

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

OF THE PROPOSED

NIGERIA INTERNAL SECURITY PROJECT PHASE II - CRITICAL INFRASTRUCTURE (RAILWAY, DAM, GAS & MINING, POWER STATION AND PORT) VIDEO SURVEILLANCE SOLUTION

BY



**MINISTRY OF
INTERIOR**

PROJECT CONTRACTOR:



**中国路桥工程有限责任公司
CHINA ROAD & BRIDGE CORPORATION**

AUGUST, 2025

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PREPARED BY: HECOL NIGERIA LIMITED

August, 2025

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LIST OF ACRONYMS AND ABBREVIATIONS

‰	-	Parts per Thousand
µg	-	Micro gram
µg/g	-	Micro gram per gram
µg/m ³	-	Micro gram per meter cube
µS/cm	-	Micro Siemens per Centimeter
°C	-	Degree Celsius
°F	-	Degree Fahrenheit
3G	-	3rd Generation
A/m	-	Ampere per meter
AAS	-	Atomic Absorption Spectrophotometer
ANSI	-	American National Standards Institute
API	-	American Petroleum Institute
ASTM	-	American Society for Testing Materials
AUC	-	Authentication Centre
Ave.	-	Average
BAT	-	Best Available Technology
BOD ₅	-	5-day Biological Oxygen Demand
BSC	-	Base Station Controller
BSS	-	Base Station Subsystem
BTS	-	Base Transceiver Station
cm	-	Centimeter
CO	-	Carbon Monoxide
CO ₂	-	Carbon dioxide
COD	-	Chemical Oxygen Demand
CS	-	Charging System
CSR	-	Corporate Social Responsibility
dB	-	Decibel
DCD	-	Development Control Department
DCP	-	Dry Chemical Powder
DO	-	Dissolved Oxygen
DPR	-	Department of Petroleum Resources
EA	-	Environmental Assessment
EAR	-	Environmental Audit Report
EHS	-	Environmental, Health and Safety
EIA	-	Environmental Impact Assessment
ELF	-	Extremely low frequency
EMF	-	Electromagnetic fields
EMP	-	Environmental Management Plan
EMS	-	Environmental Management System
ERP	-	Emergency Response Plan
ESA	-	Environmentally Sensitive Areas
ESI	-	Environmental Sensitivity Index
et. al	-	et. alli (and others)
E-Waste	-	Electronic Waste
FCT	-	Federal Capital Territory
Fe	-	Iron
FEED	-	Front End Engineering Design
FEPA	-	Federal Environmental Protection Agency
FME _{Env}	-	Federal Ministry of Environment
g	-	Gram
g/m ²	-	Gram per meter square
g/m ³	-	Gram Per Meter Cube
GHG	-	Green House Gases
GHK	-	General Housekeeping

EIA for the Proposed Nigeria Internal Security Project Phase II - Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution

GIS	-	Geographic Information System
GPS	-	Global Positioning System
GSM	-	Global System for Mobile Communications
H ₂	-	Hydrogen
HDB	-	Hydrocarbon Degrading Bacteria
HES	-	Health, Environment and Safety
HIA	-	Health Impact Assessment
HLR	-	Home Location Register
HSA	-	Highly Sensitive Area
HSE	-	Health, Safety and Environment
HUB	-	Hydrocarbon Utilizing Bacteria
HUF	-	Hydrocarbon Utilizing Fungi
ICNIRP	-	International Commission on Non- Ionizing Radiation Protection
ICT	-	Information and Communication Technology
IEC	-	International Electric Code
IEE	-	Initial Environmental Examination
IF	-	Intermediate Frequency
IFC	-	International Finance Corporation
IMT	-	the International Mobile Telecommunications
ITCZ	-	Inter Tropical Convergence Zone
ITD	-	Inter Tropical Discontinuity
Kcal	-	Kilocalorie
kg	-	Kilogram
kg/cm ²	-	Kilogram per Centimeter Square
km ²	-	Kilometer square
Kr	-	Krypton
KVA	-	Kilovolt Ampere
l/d	-	Litre/day
LCA	-	Life Cycle Analysis
LCI	-	Life Cycle Inventory
LGA	-	Local Government Area
Long.	-	Longitude
LPS	-	Lightning Protection System
LSA	-	Low Sensitive Area
m	-	Meter
m/s	-	Meter per Seconds
m ² /d	-	Meter Square per Day
Max.	-	Maximum
mg	-	Milligram
mg/l	-	Milligram per Litre
MGW	-	Media Gateway
Min	-	Minimum
Min	-	Minimum
ml	-	Millilitre
mm	-	Millimeter
mS/cm	-	Meter Seimens per Centimeter
MSC	-	Mobile Switching Centre
₦	-	Naira
N.D	-	Not Detected
NAAQS	-	Nigerian Ambient Air Quality Standards
NCC	-	Nigerian Communications Commission
ND	-	Not Detected
NEC	-	National Electric Code
NEPA	-	National Electric Power Authority
NESREA	-	National Environmental Standards and Regulations Enforcement Agency
NGO	-	Non – Governmental Organizations

EIA for the Proposed Nigeria Internal Security Project Phase II - Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution

NH ₃	-	Ammonia
NIMET	-	Nigerian Meteorological Agency
NIR	-	Non-Ionizing Radiation
NO _x	-	Nitrogen Oxides
NPC	-	National Population Commission
O ₂	-	Oxygen
OAR	-	Operations Assurance Review
OE	-	Operational Excellence
OSHA	-	Occupational Safety and Health Administration
OSS	-	Operations Support system
PAH	-	Polycyclic Aromatic Hydrocarbons
Pb	-	Lead
pH	-	Potential of Hydrogen (Hydrogen ion Concentration)
PHCN	-	Power Holding Company of Nigeria
PLCS	-	Programmable Logic Controllers
PM	-	Particulate Matter
PPE	-	Personal Protective Equipment
ppm	-	Parts per Million
QC	-	Quality Control
QHSE	-	Quality, Health, Safety and Environment
RCA	-	Regulatory Compliance Audit
RF	-	Radio Frequency
RH	-	Relative Humidity
SEP	-	Stakeholder Engagement Plan
SEPA	-	State Environmental Protection Agency
SHE	-	Safety, Health and Environment
SHES	-	Security, Health, Environment and Safety
SLA	-	Service Level Agreement
SMEnv	-	State Ministry of Environment
SOP	-	Standard Operating Procedures
SPM	-	Suspended Particulate Matter
Sqm	-	Square meter
TC	-	Tropical Continental
TDS	-	Total Dissolved Solids
TH	-	Total Hydrocarbon
THB	-	Total Heterotrophic Bacteria
THC	-	Total Hydrocarbon Contents
THF	-	Total Heterotrophic Fungi
TLC	-	Total Loss Control
TM	-	Tropical Maritime
TOC	-	Total Organic Carbon
ToR	-	Terms of Reference
TRX	-	Transceiver
TSP	-	Total Suspended Particulate
TSS	-	Total Suspended Solids
UES	-	Uniform Effluents Standards
UNEP	-	United Nations Environment Programme
UPS	-	Uninterrupted Power Supply
USEPA	-	United State Environmental Protection Agency
UTM	-	Universal Traverse Marcator
VOC	-	Volatile Organic Compounds
WHO	-	World Health Organization
WMP	-	Waste Management Plan
Yrs	-	Years
Zn	-	Zinc

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EXECUTIVE SUMMARY

E.S- 1 INTRODUCTION

The Nigeria Internal Security Project Phase II is a flagship initiative of the Federal Ministry of Interior to secure critical national infrastructure. It targets five asset categories of railways, dams, gas & mining sites, power stations, and ports through advanced video surveillance and AI-enabled technologies. The project will reduce risks of vandalism, sabotage, theft, and terrorism while enhancing resilience and public safety. It will strengthen the operational capacity of NSCDC, NPF, FFS, and NCoS through real-time monitoring and coordinated response.

Supporting infrastructure includes command-and-control centres, secure cloud storage, intelligent management systems, and independent power supply. China Road and Bridge Corporation (CRBC) has been engaged as EPC contractor, while Hecol Nigeria Limited will conduct the EIA in line with FMEnv and global standards.

The initiative spans strategic states including Lagos, Abuja, Kano, Enugu, Rivers, Benue, and others to ensure nationwide coverage. Ultimately, it demonstrates government's commitment to modernising security architecture and safeguarding Nigeria's critical assets sustainably.

Project proponent

The Federal Ministry of Interior is the proponent of the Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution, mandated to safeguard internal security and critical infrastructure through its agencies (NIS, NSCDC, FFS, and NCoS). The Ministry has appointed China Road and Bridge Corporation (CRBC) as the engineering, procurement, and construction contractor. Hecol Nigeria Limited, an accredited consultancy, has been engaged to conduct the Environmental Impact Assessment (EIA). The study is being carried out in compliance with FMEnv and NESREA regulatory requirements.

Legal and Administrative Framework

EIA studies are carried out within the framework of both local and international environmental guidelines and regulations. Various guidelines and regulations on conducting EIA studies have been stipulated by international organisations such as the World Bank (IBRD), various local organisations such as the Federal Ministry of Environment (FMEnv), the EIA Act CAP E12 LFN 2004, National Environmental Standards and Regulations Enforcement Agency (NESREA), Nigerian Communication Commission (NCC), 2003 and States Environmental Legislation

E.S-2 PROJECT JUSTIFICATION

Need and Benefit of the Project

Nigeria's critical infrastructure including railways, dams, gas and mining facilities, power stations, and ports faces escalating threats of vandalism, theft, sabotage, and terrorism. Railway networks have suffered repeated attacks, causing costly disruptions, revenue losses, and declining public trust. Dams, gas pipelines, and mining facilities are vulnerable to encroachment, illegal bunkering, and environmental damage, undermining water security, energy supply, and government revenue. Power stations remain prime targets for vandalism of transmission lines and components, while ports face smuggling, theft, and organised crime that threaten trade competitiveness. The proposed Phase II Security Video Surveillance Solution addresses these challenges by deploying AI-enabled, high-definition monitoring across strategic facilities nationwide. The system will enable 24/7 surveillance, intelligent threat detection, and real-time response, thereby strengthening the Ministry of Interior, NSCDC, NPF, and partner agencies. Key benefits include enhanced reliability of

infrastructure operations and reduced economic losses from vandalism, theft, and sabotage. The project will also improve inter-agency collaboration and intelligence sharing across transport, energy, mining, and trade sectors. Fostering public confidence, investor trust, and job creation, the initiative will boost Nigeria's socio-economic resilience.

E.S 3- PROJECT DESCRIPTION

Project Location

The Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station, and Port) Security Video Surveillance Solution will be implemented across multiple states in Nigeria, covering all six geopolitical zones. The selected sites reflect areas with high traffic density, critical economic assets, and heightened vulnerability to security threats.

In the South-West, major facilities in Lagos and Oyo (Ibadan) will be covered, including railway stations, power installations, ports, and associated infrastructure. In the North-West, sites in Kano, Katsina, Jigawa, Sokoto, and Kebbi have been identified for surveillance deployment, reflecting the region's strategic transport and mining corridors. The North-East will be represented through key locations in Bauchi and Gombe, while the North-Central zone will host sites in Abuja (FCT), Benue (Makurdi), Plateau, Nasarawa, Kwara, and Kogi, where railway, mining, and power facilities are concentrated. In the South-East, installations are planned for Enugu and Abia, while the South-South will be comprehensively covered with strategic sites in Rivers (Port Harcourt), Delta, and Cross-River axis, reflecting the importance of ports, gas infrastructure, and power facilities in this region.

Project Description

The Nigeria Internal Security Project Phase II is a strategic initiative of the Federal Ministry of Interior to enhance the protection of critical infrastructure through an integrated surveillance and communication platform. It covers railways, dams, gas and mining facilities, power stations, and ports, with 24/7 monitoring, intelligent analytics, and rapid incident response.

Key components include intelligent CCTV cameras, wireless broadband trunking, solar-powered nodes, and three national data centres with Huawei FusionModule2000 technology. The project begins with threat assessments, feasibility studies, and regulatory compliance, including alignment with FMEnv, NDPA, and NSCDC protocols. Network design incorporates fibre backbones along railway corridors, edge AI-enabled cameras, and digital eLTE trunking for secure voice, video, and data communication.

Civil works will establish towers, poles, and solar farms to support self-powered CCTV, telecom equipment, and off-grid data centre operations. AI-driven energy optimization, smart storage systems, and predictive maintenance will ensure high efficiency, cost savings, and reliability. Overall, the initiative represents a modern, technology-driven approach to securing Nigeria's infrastructure while ensuring operational resilience and sustainability.

E.S 4- DESCRIPTION OF THE EXISTING ENVIRONMENT

Field Sampling and Observations

Field Sampling and observations was carried out to cover the wet season. This was aimed at determining the ecological characteristics and variations of the area during the season. The sampling was carried out from 8th to 20th, August, 2025. This sampling period covers the one seasonal regime approved for the study. Visual observations were made and documented in the field notebook.

Climate and Meteorology

The climatic regime of Nigeria, and by extension the project area covering the six geopolitical zones, is primarily influenced by two dominant air masses: the Southwest Monsoon winds from the Atlantic Ocean and the Northeast Trade winds (Harmattan) from the Sahara Desert. The seasonal interaction of these air masses produces Nigeria's distinct wet and dry seasons, with their intensity, duration, and onset varying across regions. The southern coastal zones typically experience longer wet seasons with high annual rainfall, while the northern zones are characterised by extended dry periods and higher temperature extremes.

Air Quality and Noise

An ambient air quality and noise baseline survey was conducted at 45 sampling points across railway, dam, gas, mining, power, and port sites nationwide. Results showed that most parameters complied with FMEnv and WHO standards, though elevated CO, NO₂, and particulates (PM₁₀/PM_{2.5}) were recorded at congested urban hubs, ports, and refinery zones. Noise levels were generally moderate but exceeded recommended residential limits near power plants, ports, and high-traffic railway stations. Overall, air quality remains largely within permissible limits, with localized hotspots requiring targeted mitigation.

Geology and Hydrogeology

The project area spans Nigeria's major geological formations, including the Precambrian Basement Complex and Sedimentary Basins, which influence soils, landforms, and groundwater. Basement Complex terrains in the North-Central, North-West, and South-West comprise granites, gneisses, and schists, while the Jos Plateau features Younger Granites. Sedimentary Basins such as the Chad, Benue, Niger Delta, Anambra, and Dahomey host sandstones, shales, limestones, and hydrocarbons, providing both mineral and fertile soil resources.

Groundwater Quality

Groundwater baseline assessments at boreholes and wells showed most physico-chemical and major ion parameters complied with FMEnv and WHO standards, confirming generally good quality. Turbidity, BOD₅, and COD showed slight exceedances in some hand-dug wells, suggesting local organic inputs. Trace metals were mostly within limits, though iron, aluminium, and occasional lead exceedances were recorded, with isolated detections of mercury, chromium, and arsenic near threshold levels. Microbiological contamination (coliforms and enterococci) exceeded standards in several wells, posing a public health risk in vulnerable communities.

Surface Water Quality

Surface water samples from rivers, streams, and wetlands across project states showed generally acceptable physico-chemical quality, with pH, EC, TDS, and major ions mostly within FMEnv and WHO limits. Localized issues included high turbidity, suspended solids, and low dissolved oxygen at some sites, while BOD₅ and COD occasionally exceeded standards, reflecting organic and chemical pollution. Nutrients such as nitrate (up to 45 mg/L) and ammonia (>0.5 mg/L in some sites) indicated agricultural runoff, sewage, and livestock waste inputs, with phosphate enrichment posing eutrophication risks. Trace metals revealed exceedances of iron, lead, cadmium, chromium, aluminium, mercury, and arsenic in some sites, mainly linked to mining, industrial discharges, and natural geology. Overall, while baseline conditions are broadly stable, several hotspots show contamination requiring close monitoring and mitigation to safeguard aquatic ecosystems and community water use.

Soil Studies

Baseline soil studies across Lagos, Rivers, Delta, Kano, and Kogi showed slightly acidic, non-saline soils with sandy loam textures, moderate fertility, and adequate nutrient reserves. Most physico-chemical parameters were within FMEnv/WHO limits, though phosphorus was deficient in some sites and heavy metals such as lead, cadmium, chromium, and nickel occasionally exceeded thresholds, indicating localized contamination. Soils were biologically active, with abundant heterotrophic bacteria, fungi, actinomycetes, and nitrifying microbes supporting nutrient cycling and soil health.

Hydrobiology

Hydrobiological studies showed moderately productive aquatic ecosystems with diverse phytoplankton, zooplankton, benthic macroinvertebrates, and macrophytes, though localized pressures exist from nutrient enrichment, mining runoff, and invasive water hyacinth. Phytoplankton were dominated by green algae and diatoms in cleaner waters, with low cyanobacteria signals of early enrichment, while zooplankton communities were balanced, reflecting mesotrophic conditions.

Vegetation and Wildlife

Baseline vegetation along the project corridors reflects Nigeria's ecological gradient, from northern savanna mosaics dominated by grasses and scattered trees to southern rainforest systems with complex canopies and riverine forests. Floristic surveys recorded 20 herbaceous and 21 woody species with high diversity indices, indicating moderately healthy ecosystems, though disturbed ruderal flora and reduced sensitive species signal anthropogenic pressure. Wildlife was modest in diversity, with birds (16 species) as the most dominant group, while mammals and reptiles were less common due to habitat disturbance and hunting pressure.

Socio-Economic Conditions

The Gender balance of the Critical Infrastructure communities is relatively even (52% men, 48% women), with men engaged in farming, industry, and transport, while women sustain livelihoods through trading, farming, and fish processing. Households are large (6–10 persons), with high poverty, food insecurity, and dependency pressures, especially in rural and agrarian communities. Ethnic and religious diversity mirrors Nigeria's pluralism, with Yoruba, Hausa-Fulani, Igbo, and South-South groups, alongside Islam, Christianity, and Traditional faiths shaping community life. Housing quality varies from modern urban dwellings to mud and thatch in rural areas, while land tenure is mostly customary, limiting women's ownership rights. Livelihoods are dominated by farming, livestock rearing, and trading, with professional jobs and logistics concentrated in urban hubs such as Lagos, Abuja, and Port Harcourt. Educational opportunities are uneven: strong tertiary institutions exist in Lagos, Rivers, and Abuja, but rural states like Kebbi, Taraba, and Kwara face poor facilities and high dropout rates. Healthcare is weak overall, with Lagos and Abuja better served, but Taraba, Kebbi, and Plateau underserved; malaria, waterborne diseases, and maternal mortality remain high, with life expectancy at 53–55 years. Stakeholder consultations across 18 states revealed strong support for surveillance as a tool to protect rail, port, mining, and energy assets, though communities raised concerns over land acquisition and displacement.

E.S-5 POTENTIAL AND ASSOCIATED IMPACTS

The Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station, and Port) Security Video Surveillance Solution will generate both positive and adverse environmental and socio-economic impacts across the identified host states.

The most significant positive impact is enhanced national security through continuous 24/7 surveillance, which will reduce vandalism, sabotage, theft, smuggling, pipeline tapping,

terrorism, and other threats to critical infrastructure. Improved safety and protection of strategic assets will build investor confidence, support uninterrupted operations in the transport, energy, and mining sectors, and stimulate socio-economic growth in host communities. The project will also generate employment opportunities during construction and operations, while promoting skills transfer, ICT knowledge, and local content participation.

Potential adverse impacts are anticipated mainly during the construction and installation phases. These include land take for surveillance towers, vegetation clearance, soil disturbance, dust generation, and increased noise emissions from heavy equipment. Risks of localized air quality deterioration and improper solid and hazardous waste management may arise. Soil and water contamination could occur from poor handling of lubricants, fuel, and other construction materials.

On the socio-economic side, possible negative effects include displacement of small businesses, restrictions on farmland access, and disruptions to community livelihoods. Vulnerable groups such as women traders, youth, artisanal workers, and pastoralists may face marginalization if project benefits and impacts are not equitably managed.

E.S-6. MITIGATION MEASURES

Mitigation measures for the Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station, and Port) Security Video Surveillance Solution are designed to minimize adverse impacts while enhancing socio-economic benefits across host communities.

Impacts from land take and restricted access will be addressed through fair compensation, transparent valuation, and local content policies that prioritize community participation. Livelihood restoration programs will be implemented to support affected farmers, traders, and vulnerable groups. Dust emissions, noise, and waste generation will be controlled through best practices such as dust suppression, regulated working hours, and designated waste collection, segregation, and disposal systems. Soil and water quality will be protected through erosion control measures, spill prevention protocols, and safe handling/storage of fuels and construction materials. Vegetation clearance will be limited to essential areas, with selective site clearing, re-vegetation, and buffer protection around sensitive ecosystems such as riparian forests, wetlands, and protected habitats.

Community Health & Safety: Worker camps will be enclosed to prevent undue community interaction, while strict HSE standards will be enforced for occupational health, PPE use, and fire/emergency management. Traffic safety measures, signage, and access controls will be introduced near railway, port, and energy installations to reduce risks.

Stakeholder Engagement: Continuous engagement with communities, traditional leaders, women's associations, and youth groups will be maintained. Grievance redress mechanisms will be established to ensure transparency, accountability, and trust throughout project implementation.

E.S-7. ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management Plan (EMP) for the Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station, and Port) Security Video Surveillance Solution provides a structured framework for preventing, mitigating, and monitoring environmental and social impacts throughout the project lifecycle. It defines institutional roles, compliance requirements, and performance indicators in line with FMEEnv, NESREA, and international standards such as IFC Performance Standards and World Bank EHS Guidelines.

- **Environmental Protection Measures:** Specific action plans include air quality control through dust suppression and machinery emission checks; proper waste

management systems covering collection, segregation, recycling, and disposal; noise reduction via regulated work schedules and sound barriers; soil and water protection through erosion control, spill prevention, and safe handling of chemicals; and biodiversity conservation through selective clearing, buffer zone protection, and re-vegetation programs.

- **Health and Safety:** The EMP prioritizes occupational health and safety (OHS) by mandating compliance with HSE protocols, provision of PPE, worker training, emergency preparedness, and accident response systems. Community health and safety will be enhanced through traffic and access management near project corridors, public awareness campaigns, and security coordination around sensitive infrastructure.
- **Socio-Economic Safeguards:** Land acquisition and livelihood impacts will be addressed through fair compensation, livelihood restoration initiatives, and social inclusion programs. Vulnerable groups including women, youth, and pastoralists will be supported via capacity building, CSR-driven interventions, and equitable participation in employment and project benefits.
- **Implementation & Monitoring:** EMP implementation will be jointly coordinated by the Federal Ministry of Interior and Hecol Nigeria Limited, with oversight by FMEnv and NESREA. Regular environmental and social audits, stakeholder consultations, and adaptive management strategies will ensure continuous improvement and compliance.

E.S-8. DECOMMISSIONING AND ABANDONMENT

The Decommissioning and Abandonment (D&A) Plan for the Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station, and Port) Security Video Surveillance Solution provides structured procedures for safely dismantling surveillance infrastructure at the end of its operational life or where sites are to be relocated. The plan is guided by FMEnv and NESREA regulatory requirements, as well as international standards and best practices.

Decommissioning will involve phased dismantling of surveillance towers, CCTV systems, solar power units, trunking systems, and ICT/data center equipment. All dismantled materials will be prioritized for reuse and recycling, while non-recyclables will be disposed of responsibly at approved facilities in compliance with environmental guidelines.

E.S- 9. CONCLUSIONS AND RECOMMENDATION

The Environmental Impact Assessment (EIA) concludes that the Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station, and Port) Security Video Surveillance Solution is both environmentally feasible and socially desirable. While potential impacts such as land acquisition, vegetation clearance, soil disturbance, and livelihood disruptions are anticipated, these are localized, short-term, and can be effectively mitigated through the proposed Environmental Management Plan (EMP) and best environmental practices.

On the positive side, the project will significantly enhance national security, protect critical infrastructure, reduce vandalism and sabotage, improve community safety, and promote socio-economic development across host states. It will also generate employment, foster skills transfer, and strengthen inter-agency collaboration.

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The Federal Ministry of Interior appreciates the Federal Ministry of Environment for its guidance during the preparation of this EIA report for the Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution. Special thanks go to China Road and Bridge Corporation (CRBC), the project contractor, and Hecol Nigeria Limited, the accredited Consultant, for their commitment and professionalism. The Ministry also acknowledges the cooperation of Critical Infrastructure communities and stakeholders across the project states whose support was invaluable to the success of this study.

CHAPTER ONE

INTRODUCTION

1.1 Background Information

The Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station, and Port) Security Video Surveillance Solution is a flagship initiative of the Federal Ministry of Interior (FMOI) under the second phase of the National Security Projects. It is designed to strengthen the protection of Nigeria’s most strategic infrastructure through the deployment of intelligent sensing technologies, big data analytics, artificial intelligence (AI), and integrated video surveillance systems. The project will secure five categories of critical assets nationwide, namely railway systems, dams, gas and mining facilities, power stations, and ports, thereby reducing vulnerabilities to vandalism, sabotage, theft, terrorism, and other security threats.

This initiative is expected to significantly improve the operational capacity of the Ministry and its key agencies, including the Nigeria Security and Civil Defence Corps (NSCDC), Nigeria Police Force (NPF), Federal Fire Service (FFS), and the Nigerian Correctional Service (NCoS). With its advanced capability for real-time monitoring, intelligent threat detection, and coordinated response, the project will enhance situational awareness, public safety, and the resilience of critical infrastructure across the country. To guarantee uninterrupted operations, the surveillance system will be supported by secure cloud infrastructure, intelligent video management platforms, high-capacity storage facilities, command-and-control centres, and independent power supply solutions.

