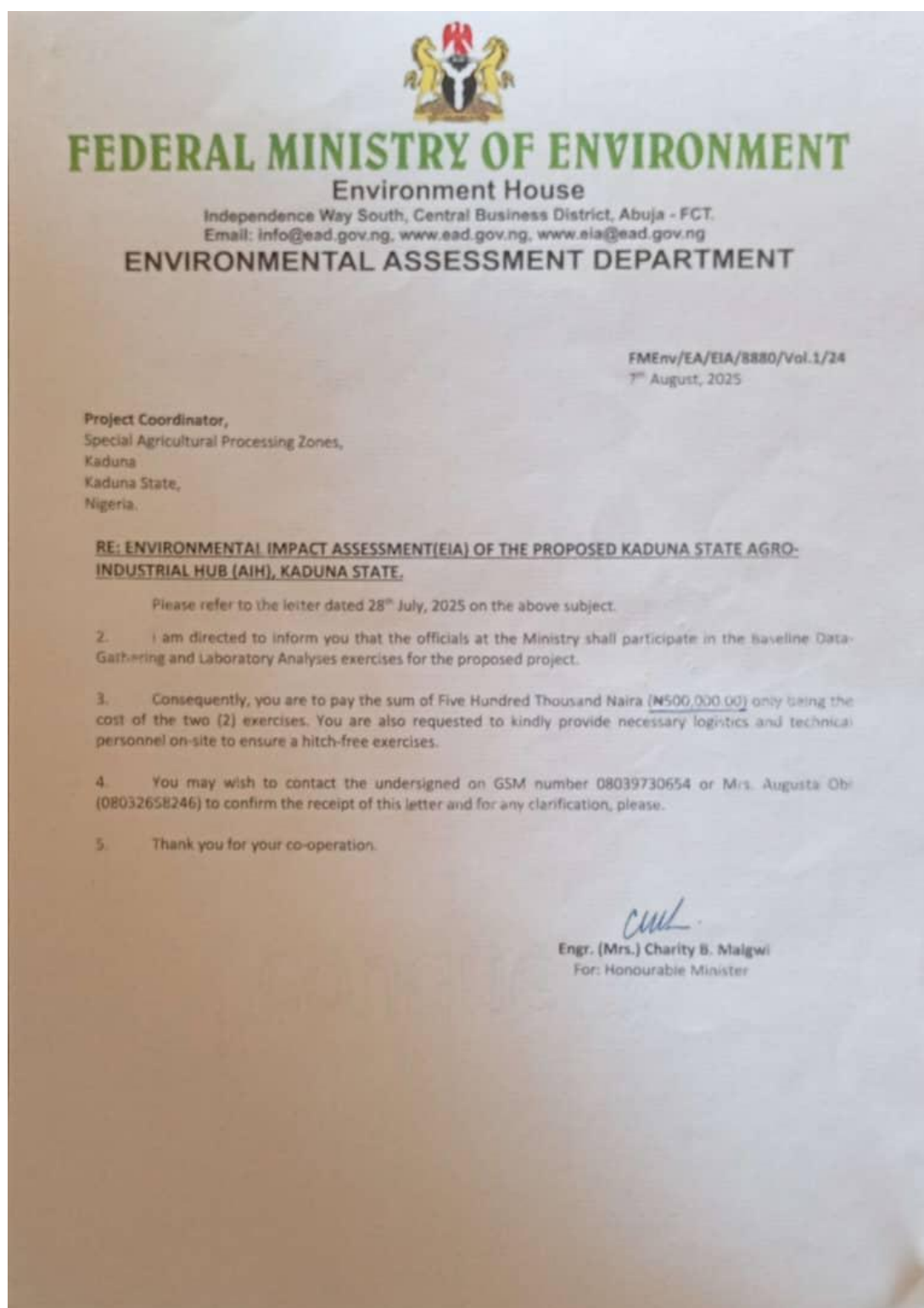
D) Decommissioning Phase

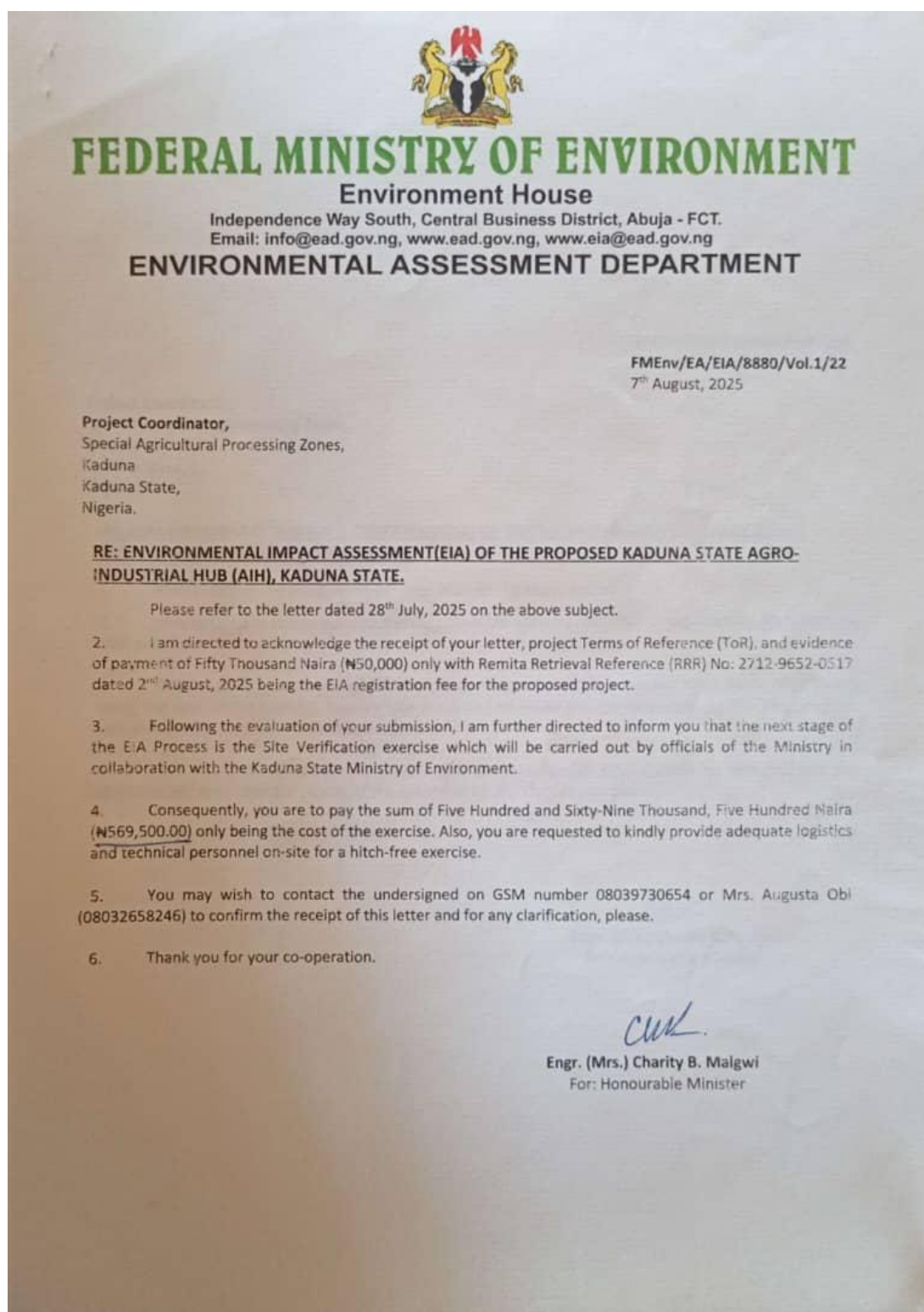
Project Activity	Potential Environmental and Social Impact	Mitigation/Enhancement Measures	Monitoring Indicators	Frequency	Responsible Institutions	Reference Standards	Estimated Cost (Naira)
Dismantling and demolition	Dust, Noise	Water spraying, PPE, restricted timing	