To deliver the project, the Federal Government has engaged China Road and Bridge Corporation (CRBC) as the Engineering, Procurement, and Construction (EPC) contractor, while Hecol Nigeria Limited, a Federal Ministry of Environment (FMEnv) accredited consultancy, has been commissioned to undertake the Environmental Impact Assessment (EIA) in line with the provisions of the EIA Act CAP E12 LFN 2004, relevant FMEnv regulations, and international standards. The EIA will assess potential environmental, socio-economic, health, safety, and cultural impacts both beneficial and adverse associated with the project, and will recommend appropriate mitigation measures to minimise negative effects while maximising positive contributions.

The infrastructure to be covered under this initiative is strategically spread across key states, including Lagos, Oyo (Ibadan), Kano, Federal Capital Territory (Abuja), Enugu, Rivers (Port Harcourt), Benue (Makurdi), Katsina, Jigawa, Bauchi, Gombe, Plateau, Nasarawa, Kwara, Kogi, Abia, Delta, Sokoto, and Kebbi. By ensuring comprehensive security coverage across these regions, the project demonstrates the Federal Government’s commitment to modernising national security architecture and safeguarding critical assets. Ultimately, the initiative will support the safe, reliable, and sustainable operation of Nigeria’s transport, energy, mining, and trade infrastructure, in compliance with both national and international best practices.

1.2 Project proponent

The proponent of the Proposed Nigeria Internal Security Project Phase II - Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution is the Federal Ministry of Interior, Government of the Federal Republic of Nigeria. The Ministry is responsible for internal security and protection of critical infrastructure through its agencies, including the Nigeria Immigration Service (NIS), Nigeria Security and Civil Defence Corps (NSCDC), Federal Fire Service (FFS), and the Nigerian Correctional Service (NCoS).

The Ministry has commissioned China Road and Bridge Corporation (CRBC) as the engineering, procurement, and construction contractor, and engaged Hecol Nigeria Limited, an accredited environmental consultancy, to conduct the Environmental Impact Assessment (EIA) in line with Federal Ministry of Environment (FMEnv) and National Environmental Standards and Regulatory Enforcement Agency (NESREA) requirements.

1.3 Objectives of the EIA Study

The main objective of this Environmental Impact Assessment (EIA) study is to support informed decision-making and ensure that the design, construction, and operation of the Proposed Nigeria Internal Security Project Phase II - Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution are environmentally sound, socially responsible, and sustainable. The EIA will provide a framework for integrating environmental safeguards into project planning, execution, and decommissioning, in line with national regulations and international best practices.

Specifically, the objectives of the EIA are to:

- Establish the baseline environmental and socio-economic conditions within the project areas and identify sensitive environmental components.
- Identify and assess potential environmental, social, health, and economic impacts associated with the project's location, construction, operation, and eventual decommissioning.
- Recommend feasible mitigation measures to avoid, minimize, or offset adverse impacts and enhance project benefits.
- Develop an Environmental and Social Management Plan (ESMP) covering the project life cycle, including monitoring, auditing, and contingency planning.
- Identify relevant environmental regulations, standards, and guidelines applicable to the project and ensure compliance.
- Facilitate consultation and cooperation with regulatory authorities, stakeholders, and the public.
- Provide a comprehensive EIA report presenting clear, evidence-based findings on the project's potential impacts.
- Support the Ministry of Interior in obtaining all necessary environmental permits and approvals from competent authorities.

1.4 EIA Terms of Reference

As statutorily required, a Terms of Reference (ToR) was prepared for the Proposed Nigeria Internal Security Project Phase II - Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution, and submitted to the Federal Ministry of Environment (FMEnv), Abuja, for review and approval. The approved ToR provides the framework for achieving the overall objectives of the EIA study.

The key elements of the ToR are as follows:

- Outline the general scope of the EIA study, including overall data requirements on the proposed Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution project and the affected environment.
- Define the procedures and protocols for identifying and assessing associated and potential environmental and socio-economic impacts, and for developing an effective Environmental and Social Management Plan (ESMP) for the project.
- Establish a framework for stakeholder engagement, integrating the views of a multidisciplinary EIA team, regulatory agencies, host communities, and other relevant stakeholders.
- Identify and review the applicable legal, regulatory, and administrative requirements relevant to the proposed project.
- Develop a decommissioning and site restoration plan to guide environmental rehabilitation upon project completion or closure.

1.5 Scope of the EIA

The scope of this Environmental Impact Assessment (EIA) covers the following:

- Review of applicable national and international laws, regulations, standards, and codes relevant to the proposed Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution project.
- Description of all actions and activities to be undertaken during the planning, construction, operation, and decommissioning phases of the project.
- Review of existing literature on the project area and its area of influence, identification of data gaps, and execution of field surveys and laboratory analyses to complement available data.
- Analysis of collected data and detailed description of baseline environmental and socio-economic conditions in the study area, with emphasis on sensitive environmental components and receptors.
- Identification and evaluation of potential adverse environmental and social impacts of the project on nearby communities, including effects on cultural heritage, social infrastructure, and lifestyle values.
- Assessment of potential health hazards associated with the various phases of the project and evaluation of local population exposure to these hazards.
- Recommendation of appropriate, cost-effective mitigation measures and development of an Environmental and Social Management Plan (ESMP) for the project.

- Preparation of the EIA report in accordance with national and international guidelines and standards for EIA.
- Facilitation of the process for obtaining the necessary approvals and EIA Certificate from the Federal Ministry of Environment (FMEnv).

1.6 Legal and Administrative Framework

This section of the report provides the relevant Nigerian legislation and policy context as well as international legislations, good industry practices, standards and guidance that are applicable to the proposed project in general and EIA study in particular.

1.6.1 National Policy Guidelines and Regulations

- **Federal Ministry of Environment (FMEnv)**

In Nigeria the Federal Ministry of Environment is the nation's primary authority for the regulation and enforcement of environmental laws. The federal Government of Nigeria through the Act No, 58 of 1998 established the then Federal Environmental Protection Agency (FEPA) to protect, restore and preserve the ecosystem of the federal republic of Nigeria. In 1999, the FMEnv was created to oversee the functions of the defunct FEPA. The Act establishing the Ministry places on it the responsibility of ensuring that all development and industry activity operations and emission are within the limits prescribed in the national Guidelines and Standards, and comply with the relevant regulations for environmental pollution management in Nigeria as may be released by the ministry.

In furtherance of her mandate to ensure the overall protection of the environment and conservation of natural resources, the FMEnv developed laws/guidelines on various sectors of national economy.

- **Federal Ministry of Interior (MoI)**

Federal Ministry of Interior (MoI) Serves as the project proponent and supervising authority, providing strategic direction and oversight for the Nigeria Internal Security Project Phase II. The Ministry ensures that the project is aligned with national internal security policies, critical infrastructure protection frameworks, and broader government security strategies. It also coordinates with relevant security agencies such as the Nigerian Correctional Service (NCoS), Nigeria Security and Civil Defence Corps (NSCDC), Federal Fire Service (FFS), and the Nigeria Immigration Service (NIS) to guarantee effective inter-agency collaboration and operational sustainability of the surveillance solution.

- **National Policy on the Environment (1999)**

Environmental management in Nigeria is based on the National Policy on the environment (1989), was revised in 1999. The goal of this policy is to achieve sustainable development and secure for all Nigerians a quality environment which is adequate for their health and wellbeing. National Guidelines and Standards for Environmental Pollution Control in Nigeria (1991). This is the basic instrument for monitoring and controlling industrial and urban pollution.

- **EIA Act CAP E12 LFN 2004**

EIA Act CAP E12 LFN 2004 was the primary instrument for governing EIA in Nigeria. It was promulgated in order to enable the prior consideration of an EIA on specified public or private projects. The Act sets out the procedure to be followed and methods to be used in undertaking and EIA. Sections 2(2) of the Act requires that where the extent, nature or location of the proposed project or activity is such that it is likely to significantly affect the environment, an EIA must be undertaken in accordance with the provisions of the Act.

- **National Environmental Impact Assessment Procedures and Sectoral Guidelines**

In response to the promulgation of EIA Act, FMEnv developed a National EIA procedure in 1995. The procedure provides steps to be followed from the stage of project conception to commissioning in order to ensure that the project is implemented with maximum consideration for the environment. The FMEnv EIA process flow chart is shown in Figure 1.1.

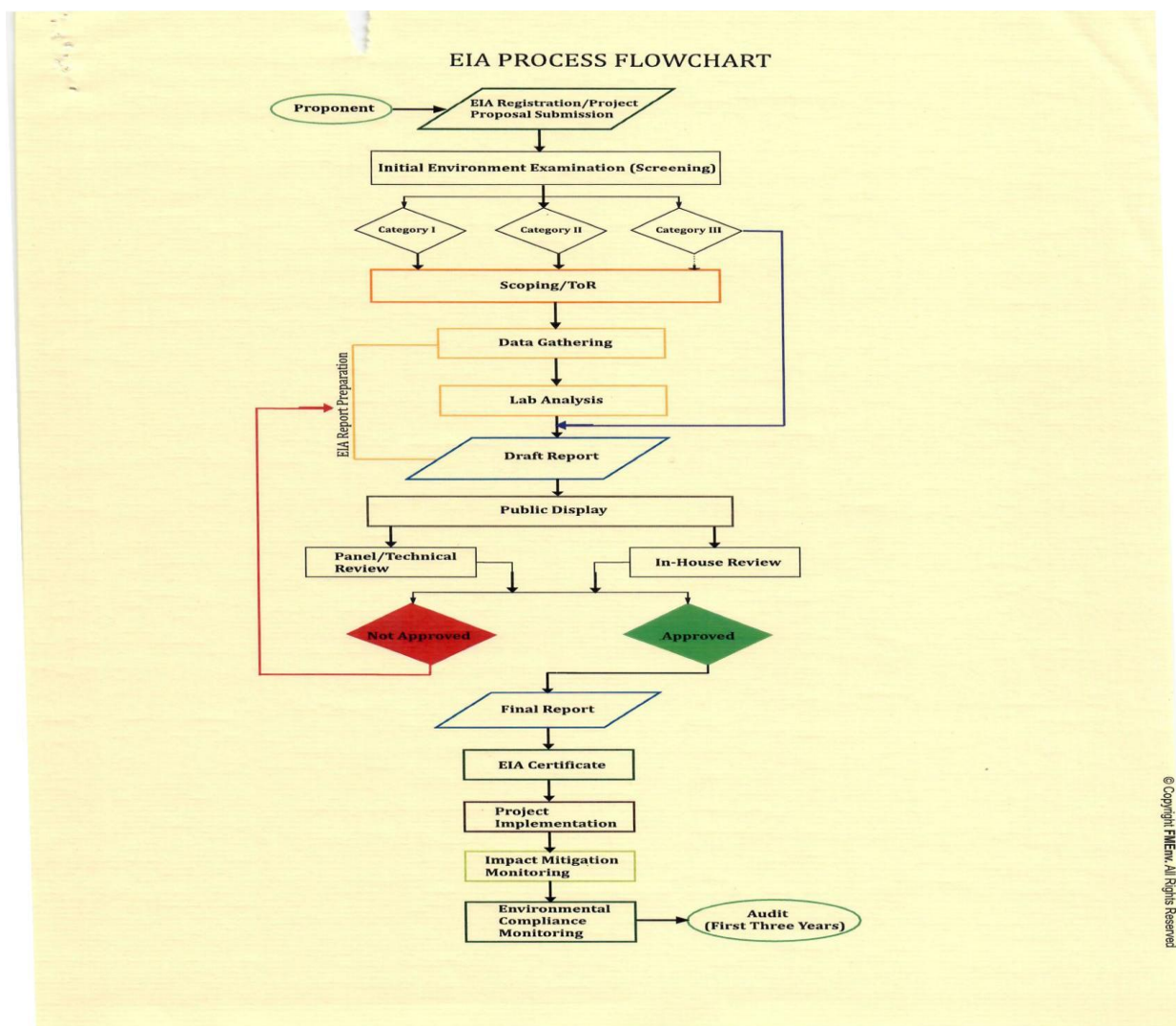


Figure 1.1: FMEnv EIA Process Flowchart

Source: Federal Ministry of Environment

- **Nigerian Communications Commission (NCC), 2003**

The Nigerian Communications Commission (NCC), established under the Nigerian Communications Act 2003, is the regulatory authority for the country's telecommunications industry. The Act empowers the NCC to oversee licensing, frequency allocation, and quality standards for communication services. In relation to the proposed security surveillance project, the Commission plays a key role in ensuring reliable and secure data transmission across the network infrastructure supporting the video surveillance system.

- **National Environmental Standards and Regulation Enforcement Agency, 2007**

The National Environmental Standards and Regulations Enforcement Agency (NESREA) were established in 2007 by Federal Government of Nigeria as a parastatal of the Federal Ministry of Environment. The Agency is charged with the responsibility of enforcing all environmental laws, guidelines, policies, standards and regulations in Nigeria. It also has the responsibility to enforce compliance with provisions of international agreements, protocols, conventions and treaties on the environment. The vision of the agency is to ensure a cleaner and healthier environment for all Nigerians, while the mission is to inspire personal and collective responsibility in building an environmentally conscious society for the achievement of sustainable development in Nigeria.

- National Environmental (Standards for Telecommunications and Broadcast Facilities) Regulations, 2011: Provides environmental guidelines for the location, design, and operation of telecommunication and broadcast infrastructure (applicable to surveillance and data transmission equipment).
- National Environmental (Noise Standards and Control) Regulations, 2009 – Regulates permissible noise levels during construction and operation.
- National Environmental (Control of Hazardous Substances and Chemicals) Regulations, 2011 – Governs the handling, storage, and disposal of hazardous substances used during the project.
- National Environmental (Sanitation and Waste Control) Regulations, 2009 – Provides standards for waste segregation, storage, and disposal during all project phases.

- **Nigeria Railway Corporation Act, CAP N129 LFN 2004**

The act provides the primary legal framework for the ownership, management, operation, and regulation of the Nigerian railway system. Establishes the Nigerian Railway Corporation (NRC) as the statutory body responsible for the construction, maintenance, and protection of railway lines, stations, depots, and associated infrastructure. Authorises the Federal Government, through the NRC and relevant agencies, to ensure the safety, security, and operational reliability of railway transport services across the country. Empowers the NRC to collaborate with other security and law enforcement agencies (e.g., Ministry of Interior, NSCDC, NPF) in protecting railway infrastructure against vandalism, theft, sabotage, and other security threats. Provides the legal basis for integrating modern security technologies, such as surveillance systems, monitoring devices, and communication infrastructure, into the railway network to safeguard passengers, staff, and assets.

- **Nigeria Data Protection Act (2023)**

The Nigeria Data Protection Act (2023) regulates the collection, processing, storage, and use of personal data, including surveillance footage and biometric information, to ensure lawful and secure handling. It protects individual privacy rights, prevents misuse of sensitive information, and establishes the Nigeria Data Protection Commission (NDPC) to oversee compliance. In relation to the proposed surveillance project, the Act provides the legal basis for applying strict data security and privacy measures in line with national and international standards.

- **National Security Agencies Act (CAP N74 LFN 2004)**

The National Security Agencies Act (CAP N74 LFN 2004) provides the legal basis for the operations of Nigeria's security and intelligence agencies in maintaining internal security and safeguarding national interests. It enables coordination among agencies such as the Department of State Services (DSS), National Intelligence Agency (NIA), and Defence Intelligence Agency (DIA), while also supporting collaboration with the Ministry of Interior for the protection of critical infrastructure, including railway facilities, against threats of sabotage, terrorism, and other security risks.

- **Cybercrimes (Prohibition, Prevention, etc.) Act, 2015**

Provides the legal framework for the prevention, detection, prosecution, and punishment of cybercrimes in Nigeria. It governs data protection, cyber-security, and the integrity of digital information, ensuring that surveillance data, transmission systems, and storage facilities under the project are secure, protected from unauthorized access, and compliant with national cyber-security standards.

- **Land Use Act Cap L5 LFN 2004**

The Land Use Act Cap L5 LFN 2004 is the legal framework for land acquisition and resettlement in Nigeria. The following are selected relevant sections: Section 1: Subject to the provisions of this Act, all land comprised in the territory of each State in the Federation are hereby vested in the Governor of that State and such land shall be held in trust and administered for the use and common benefit of all Nigerians in accordance with the provisions of this Act.

Section 2: (a) All land in urban areas shall be under the control and management of the Governor of each State; and (b) all other land, subject to this Act, shall be under the control and management of the Local Government within the area of jurisdiction in which the land is situated. The Act gives the government the right to acquire land by revoking both statutory and customary rights of occupancy for the overriding public interest. In doing so, the Act specifies that the State or Local Government should pay compensation to the current holder or occupier with equal value.

- **The Nigerian Urban and Regional Planning Act CAP N138, LFN 2004**

The Nigerian Urban and Regional Planning Act CAP N138, LFN 2004 established a Development Control Department (DCD) charge with the responsibility for matters relating to development control and implementation of physical development plans at Federal, State and Local Government levels within their respective jurisdiction.

- Approval of the relevant DCD shall be required for any land development
- A developer shall submit a development plan for the approval of the DCD of local Government, State or Federal Government.
- A developer (whether private or government) shall apply for a development permit in such manner using such forms and providing such information including plans, designs, drawings and any other information, as may be prescribed,
- A developer shall at the time of submitting his application for development submit to an appropriate Control Department a detailed Environmental Impact Statement (EIS) for an application.

- **Nigerian Mining and Minerals Act, 2007**

This Act governs the exploration and exploitation of mineral resources in Nigeria. It promotes sustainable mining practices, ensures environmental protection, and regulates community relations in mining areas. Its provisions are directly relevant to the gas and mining infrastructure components of the proposed Security Video Surveillance Solution.

- **Petroleum Industry Act (PIA), 2021**

This Act regulates Nigeria's oil and gas sector, covering upstream, midstream, and downstream operations. It establishes regulatory bodies (NUPRC and NMDPRA), provides fiscal and governance frameworks, and mandates Host Community Development Trusts for social benefits. The Act also embeds provisions for environmental protection and sustainable management of petroleum activities, making it directly relevant to the security and environmental oversight of gas infrastructure under this project.

- **Electric Power Sector Reform Act, 2005**

This Act provides the legal foundation for the restructuring and regulation of Nigeria's electricity sector, covering power generation, transmission, distribution, and supply. It establishes the Nigerian Electricity Regulatory Commission (NERC) as the primary regulatory authority, with powers to ensure safe, reliable, and efficient electricity services. The Act also mandates the protection of power infrastructure and associated assets, thereby offering legal backing for the deployment of surveillance and security systems to safeguard power stations, transmission lines, and distribution facilities as part of critical national infrastructure.

- **Nigerian Ports Authority Act, 1999 (as amended)**

This Act establishes the Nigerian Ports Authority (NPA) and provides the regulatory framework for the ownership, administration, and control of all Nigerian ports. It vests the NPA with powers to plan, develop, and regulate port operations, including safety, environmental management, and security oversight of maritime infrastructure. The Act also mandates measures for safeguarding port facilities against vandalism, theft, and terrorism, thereby aligning with the objectives of the proposed Security Video Surveillance Solution in enhancing the protection of ports as critical national infrastructure.

- **National Security Agencies Act CAP N74 LFN 2004**

This Act establishes the principal security and intelligence agencies in Nigeria, including the State Security Service (SSS), National Intelligence Agency (NIA), and Defence Intelligence Agency (DIA). It provides the statutory mandate for coordinating intelligence gathering, surveillance, and counter-intelligence operations in support of national security. The Act also offers the legal basis for the integration of advanced surveillance technologies, such as video monitoring and analytics, into Nigeria's security architecture, thereby directly supporting the objectives of the proposed Critical Infrastructure Security Video Surveillance Solution.

- **Criminal Code Act, Cap C38 LFN 2004**

The Nigerian Criminal Code makes it an offensive punishment with up to six months imprisonment for any person who violates the atmosphere in any place so as to make it noxious to the health of persons in general dwelling, or carry on business in the neighbourhood, 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 that infection of any disease dangerous to life whether human or animal.

- **Penal Code Act, CAP P53, LFN 2004**

The Penal Code Act, applicable in the northern states of Nigeria, incorporates principles of Islamic law (Sharia) alongside common law, serving as the legal framework for criminal justice in the region. In relation to environmental and public health, the Penal Code addresses violations that affect the well-being of communities and the natural environment.

Of particular relevance to environmental protection, Section 247 of the Penal Code makes it a punishable offense to pollute the atmosphere or engage in any act likely to spread diseases dangerous to human or animal life. Such offenses are subject to imprisonment, reinforcing the government's commitment to safeguarding public health and maintaining environmental standards.

- **Endangered Species Act, CAP E9, LFN 2004**

This Act focuses on the protection and management of Nigeria's wildlife and some of their species in danger of extinction as a result of overexploitation. These sections are noteworthy:

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

- **Factories Act, Cap. F1, LFN 2004**

The Factories Act is the primary law regulating health, safety and welfare of worker in factories in the country. The Acts seeks to make adequate provisions for the health and safety of workers and generally bring safety legislation in line with requirements of modern industrial setting.

- **National Health Act of 2014**

The Nigerian National Health Act of 2014 provides a legal framework for regulating, developing, and managing the national health system by setting standards for healthcare services, defining responsibilities for all levels of government and private entities, and establishing the Basic Health Care Provision Fund (BHCPF) to ensure essential services. Key provisions include the right to emergency treatment, the regulation of health establishments, standards for human resources, and the establishment of a national health information system.

- **Labour Act Cap L1 LFN, 2004.**

The Labour Act (1990) is the primary law protecting the employment rights of individual workers. The Labour Act makes general provisions for the protection of wages, contracts of employment as well as terms and conditions of employment. It also makes provisions for recruitment and identifies special classes of workers.

- **States Environmental Legislation**

This project spans multiple states across Nigeria, and the respective State Environmental Protection Agencies (SEPAs) are mandated to develop and enforce procedures aimed at minimizing the impacts of physical development on the ecosystem. They are also responsible for ensuring an environment that is safe, healthy, and conducive to the well-being of residents.

In relation to this project, the key functions of the SEPAs include:

- Liaising with the Federal Ministry of Environment (FMEnv) to implement the National Policy on Environment.
- Cooperating with FMEnv and other national agencies in carrying out environmental functions, including public environmental education and awareness.
- Overseeing general environmental matters within their respective states.
- Monitoring the implementation of Environmental Impact Assessments (EIAs) and other environmental studies for development projects within their jurisdiction.

1.6.2 International Guidelines and Conventions

- **International Guidelines**

World Bank Guidelines on Environmental Assessment

The World Bank requires an Environmental Assessment on a proposed activity/ facility (i.e. project) from a borrower as a pre-requisite before granting any financial assistance in the form of loans. The EIA report usually forms part of the overall feasibility study or project preparation. The bank has categorization projects based on their EA requirements, which is very similar to that of FMEnv.

- *The International Finance Corporation (IFC) Environment, Health and Safety Guidelines for Telecommunications*

The IFC and World Bank Group have developed a set of Sectoral Environmental Health and Safety (EHS) Guidelines which provides guidance to users on common EHS issues potentially application to all industry sectors including Telecommunication.

- *China Export and Import (EXIM) Bank Guidelines on Environmental and Social Policies on Oversea Investment*

Adopting the policies of the International Finance Corporation (IFC) the EXIM bank put up environmental and social policies for proposed projects that it intends to finance or execute overseas. These policies are effectively tailored towards identifying and mitigation not only unanticipated environmental and social harm, but also some investment risk that can undermine the long-term financial success of a project.

- *Equator Principle*

The Equator Principles are a voluntary set of guidelines developed by leading financial institutions for managing environmental and social issues in project finance lending. The guidelines are based on the environmental and social standards of the IFC, and apply globally to development projects with a capital cost of US dollars (US\$) 10 million or more in all industry sectors. These principles are intended to serve as a common baseline and framework for the implementation of participating institutions' individual, internal environmental and social procedures and standards for project financing activities across all industry sectors globally.

The first set of Equator Principles was launched in 2003 and was ultimately adopted by over 40 financial institutions during a three-year implementation period. A subsequent updating process took place in 2006 leading to a newly revised set of Equator Principles that were released in July 2006. The new, revised set of Equator Principles is fully consistent with recently revised IFC Performance Standards.

The Equator Principles aim is to ensure that prior to agreeing to provide financing, (a) a project has been subject to an appropriate level of environmental and social assessment in accordance with the requirements of the IFC Performance Standards (2006) and (b) that the project will implement appropriate measures for the management of environmental, social and health issues during construction, operation and decommissioning phases. Adopting the Principles, financial institutions undertake to review carefully proposals for which their customers request project financing. They commit not to provide loans to projects where the borrower will not, or is unable to, comply with the requirements of the IFC Performance Standards.

- **International Conventions**

The Nigerian government is an important player in the international support the protection of the environment. As such, the country is a signatory to some international laws and conventions, which are targeted towards conservation and protection of the environment in order to ensure sustainable development. Some international conventions and regulations that are related to the present study and the protection of environment in Nigeria include:

- *African Convention on Conservation of Nature and Natural Resources*

The African Convention on Conservation of Nature and Natural Resources was adopted in Algiers, Algeria on September 15, 1968 and entered into force on June 16, 1969. The convention stipulates that the contracting States shall undertake to adopt the measures necessary to ensure

conservation, utilization and development of soil, water, flora and fauna resources in accordance with scientific principles and with due regard to the best interested of the people.

- *Convention Concerning the Protection of the World Cultural and Natural Heritage*

The convention was adopted in Paris, France on October, 17, 1972; the Convention set aside areas of cultural and natural heritage for protection. It places obligations to each State Party to recognize that the duty of ensuring the identification, protection, conservation, presentation and transmission to future generation of the cultural and natural heritage situation on its territory, belongs primarily to the State.

- *Conservation on the Conservation of Migratory Species of Wild Animals*

This convention also known as Bonn Convention was adopted in 1979 and entered into force in 1983. It stipulates actions for the conservation and management of migratory species including habitat conservation.

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

The Vienna Convention was adopted in 1985 and entered into force on September 22, 1988. It places general obligation obligations on countries to make appropriate measures to protect the environment against adverse effects resulting from human activities which tend to modify the ozone layer.

- *The Montreal Protocol on Substances that Deplete the Ozone Layer*

The protocol was adopted on September, 16, 1987 as an international treaty to eliminate ozone depleting chemicals production and consumption.

- *Basel Convention on the Control of Trans-boundary Movement of Hazardous Waste and their Disposal*

The Conservation was adopted on March 22, 1989 and entered into force on May, 1989. It forces attention on the hazard of the generation and disposal of hazardous waste. The Convention defines the waste to be regulated and controlled, warned on their transboundary movements in other to prevent human and their environmental health against their adverse effects.

- *United Nations Convention on Biological Diversity*

The Convention was adopted in 1994. The objectives of the Convention include the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits arising out of the utilization of genetic resources.

- *United Nations Framework Convention on Climate Change*

The Convention on Climate Change was adopted in 1992 during the Rio Earth Summit in Rio De Janerio, Brasil and entered into 19945; to limit Greenhouse Gas (GHG) emissions which cause global warming.

1.6.3 Contractor's Environment, Health and Safety (EHS) Policy

The contractor (China Road and Bridge Corporation) recognises that leading in technology must go hand-in-hand with promoting environmental protection, health, and safety. An Environment, Health and Safety (EHS) Management System, based on international standards, will be

implemented to ensure a safe and healthy working environment, protect the public, and safeguard the environment.

Key EHS objectives include:

- Raising awareness of EHS in all project phases.
- Identifying and managing environmental risks and occupational hazards.
- Integrating EHS requirements into procurement and promoting EHS awareness across the supply chain.
- Reducing energy use, optimizing resource efficiency, and supporting sustainable development.
- Conducting regular audits and reviews to ensure continual improvement.

Workplace Safety

All activities will be planned and executed to avoid injury, protect worker health, and prevent adverse effects on host communities. Project Managers and Supervisors will ensure compliance with the EHS Policy, with work suspended if essential safety systems are not in place. Employees and contractors must use appropriate Personal Protective Equipment (PPE) such as coveralls, safety shoes, hard hats, gloves, and rain gear, with regular inspection and replacement of defective PPE.

Emergency Preparedness

The contractor will maintain contingency plans for emergencies including fires, explosions, hazardous exposure, radiation incidents, civil unrest, and medical emergencies.

Green Product and Sustainability Commitment

The contractor is committed to eco-friendly design, procurement, and operations, aiming for environmental conservation, product quality enhancement, and efficient resource use. Compliance will be maintained with relevant international and Nigerian standards including ISO 14001, OHSAS 18001.

1.7 Structure of the EIA Report

The report format and outline of the EIA study is in line with the Federal Ministry of Environment's EIA Guidelines. Accordingly, the structure of the report is as follows:

- **Executive Summary:** A non-technical summary of the EIA report
- **Chapter One:** Provides introduction to the project; objectives and scope of work of the EIA; legal and administrative framework as well as information on the project proponent.
- **Chapter Two:** Provides the rationale for the proposed project and analysis of various alternative scenarios.
- **Chapter Three:** Describes the project location, project activities development phases and schedule.
- **Chapter Four:** Describes the current baseline environment (biophysical, chemical, socio-economic and health) characteristics of the project site and its influence.
- **Chapter Five:** Identifies and presents the associated and potential environmental impacts of the proposed project.

- **Chapter Six:** Highlights the recommended mitigation measures for ameliorating any significant adverse environmental impacts and enhancing beneficial impacts.
- **Chapter Seven:** Defines the environmental management plan that will be adopted by the company throughout the project lifecycle.
- **Chapter Eight:** Sets out procedures and remediation plans that will be followed in the event of decommissioning the project.
- **Chapter Nine:** Conclusion and recommendation
- **References**
- **Appendices**

CHAPTER TWO

PROJECT JUSTIFICATION

2.1 Need for the Project

Nigeria's critical infrastructure including railway networks, dams, gas and mining facilities, power stations, and ports forms the backbone of the country's economic growth, trade, mobility, and social development. However, these assets face persistent and growing security threats that undermine their efficiency, reliability, and sustainability.

The railway system, which spans thousands of kilometres and connects major cities, industrial hubs, and ports, has been repeatedly targeted by acts of vandalism, theft of signalling equipment, sabotage of tracks and bridges, and armed assaults on passengers. Such incidents have eroded public trust, caused costly service disruptions, and led to billions of naira in losses annually (Federal Ministry of Transportation, 2023).

Dams and water infrastructure are equally vulnerable to deliberate attacks, illegal encroachments, and environmental degradation, threatening not only power generation and irrigation but also national water security. Gas and mining facilities suffer frequent cases of pipeline vandalism, illegal bunkering, and resource theft, which damage the environment, disrupt production, and deprive the government of revenue. Power stations remain prime targets for vandalism of transmission lines, theft of electrical components, and sabotage, all of which compromise Nigeria's already fragile electricity supply. Ports, serving as gateways for international trade, are exposed to smuggling, theft, terrorism, and organised criminal networks that weaken national security and trade competitiveness.

The Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station, and Port) Security Video Surveillance Solution is designed to address these challenges through the deployment of advanced, high-definition surveillance systems across key facilities nationwide. Supported by secure cloud infrastructure, intelligent video analytics, and real-time data transmission, the project will significantly strengthen the operational capacity of the Ministry of Interior and its agencies, including the Nigeria Security and Civil Defence Corps (NSCDC), Nigeria Police Force (NPF), and other relevant security stakeholders. The technology-driven solution will enable 24/7 monitoring, generate actionable intelligence, and facilitate rapid, coordinated responses to sabotage, vandalism, or terrorist attacks across all critical infrastructure sectors.

The urgency of this project is underscored by both national and international assessments of infrastructure insecurity. The United Nations Office on Drugs and Crime (UNODC, 2022) warns that infrastructure insecurity across West Africa not only undermines economic stability but also fuels organised crime. In Nigeria, the National Bureau of Statistics (NBS, 2023) reported that the rail transport sector alone generated over ₦6 billion in passenger and freight revenue, with even greater potential in energy, mining, and maritime trade—if secured and modernised. However, persistent insecurity deters investment, disrupts operations, and weakens public confidence in these critical sectors.

2.2 Benefits of the Project

The Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station, and Port) Security Video Surveillance Solution will deliver significant benefits to Nigeria’s national security, economic growth, and public safety. By protecting vital assets across multiple sectors, the project will enhance infrastructure resilience, strengthen inter-agency coordination, and boost public confidence. The major benefits include:

- **Comprehensive Surveillance Coverage:** Deployment of high-definition video systems across railway stations, dams, gas plants, mining facilities, power stations, and ports, ensuring continuous, reliable monitoring of critical assets.
- **Proactive Threat Detection:** Integration of intelligent video analytics, secure cloud storage, and real-time data transmission to identify threats early and enable swift incident management across all infrastructure categories.
- **Operational Reliability:** Improved performance and reduced downtime of railway, energy, mining, and port facilities through rapid detection and prevention of vandalism, sabotage, or emergencies.
- **Enhanced Inter-Agency Collaboration:** Strengthened coordination and intelligence sharing among the Ministry of Interior, NSCDC, NPF, Federal Fire Service, Nigerian Ports Authority (NPA), Nigerian Railway Corporation (NRC), and energy regulators.
- **Economic Loss Prevention:** Reduction in annual losses from vandalism, theft of infrastructure components, pipeline tapping, illegal mining, and smuggling, which collectively cost Nigeria billions of naira yearly.
- **Investor and Public Confidence:** Increased trust in the safety and reliability of Nigeria’s critical infrastructure, encouraging foreign and domestic investment in transport, energy, and extractive sectors.
- **Job Creation and Skills Development:** Generation of direct and indirect employment during project implementation and maintenance, while also creating opportunities for skilled ICT and security professionals.
- **Cost Efficiency:** Long-term cost savings for operators and security agencies by reducing reliance on manual patrols and replacing them with technology-driven monitoring systems.
- **Public and Occupational Safety:** Enhanced protection of passengers, workers, host communities, and goods in transit, reducing risks of fatalities, injuries, and property loss across multiple sectors.
- **Rapid Emergency Response:** Faster and more coordinated responses to critical incidents, ensuring response times of under 10 minutes in emergencies.

2.3 Value of the Project

The Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station, and Port) Security Video Surveillance Solution is a strategic Federal Government investment to safeguard vital assets and modernise internal security. Deploying advanced surveillance systems supported by cloud infrastructure, analytics, and

command centres, the project will reduce economic and social losses from vandalism, sabotage, theft, and attacks on critical facilities.

Its value lies in protecting infrastructure worth billions of naira, improving safety, ensuring reliable operations, and boosting investor confidence. In the long term, it will lower security costs, create jobs, strengthen service delivery, and demonstrate Nigeria's commitment to resilient infrastructure and the Sustainable Development Goals (SDGs).

2.4 Envisaged Sustainability

The Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station, and Port) Security Video Surveillance Solution will adopt Best Available Technology (BAT) and international best practices to ensure technical, economic, environmental, and social sustainability throughout its life cycle.

Economic Sustainability: The project will create direct and indirect jobs during installation and operation, reduce infrastructure losses from vandalism and sabotage, and build investor confidence across transport, energy, and trade sectors. By safeguarding assets with multi-billion-naira revenue potential, it will strengthen national economic resilience.

Technical Sustainability: Advanced, high-reliability surveillance technologies with intelligent analytics, secure transmission, and cloud-based storage will be deployed. Regular system upgrades and continuous personnel training will ensure long-term functionality and compliance with engineering and EHS standards.

Environmental Sustainability: Implementation will follow FMEnv regulations, state laws, and global environmental conventions. Ecologically sensitive areas around dams, rail corridors, and ports will be managed with minimal disturbance. Waste reduction, resource efficiency, and strict Environmental Management Plan (EMP) compliance will guide operations.

Social Sustainability: Improving safety and protecting passengers, workers, and host communities, the project will foster public trust, social stability, and safer economic activities. It supports the Sustainable Development Goals (SDGs), particularly SDG 9 (Industry, Innovation, and Infrastructure) and SDG 16 (Peace, Justice, and Strong Institutions).

2.5 Project Options

2.5.1 No Project Option

The no-project option implies that the proposed Critical Infrastructure Security Video Surveillance Solution will not be implemented, and thus no Environmental Impact Assessment (EIA) would be required. While this option would avoid potential environmental disturbance from construction and operation, it is economically and socially unviable. Failure to implement the project would leave railways, dams, gas and mining sites, power stations, and ports vulnerable to vandalism, sabotage, theft, illegal bunkering, and violent attacks. It would also undermine the Federal Government's efforts to modernise security infrastructure, enhance inter-agency coordination, protect lives, and safeguard investments.

2.5.2 Delayed Project Option

The delayed project option entails postponing implementation due to political, economic, or social uncertainties. However, the current environment is favourable, while the security situation highlights an urgent need to protect critical assets. Any delay would escalate risks to public safety, increase the frequency of infrastructure attacks, and weaken investor confidence. In addition, postponement would lead to inflation-driven cost increases, technological obsolescence, and wasted preparatory resources, making this option unsustainable.

2.5.3 Go-Ahead Project Option

The go-ahead option involves proceeding with the project as planned, deploying Best Available Technology (BAT) and adhering to national and international environmental, social, and engineering standards. This option directly aligns with the Federal Government's strategic objectives of safeguarding critical infrastructure and strengthening national security. It addresses urgent vulnerabilities across rail, energy, mining, and port sectors, reduces losses from vandalism and sabotage, and ensures enhanced operational reliability. The go-ahead option is therefore the most practical and beneficial, delivering broad economic, social, security, and institutional gains, while reinforcing Nigeria's infrastructure protection framework in line with global best practices.

2.6 Project Alternatives

2.6.1 Alternative Site / Location

Given the nationwide security objectives of the Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station, and Port) Security Video Surveillance Solution, the project is specifically designed to cover priority facilities across all six geopolitical zones. Alternative sites were considered; however, relocating surveillance away from identified high-risk assets such as busy railway corridors, major dams, power installations, ports, and gas/mining facilities would significantly reduce effectiveness. The selected sites were determined through vulnerability assessments, traffic density analysis, and security intelligence from agencies including the Nigerian Railway Corporation (NRC), Nigeria Security and Civil Defence Corps (NSCDC), Nigeria Police Force (NPF), and relevant sector regulators. Alternative locations were therefore deemed unsuitable.

Different Scale Alternative

A smaller-scale deployment was assessed as a possible cost-saving measure. However, reducing the number of installations would leave large sections of infrastructure unmonitored, creating security gaps and undermining the project's objectives of comprehensive surveillance and rapid response. This option was rejected as it would compromise national coverage and inter-agency coordination.

Different Technology or Configuration Alternative

Alternatives such as mobile surveillance vans, drone-based monitoring, and satellite-driven observation were considered. While these options provide flexibility, they cannot deliver the continuous, high-definition, real-time video required for proactive threat detection and incident

response. Similarly, increased reliance on human patrols or mobile units would raise long-term operational costs and reduce monitoring reliability. These alternatives were therefore not suitable.

Wireless Network Alternative

A wireless-only surveillance system was explored as a cost-saving option. However, it would not provide the bandwidth, reliability, or resilience required for uninterrupted monitoring, particularly in remote or underserved areas. It would also require additional construction in undisturbed locations, increasing environmental impacts. For these reasons, the wireless-only option was considered unviable.

2.6.2 Design and Technology Alternative

The chosen design prioritises compatibility, safety, and sustainability across diverse infrastructure sites. It complies with national and international codes on surveillance systems, network integration, electrical installations, and lightning protection. The technology incorporates energy-efficient, high-availability systems with intelligent video analytics, encrypted transmission, and scalable cloud storage. Continuous operator training will sustain long-term performance. Considering cost efficiency, resilience, and operational effectiveness, no design or technology alternative was found preferable to the proposed configuration.

CHAPTER THREE

PROJECT DESCRIPTION

3.1 Introduction

The Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station, and Port) Security Video Surveillance Solution is a strategic initiative of the Federal Ministry of Interior aimed at enhancing the monitoring, protection, and resilience of Nigeria’s most vital national assets. This phase of the project focuses on deploying an advanced surveillance network that integrates high-definition video monitoring, intelligent analytics, secure data storage, and robust communication systems into a unified operational platform.

The system is designed to provide continuous 24/7 monitoring across priority sites including railway corridors and stations, hydro-electric dams, gas processing and mining facilities, power generation and transmission installations, and seaports/inland ports. It will generate real-time intelligence for proactive threat detection, incident prevention, and rapid deployment of security resources in response to risks such as vandalism, sabotage, theft, illegal bunkering, and armed attacks.

3.2 Project Location

The Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station, and Port) Security Video Surveillance Solution will be implemented across multiple states in Nigeria, covering all six geopolitical zones. The selected sites reflect areas with high traffic density, critical economic assets, and heightened vulnerability to security threats.

In the South-West, major facilities in Lagos and Oyo (Ibadan) will be covered, including railway stations, power installations, ports, and associated infrastructure. In the North-West, sites in Kano, Katsina, Jigawa, Sokoto, and Kebbi have been identified for surveillance deployment, reflecting the region’s strategic transport and mining corridors. The North-East will be represented through key locations in Bauchi and Gombe, while the North-Central zone will host sites in Abuja (FCT), Benue (Makurdi), Plateau, Nasarawa, Kwara, and Kogi, where railway, mining, and power facilities are concentrated. In the South-East, installations are planned for Enugu and Abia, while the South-South will be comprehensively covered with strategic sites in Rivers (Port Harcourt), Delta, and Cross-River axis, reflecting the importance of ports, gas infrastructure, and power facilities in this region.

This geographic spread ensures that critical infrastructure across Nigeria including transport hubs, dams, mining facilities, energy assets, and maritime gateways is fully represented. The project’s configuration will therefore provide nationwide coverage, linking state-level surveillance sites to regional data centres and ultimately to the central command-and-control facility at the Federal Ministry of Interior in Abuja.

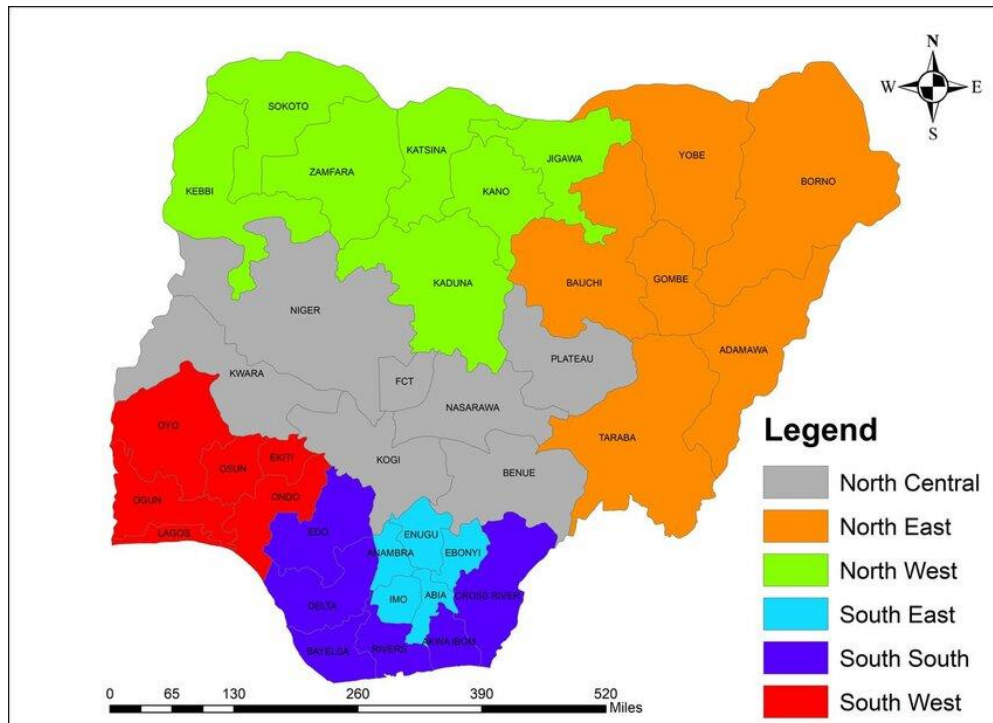


Figure 3.1: Map of Nigeria showing boundaries of six geopolitical zones

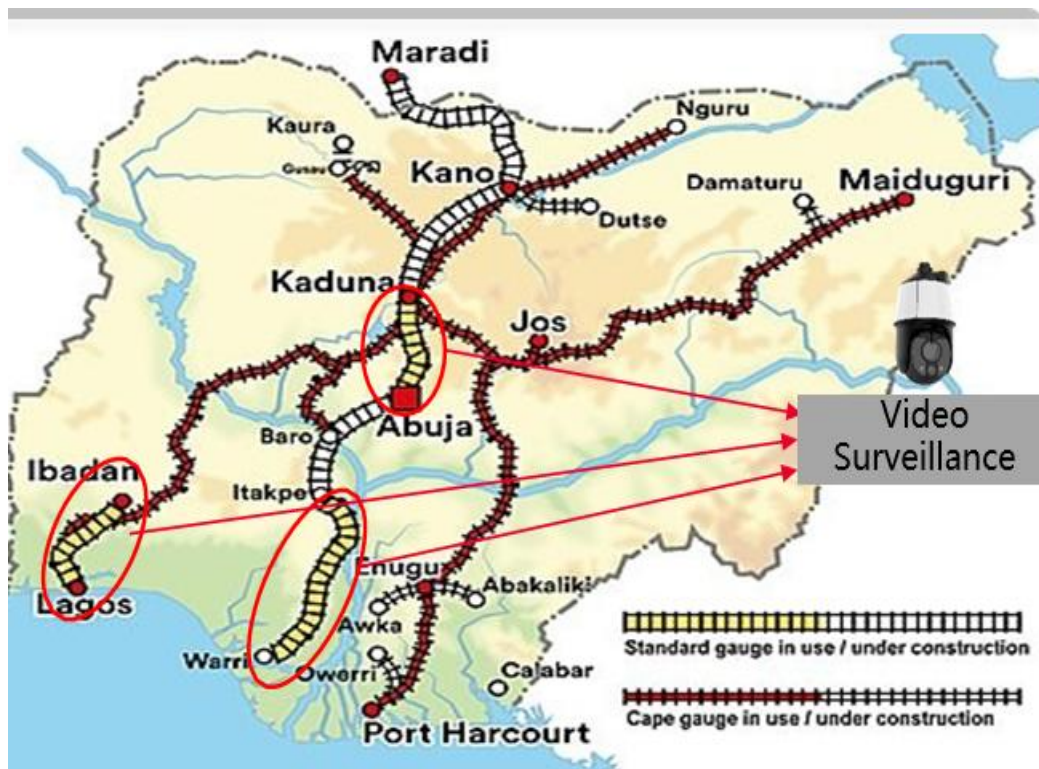


Figure 3.2 Critical Infrastructure Security Video Surveillance Solution

Table 3.1: Critical Infrastructure Site Location

Critical Infrastructure	No.	Site Name	latitude (°)	longitud e (°)	State
	1	Ebute Metta_lagos	6.484398725	3.381783278	lagos
	2	lagos_lagos	6.469434626	3.382886974	lagos
	3	Dugbe Railway Station_Ibadan	7.388609425	3.87637849	Ibadan
	4	Kano_kano	11.99947065	8.539464608	kano
	5	Idu Rail Station_abuja	9.045662048	7.342764639	abuja
	6	Kubwa Train Station_Abuja	9.163895365	7.324431027	abuja
	7	Railway Station Moniya_Ibadan	7.558596872	3.895993824	Ibadan
	8	LADOKE AKINTOLA TRAIN STATION, OMI-ADIO, IBADAN	7.4081658	3.746376	Ibadan
	9	Agege Train Station (Babatunde Fashola Station)_lagos	6.62187565	3.32565835	lagos
Railway	10	Apapa Train Station_lagos	6.451142851	3.369130771	lagos
	11	Bassanjiwa railway station_abuja	9.011775424	7.281269646	abuja
	12	KAGINI RAIL STATION_abuja	9.124194874	7.292203844	abuja
	13	Yaba Railway Station_lagos	6.503318076	3.374853569	lagos
	14	Iju Train Station_lagos	6.660830814	3.320097232	lagos
	15	Abuja metro Train station_Abuja	9.050188149	7.471842346	abuja
	16	Enugu Railway Station_Enugu	6.498929405	7.508579354	Enugu
	17	Port Harcourt Railway Station_Port Harcourt	4.787902423	7.003003843	Port Harcourt
	18	Makurdi Railway Station Makurdi	7.726297654	8.532293314	Makurdi
	19	Katsina Railway Station Katsina	11.52798594	7.320254051	Katsina
	20	Kaugama railway station_Jigawa	12.47752599	9.736233861	Jigawa
	21	Bauchi Railway Station Bauchi	10.29262584	9.847942049	Bauchi
	22	Gombe Railway Station_Gombe	10.28668543	11.18698581	Gombe
	23	Plateau Railway Station Plateau	9.916438128	8.890720573	Plateau
	24	Nasarawa Railway Station Nasarawa	8.697267434	8.311914723	Nasarawa
	25	Kwara Railway Station_Kwara	9.125000115	4.823811251	Kwara
	26	Itakpe-Ajaokuta Railway Station Kogi	7.620837074	6.323822497	Kogi
	27	Lagos Mass Transit Railway_lagos	6.445051962	3.39779534	lagos
	28	Omoba Railway Station_Abia	5.244588495	7.406757144	Abia

EIA for the Proposed Nigeria Internal Security Project Phase II - Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution

	29	Agbor Train Station Delta	6.136558323	6.210037279	Delta
Dam	30	Dadin Kowa Dam	10.32128928	11.48149865	Gombe
	31	Goronyo Dam	13.530556	5.882221999	Sokoto
	32	Kainji Dam	9.913114184	4.642058128	Kebbi
	33	Jebba Dam	9.124166281	4.811684248	kwara
	34	Ikere Gorge Dam	8.189781861	3.725539476	Oyo
Gas&Mining	35	NNPC Gas Depot	6.410225076	3.390240716	lagos
	36	NLNG Gas Plant	4.424647978	7.200797913	Rivers
	37	NIPCO CNG Plant	7.439319349	6.684829976	Kogi
	38	Dangote Refinery	6.442168809	3.995334187	lagos
	39	Warri Refinery	5.568641231	5.720432313	Delta
	40	Itakpe Mining	7.60927108	6.300563356	Kogi
Power Station	41	Sapele Power Plant	5.9239175	5.6458569	Delta
	42	Alaoji Power Station	5.066990304	7.321467049	Abia
	43	Ughelli Delta Power Plant	5.543703244	5.919151856	Delta
Port	44	Apapa Port	6.467673442	3.389928875	Lagos
	45	Harcourt Port	4.847228513	6.97467736	Rivers

3.3 Project Components and Technical details

The information below consists of comprehensive stage-by-stage process for deploying advanced ICT infrastructure and technology across Nigerian National infrastructure, incorporating CCTV, wireless networks, trunking systems, 3 National data centers and Solar power Solutions.