Noise/dust readings	Weekly	Contractor, SPIU	FMEnv Decommissioning Guide	6,034, 123
Waste handling and site cleanup	Contamination Risk	Recycle, reuse, or licensed disposal	Waste logs, reuse records	Weekly	Contractor, KEPA	FMEnv Waste Reg	6,000,000
Worker retrenchment	Job loss, social tension	Provide retraining, compensation, livelihood support	No. retrained, satisfaction level	Once	SPIU, LGA	AfDB OS2	4,500,000
Site restoration	Soil Habitat Loss	Backfill, replant native vegetation, slope stabilization	Vegetation survival rate	Bi-Annually	Contractor, SPIU	AfDB OS3	7,000,000
						SUB TOTAL	23,534,123

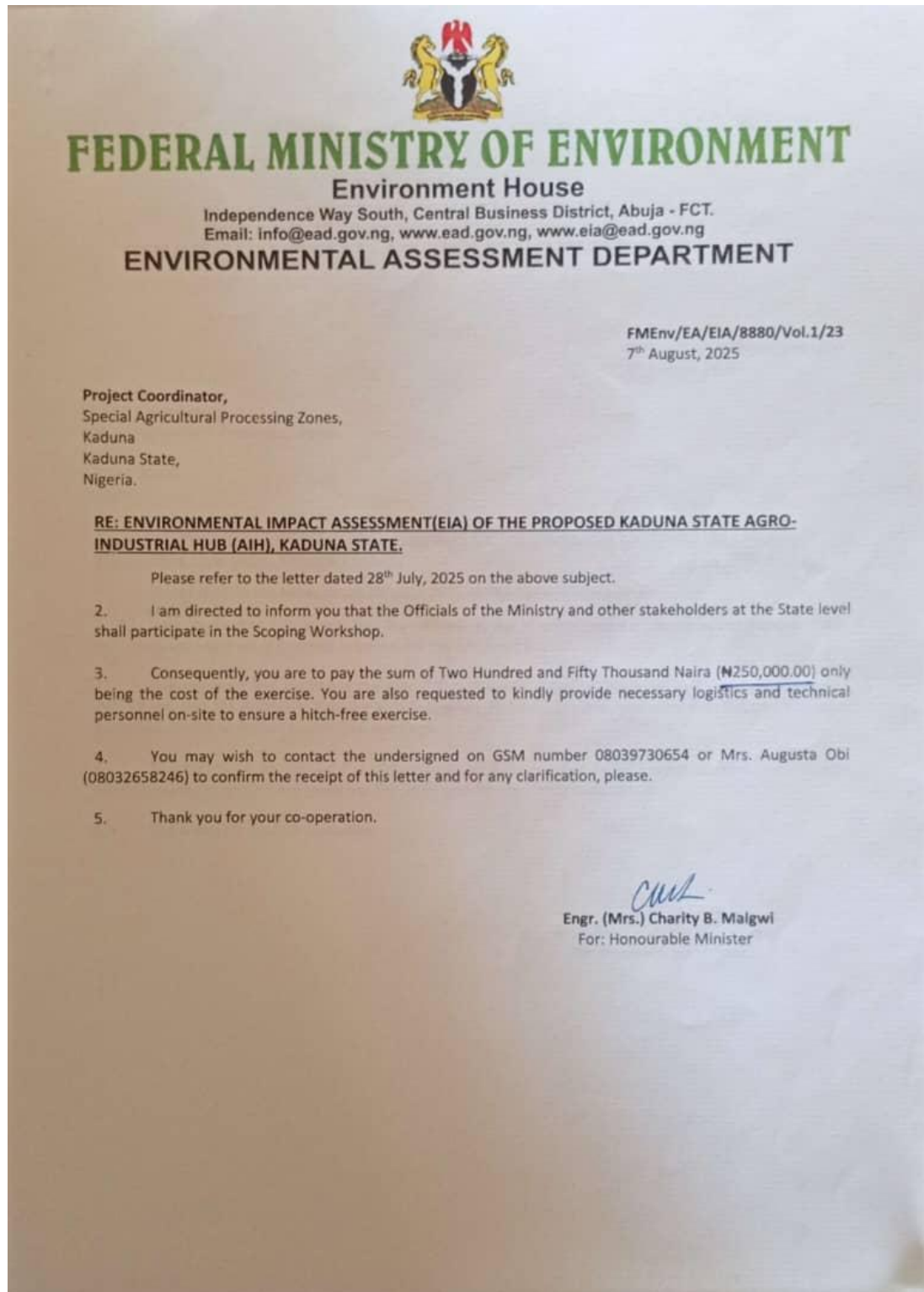


Appendix 15: Federal Ministry of Environment Letters









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