3.3.1 Project Initiation phase: Strategic Planning, Feasibility studies and analysis

1. Threat & Site Assessment

- a) Conduct sites survey, situational analysis and vulnerability mapping: Border smuggling routes (Seme/Illela), prison weak points (e.g., Kuje), vandalism hotspots (Niger Delta), school security gap and the Railway corridors.
- b) Analyze terrain challenges: Desert (Sahara borders), urban obstructions (govt buildings), challenges on the Railway corridors

2. Requirements Definition

- a) Intelligent video surveillance systems: This is to specify the camera types (thermal for borders, explosion-proof for oil facilities, AI-enabled for prisons and long-range cameras on the Railway corridors)
- b) Wireless Base Station: Determine bandwidth needs

Trunking: Calculate radio channels needed for sites deployments.

- c) Data Center: Determine the project storage and compute needs (AI analytics)
- d) Solar mini grid solution: Conduct the need analysis and locations where the solar farms would be deployed

3. Regulatory Compliance

- Submit application for all related compliance certificates including EIA, NCAA, State, LG permits etc
- Align with NDPA (Nigeria Data Protection Act) and NSCDC security protocols

3.3.2 Project Planning Phase: System Design & Architecture

1. Network Topology Design

Plan the network connectivity along the Border, Railway, schools and Prisons including other National critical infrastructures. All the remote infrastructure would be backhauled back to the datacenter and ultimately be projected to the TV wall.

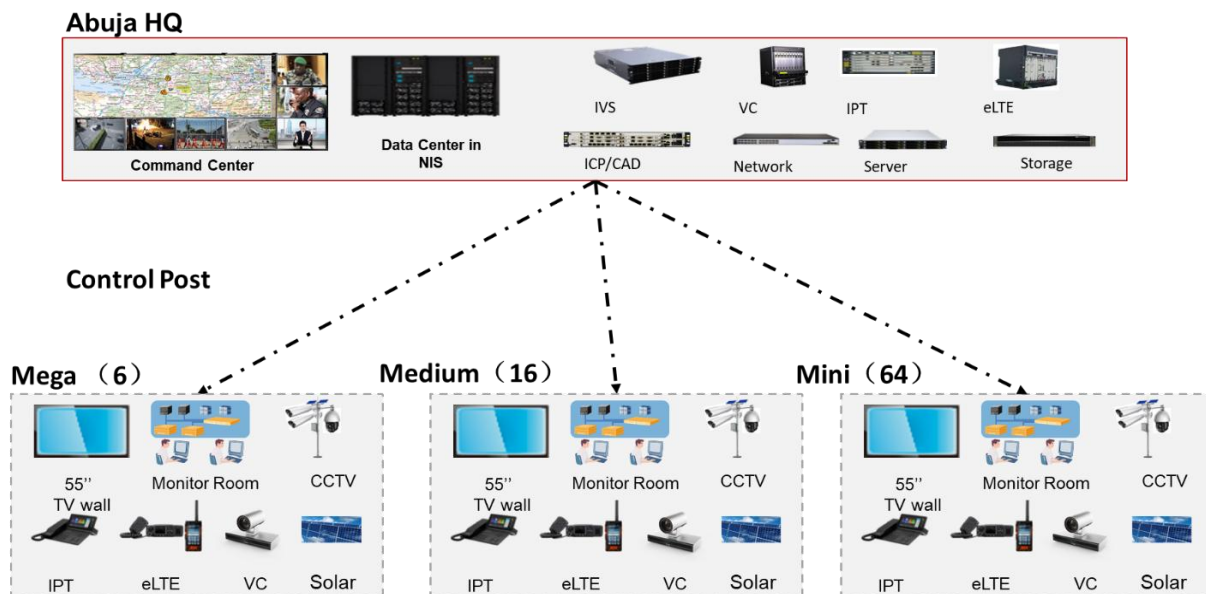


Figure 3.3: Network Topology Design

- Fiber Trucking: Fiber backbone route design along railway with redundant rings

2. CCTV Architecture

- Edge AI cameras design with on-device analytics



Figure 3.4: Edge AI cameras

3. Data Center Design: Huawei Fusion Module 2000 is applicable to indoor data center scenarios, which features simple design and high building adaptability. It meets the data center deployment requirements of various sectors such as enterprise, finance, governments and carriers. FusionModule2000 is a modular-design, highly integrated solution which comprises power supply, cooling, rack & structure, cabling, management system within a module, meeting the requirements for quick delivery and on-demand deployment.

- 2N+1 redundancy (power/cooling),
- Locations: Abuja (primary), Ibadan and another 1 location.

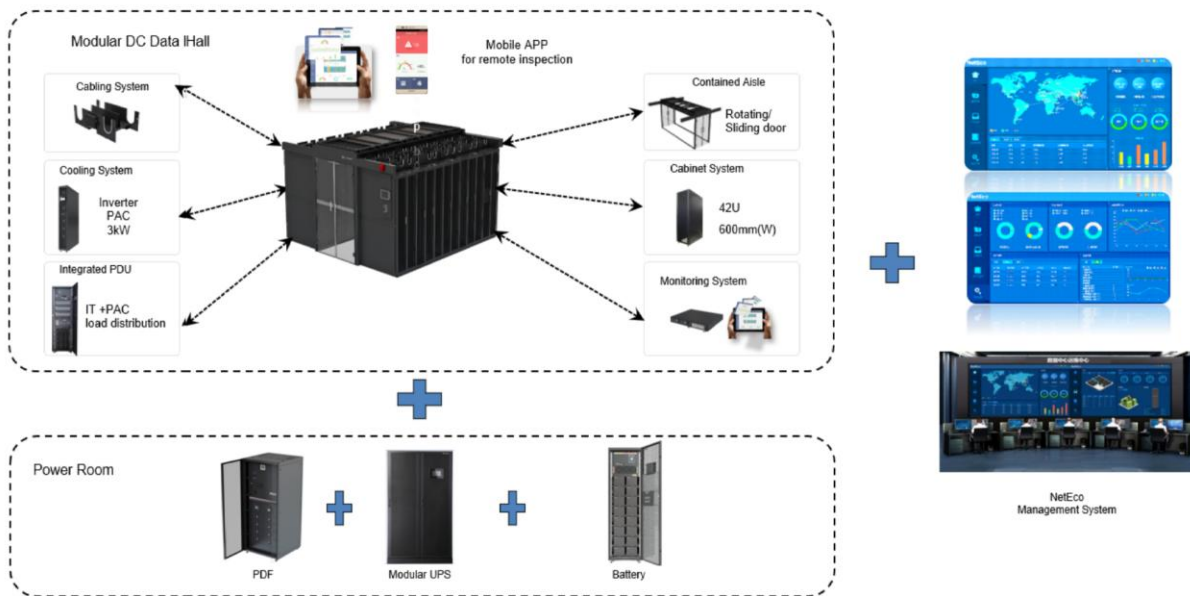


Figure 3.5: Data Center Design

4. Trunked Radio System

Digital eLTE system with base stations Huawei's eLTE (enhanced Long-Term Evolution) trunking systems are a suite of wireless broadband solutions designed for various industries, offering features like high-speed data, voice trunking, and video capabilities. They are particularly known for their use in public safety, transportation, and other sectors requiring reliable and secure communication.

As the world's first 100-megabyte professional broadband trunking solution based on LTE technology, the Huawei eLTE broadband trunking solution is designed to address the evolution of trunking technology, from voice to multimedia within private networks in vertical industries. This new technology meets the requirements for efficient operational communications in governments, railway systems, airports, ports, power grids, as well as oil and mining industries. With the capability to provide voice trunking, video dispatch, video surveillance and location services, the Huawei eLTE broadband trunking solution will help customers significantly improve operational efficiency and emergency response rates.

Developed to provide optimal communications services and connection during operations and emergency incidents, the Huawei eLTE broadband trunking system is able to operate under harsh environments. In the demonstration conducted by Jörg Huth, Director, Railway Solution Unit of Huawei Enterprise in Western Europe during the launch, the Huawei EP680 terminal, a terminal which provides voice trunking, as well as video dispatching service, was able to maintain high quality voice and video transmission while fully submerged in a simulated flood environment



Figure 3.6: Trunked Radio System I



Figure 3.7: Trunked Radio System II

5. Solar farm: All equipment would be powered using off grid Solar solutions including the 3 Data Centers

3.3.3 Sites implementation Phase: Infrastructure Deployment

1. Sites Civil work: Civil work including excavation of the Top soils, reinforcement placing, formwork and concrete works would be carried out. New Tower infrastructure or Poles would be erected to support a designed height for equipment installation.



Figure 3.8: Infrastructure Deployment

2. Wireless Network Rollout (Telecom and ICT Equipment installation)

- Install Telecommunication and ICT equipment on the planned sites
- Deploy solar-powered nodes for equipment on sites locations as designed



Figure 3.9: Wireless Network Rollout

3. CCTV Installation: Intelligence+ has become a key factor driving industrial upgrade in diverse sectors. Huawei keeps up with the trend by reshaping the security industry with software-defined cameras as the pioneer. Huawei state-of-the-art software-defined cameras support continuous evolution and development of algorithms and applications, enabling more rigorous AI-based

intelligent analysis in a wider variety of security scenarios. The step-by-step series of activities are explained below:

- **Installation:**
Huawei provides detailed instructions for installing cameras, including SD card insertion, cable routing, and angle adjustment.
- **Network Configuration:**
Proper network configuration, including IP addressing and firewall settings, is crucial for connecting cameras to the video management system.
- **Software Updates:**
It's important to keep the camera and management software updated to benefit from the latest features and security patches.
- **Security Considerations:**
Huawei addresses security vulnerabilities in our video surveillance chips and devices, emphasizing the importance of keeping systems updated and properly configure

Self-powered solar CCTV would be installed at the Border line, Prisons, schools, Railway corridors



Figure 3.10: CCTV Installation

4. Data Center Build 3 (locations concurrently)



Figure 3.11: Data Center

The HUAWEI Fusion Module FM2000 is a high-density, integrated DC power supply solution primarily designed for telecommunications sites, data centers, and distributed energy systems (including solar hybrid applications). Here are its key components and features:

1. Intelligent Controller Unit (ICU)

Function: The "brain" of the FM2000, managing system operations.

Capabilities:

Real-time monitoring of input/output voltage/current, battery status, temperature.

Control of rectifier modules (on/off, current sharing).

Battery management (charging profiles, temperature compensation, low-voltage disconnect).

Alarm processing and reporting.

Communication interfaces (RS485, dry contacts, CAN bus, LAN/WAN via optional gateway).

2. Rectifier Modules

Function: Convert AC input (or DC from solar) to regulated -48V DC output.

Key Characteristics (Typical):

High Efficiency: Up to 96.5% (reducing energy loss and OPEX).

High Power Density: 3000W modules (e.g., R4850G2) are common, allowing large capacity in small footprint.

Wide Input Voltage Range: Typically, 85-300V AC (or 120-425V DC for solar input compatibility).

Hot-Swappable: Modules can be replaced without shutting down the system.

Plug-and-Play: Automatic recognition and configuration by the ICU.

3. Power Distribution Unit (PDU)

Function: Distributes the -48V DC output to connected loads and batteries.

Features: Multiple high-current output terminals (e.g., 63A, 100A, 250A).

Integrated fusing or circuit breakers for overload/short-circuit protection.

Dedicated battery connection terminals with disconnect/protection.

4. Battery Management System

Integrated with ICU: Manages lead-acid or lithium-ion battery strings.

Functions:

Smart charging (float/boost/equalization with temperature compensation).

Deep discharge protection (LVLD).

Battery health monitoring and capacity estimation.

Critical for backup during grid/solar outages.

5. Monitoring & Sensors

Built-in Sensors: Measure input AC/DC, output DC, battery voltage/current, temperature.

External Sensor Support: For battery temperature, ambient temperature, smoke detection, etc.

6. Communication Interfaces

Standard: RS485, dry contact alarms (critical/major/minor).

7. Structural Frame & Cooling

Compact Design: High power density in a 1-2U rack-mountable frame.

Intelligent Fan Cooling: Variable-speed fans controlled by the ICU based on load/temperature for efficiency and low noise.

5. Trunking Implementation

- Tower erection with 35m for the wireless and 18m height for the CCTV (border coverage)
- Rugged handheld terminals

6. Solar farm: Due to the Power gap and grid situation in Nigeria, equipment at the remote locations including the Data Centre would be powered using Solar power solution.



Figure 3.12: Solar farm

Key components of the Solution

AI Optimization: Smart I-V Curve Diagnosis 4.0 – Automatic, pinpoint fault detection (shading, defects, disconnects) – dramatically cuts O&M costs.

1. Ultra-High Efficiency: >99% conversion – maximizes every watt generated.

Built-in Safety: Integrated AFCL, no fuses, surge protection – prevents fires & enhances reliability.

Scalable: SUN2000 (Residential/C&I) to Utility-scale systems – fits any project size.

2. Smart String ESS (Game-Changing Storage):

DC-Coupled Architecture: >95% round-trip efficiency – minimizes energy loss vs. AC-coupled.

Pack-Level Optimization: Individual battery control (LUNA series) – extends lifespan & boosts performance.

Seamless Integration: Native compatibility with Huawei inverters – simplifies design & operation.

3. Fusion Solar (The Intelligent Brain):

Centralized AI Platform: Remote monitoring, analytics & optimization of entire fleets.

Predictive O&M: Automated fault reports, proactive maintenance – slashes operational expenses.

User Control: Real-time insights & management via App/Web – empowers owners/operators.

3.4 Manpower Requirements

The manpower needs for the project will vary across the construction/installation, operational, and maintenance phases. Table 3.2 provides a summary of the estimated manpower requirements.

Table 3.2: Manpower Requirements for the Project

S/N	Category of Staff	Estimated Number
1	Project Managers, Engineers (Civil, Electrical, ICT)	25–30
2	Technical Specialists (CCTV, Fibre Optic, Power)	30–40
3	Skilled/Semi-Skilled Workers	60–80
4	Support Staff (Admin, Security, Drivers, Logistics)	35–50
5	Control Room Operators	25–30
6	Security Analysts/Response Coordinators (NRC, NSCDC, NPF)	20–25
7	ICT/Data Specialists	15–20
8	Maintenance Technicians	10–15
9	Support Staff (Admin, Clerical, Logistics)	10–15
10	Maintenance Engineers/Technicians	15–20
11	System Upgrade Specialists (ICT Engineers)	10–15
12	Waste/Environmental Officers	10–15
	Total Estimated Manpower	295–370

3.5 Materials, Equipment, and Machinery

The materials, equipment, and machinery required for the Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway) Security Video Surveillance Solution is shown in table 3.3 below.

Table 3.3: Materials, Equipment, and Machinery

S/N	Materials, Equipment, and Machinery
1	Cement, sand, gravel, reinforcement rods, concrete blocks
2	Power cables, fibre-optic cables, conduits, junction boxes, lightning arrestors
3	Excavators, drilling machines, concrete mixers, cranes, welding machines, scaffolding
4	Generators (diesel/petrol)
5	High-definition CCTV cameras (fixed and PTZ)
6	Servers, racks, and data storage units
7	Solar panels, inverters, and 48-hour backup batteries
8	Video Management Systems (VMS), display walls, monitoring consoles
9	Secure IP-based network devices (routers, firewalls, switches, backhaul systems)
10	Public address systems, alarm units, handheld radios, emergency call boxes
11	Mobile terminals for patrol/security teams
12	Testing kits, toolboxes, spare parts (lenses, cables, sensors), calibration devices
13	Mobile cranes, ladders, forklifts
14	Personal Protective Equipment (PPE) – helmets, gloves, boots, harnesses, reflective vests
15	Waste collection containers, e-waste disposal units, battery recycling bins

3.6 Utilities and Infrastructure Requirements

The successful implementation and operation of the Railway Security Video Surveillance Solution will require a range of supporting utilities and infrastructure. These provisions are essential to ensure reliable functionality, safety, and sustainability of the project across all locations.

3.6.1 Power Supply

Reliable and uninterrupted power is critical for continuous 24/7 operation of the surveillance system. Each site will be equipped with:

- Hybrid power solutions, consisting of solar panels with 48-hour battery backup to ensure autonomy.
- Grid power connections where available.
- Standby diesel/petrol generators to provide redundancy in case of prolonged outages.

3.6.2 Communication Infrastructure

The project will rely on a secure IP-based communication network to transmit live video feeds from field sites to regional data centres and the MoI Command-and-Control Centre in Abuja. Infrastructure requirements include:

- Fibre-optic cabling for high-capacity data transmission.
- Wireless backhaul links in areas with limited terrestrial connectivity.
- Routers, switches, and firewalls to ensure secure, encrypted communications.

3.6.3 Water Supply

Minimal water demand will arise during construction and routine maintenance activities. Water will be required for:

- Mixing of concrete and other civil works during installation.
 - Sanitation and welfare facilities for construction and operational staff.
- Sources will include existing municipal supply systems or boreholes where available.

3.6.4 Access Roads and Transportation

Access routes are essential for transporting materials, equipment, and personnel to surveillance installation sites along the railway corridors. Where existing access roads are inadequate, minor upgrades or temporary access tracks may be constructed to facilitate movement. The Nigerian Railway Corporation (NRC) will also provide logistic support through designated service corridors.

3.6.5 Information and Communication Technology (ICT) Infrastructure

Data management and storage infrastructure will be central to the project's operation. Key requirements include:

- Regional data centres for intermediate storage and analysis.
- A centralised MoI Command-and-Control Centre equipped with display walls, servers, and monitoring consoles.
- Secure cloud storage with 30-day minimum video retention capacity.

3.7 Waste Management

The implementation of the Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway) Security Video Surveillance Solution will generate different categories of waste during construction, installation, operation, maintenance, and eventual decommissioning. To ensure compliance with the Federal Ministry of Environment (FMEnv), the National Environmental Standards and Regulations Enforcement Agency (NESREA), and relevant international standards, appropriate facilities and procedures will be provided for effective waste management.

Key provisions include:

- Temporary Waste Collection Points strategically located at railway corridor construction and installation sites.
- Segregation Bins for recyclable, hazardous, and non-hazardous waste streams.

- Licensed Disposal Facilities for construction debris, metallic waste, plastics, and packaging materials.
- Approved Systems for E-Waste Management, including obsolete CCTV cameras, fibre optic cables, sensors, power backup units, and other electronic equipment.
- Special Handling for Hazardous Materials, including batteries, oils, chemicals, and other materials with potential environmental risks.
- Contracting NESREA-Approved Waste Handlers for collection, treatment, and final disposal of hazardous and electronic waste.
- Documentation and Tracking of all waste generated using a Waste Inventory Register to enhance accountability, regulatory reporting, and environmental sustainability.

Table 3.4: Waste Inventory for the Project

S/N	Waste Type	Source/Activity	Characteristics	Estimated Quantity (Range)	Proposed Management/Disposal Method
1	Construction Debris (concrete, metal scraps, cables, packaging materials)	Civil works, installation of surveillance masts and control rooms	Non-hazardous solid waste	20–30 tons during construction	Collected at site, sent to licensed recycling/recovery facilities
2	Plastic Waste (wrappers, cable insulation, packaging materials)	Installation and operational supplies	Non-hazardous, recyclable	5–10 tons annually	Segregation and transfer to recycling companies
3	E-Waste (obsolete CCTV cameras, fibre optic cables, servers, monitors, routers, sensors)	Equipment replacement, upgrades, decommissioning	Hazardous due to heavy metals and plastics	3–5 tons annually during operations and upgrades	Disposal through NESREA-approved e-waste recycling vendors
4	Batteries (UPS, backup power, solar systems)	Power supply units for surveillance sites	Hazardous – lead-acid, lithium-ion	1–2 tons annually	Collected and transferred to licensed battery recycling facilities
5	Used Oils and Lubricants	Generator sets, mechanical equipment servicing	Hazardous liquid waste	500–700 liters annually	Stored in leak-proof drums, collected by certified hazardous waste handlers
6	General Office Waste (paper, food waste, plastics)	Administrative/control room operations	Mixed non-hazardous	1–2 tons annually	Segregation, recycling (paper, plastics), and disposal via municipal waste system
7	Scrap Metal (steel frames, cable reels, defective mounts)	Equipment installation, maintenance, and dismantling	Recyclable metallic waste	2–4 tons during project lifecycle	Collected and sold to scrap recyclers
8	Hazardous Chemical Waste (paints, solvents, adhesives)	Construction/maintenance of facilities	Hazardous – toxic chemicals	<1 ton annually	Stored in secure containers, disposed via approved hazardous waste facility
9	Obsolete ICT Equipment (servers, computers, storage)	Control rooms, data centers	Hazardous – electronic waste	2–3 tons every 5 years	Returned to manufacturers or recycled via licensed e-

	units, switches)				waste handlers
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3.8 Health, Safety, and Security (HSS) Provisions

To safeguard personnel, assets, host communities, and the environment during construction, installation, operation, maintenance, and decommissioning of the Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway) Security Video Surveillance Solution, robust Health, Safety, and Security (HSS) provisions will be put in place. These measures will ensure compliance with the Federal Ministry of Environment (FMEnv), NESREA guidelines, and relevant international best practices such as the International Labour Organization (ILO) conventions, World Bank Environmental, Health and Safety (EHS) Guidelines, and the Occupational Safety and Health Administration (OSHA) standards.

Key provisions include:

1. Comprehensive HSE Management Plan

- Development and implementation of a site-specific Health, Safety, and Environment (HSE) Plan.
- Integration of hazard identification, risk assessment, and control measures (HIRAC) at all project phases.
- Continuous monitoring and auditing of compliance with HSE standards.

2. Mandatory Use of Personal Protective Equipment (PPE)

- Compulsory use of PPE such as helmets, reflective vests, gloves, safety boots, ear protection, and safety harnesses.
- Periodic inspection and replacement of PPE to maintain effectiveness.
- Enforcement through HSE supervisors and site safety officers.

3. Emergency Preparedness and Response Plans

- Development of Emergency Response Plans (ERP) covering accidents, medical emergencies, fire outbreaks, equipment failures, and security incidents.
- Installation of firefighting equipment (extinguishers, hydrants) at strategic surveillance control sites.
- Training of staff and contractors on emergency drills, evacuation procedures, and first aid.
- Collaboration with Railway Police Command, Nigerian Civil Defence (NSCDC), and host communities for coordinated response.

4. Occupational Health and Worker Welfare

- Provision of medical surveillance and health checks for project workers.
- Adequate welfare facilities including potable water supply, sanitation, and rest shelters.
- HIV/AIDS awareness and sensitization programmes for workforce and host communities.

5. Site Access Control and Security Patrols

- Restricted access to sensitive facilities such as control centers, surveillance masts, and data rooms.
- 24/7 physical security presence, CCTV monitoring, and perimeter fencing at installation sites.
- Security patrols along railway corridors to prevent vandalism, theft, and sabotage.
- Use of biometric access control for control room operators and critical staff.

6. Training and Capacity Building

- Regular HSE induction for all workers and contractors before site mobilization.
- Specialized training for emergency response teams, fire wardens, and first aiders.
- Ongoing refresher courses to build safety culture and ensure compliance with evolving standards.

3.9 Project Schedule and Timeline

The project schedule is shown in table 3.5.

**EIA for the Proposed Nigeria Internal Security Project Phase II - Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port)
Security Video Surveillance Solution**

Table 3.5: Project Schedule and Timeline

Phase	Key Activities	Duration	Timeline	Remarks
Project Initiation	- Threat & site assessment (border smuggling routes, prison weak points, vandalism hotspots, railway corridors, schools) - Terrain challenge analysis (desert, urban obstructions, railway corridors) - Requirements definition (camera types, wireless base stations, trunking channels, data center capacity, solar solutions) - Regulatory compliance (EIA, NCAA, FMEnv, State & LG permits, NDPA, NSCDC protocols)	4 Months	Months 1–4	Establishes foundation for technical, legal, and environmental approvals
Project Planning	- Network topology design (border, railway, schools, prisons; fiber backbone with redundant rings) - CCTV architecture (AI-enabled, edge analytics) - Data center design (FusionModule2000, 2N+1 redundancy, Abuja primary + 2 backups) - Trunked radio system (Huawei eLTE broadband trunking) - Solar farm planning (off-grid solutions for remote nodes & data centers)	4 Months	Months 5–8	Produces detailed engineering, architectural & system integration designs
Site Implementation	Infrastructure Deployment (24 Months) Civil Works: - Excavation, reinforcement, formwork, tower/pole erection Wireless Network Rollout: - Install ICT & telecom equipment, deploy solar-powered nodes CCTV Installation: - Install Huawei software-defined cameras; configure networks, security, AI updates - Deploy self-powered solar CCTV at borders, prisons, schools, railway corridors Data Center Build (3 sites concurrently): - Install FusionModule FM2000 with ICU, rectifier modules, PDU, BMS, cooling, monitoring, sensors Trunking System Implementation: - Erect 35m towers for wireless, 18m for CCTV, deploy rugged terminals	24 Months	Months 9–32	Longest phase; staggered deployment by region (borders, railways, prisons, schools). Data centers built in parallel to reduce downtime

**EIA for the Proposed Nigeria Internal Security Project Phase II - Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port)
Security Video Surveillance Solution**

	Solar Farm Deployment: – Deploy AI-optimized smart solar + ESS storage, Fusion Solar platform integration			
Testing & Commissioning	• System integration testing (CCTV + wireless + trunking + solar) • Data center validation (power, cooling, redundancy, cybersecurity) • User acceptance testing (UAT) with NSCDC, NRC, NPF, NIS, and other stakeholders • Handover protocols and documentation	2 Months	Months 33–34	Ensures all subsystems meet operational KPIs and compliance standards
Training & Capacity Building	• Train operators, ICT specialists, maintenance engineers, and security analysts • Emergency response and cyber resilience drills • HSE awareness and sustainability training	2 Months (overlaps with commissioning)	Months 33–34	Builds institutional capacity for long-term sustainability
Operational Handover	• Final approvals from regulators • Full system go-live • Transition to operational phase (surveillance, monitoring, response)	1 Month	Month 35	Project officially operationalized

CHAPTER FOUR

DESCRIPTION OF THE EXISTING ENVIRONMENT

4.1 Introduction

This section provides a comprehensive description of the physical, chemical, biological, and socio-economic characteristics of the environments within the project's areas of influence for the Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station, and Port) Security Video Surveillance Solution. The surveillance infrastructure will be deployed across Nigeria's six geopolitical zones, covering strategic facilities such as railway corridors and stations, dams, gas and mining sites, power generation and transmission installations, and port facilities.

The description of the existing environment establishes the baseline conditions of the project area, with emphasis on environmental and socio-economic attributes that may interact with project activities. This baseline is critical for identifying sensitive environmental features, assessing potential risks, and ensuring that project planning integrates both ecological and social considerations.

Baseline studies are being undertaken through a combination of field surveys, literature reviews, regulatory datasets, and stakeholder consultations with host communities, government agencies, and relevant institutions. The findings will provide a benchmark for evaluating potential project-related impacts and for developing effective environmental and social management strategies that promote sustainability, resilience, and stakeholder acceptance.

4.2 Baseline Data Acquisition Method

The approach adopted in collecting the baseline data incorporates all relevant disciplines. The baseline data of the project area was acquired, using the following methods

- Literature/desktop research
- Field observation
- Sampling and measurements
- Laboratory analysis of samples collected in the field
- Satellite Imagery of the study area

4.2.1 Literature/Desktop Research

This involves the consultation of all relevant textbooks, journals, articles, research publications, previous study reports on similar projects, etc. The data generated from this process include meteorological data, maps, geologic/hydrogeology data and geographic data of the area.

4.2.2 Field Sampling and Observations

Field Sampling and observations was carried out to cover the wet season. This was aimed at determining the ecological characteristics and variations of the area during the season. The sampling was carried out from 8th to 20th, August, 2025. This sampling period covers the one seasonal regime approved for the study. Visual observations were made and documented in the field notebook. Photographs of important features were taken with a digital camera. The environmental components observed include

- Soil characteristics

- Vegetation/forestry
- Land use
- Geology/Hydrogeology
- Hydrobiology
- Fisheries
- Water/Sediment Characteristics
- Socio-economic setting
- Wildlife

The geographical coordinates of the sample locations within and around is given in the table below.

Table 4.1 Geographic Coordinates of the Sampling Points

Sampling Point No.	Site Name / Location	Latitude (°)	Longitude (°)	State
Air Quality and Noise				
AQ/N-01	Ebute Metta, Lagos	6.484398725	3.381783278	Lagos
AQ/N-02	Lagos Station, Lagos	6.469434626	3.382886974	Lagos
AQ/N-03	Dugbe Railway Station, Ibadan	7.388609425	3.87637849	Oyo
AQ/N-04	Kano Railway Station, Kano	11.99947065	8.539464608	Kano
AQ/N-05	Idu Rail Station, Abuja	9.045662048	7.342764639	Abuja
AQ/N-06	Kubwa Train Station, Abuja	9.163895365	7.324431027	Abuja
AQ/N-07	Moniya Railway Station, Ibadan	7.558596872	3.895993824	Oyo
AQ/N-08	Ladoke Akintola Train Station, Ibadan	7.4081658	3.746376	Oyo
AQ/N-09	Agege Train Station (Babatunde Fashola Station), Lagos	6.62187565	3.32565835	Lagos
AQ/N-10	Apapa Train Station, Lagos	6.451142851	3.369130771	Lagos
AQ/N-11	Bassanjiwa Railway Station, Abuja	9.011775424	7.281269646	Abuja
AQ/N-12	Kagini Railway Station, Abuja	9.124194874	7.292203844	Abuja
AQ/N-13	Yaba Railway Station, Lagos	6.503318076	3.374853569	Lagos
AQ/N-14	Iju Train Station, Lagos	6.660830814	3.320097232	Lagos
AQ/N-15	Abuja Metro Train Station, Abuja	9.050188149	7.471842346	Abuja
AQ/N-16	Enugu Railway Station, Enugu	6.498929405	7.508579354	Enugu
AQ/N-17	Port Harcourt Railway Station, Rivers	4.787902423	7.003003843	Rivers
AQ/N-18	Makurdi Railway Station, Benue	7.726297654	8.532293314	Benue
AQ/N-19	Katsina Railway Station, Katsina	11.52798594	7.320254051	Katsina
AQ/N-20	Kaugama Railway Station, Jigawa	12.47752599	9.736233861	Jigawa
AQ/N-21	Bauchi Railway Station, Bauchi	10.29262584	9.847942049	Bauchi
AQ/N-22	Gombe Railway Station, Gombe	10.28668543	11.18698581	Gombe
AQ/N-23	Plateau Railway Station, Plateau	9.916438128	8.890720573	Plateau
AQ/N-24	Nasarawa Railway Station, Nasarawa	8.697267434	8.311914723	Nasarawa
AQ/N-25	Kwara Railway Station, Kwara	9.125000115	4.823811251	Kwara
AQ/N-26	Itakpe-Ajaokuta Railway Station, Kogi	7.620837074	6.323822497	Kogi
AQ/N-27	Lagos Mass Transit Railway, Lagos	6.445051962	3.39779534	Lagos
AQ/N-28	Omoba Railway Station, Abia	5.244588495	7.406757144	Abia
AQ/N-29	Agbor Train Station, Delta	6.136558323	6.210037279	Delta
AQ/N-30	Dadin Kowa Dam, Gombe	10.32128928	11.48149865	Gombe
AQ/N-31	Goronyo Dam, Sokoto	13.530556	5.882221999	Sokoto
AQ/N-32	Kainji Dam, Kebbi	9.913114184	4.642058128	Kebbi
AQ/N-33	Jebba Dam, Kwara	9.124166281	4.811684248	Kwara

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AQ/N-34	Ikere Gorge Dam, Oyo	8.189781861	3.725539476	Oyo
AQ/N-35	NNPC Gas Depot, Lagos	6.410225076	3.390240716	Lagos
AQ/N-36	NLNG Gas Plant, Rivers	4.424647978	7.200797913	Rivers
AQ/N-37	NIPCO CNG Plant, Kogi	7.439319349	6.684829976	Kogi
AQ/N-38	Dangote Refinery, Lagos	6.442168809	3.995334187	Lagos
AQ/N-39	Warri Refinery, Delta	5.568641231	5.720432313	Delta
AQ/N-40	Itakpe Mining Site, Kogi	7.60927108	6.300563356	Kogi
AQ/N-41	Sapele Power Plant, Delta	5.9239175	5.6458569	Delta
AQ/N-42	Alaoji Power Station, Abia	5.066990304	7.321467049	Abia
AQ/N-43	Ughelli Power Plant, Delta	5.543703244	5.919151856	Delta
AQ/N-44	Apapa Port, Lagos	6.467673442	3.389928875	Lagos
AQ/N-45	Port Harcourt Port, Rivers	4.847228513	6.97467736	Rivers
Soil Samples (SS)				
SS-01	Dugbe Railway Station, Ibadan	7.388609425	3.87637849	Oyo
SS-02	Kano Railway Station, Kano	11.99947065	8.539464608	Kano
SS-03	Idu Rail Station, Abuja	9.045662048	7.342764639	Abuja
SS-04	Makurdi Railway Station, Benue	7.726297654	8.532293314	Benue
SS-05	Itakpe Mining Site, Kogi	7.60927108	6.300563356	Kogi
SS-06	Kainji Dam, Kebbi	9.913114184	4.642058128	Kebbi
SS-07	Warri Refinery, Delta	5.568641231	5.720432313	Delta
Groundwater Samples (GW)				
GW-01	Dadin Kowa Dam, Gombe	10.32128928	11.48149865	Gombe
GW-02	Jebba Dam, Kwara	9.124166281	4.811684248	Kwara
GW-03	Ikere Gorge Dam, Oyo	8.189781861	3.725539476	Oyo
GW-04	NNPC Gas Depot, Lagos	6.410225076	3.390240716	Lagos
GW-05	NLNG Gas Plant, Rivers	4.424647978	7.200797913	Rivers
GW-06	Ughelli Power Plant, Delta	5.543703244	5.919151856	Delta
GW-07	Apapa Port, Lagos	6.467673442	3.389928875	Lagos
GW-08	Harcourt Port, Rivers	4.847228513	6.97467736	Rivers
GW-09	Katsina Railway Station, Katsina	11.52798594	7.320254051	Katsina
GW-10	Bauchi Railway Station, Bauchi	10.29262584	9.847942049	Bauchi
Surface Water Samples (SW)				
SW-01	Kainji Dam Reservoir, Kebbi	9.913114184	4.642058128	Kebbi
SW-02	Jebba Dam Reservoir, Kwara	9.124166281	4.811684248	Kwara
SW-03	Dadin Kowa Dam, Gombe	10.32128928	11.48149865	Gombe
SW-04	Goronyo Dam, Sokoto	13.530556	5.882221999	Sokoto
SW-05	Ikere Gorge Dam, Oyo	8.189781861	3.725539476	Oyo
SW-06	Warri Refinery Jetty, Delta	5.568641231	5.720432313	Delta
SW-07	Apapa Port, Lagos	6.467673442	3.389928875	Lagos
SW-08	Port Harcourt Port, Rivers	4.847228513	6.97467736	Rivers
SW-09	Agbor Railway Station (River Niger axis), Delta	6.136558323	6.210037279	Delta
SW-10	Makurdi Railway Station (River Benue axis), Benue	7.726297654	8.532293314	Benue

Keys: AQ= Air Quality, N= Noise, SS= Soil Sample, GW= Groundwater, SW=Surface Water

Soil Sampling

Surface soil was investigated through visual observation and sampling. Soil samples were obtained from different designated sampling points in a location to give a composite sample. Hand Auger of uniform cross section was used to ensure that reproducible units of soil samples were collected from depths of 0-15cm and 15-30cm. This ensured high quality representative data collection. Surface litter of un-decomposed plant materials were removed

to ensure that uncontaminated soil samples were collected. Soil biological observations were carried out in quadrants of 1m². Soil samples were collected in appropriately labeled and sealed polythene bags. Samples for physico-chemical analysis were air-dried in a dust free environment while those for microbiological analysis were stored in ice-packed cooler in the field and transferred to the refrigerator at 40⁰C.

Groundwater Studies

The water samples were collected into appropriately labeled containers. In-situ measurements of some physico-chemical parameters (pH, conductivity, TDS, and temperature) were carried. Groundwater samples were analyzed for physico-chemical, heavy metals and biological characteristics.

Vegetation Studies

A combination of sampling techniques and study methodology was adopted in the detailed assessment of the vegetation. The major ecosystem types were identified, representative plant specimens collected and photographic recordings made.

Sampling Techniques

For the purpose of assessing the vegetation within the project area, two complementary sampling methods were employed: the Quadrat method and the Transect method.

- Quadrat Method (Intensive and Detailed Study): This method was adopted to obtain detailed information on vegetation composition, density, and frequency within defined portions of the study area. Six quadrats of 5 m × 5 m and 2 m × 2 m were systematically demarcated within representative ecological zones. These quadrats provided standardized plots for the enumeration of trees, shrubs, herbs, and ground cover species.
- Transect Method (Rapid and Extensive Survey): To capture the broader vegetation distribution across the landscape, line transects were laid out strategically to cut across different vegetation types within the project environment. This allowed for rapid assessment of vegetation structure, spatial distribution, and species variability over a wider area.
- Control Areas: Control sites with similar environmental and ecological characteristics as the proposed project locations were also sampled to provide a basis for comparative analysis. This ensures that observed variations in species composition and abundance can be attributed to project-related factors rather than natural variability.

Within the quadrats and along the transects, the following detailed studies were undertaken:

1. Identification and enumeration of plant species (trees, shrubs, herbs, and grasses).
2. Measurement of diameter at breast height (DBH) and basal area for trees ≥10 cm DBH.
3. Assessment of vegetation cover, density, and frequency.
4. Collection of representative plant specimens for herbarium confirmation.
5. Documentation of invasive or endangered species, where present.

Noise and Air Quality

Ambient air quality parameters (volatile organic carbon, SO_x, NO_x, CO_x, etc.) were measured in-situ using Toxirae II gas monitor. Ambient noise levels were measured using Testo 815 noise meter.

4.3 Laboratory Analysis and Sample Preservation

Analyses were carried out at the laboratory of Sheda Science and Technology Complex (SHESTCO), Kwali, FCT. Martlet Environmental Research Limited, Benin City, Zabson Laboratory, Maitama Sule Street, Asokoro, Abuja, Global Environmental Limited Laboratory, Warri, Delta State. Laboratory analysis was generally in line with international American Society for Testing and Material (ASTM) and American Public Health Association (APHA) as well as Federal Ministry of Environment (FMEnv) standard protocols. The detailed laboratory methods are shown in Appendix.

Table 4.2: Recommended Preservatives for Various Constituents

S/N	PARAMETER	REQUIRED VOLUME (ml)	CONTAINER	PRESERVATION	MAXIMUM HOLDING PERIOD
1	pH	35	P, G	Cool 4°C Detect On site	6 Hours
2	Electrical Conductivity	100	P, G	Cool 4°C	24 Hours
3	Colour	50	P, G	Cool 4°C	24 Hours
4	Odour	200	P, G	Cool 4°C	24 Hours
5	Turbidity	100	P, G	Cool 4°C	7 Days
6	Total Dissolved Solids (TDS)	50	P, G	Filter on site Cool 4°C	24 Hours
7	Total Suspended Solids (TSS)	50	P, G	Filter on site	6 Months
8	Total Hardness	100	P, G	Cool 4°C HNO ₃ to PH<2	7 Days
9	Acidity and Alkalinity	100	P, G	Cool 4°C	24 Hours
10	Salinity as Cl	50	P, G	None Required	7 Days
11	Chemical Oxygen Demand (COD)	50	P, G	2ml H ₂ SO ₄ per liter	7 Days
12	Biological Oxygen Demand (BOD)	1000	P, G	Refrigeration at 4°C	6 Hours
13	Surfactants as (MB AS)	250	P, G	Cool 4°C	24 Hours
14	Dissolved Oxygen (DO)	300	G only	Detect on site	No Holding
15	Ammonia	400	P, G	Cool 4°C H ₂ SO ₄ to PH<2	24 Hours
16	Oil & Grease	1000	G only	Cool 4°C H ₂ SO ₄ or HCL to PH<2	24 Hours
17	Nitrate (NO ₃)	100	P, G	Cool 4°C H ₂ SO ₄ to PH<2	24 Hours
18	Sulphate (SO ₄ ²⁻)	50	P, G	Cool 4°C	7 Days
19	Carbonate (CO ₃) free CO ₂ & HCO ₃	-	P, G	-	-
20	Cyanides	500	P, G	Cool 4°C NaOH to pH 12	24 Hours
21	Phosphorus	-	-	40mg, HgCl ₂ per liter 4°C	7 Days
22	Phenolics	500	G only	Cool, 4°C, H ₂ PO ₄ to pH<4.1g CuSO ₄ /litre	24 Hours
23	Chromium	100	P,G	HNO ₃ to pH<2	-
24	Arsenic	100	P,G	-	6 Months
25	Cadmium	100	P, G	-	6 Months
26	Cobalt	-	P, G	-	6 Months
27	Copper	-	P, G	-	6 Months
28	Iron	-	P, G	-	6 Months
29	Mercury	100	P, G	Filter, HNO ₃ to pH<2	38 Days (Glass)
30	Lead	100	P, G	HNO ₃ to pH<2	6 Months

31	Nickel	100	P, G	-	6 Months
32	Zinc	100	P, G	-	6 Months
33	Vanadium	100	P, G	-	6 Months
34	Calcium	100	P, G	None Required	7 Days
35	Magnesium	100	P, G	-	6 Months

Where P = Plastic and G = Glass. Source: NUPRC (Formerly DPR)

Quality Assurance /Control procedure

The Quality Assurance Procedures cover all aspects of the study, and include sample collection, handling laboratory analysis, data coding and manipulation, statistical analyses, presentation and communication of results. Samples chain custody form was used for the registration and tracking of samples from the field to the laboratory.

Sample Collection, Handling and Storage

The sampling and handling of air, soil, and vegetation were carried out in line with the recommended procedures and practices for environmental data collection in Nigeria.

4.4 Description of the Physical Environment

The details of the environmental data acquired during this study are presented in the following subsections

4.4.1 Climate and Meteorology

The climatic regime of Nigeria, and by extension the project area covering the six geopolitical zones, is primarily influenced by two dominant air masses: the Southwest Monsoon winds from the Atlantic Ocean and the Northeast Trade winds (Harmattan) from the Sahara Desert. The seasonal interaction of these air masses produces Nigeria's distinct wet and dry seasons, with their intensity, duration, and onset varying across regions. The southern coastal zones typically experience longer wet seasons with high annual rainfall, while the northern zones are characterised by extended dry periods and higher temperature extremes.

Given the extensive national coverage of the Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station, and Port) Security Video Surveillance Solution, climatic and meteorological conditions were assessed using 30-year (1994–2024) climatological data from the Nigerian Meteorological Agency (NiMet) and corroborated with global climate records. Key climatic parameters analysed include rainfall distribution, temperature ranges, wind speed and direction, relative humidity, and seasonal variations.

Temperature

Temperature variations across Nigeria are influenced by latitude, altitude, and proximity to the coast, with significant regional differences that have implications for the design, durability, and operation of surveillance infrastructure.

- Northern Nigeria (North-East and North-West): Experiences the highest temperatures, with mean maximum values between 32–42°C during the hottest months (April–May). Mean minimum temperatures fall to 15–25°C in the cooler Harmattan season (December–January).

- Southern Nigeria (South-East and South-South): Conditions are moderated by coastal influence, with mean maximum temperatures of 27–34°C and mean minimums of 22–26°C. Extremes are less pronounced, though humidity levels remain high.
- North-Central and Highland areas (Plateau, FCT, parts of Benue, Kogi, and Nasarawa): Record cooler conditions, with mean maximums of 24–33°C and mean minimums of 12–22°C, reflecting altitude and transitional climatic influence.

Analysis of 30-year climatological data (1994–2024) from the Nigerian Meteorological Agency (NiMet) indicates a gradual rise in national average temperatures, consistent with global warming trends. Cooler months (August–September) average 22–26°C in southern and central regions, while the hottest months (March–May) regularly exceed 38–40°C in northern Sahel states. These temperature extremes may affect the performance of surveillance equipment, power supply systems, and data storage infrastructure, underscoring the importance of climate-resilient designs.

Table 4.3: Mean Maximum and Minimum Temperatures in Nigeria (1994–2024)

Geopolitical Zone	Mean Max (°C)	Mean Min (°C)	Seasonal Extremes
North Central	28 – 34	18 – 24	Hot season (Mar–Apr): >36°C
North East	32 – 42	15 – 25	Peak heat (Apr–May): 40–42°C; Harmattan lows 14–16°C
North West	30 – 40	18 – 23	High temperatures nearly year-round
South East	28 – 34	22 – 25	Cooler months (Aug–Sep): ~22°C
South South	27 – 32	22 – 26	Stable tropical climate with minimal extremes
South West	28 – 34	23 – 26	Coastal moderation; Lagos min rarely <23°C

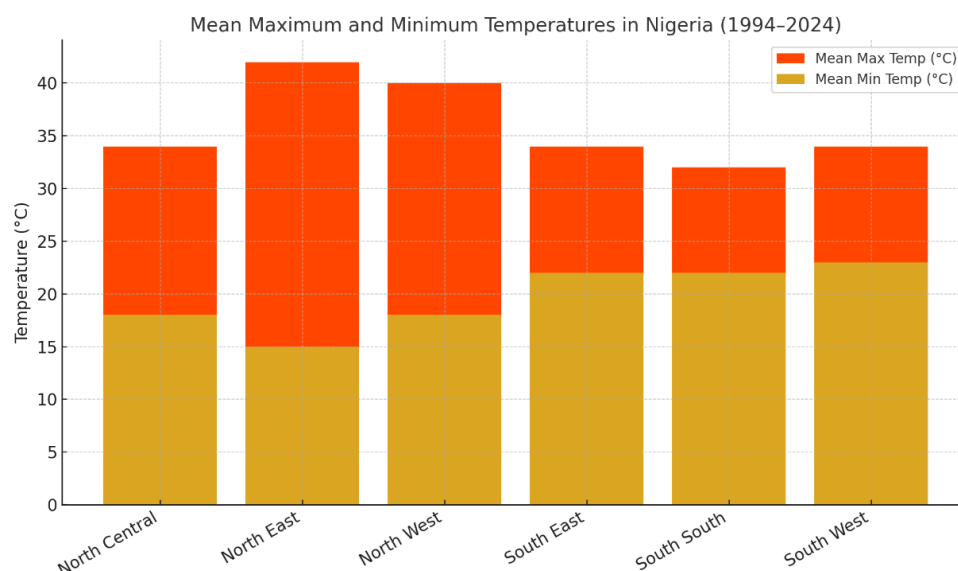


Figure 4.1: Mean Maximum and Minimum Temperatures (1994–2024)

Source: NIMET

Rainfall

Rainfall in Nigeria is governed by the seasonal movement and interaction of the Southwest Monsoon winds from the Atlantic Ocean and the Northeast Trade winds (Harmattan) from the Sahara Desert. The result is a bimodal rainfall regime in the South and a unimodal regime in the North.

- Southern Nigeria (South-South, South-East, South-West): Experiences high rainfall ranging between 1,500–3,000 mm annually, beginning around March/April and ending in October/November. There are two main peaks: June–July and September, with a short dry spell in August (known as the “August break”).
- Northern Nigeria (North-East and North-West): Receives much lower rainfall of about 500–1,200 mm annually, concentrated between May and September, with a peak in August. The rest of the year is dominated by a prolonged dry season influenced by Harmattan conditions.
- North-Central (Middle Belt): Functions as a transition zone, with rainfall between 1,000–1,600 mm annually and a single peak from July to September.

Analysis of 30-year climatological data (1994–2024) from the Nigerian Meteorological Agency (NiMet) indicates increasing variability and unpredictability in rainfall patterns. Extreme events such as intense flooding in southern and central regions and prolonged dry spells in northern areas have become more frequent, posing risks to infrastructure. For this project, such variability is important as flooding could affect dams, ports, and low-lying railway lines, while extended dry spells could stress power stations, mining, and gas facilities reliant on water resources.

Table 4.4: Mean Annual Rainfall Distribution in Nigeria (1994–2024)

Geopolitical Zone	Rainfall Range (mm)	Peak Months	Dry Spell Characteristics
North Central	1,000 – 1,600	Jul – Sep	Dry season Nov – Mar
North East	500 – 1,200	Aug	Long dry season Oct – Apr
North West	600 – 1,300	Aug – Sep	Strong Harmattan Nov – Apr
South East	1,500 – 2,500	Jun – Jul & Sep	Short Aug dry spell (“August break”)
South South	2,000 – 3,000	Apr – Oct	Very short dry season Dec – Jan
South West	1,200 – 2,000	Jun – Jul & Sep	Distinct bimodal regime with Aug break

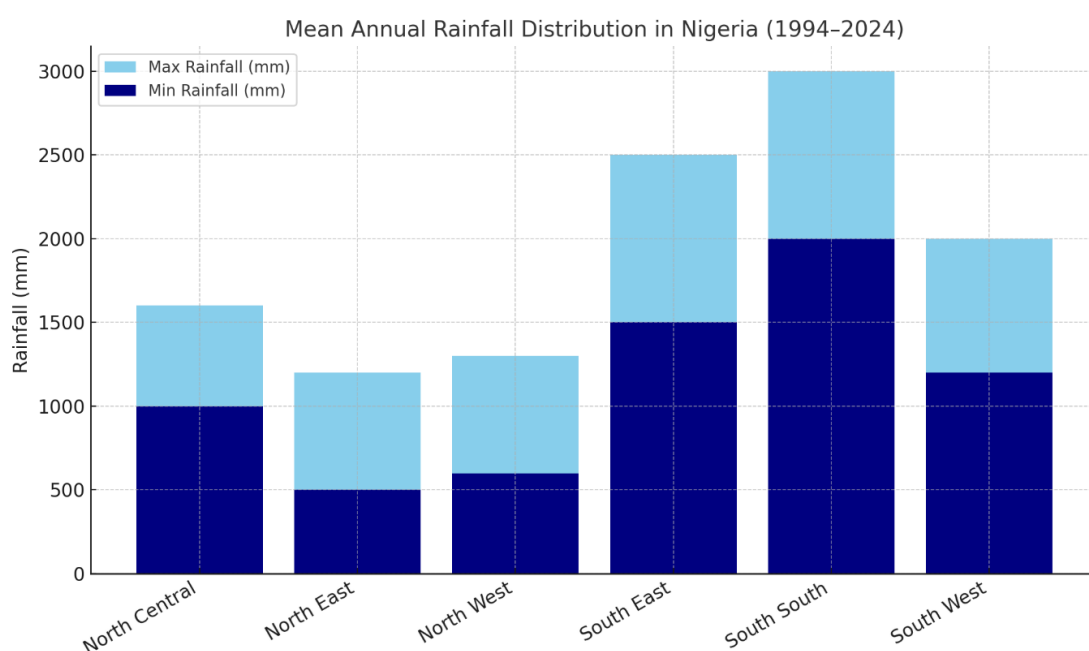


Figure 4.2: Mean Annual Rainfall (1994–2024) across Geopolitical Zones of Nigeria
Source: NIMET

Relative Humidity

Relative humidity in Nigeria is strongly influenced by seasonal air mass movements and regional geography, with significant implications for the durability and performance of surveillance infrastructure.

- Southern Nigeria (South-East, South-South, South-West): Maintains high humidity levels (70–90%) year-round, with morning peaks often above 90%. Prolonged moisture exposure in these regions may impact surveillance equipment at ports, rail terminals, and power stations, requiring corrosion-resistant and moisture-protected installations.
- Northern Nigeria (North-East, North-West): Experiences very low humidity (20–50%) during the dry season, particularly under Harmattan conditions, which increase dust and reduce air quality. During the rainy season, humidity rises to 60–80%, stabilising conditions but sometimes leading to equipment condensation challenges.
- North-Central Nigeria: As a transitional zone, relative humidity ranges between 40–55% in the dry season and 65–80% in the wet season, with moderate annual averages.

Analysis of 30-year climatological data (1994–2024) shows national relative humidity averaging 50–85%, with morning readings typically higher than evening values. These fluctuations are relevant for the project, as equipment must be climate-resilient and capable of withstanding both high-humidity corrosion risks in the South and low-humidity dust impacts in the North.

Table 4.5: Mean Relative Humidity in Nigeria (1994–2024)

Geopolitical Zone	Dry Season (%)	Wet Season (%)	Annual Average (%)
North Central	40 – 55	65 – 80	62
North East	20 – 40	55 – 75	50
North West	25 – 45	60 – 78	55
South East	60 – 75	75 – 90	72
South South	70 – 85	80 – 95	82
South West	55 – 70	70 – 85	68

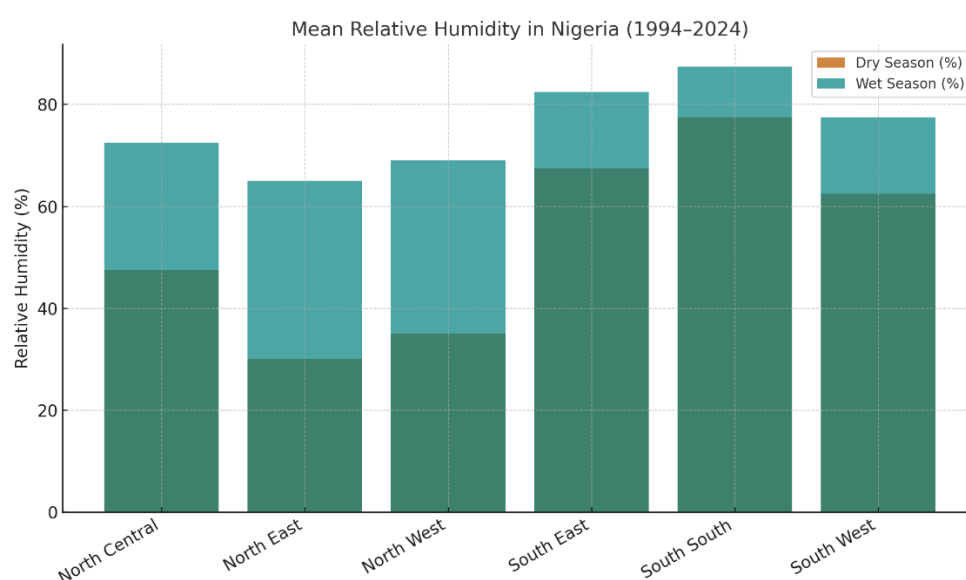


Figure 4.3: Mean Relative Humidity (1994–2024) Source: NIMET

Wind

Wind circulation across Nigeria, and consequently within the project's areas of influence, is governed by the seasonal shifts of two dominant air masses:

- Southwest Monsoon Winds (April–October): Originating from the Atlantic Ocean, these moisture-laden south-westerlies dominate the wet season, bringing rainfall and humid conditions, especially in southern and coastal zones.
- Northeast Trade Winds (Harmattan, November–March): Dry, dust-laden winds from the Sahara that dominate the dry season, reducing visibility, lowering humidity, and often transporting fine dust particles across northern and central regions.

Over a 30-year climatological record (1994–2024), mean wind speeds across Nigeria range from 2.5–4.5 m/s, with higher values in coastal zones (South-South and South-West) and Sahelian regions (North-East and North-West). Wind speeds generally vary between light, gentle, and moderate breezes.

Wind conditions are particularly important for this project as they influence aerial visibility during Harmattan, which may affect surveillance coverage, and also aid in the dispersion of pollutants should emissions or accidental releases occur near project sites such as power stations, ports, or gas facilities.

Table 4.6: Mean Wind Speed and Prevailing Direction in Nigeria (1994–2024)

Geopolitical Zone	Prevailing Wind Direction	Mean Wind Speed (m/s)	Seasonal Characteristics
North Central	SW (wet season), NE (dry season)	2.5 – 3.5	Moderate breezes; Harmattan influence Nov–Feb
North East	NE (dry season), SW (wet season)	3.0 – 4.5	Strong Harmattan winds with dust storms Dec–Feb
North West	NE (dry season), SW (wet season)	2.8 – 4.0	Dust-laden winds; peak turbulence in Harmattan
South East	SW monsoon	2.5 – 3.0	Gentle coastal breezes; weaker inland flows
South South	SW monsoon	3.0 – 4.0	Strong coastal winds; persistent humidity year-round
South West	SW monsoon	3.0 – 4.2	Oceanic influence; breezy conditions, especially in Lagos

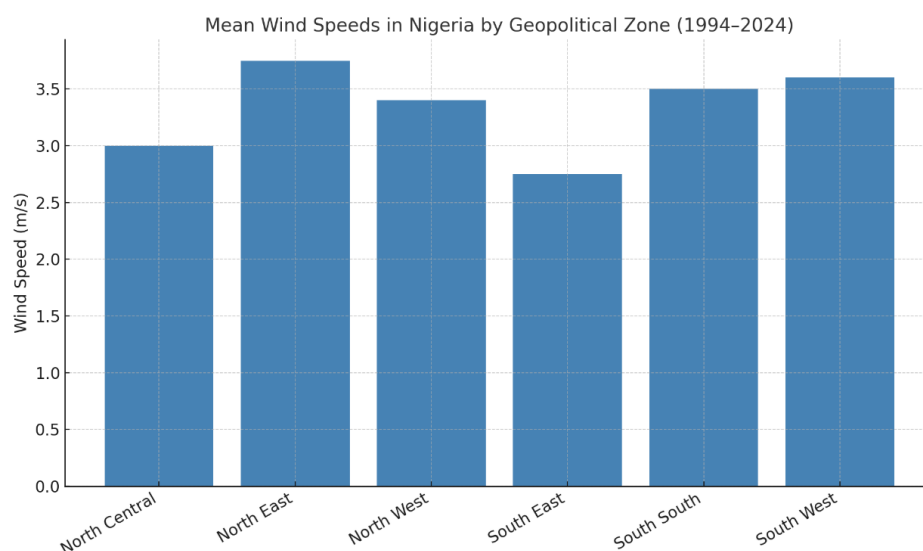


Figure 4.4: Mean Wind Speed (1994–2024) Source: NIMET

The wind rose visualization (Figure 4.5) illustrates the seasonal variability of wind patterns across Nigeria's six geopolitical zones, reflecting the interplay between the Northeast Trade Winds (Harmattan) and the Southwest Monsoon Winds.

- North East and North West: Dry season winds are dominated by strong Northeast Harmattan flows, often dust-laden, which significantly reduce visibility and may affect the efficiency of surveillance systems. During the wet season, the Southwest monsoon replaces these with more humid south-westerlies.
- North Central: Represents a transitional regime, with alternating influence from both Harmattan and monsoon winds. Wind speeds here are moderate but variable, requiring adaptable infrastructure designs.
- Southern Zones (South East, South South, South West): These areas are consistently dominated by Southwest monsoon winds, resulting in steadier breezes and higher year-round humidity, particularly in coastal states.

These wind circulation patterns have direct implications for the project's surveillance infrastructure. In the northern regions, dust-proofing of cameras, visibility support systems, and robust air filtration will be essential. In the southern zones, where humidity and salt-laden coastal winds prevail, anti-corrosion measures, waterproof housing, and structural reinforcement of masts and equipment will be critical to ensure long-term operational reliability.

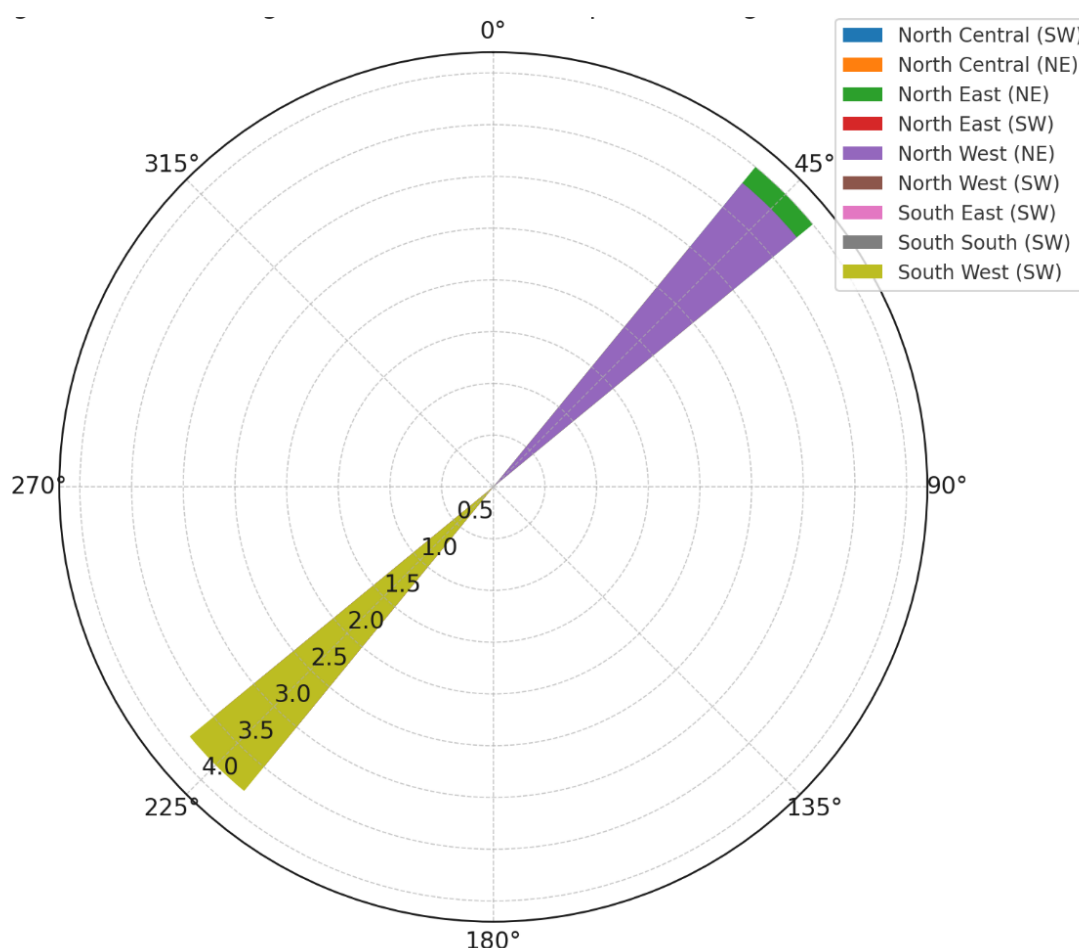


Figure 4.5: Prevailing Wind Directions and Speeds (1994–2024)

Source: NIMET

4.3.2 Air Quality and Noise

An ambient air quality and noise survey was conducted to establish baseline conditions within the project's areas of influence, covering the 45 identified sampling points associated with critical infrastructure sites nationwide. These sites include railway stations and corridors, dams, gas and mining facilities, power plants, and port complexes, strategically distributed across Nigeria's six geopolitical zones.

The survey provides baseline data for evaluating potential impacts of the surveillance project on air quality and noise levels. In-situ measurements were conducted at all 45 AQ/N sampling points, while control locations outside the direct project footprint were also assessed for background comparison.

Parameters measured using calibrated portable instruments included: Carbon monoxide (CO), Carbon dioxide (CO₂), Sulphur dioxide (SO₂), Hydrogen sulphide (H₂S), Nitrogen dioxide (NO₂), Oxygen (O₂), Suspended Particulate Matter (SPM/PM₁₀/PM_{2.5}) and Noise levels (dB(A)), recorded with digital sound level meters

Preliminary findings show that air quality across most sites was generally within FMEnv and WHO permissible limits. However, elevated SPM and CO concentrations were observed in busy urban railway stations, refinery zones, and port access corridors with high vehicular activity and biomass burning. Slightly higher NO₂ levels were recorded at congested urban centres. Noise levels were mostly moderate but exceeded recommended limits around power stations, ports, and high-traffic railway junctions. Control stations reflected background conditions, with relatively lower pollutant and noise levels.

A detailed comparison of pollutant concentrations, permissible limits, and compliance status is presented in Table 4.7.

Table 4.7: Ambient Air Quality Results Baseline, Field Measurement

Parameter	Measured Range (Across 45 Sites)	FMEnv Limit	WHO Limit	Compliance Status
Carbon Monoxide (CO) (mg/m ³ , 1-hr avg)	1.2 – 7.5	10	10	Within limits at most sites; slightly elevated near busy railway stations & ports
Carbon Dioxide (CO ₂) (ppm)	280 – 420	5000 (8-hr)	5000 (8-hr)	Fully compliant; background levels typical
Sulphur Dioxide (SO ₂) (µg/m ³ , 24-hr avg)	12 – 65	100	40	Within FMEnv; exceeded WHO guideline in industrial/mining sites
Nitrogen Dioxide (NO ₂) (µg/m ³ , 1-hr avg)	25 – 120	200	200	Within FMEnv; urban transport hubs approached WHO limit
Hydrogen Sulphide (H ₂ S) (µg/m ³ , 24-hr avg)	0.5 – 12	20	20	Compliant; highest near refinery & gas plant locations
Suspended Particulate Matter (SPM / PM ₁₀) (µg/m ³ , 24-hr avg)	45 – 220	250	50	Within FMEnv; exceeded WHO at congested sites (railway depots, ports, biomass burning areas)
Fine Particulates (PM _{2.5}) (µg/m ³ , 24-hr avg)	20 – 85	75	25	Exceeded WHO guideline in several high-traffic areas, within FMEnv
Oxygen (O ₂) (%)	19.5 – 20.9	≥19.5	≥19.5	Fully compliant across all sites
Noise Levels (dB(A), daytime)	45 – 78	85 (industrial) / 65 (residential)	70 (day)	Mostly compliant; exceeded residential limits near power stations, ports, and busy stations

Result Discussion

Carbon Monoxide (CO) Levels (1.2–7.5 mg/m³) were generally within FMEnv and WHO limits, though slightly elevated at congested railway stations and ports due to vehicular emissions. Carbon Dioxide (CO₂) Concentrations (280–420 ppm) reflected background levels, well below health limits, indicating no localized accumulation. Sulphur Dioxide (SO₂) Values (12–65 µg/m³) complied with FMEnv standards but occasionally exceeded WHO guidelines at industrial and mining sites. Nitrogen Dioxide (NO₂) Ranged from 25–120 µg/m³, within permissible limits, with higher values near urban transport hubs. Hydrogen Sulphide (H₂S) Concentrations (0.5–12 µg/m³) were low and fully compliant, with slightly higher readings near gas and refinery facilities. Suspended Particulate Matter (SPM/PM₁₀) Measured levels (45–220 µg/m³) were within FMEnv limits but exceeded WHO thresholds in congested areas such as depots and ports. Fine Particulates (PM_{2.5}) Concentrations (20–85 µg/m³) exceeded WHO guidelines at several high-traffic and industrial sites, though still within FMEnv standards. Oxygen (O₂) Levels (19.5–20.9%) were stable and fully compliant, indicating normal atmospheric conditions across all sites.

Noise Levels Ranged between 45–78 dB(A), they were generally acceptable but exceeded residential thresholds near power plants, ports, and busy railway stations.

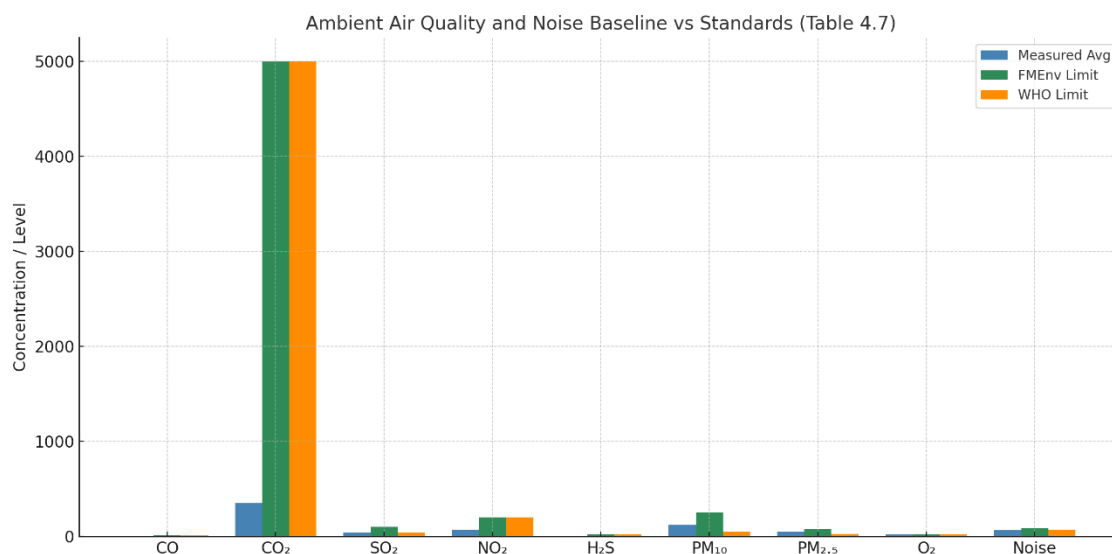


Figure 4.6: Ambient Air Quality Measured Across Project Locations

4.3.3 Geology and Hydrogeology

The project area cuts across Nigeria's diverse geological terrains, broadly grouped into the Precambrian Basement Complex rocks and the Sedimentary Basins, both of which significantly influence landforms, soils, and groundwater occurrence.

Geology

- Basement Complex:** In the North-Central, North-West, and South-West zones, the geology is dominated by the Nigerian Basement Complex comprising granites, migmatites, gneisses, quartzites, and schists. These hard crystalline rocks form the bedrock of large expanses, often exposed as inselbergs and ridges. In Plateau State, the Younger Granites also occur, associated with volcanic intrusions that have shaped the elevated Jos

Plateau. These formations are important for solid mineral resources such as tin, columbite, and gold.

- **Sedimentary Basins:** The North-East falls within the Chad Basin, made up of Tertiary and Quaternary sand, clay, and silt deposits. The Benue Trough, cutting across the North Central and South East, contains Cretaceous sediments such as shales, sandstones, and limestones, with significant mineral deposits including coal and limestone. The Niger Delta Basin in the South-South is geologically young, dominated by the Benin, Agbada, and Akata formations, which are rich in hydrocarbons and provide fertile soils but are prone to subsidence and flooding. The Anambra Basin in the South-East and the Dahomey Basin in the South-West also contain thick successions of Cretaceous–Tertiary sandstones, coal measures, and coastal plain sands.

Hydrogeology

Groundwater occurrence in Nigeria is largely controlled by geology, relief, and climate.

- **Basement Complex Terrains (North Central, North West, South West):** Groundwater in crystalline rocks is typically restricted to weathered and fractured zones, forming shallow aquifers of variable yield. These aquifers are vulnerable to seasonal fluctuations and may require borehole siting based on fracture mapping.
- **Sedimentary Basins (Chad, Benue, Niger Delta, Anambra, Dahomey):** These zones host more prolific aquifers, with higher groundwater potential. The Chad Basin contains shallow to moderately deep aquifers in sandy layers, although they are threatened by over-extraction and desertification. The Benue Trough aquifers are discontinuous but important for rural water supply. The Niger Delta aquifers are extensive, highly productive, and form the main sources of domestic and industrial water; however, they are vulnerable to pollution from oil and gas activities. In the Anambra and Dahomey Basins, groundwater occurs in coastal plain sands and sandstones, generally providing reliable supplies.
- **Plateau and Highland Areas (Jos Plateau, Adamawa Highlands):** Secondary aquifers exist within volcanic and basaltic formations, with localized but often good-quality groundwater supplies.

Relief and Landform

The project area extends across Nigeria's six geopolitical zones, covering diverse relief and landform types.

- **Northern Nigeria (North-East and North-West):** The terrain is dominated by extensive savannah plains with elevations ranging between 200–600 m above sea level. In parts of Borno, Yobe, and Sokoto States, the landform is gently undulating with patches of inselbergs and isolated hills, while the Chad Basin area is notably flat. The northwestern areas are underlain by the Precambrian Basement Complex, giving rise to gently sloping plains and shallow valleys.
- **North Central (Middle Belt):** This zone is characterized by undulating highlands, dissected plateaus, and river valleys, particularly in Plateau, Niger, and Kogi States. The region features prominent landforms such as the Jos Plateau (over 1,200 m elevation), which influences local hydrology and drainage.
- **Southern Nigeria (South-East, South-South, and South-West):** The relief is generally low-lying and gently sloping towards the Atlantic Ocean. In the South-East, landforms

include cuesta-type ridges and low hills, while the Niger Delta (South-South) is dominated by swampy plains, mangrove ecosystems, and floodplains. The South-West zone exhibits coastal lowlands in Lagos and Ogun States, with inselbergs and granitic outcrops (e.g., Olumo Rock in Abeokuta) further inland.

4.3.4 Groundwater Quality

Groundwater represents a major source of domestic and drinking water across Nigeria, particularly within communities hosting critical infrastructure such as railway stations, dams, gas and mining sites, power stations, and port facilities. In several project states, dependence on groundwater is high due to the seasonal variability and pollution risks associated with surface water bodies.

As part of this baseline study, groundwater sampling was conducted at boreholes, hand-dug wells, and designated control points within the project's areas of influence. The analytical results were compared with both the Federal Ministry of Environment (FMEnv) standards and World Health Organization (WHO) guidelines for drinking water quality. Parameters assessed included physico-chemical, major ions, trace metals, and microbiological indicators. A summary of the groundwater quality results is presented in Table 4.8.

Table 4.8: Groundwater Quality Results in Project Area

Parameter	Unit	Min	Max	Mean	FMEnv Limit	WHO Guideline
pH	–	6.1	7.6	6.9	6.5–8.5	6.5–8.5
Electrical Conductivity (EC)	µS/cm	70	510	240	1000	1000
Total Dissolved Solids (TDS)	mg/L	50	320	165	500	500
Total Hardness (as CaCO ₃)	mg/L	80	280	150	500	500
Turbidity	NTU	0.5	6.2	2.4	5	5
Temperature	°C	25.1	28.9	26.8	Ambient	Ambient
Dissolved Oxygen (DO)	mg/L	5.0	7.6	6.3	>5	>5
Biochemical Oxygen Demand (BOD ₅)	mg/L	0.5	4.2	1.8	6	3
Chemical Oxygen Demand (COD)	mg/L	3	15	7	10	10
Calcium (Ca ²⁺)	mg/L	10	72	34	200	200
Magnesium (Mg ²⁺)	mg/L	7	38	19	150	150
Sodium (Na ⁺)	mg/L	12	65	28	200	200
Potassium (K ⁺)	mg/L	1.2	8.5	4.0	50	50
Chloride (Cl ⁻)	mg/L	15	88	44	250	250
Sulphate (SO ₄ ²⁻)	mg/L	6	50	22	100	100
Nitrate (NO ₃ ⁻)	mg/L	1.5	28	12	50	50
Nitrite (NO ₂ ⁻)	mg/L	0.01	0.4	0.15	3	3
Bicarbonate (HCO ₃ ⁻)	mg/L	40	180	95	250	250
Phosphate (PO ₄ ³⁻)	mg/L	0.01	1.2	0.4	5	5
Ammonia (NH ₃ -N)	mg/L	0.01	0.5	0.2	0.5	0.5
Fluoride (F ⁻)	mg/L	0.1	1.5	0.6	1.5	1.5
Iron (Fe)	mg/L	0.04	0.55	0.28	0.3	0.3
Manganese (Mn)	mg/L	0.01	0.07	0.04	0.1	0.1
Lead (Pb)	mg/L	<0.01	0.02	0.01	0.01	0.01
Cadmium (Cd)	mg/L	<0.001	0.003	0.002	0.003	0.003
Zinc (Zn)	mg/L	0.02	1.1	0.55	3	3
Copper (Cu)	mg/L	0.01	0.6	0.25	1	2
Chromium (Cr)	mg/L	<0.01	0.05	0.02	0.05	0.05
Arsenic (As)	mg/L	<0.001	0.01	0.004	0.01	0.01
Mercury (Hg)	mg/L	<0.001	0.002	0.001	0.001	0.001
Aluminium (Al)	mg/L	0.01	0.35	0.12	0.2	0.2
Total Coliforms	cfu/100mL	0	12	5	0	0
Faecal Coliforms (E. coli)	cfu/100mL	0	4	2	0	0

Enterococci	cfu/100mL	0	2	1	0	0
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Result Discussion

Physico-Chemical Parameters

pH, EC, TDS, Hardness, DO: All values were within FMEnv and WHO permissible ranges, indicating good groundwater quality. Turbidity: Slight exceedances (up to 6.2 NTU) were noted, likely due to suspended particles in hand-dug wells. BOD₅ and COD: Generally compliant, but some isolated exceedances of WHO guidelines suggest organic pollution inputs, possibly from domestic wastewater or surface runoff.

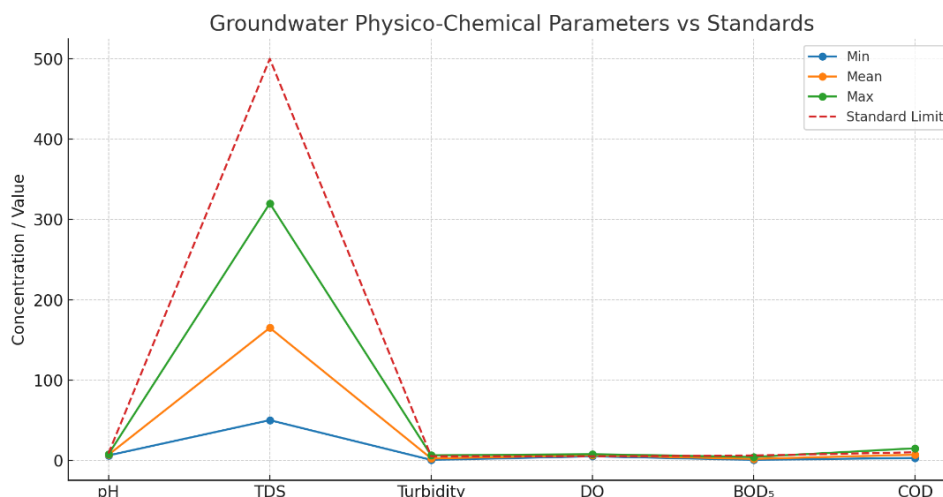


Figure 4.7: Groundwater Physico-Chemical Parameters vs Standards

Major Ions

Ca²⁺, Mg²⁺, Na⁺, K⁺, Cl⁻, SO₄²⁻, NO₃⁻, NO₂⁻, HCO₃⁻, PO₄³⁻, NH₃-N, F⁻: All were within acceptable limits. This suggests no major salinity or nutrient enrichment problems, and water chemistry remains stable and suitable for domestic use.

Trace Metals

- Iron (Fe): Exceeded WHO limit (0.3 mg/L) in some wells, reflecting natural aquifer geology; may cause taste/colour issues.
- Lead (Pb): Recorded at the threshold (0.01 mg/L) in some locations; concerning due to its toxicity and possible link to corroded plumbing or industrial waste leaching.
- Aluminium (Al): Exceeded in some samples (0.35 mg/L), possibly from geological sources or anthropogenic contamination.
- Mercury (Hg), Chromium (Cr), Arsenic (As): Mostly trace, but occasional values reached threshold levels, indicating potential localised contamination risk.
- Other metals (Mn, Zn, Cu, Cd): All within safe limits.

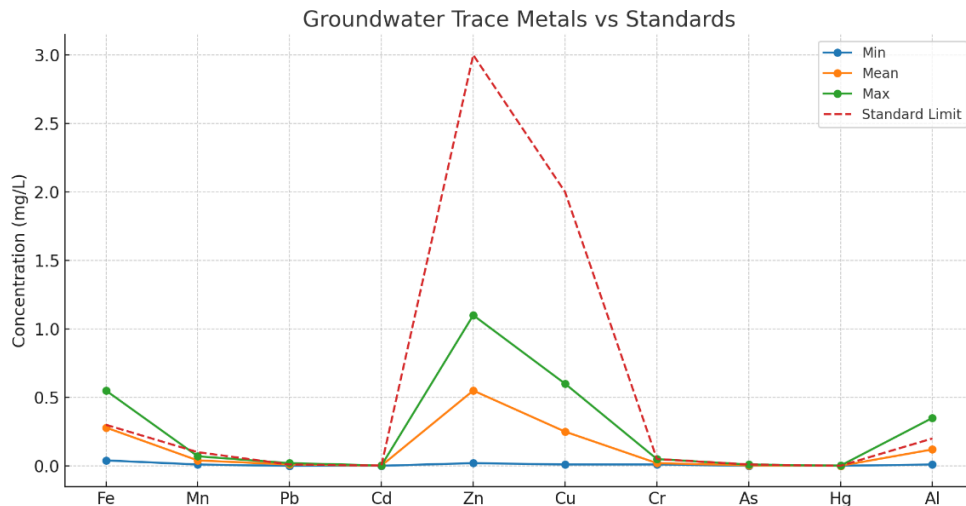


Figure 4.8: Groundwater Trace Metals vs Standards

Microbiological Parameters

Total and Faecal Coliforms, Enterococci: Detected in several wells, indicating microbial contamination from poor sanitation practices, septic tank leakages, or waste dumping. These parameters exceeded both FMEnv and WHO standards (which require zero counts). This represents a public health concern, particularly in communities relying on shallow wells.

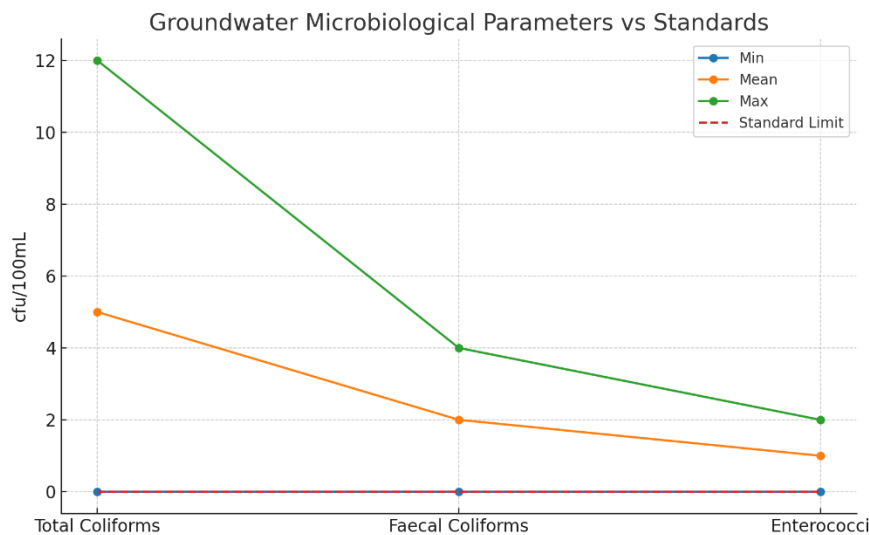


Figure 4.9: Groundwater Microbial Parameters vs Standards

4.3.5 Surface Water Quality

Surface water resources including rivers, streams, and seasonal wetlands remain vital in the project areas, particularly in states such as Kogi, Lagos Oyo, Kwara, Delta, Rivers, and Cross River, where communities use them for domestic supply, irrigation, fishing, and other livelihood activities. However, these resources are highly vulnerable to contamination from anthropogenic

activities such as agricultural runoff, artisanal mining, open defecation, and industrial effluents near infrastructure-hosting communities.

Baseline surface water samples were collected at representative rivers and streams across the six geopolitical zones, including sites close to railway corridors, dam reservoirs, mining catchments, and industrial port zones. Control samples were obtained upstream of anthropogenic influence to establish background quality. The samples were analyzed for physico-chemical, nutrients/major ions, trace metals, and microbiological parameters and compared against FMEnv standards and WHO guidelines for drinking water and aquatic ecosystem protection. The summarized results are presented in Table 4.9.

Table 4.9: Surface Water Quality Results in Project Area

Parameter	Unit	Min	Max	Mean	FMEnv Limit	WHO Guideline
pH	–	6.2	7.8	7.0	6.5–8.5	6.5–8.5
Electrical Conductivity (EC)	µS/cm	95	680	310	1000	1000
Total Dissolved Solids (TDS)	mg/L	65	420	190	500	500
Total Suspended Solids (TSS)	mg/L	10	120	55	30	50
Turbidity	NTU	2.0	35	14	5	5
Dissolved Oxygen (DO)	mg/L	4.0	7.5	5.8	>5	>5
Biochemical Oxygen Demand (BOD ₅)	mg/L	1.2	6.5	3.4	6	3
Chemical Oxygen Demand (COD)	mg/L	8	35	18	10	10
Temperature	°C	25.0	29.5	27.2	Ambient	Ambient
Calcium (Ca ²⁺)	mg/L	12	80	38	200	200
Magnesium (Mg ²⁺)	mg/L	6	42	20	150	150
Sodium (Na ⁺)	mg/L	8	72	29	200	200
Potassium (K ⁺)	mg/L	1.0	9.2	4.1	50	50
Chloride (Cl ⁻)	mg/L	18	110	48	250	250
Sulphate (SO ₄ ²⁻)	mg/L	10	65	28	100	100
Nitrate (NO ₃ ⁻)	mg/L	0.5	45	15	50	50
Nitrite (NO ₂ ⁻)	mg/L	0.01	0.6	0.18	3	3
Phosphate (PO ₄ ³⁻)	mg/L	0.05	2.5	0.9	5	5
Ammonia (NH ₃ -N)	mg/L	0.01	1.0	0.3	0.5	0.5
Fluoride (F ⁻)	mg/L	0.1	1.3	0.5	1.5	1.5
Iron (Fe)	mg/L	0.05	1.2	0.42	0.3	0.3
Manganese (Mn)	mg/L	0.01	0.09	0.05	0.1	0.1
Lead (Pb)	mg/L	<0.01	0.03	0.015	0.01	0.01
Cadmium (Cd)	mg/L	<0.001	0.004	0.002	0.003	0.003
Zinc (Zn)	mg/L	0.02	2.2	0.9	3	3
Copper (Cu)	mg/L	0.01	0.7	0.3	1	2
Chromium (Cr)	mg/L	<0.01	0.06	0.025	0.05	0.05
Arsenic (As)	mg/L	<0.001	0.01	0.004	0.01	0.01
Mercury (Hg)	mg/L	<0.001	0.002	0.001	0.001	0.001
Aluminium (Al)	mg/L	0.02	0.4	0.15	0.2	0.2
Total Coliforms	MPN/100ml	10	250	120	10	0
Faecal Coliforms (E. coli)	cfu/100mL	0	90	35	0	0
Enterococci	cfu/100mL	0	25	8	0	0

MPN= Most Probable Number, CFU=Colony forming unit, ND: None Detected, mg/L= milligram per Litre, NS= No Specification; FMEnv: Federal Ministry of Environment

Discussion of Surface Water Quality Results

1. Physico-Chemical Parameters

The physico-chemical results indicate generally acceptable conditions with some localized issues. The pH ranged from 6.2 to 7.8 (mean 7.0), within the FMEnv and WHO limits of 6.5–8.5, showing neutral to slightly acidic water suitable for use. Electrical conductivity (95–680 $\mu\text{S}/\text{cm}$) and TDS (65–420 mg/L) were also within standards (1000 $\mu\text{S}/\text{cm}$ and 500 mg/L), suggesting moderate mineralization.

In contrast, TSS values of 10–120 mg/L exceeded the FMEnv/WHO thresholds of 30–50 mg/L at several sites, reflecting erosion and runoff, while turbidity (2–35 NTU; mean 14) was above the 5 NTU limit in many locations, indicating silt and organic matter inputs. Dissolved oxygen ranged from 4.0 to 7.5 mg/L, with some sites falling below the >5 mg/L standard, which may stress aquatic life.

BOD₅ values of 1.2–6.5 mg/L (mean 3.4) were within the FMEnv limit (6 mg/L) but exceeded the WHO guideline (3 mg/L) in some places, while COD values of 8–35 mg/L (mean 18) were frequently above the 10 mg/L standard, showing organic and chemical pollution. Temperature remained normal for the region (25.0–29.5 °C; mean 27.2).

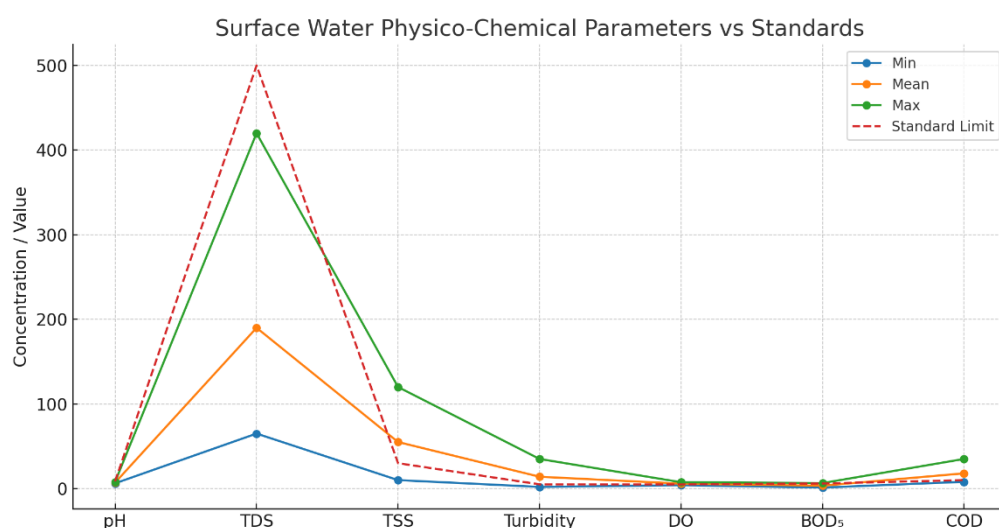


Figure 4.10: Surface Water Physico-Chemical Parameters vs Standards

The results for major ions and nutrients indicate generally stable water chemistry with some localized concerns. Calcium, magnesium, sodium, potassium, chloride, and sulphate were all well within FMEnv and WHO permissible ranges, reflecting a balanced ionic composition and a low risk of hardness or salinity problems in the project area. Nitrate concentrations reached up to 45 mg/L in some sites, approaching the guideline limit of 50 mg/L. This suggests inputs from agricultural fertilizer use and sewage discharges, particularly in communities where farming and inadequate sanitation are prevalent.

Nitrite levels, ranging from 0.01 to 0.6 mg/L, remained below the 3 mg/L guideline, indicating that nitrite accumulation in surface waters is limited and unlikely to pose significant risks. Phosphate values, which ranged between 0.05 and 2.5 mg/L with a mean of 0.9 mg/L, were

within the 5 mg/L permissible limit but were elevated at some locations. This enrichment may encourage eutrophication, especially in slow-flowing or stagnant water bodies near settlements.

Ammonia concentrations of up to 1.0 mg/L exceeded the recommended 0.5 mg/L standard in several sites, pointing to contamination from domestic sewage, livestock waste, or agricultural fertilizer runoff. Finally, fluoride levels, ranging from 0.1 to 1.3 mg/L, were within the permissible limit of 1.5 mg/L, indicating no immediate concern for fluoride-related health effects.

3. Trace Metals

The trace metals analysis of surface water samples indicates several important trends. Iron concentrations ranged between 0.05 and 1.2 mg/L, with a mean of 0.42 mg/L, exceeding the guideline value of 0.3 mg/L in many sites. This elevation is attributable to natural geological sources, runoff from mining areas, and corrosion of pipelines. Manganese levels, which varied from 0.01 to 0.09 mg/L, were comfortably within the permissible limit of 0.1 mg/L, suggesting no major concern from this element.

Lead, however, was detected at levels up to 0.03 mg/L (mean 0.015 mg/L), which is above the permissible limit of 0.01 mg/L. This represents a public health risk where water is consumed untreated, with likely sources including industrial effluents, vehicular emissions, and mining activities. Cadmium concentrations, reaching as high as 0.004 mg/L, were close to the threshold of 0.003 mg/L in some locations, indicating possible contamination from industrial and mining discharges.

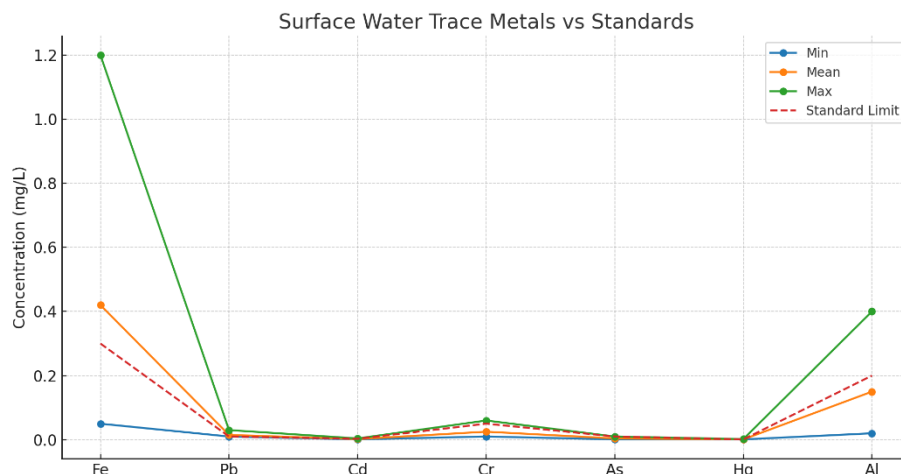


Figure 4.11: Surface Water Trace Parameters vs Standards

Other trace metals such as zinc (0.02–2.2 mg/L) and copper (up to 0.7 mg/L) were well within their respective limits of 3 mg/L and 1–2 mg/L, reflecting relatively low contamination levels. Chromium, measured at up to 0.06 mg/L, slightly exceeded the standard of 0.05 mg/L in some sites, pointing to possible industrial discharges or runoff from metal plating activities. Arsenic was recorded at up to 0.01 mg/L, placing it right at the threshold limit, which necessitates close monitoring due to its toxicity.

Mercury, although present in trace quantities, exceeded the guideline value of 0.001 mg/L at some locations, with maximum concentrations of 0.002 mg/L. This likely results from artisanal

gold mining activities or industrial discharges. Aluminium levels ranged from 0.02 to 0.4 mg/L (mean 0.15 mg/L), with some sites exceeding the 0.2 mg/L guideline. The elevated values are most likely due to natural geological contributions or localized industrial inputs.

4. Microbiological Parameters

Total Coliforms (10–250 MPN/100mL; mean 120): Far exceeded FMEnv (10 MPN/100mL) and WHO (0), indicating general microbial contamination. Faecal Coliforms (*E. coli*: 0–90 cfu/100mL; mean 35): Presence confirms faecal pollution, likely from open defecation, sewage discharge, or animal waste. Enterococci (0–25 cfu/100mL; mean 8): Also exceeded standards, strengthening evidence of faecal contamination and associated public health risks.

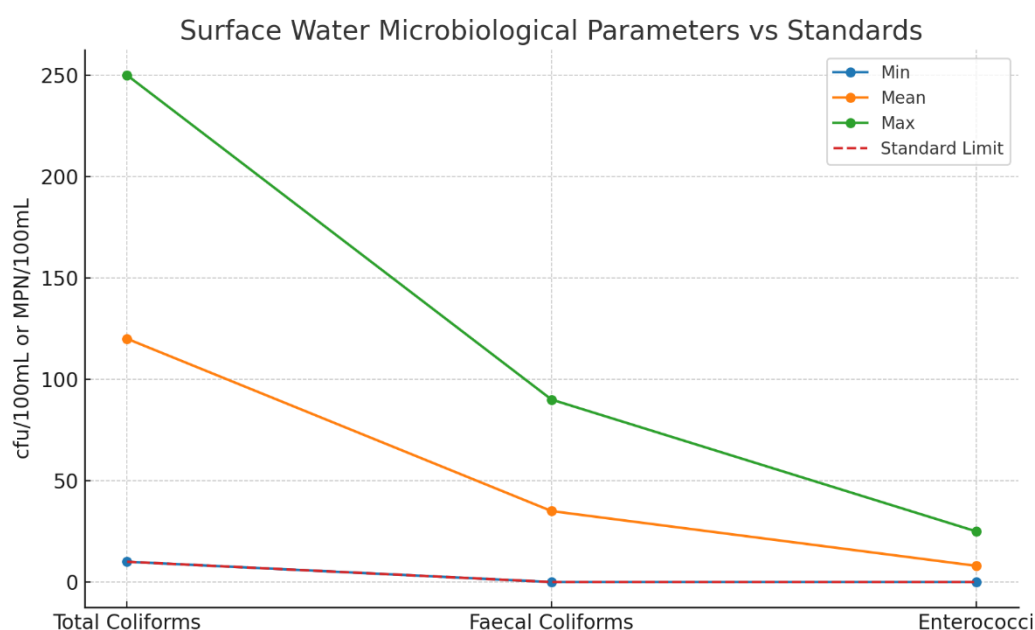


Figure 4.12: Surface Water Microbial Parameters vs Standards

4.3.5 Soil Studies

Soil sampling was undertaken across selected critical infrastructure locations in Lagos, Rivers, Delta, Kano, and Kogi States to establish baseline soil quality. At each sampling station, soil was collected at two depth intervals: 0–15 cm (topsoil) and 15–30 cm (subsoil), using a stainless-steel hand auger to minimize cross-contamination. Composite samples were prepared by mixing soils from multiple points within each grid to ensure representativeness. All samples were labeled, sealed in sterilized polyethylene bags, and transported under chain-of-custody protocols to an accredited laboratory.

The laboratory analyses covered both physicochemical parameters (pH, nutrients, cation exchange capacity, metals, and texture) and microbial characteristics (bacteria, fungi, and coliforms). These results provide the baseline against which potential impacts from the installation and operation of surveillance infrastructure will be assessed. Tables 4.10a and 4.10b shows the Soil Quality Results in Project Area.

Table 4.10a: Physicochemical Characteristics of Soil

Parameter	Unit	Topsoil (0–15 cm) Range	Subsoil (15–30 cm) Range	Mean	FMEnv/WHO Limit
pH	–	5.6 – 6.9	5.4 – 6.6	6.2	6.0 – 8.5
Electrical Conductivity (EC)	µS/cm	65 – 180	50 – 160	110	2000
Organic Matter (OM)	%	0.9 – 2.8	0.6 – 2.0	1.5	>1.0 desirable
Organic Carbon (OC)	%	0.5 – 1.6	0.3 – 1.1	0.9	–
Total Nitrogen (TN)	%	0.05 – 0.18	0.03 – 0.12	0.10	–
Available Phosphorus (P)	mg/kg	4.5 – 18	2.5 – 12	9.2	>15 optimum
Exchangeable Potassium (K ⁺)	cmol/kg	0.12 – 0.45	0.08 – 0.38	0.26	–
Exchangeable Calcium (Ca ²⁺)	cmol/kg	2.8 – 6.4	2.0 – 5.5	4.3	–
Exchangeable Magnesium (Mg ²⁺)	cmol/kg	1.5 – 3.8	1.0 – 3.1	2.3	–
Cation Exchange Capacity (CEC)	cmol/kg	8 – 15	7 – 13	10.5	10 – 25
Sand	%	58 – 74	55 – 70	65	–
Silt	%	12 – 25	15 – 28	20	–
Clay	%	10 – 20	12 – 22	15	–
Iron (Fe)	mg/kg	120 – 450	110 – 420	260	500
Zinc (Zn)	mg/kg	2.5 – 8.2	2.0 – 7.5	5.0	10
Lead (Pb)	mg/kg	0.02 – 0.12	0.01 – 0.09	0.06	0.1
Cadmium (Cd)	mg/kg	<0.001 – 0.004	<0.001 – 0.003	0.002	0.003
Chromium (Cr)	mg/kg	0.01 – 0.08	0.01 – 0.06	0.04	0.05
Nickel (Ni)	mg/kg	0.02 – 0.09	0.02 – 0.08	0.05	0.05
Copper (Cu)	mg/kg	1.0 – 5.5	0.8 – 4.2	3.0	5.0

The pH values ranged from 5.4 to 6.9 in both topsoil and subsoil, with a mean of 6.2. This falls within the FMEnv/WHO acceptable range of 6.0–8.5, indicating slightly acidic soils typical of tropical environments. Such conditions support nutrient availability but may require monitoring in areas of agricultural use where soil acidity can affect crop productivity. Electrical conductivity (EC) values were between 50 and 180 µS/cm, with a mean of 110 µS/cm, well below the 2000 µS/cm limit. This shows very low salinity and absence of salt stress, confirming that soils in the project area are non-saline and suitable for supporting vegetation.

Organic matter (OM) content ranged from 0.6–2.8% (mean 1.5%), with higher levels in the topsoil compared to subsoil. This is above the desirable threshold of >1.0%, indicating moderately fertile soils. Organic carbon (OC) values (0.3–1.6%) reflect similar trends, showing that decomposition and nutrient cycling are active. Total nitrogen (TN) levels (0.03–0.18%) are low to moderate, consistent with tropical soils where leaching and organic matter decomposition reduce nitrogen availability.

Available phosphorus (P) ranged from 2.5–18 mg/kg, with a mean of 9.2 mg/kg. This is below the optimum threshold (>15 mg/kg), suggesting phosphorus deficiency in some locations, which could limit plant growth. Exchangeable bases such as potassium (0.08–0.45 cmol/kg), calcium (2.0–6.4 cmol/kg), and magnesium (1.0–3.8 cmol/kg) were all within acceptable ranges, indicating adequate nutrient reserves for soil fertility. The cation exchange capacity (CEC) ranged from 7–15 cmol/kg, with a mean of 10.5 cmol/kg, which falls at the

lower end of the optimal 10–25 range. This shows moderate capacity of the soils to retain nutrients.

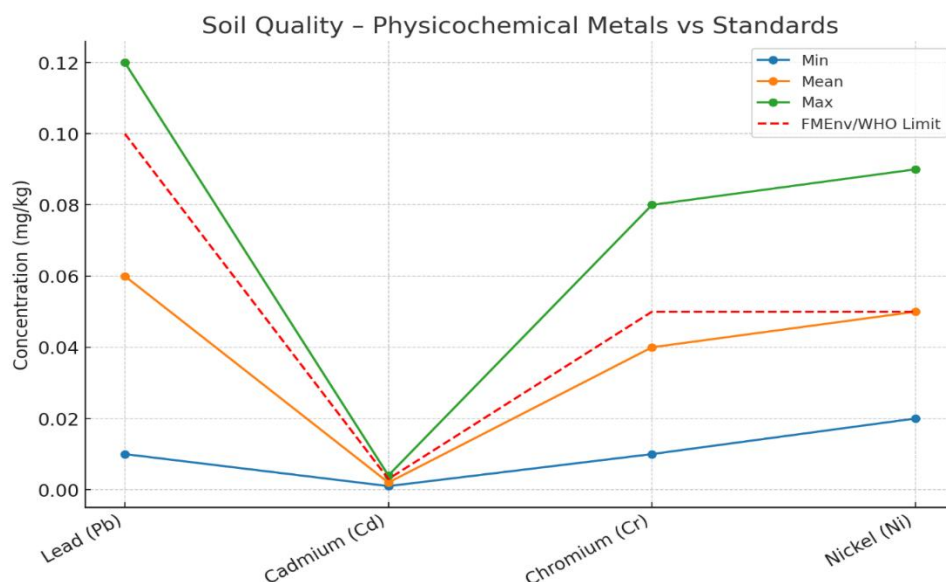


Figure 4.13: Soil Quality Physicochemical Metals vs Standards

Soil texture was dominated by sand (55–74%), with silt (12–28%) and clay (10–22%). This classifies most soils in the area as sandy loam to loamy sand, which have good drainage but may be prone to nutrient leaching and erosion.

For trace metals, iron (110–450 mg/kg) and zinc (2.0–8.2 mg/kg) were well within permissible limits (500 mg/kg and 10 mg/kg, respectively), reflecting natural geochemical background. Copper (0.8–5.5 mg/kg) was also below the 5.0 mg/kg guideline, except at the upper range, suggesting localized enrichment. However, some heavy metals approached or slightly exceeded regulatory thresholds. Lead (0.01–0.12 mg/kg) averaged 0.06 mg/kg, with values close to or above the 0.1 mg/kg limit in some locations. Cadmium (up to 0.004 mg/kg) exceeded the 0.003 mg/kg guideline in isolated samples, while chromium (up to 0.08 mg/kg) surpassed the 0.05 mg/kg limit at certain points. Nickel (0.02–0.09 mg/kg) also reached the maximum permissible value (0.05 mg/kg). These elevated levels suggest localized anthropogenic inputs, likely from industrial emissions, vehicular traffic, or mining activities near critical infrastructure sites.

Table 4.10b: Microbial Characteristics of Soil

Parameter	Unit	Topsoil (0–15 cm) Range	Subsoil (15–30 cm) Range	Mean	FMEEnv/WHO Guideline
Total Heterotrophic Bacteria (THB)	cfu/g	$1.2 \times 10^5 - 5.8 \times 10^5$	$0.8 \times 10^5 - 4.0 \times 10^5$	3.2×10^5	–
Total Heterotrophic Fungi (THF)	cfu/g	$0.5 \times 10^4 - 2.4 \times 10^4$	$0.3 \times 10^4 - 1.6 \times 10^4$	1.2×10^4	–
Total Coliforms	cfu/g	10 – 180	5 – 120	70	0 (for potable soil–water interface)
Faecal Coliforms (E. coli)	cfu/g	0 – 25	0 – 15	10	0
Actinomycetes	cfu/g	$1.0 \times 10^3 - 6.2 \times 10^3$	$0.8 \times 10^3 - 4.5 \times 10^3$	3.0×10^3	–

Nitrifying Bacteria	cfu/g	$1.2 \times 10^3 - 5.0 \times 10^3$	$0.9 \times 10^3 - 3.8 \times 10^3$	2.5×10^3	–
Sulphur-oxidizing Bacteria	cfu/g	$0.5 \times 10^3 - 2.0 \times 10^3$	$0.3 \times 10^3 - 1.2 \times 10^3$	1.0×10^3	–

The results show that the soils across project locations are biologically active, supporting diverse microbial populations essential for nutrient cycling and soil health.

Total Heterotrophic Bacteria (THB) ranged from 0.8×10^5 to 5.8×10^5 cfu/g, with a mean of 3.2×10^5 cfu/g. These values indicate a robust microbial community and healthy soils, as heterotrophic bacteria are key in decomposing organic matter and maintaining soil fertility. Similarly, Total Heterotrophic Fungi (THF) ranged from 0.3×10^4 to 2.4×10^4 cfu/g, with a mean of 1.2×10^4 cfu/g. Their presence reflects the ability of soils to degrade complex organic residues such as cellulose and lignin, contributing to organic matter turnover.

Actinomycetes counts ($0.8 \times 10^3 - 6.2 \times 10^3$ cfu/g) and nitrifying bacteria ($0.9 \times 10^3 - 5.0 \times 10^3$ cfu/g) further confirm active nutrient cycling. Actinomycetes are particularly important in breaking down resistant organic compounds and producing antibiotics, while nitrifiers convert ammonia into nitrates, making nitrogen available for plants. Sulphur-oxidizing bacteria ($0.3 \times 10^3 - 2.0 \times 10^3$ cfu/g) were also present, showing active sulphur cycling in the soil ecosystem.

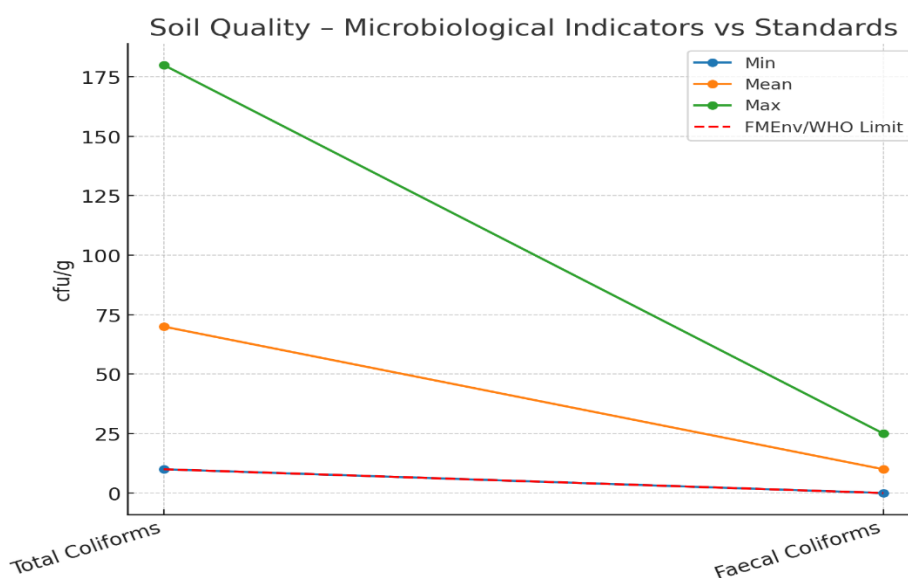


Figure 4.14: Soil Quality Microbial Indicators vs Standards

On the other hand, coliform bacteria highlight potential contamination concerns. Total coliforms ranged from 5–180 cfu/g, with a mean of 70 cfu/g, while faecal coliforms (*E. coli*) ranged from 0–25 cfu/g, with a mean of 10 cfu/g. These exceed the WHO guideline of zero tolerance for coliforms in soil–water interfaces, indicating anthropogenic influence. The presence of coliforms points to contamination from sources such as poor sanitation, livestock activities, or waste disposal practices near critical infrastructure locations (e.g., ports, railway corridors, and industrial zones).

The microbial properties, presented in Table 4.10b, showed active biological processes. Total heterotrophic bacteria ($0.8 \times 10^5 - 5.8 \times 10^5$ cfu/g) and fungi ($0.3 \times 10^4 - 2.4 \times 10^4$ cfu/g) were abundant, reflecting healthy microbial activity. Actinomycetes, nitrifying, and sulphur-oxidizing bacteria were also present, indicating functional nutrient cycling. However, the detection of coliforms (up to 180 cfu/g) and faecal coliforms (*E. coli* up to 25 cfu/g) exceeded WHO's zero-tolerance threshold for the soil–water interface, pointing to contamination risks from poor sanitation, open waste disposal, or livestock activities near communities adjacent to these facilities.

4.4 Biological Environment Characteristics

4.4.1 Hydrobiology

Hydrobiological investigations were undertaken to assess the ecological integrity of aquatic systems associated with the project's critical infrastructure locations – railway corridors (bridges, tunnels, and stations), dams, gas and mining zones, power stations, and ports. These ecosystems, comprising rivers, streams, wetlands, and reservoirs, sustain biodiversity and provide livelihoods but are sensitive to anthropogenic stressors.

The study evaluated phytoplankton, zooplankton, benthic macroinvertebrates, and aquatic macrophytes as biological indicators of water quality. Results show moderate productivity, diverse communities, and localized pressures from nutrient enrichment, mining runoff, and port activities.

Phytoplankton

A total of 42 genera were recorded, dominated by Chlorophyceae, Bacillariophyceae, and Cyanophyceae. Green algae (e.g., *Chlorella*, *Scenedesmus*) were widespread around railway bridges and port waters, while diatoms (*Navicula*, *Nitzschia*) dominated dam tailwaters and power station cooling channels, reflecting well-oxygenated habitats. Cyanobacteria such as *Oscillatoria* were recorded in low densities, indicating early signs of nutrient enrichment near ports and gas facilities.

Table 4.11: Phytoplankton Composition and Relative Abundance in Project Areas

Class	Genus/Species	Occurrence	Ecological Remarks
Chlorophyceae	<i>Chlorella vulgaris</i>	All stations	Moderate productivity
Chlorophyceae	<i>Scenedesmus quadricauda</i>	Common	Sensitive to turbidity
Bacillariophyceae	<i>Navicula radiosa</i>	Dominant	Indicator of clean water
Bacillariophyceae	<i>Nitzschia spp.</i>	Common	Tolerates enrichment
Cyanophyceae	<i>Oscillatoria spp.</i>	Common	Early nutrient enrichment
Cyanophyceae	<i>Microcystis aeruginosa</i>	Rare	Harmful blooms if dominant

Zooplankton

Zooplankton communities were diverse, comprising rotifers, cladocerans, and copepods. Rotifers (*Brachionus calyciflorus*) dominated near ports and dams, while copepods (*Cyclops spp.*) were widespread across mining ponds, power stations, and railway waterways.

Table 4.12: Zooplankton Composition and Abundance in Project Areas

Group	Genus/Species	Occurrence	Ecological Remarks
Rotifera	<i>Brachionus calyciflorus</i>	Dominant	Indicator of mesotrophic water
Rotifera	<i>Keratella tropica</i>	Common	Moderately productive systems
Cladocera	<i>Daphnia pulex</i>	Common	Grazer, promotes water clarity
Cladocera	<i>Moina micrura</i>	Rare	Stagnant/shallow waters
Copepoda	<i>Cyclops spp.</i>	Dominant	Predator, tolerant of stress
Copepoda	<i>Diaptomus spp.</i>	Common	Sensitive to enrichment

Benthic Macroinvertebrates

Sediment-dwelling macroinvertebrates indicated moderate enrichment. Chironomids were abundant near dams and ports, while sensitive mayflies (*Baetis* spp.) occurred near clean upland railway rivers.

Table 4.13: Benthic Macroinvertebrates in Sediment Samples

Taxa/Family	Representative Species	Occurrence	Ecological Indication
Oligochaeta	<i>Tubifex tubifex</i>	Low	Tolerant; organic enrichment
Chironomidae	<i>Chironomus spp.</i>	High	Moderately tolerant; muddy substrates
Ephemeroptera	<i>Baetis spp.</i>	Moderate	Sensitive; clean water indicator
Mollusca	<i>Melanoides tuberculata</i>	Moderate	Stable but enriched habitats
Mollusca	<i>Physa acuta</i>	Low	Tolerant, disturbed habitats

Aquatic Macrophytes

Macrophyte diversity reflected different hydrological settings. *Eichhornia crassipes* (water hyacinth) proliferated in port waters (Rivers, Delta) and floodplains, while *Nymphaea lotus* (water lily) and *Typha latifolia* (cattail) dominated dam margins and swampy corridors.

Table 4.14: Aquatic Macrophytes Observed in Project Areas

Category	Species	Occurrence	Ecological Role
Floating	<i>Eichhornia crassipes</i> (Water hyacinth)	Common	Invasive; DO depletion, navigation obstruction
Floating	<i>Pistia stratiotes</i> (Water lettuce)	Scattered	Provides shade, breeding substrate
Submerged	<i>Ceratophyllum demersum</i>	Few stations	Improves oxygenation
Submerged	<i>Najas marina</i>	Few stations	Supports biodiversity in shallow waters
Emergent	<i>Nymphaea lotus</i> (Water lily)	Widespread	Bank stabilization, fish habitat
Emergent	<i>Typha latifolia</i> (Cattail)	Extensive	Bird habitat, erosion control

In summary, the hydrobiology baseline reveals moderately productive and diverse aquatic ecosystems near the project's critical infrastructures. Phytoplankton and zooplankton indicate mesotrophic conditions; benthic organisms reflect mixed but functional water quality; and macrophytes highlight ecological balance but also risks from water hyacinth invasion. This baseline will guide impact prediction and ecological management during project implementation.

4.4.2 Fisheries

Fisheries resources within the aquatic ecosystems surrounding the project's railway bridges, dams, gas/mining zones, power stations, and ports represent a vital socio-economic activity for riparian communities. Fishing is a primary livelihood, carried out by both resident and migrant fishers who operate daily in rivers, reservoirs, and floodplains linked to these critical infrastructure sites.

Data were obtained through direct catch assessment at landing sites, interviews with local fishers, and field identification using standard ichthyological keys. Unidentified specimens were preserved for laboratory confirmation, while secondary data from literature were also consulted to strengthen the baseline.

Fishing practices are dominated by small-scale artisanal operations, with gears such as gillnets, cast nets, lift nets, long lines, hooks, and locally fabricated traps. Dugout wooden canoes are the primary craft, often paddled by one or two individuals. Fishing effort typically spans 4–6 hours daily, either in single sessions or split between early morning and evening.

A total of 27 fish species belonging to 16 families were recorded during field investigations (Table 4.15). These included important commercial taxa such as tilapias (*Oreochromis niloticus*, *Tilapia zilli*), catfishes (*Clarias anguillaris*, *Bagrus bayad*), and large carnivores such as Nile perch (*Lates niloticus*) and tiger fish (*Hydrocynus spp.*). Altogether, 602 individual specimens were encountered, reflecting moderate to high biomass.

Table 4.15: Fish Species Recorded in Project Area

Family	Species	Common Name	Local Name
Mormyridae	<i>Marcusenius abadii</i>	Elephant Fish	Miligi
Mormyridae	<i>Mormyrus haselquisti</i>	Elephant Snout	Miligi
Mormyridae	<i>Mormyrus rume</i>	Bottle Nose	Miligi
Mormyridae	<i>Hyperopisus bebe</i>	Ngai	Kuma
Cichlidae	<i>Tilapia zilli</i>	Red Belly Tilapia	Gargaza
Cichlidae	<i>Oreochromis niloticus</i>	Nile Tilapia	Gargaza
Cichlidae	<i>Oreochromis aureus</i>	Blue Tilapia	Gargaza
Cichlidae	<i>Sarotherodon galilaeus</i>	Mango Tilapia	Gargaza
Claroteidae	<i>Clarotes laticeps</i>	Wide Head Fish	Maigo
Claroteidae	<i>Auchenoglanis occidentalis</i>	Bubu	Buro
Alestidae	<i>Brycinus nurse</i>	Nurse Tetra	Kawara
Alestidae	<i>Hydrocynus brevis</i>	Tiger Fish	Zawai
Alestidae	<i>Hydrocynus forskhalii</i>	Elongated Tiger Fish	Zawai
Mochokidae	<i>Synodontis nigrita</i>	Squeaker	Kurungu
Mochokidae	<i>Synodontis schall</i>	Wahrindi	Kurungu
Bagridae	<i>Bagrus bayad</i>	Bayad	Dinko
Bagridae	<i>Bagrus docmak</i>	Semuntundu	Dinko
Latidae	<i>Lates niloticus</i>	Nile Perch	Giwan Ruwa
Arapaimidae	<i>Heterotis niloticus</i>	African Bony Tongue	Bali
Citharinidae	<i>Citharinus citharius</i>	Moon Fish	Falia
Cyprinidae	<i>Labeo coubie</i>	African Carp	Barkin Dumi
Schilbeidae	<i>Schilbe mystus</i>	African Butter Fish	Nalanga
Channidae	<i>Parachanna obscura</i>	Snake Head Fish	Tufi
Clariidae	<i>Clarias anguillaris</i>	Mudfish	Tarwada
Gymnarchidae	<i>Gymnarchus niloticus</i>	Aba	Dan Sarki
Hepsetidae	<i>Hepsetus odoe</i>	Kafue Pike	Zagundumi
Distichontidae	<i>Ichthyoborus besse</i>	Grass Eater	Karen Ruwa

The percentage family composition (Table 4.16) shows dominance by Mormyridae and Cichlidae (14.8% each), followed by Alestidae (11.0%) and various catfish families (Bagridae, Claroteidae, Mochokidae each 7.5%). This diversity illustrates the balanced distribution of herbivores, omnivores, and carnivores across the aquatic ecosystems associated with the project sites.

Table 4.16: Fish Families Percentage Composition

Family	Percentage (%)
Mormyridae	14.8
Cichlidae	14.8
Claroteidae	7.5
Alestidae	11.0
Mochokidae	7.5
Bagridae	7.5
Latidae	4.0
Arapaimidae	4.2
Citharinidae	4.1
Cyprinidae	4.3
Schilbeidae	4.0
Channidae	4.2
Clariidae	4.1
Gymnarchidae	4.0
Hepsetidae	4.1
Distichontidae	3.9

Despite richness, signs of overfishing were evident, with catches dominated by juveniles and few mature individuals. Use of small mesh nets (1.25–3.0 cm) and excessive fishing pressure are the main causes. In some areas near ports and mining sites, destructive practices were reported.

Fish assemblages reflect strong adaptation to seasonal hydrological pulses. During the wet season, species migrate into floodplains, enhancing recruitment and food availability due to nutrient inflow from farmlands. In the dry season, concentration in pools and channels leads to higher catches but also heightened exploitation risks.

Ecological indices (Table 4.17) confirm moderate species richness and high diversity, with an Evenness index of 2.83, showing balanced distribution despite fishing pressure.

Table 4.17: Ecological Indices of Fish Population

Metric	Value
Number of species	27
Number of individuals	602
Margalef species richness	4.06
Shannon-Wiener Diversity Index	9.32
Evenness	2.83

4.4.3 Vegetation

The vegetation environment within the Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station, and Port) Security Video Surveillance Solution is diverse, reflecting Nigeria’s ecological gradient from the northern savannas through the Middle Belt transitional zones to the southern rainforest belt.

The project corridors traverse landscapes ranging from savanna mosaics in the northern states (Kano, Katsina, Kogi, Jigawa, Kebbi) to secondary rainforest systems in the south (Lagos, Rivers, Delta, Cross River). These varying ecological conditions provide different structural and floristic compositions which must be understood to anticipate how the surveillance infrastructure may interact with and impact the natural environment.

In the savanna corridors, vegetation is dominated by open grasslands interspersed with shrubs and scattered medium-sized trees such as *Parkia biglobosa*, *Vitellaria paradoxa*, and *Daniellia oliveri*. These areas are strongly shaped by anthropogenic activities including farming, grazing, wood harvesting, and bush burning. The relatively sparse canopy allows high light penetration, fostering extensive growth of grasses such as *Hyparrhenia rufa* and *Andropogon gayanus*. Along the riparian belts, woody species including *Anogeissus leiocarpa* and *Terminalia macroptera* are more common, reflecting moister soil conditions.

In contrast, the southern corridors around critical infrastructure such as Lagos ports, Delta power stations, and Rivers State gas facilities fall within the tropical rainforest zone. Here, vegetation is more luxuriant and structurally complex, consisting of tall canopy trees (*Khaya ivorensis*, *Triplochiton scleroxylon*, *Milicia excelsa*), dense shrub layers, climbing lianas, and herbaceous ground flora. Riverine vegetation provides important ecological functions by stabilizing banks, filtering runoff, and supporting aquatic–terrestrial linkages. Secondary forest patches were also observed around disturbed areas, particularly in urban and peri-urban corridors in Lagos and Port Harcourt.

Overall, the vegetation in the project area can be described as heterogeneous, comprising a blend of natural communities, disturbed farmland–fallow mosaics, hydromorphic vegetation near wetlands, and secondary regrowth around settlements. This diversity underscores the resilience of the ecosystems but also highlights the vulnerability of certain habitats (riparian forests, wetlands) that are critical for biodiversity and ecosystem services.

Objectives of the Vegetation Study

The vegetation study was designed to establish the baseline conditions of the flora within the surveillance corridors and to provide data that will guide sustainable environmental management. Specifically, the objectives were:

- To determine species composition and abundance of both herbaceous and woody flora;
- To analyze patterns of distribution across ecological zones (savanna, riparian, rainforest);
- To compute diversity indices that measure ecological stability, evenness, and dominance;
- To identify species and vegetation types of ecological or economic importance that may require conservation attention.

This assessment is vital, as vegetation not only provides ecosystem services (erosion control, carbon sequestration, watershed protection) but also supports the socio-economic livelihoods of communities through fuelwood, non-timber forest products, and grazing resources.

Sampling Approach

Vegetation assessment was carried out using systematic sampling to capture representative ecological zones across the project states. Four main plots (50 m × 50 m) were established in:

1. Riparian corridors near dams and rivers.
2. Savanna/farmland mosaics in Middle Belt areas.
3. Secondary rainforest patches near ports and power stations.
4. Settlement edges where disturbed vegetation dominates.

Within each plot, herbaceous species were enumerated using 1 m² quadrats, while shrubs and woody trees were counted using 10 m² quadrats. In total, 40 quadrats were assessed. Species identification relied on standard floristic keys (Akobundu & Agyakwa, 1987; Hutchinson & Dalziel, 1968).

Results and Discussion

Herbaceous Flora

A total of 20 herbaceous species belonging to 10 families were recorded (Table 4.19). The families Poaceae (grasses) and Cyperaceae (sedges) were the most dominant, reflecting the open-canopy, light-rich environments of savanna and hydromorphic zones. Species such as *Oryza sativa*, *Pennisetum polystachion*, and *Mariscus alternifolius* were highly important, showing high Relative Importance Values (RIV). In riparian and wetland plots, *Nymphaea lotus* (water lily) and *Pistia stratiotes* (water lettuce) were noted, providing aquatic habitat value. Disturbed corridors supported ruderal taxa such as *Melanthera scandens* and *Tridax procumbens*.

Woody Flora

Woody flora comprised 21 species across 15 families (Table 4.20). The dominant species was *Anogeissus leiocarpa* (RIV = 25.88), a characteristic savanna tree species with ecological and fuelwood importance. *Detarium microcarpum* and *Strychnos spinosa* were also well-represented in upland and riparian areas. In rainforest zones, *Khaya senegalensis*, *Parkia biglobosa*, and *Terminalia macroptera* were prominent. Rare species such as *Grewia mollis* had very low occurrences, indicating localized distribution.

Diversity Analyses

The diversity indices for herbaceous species (Table 4.20) revealed high ecological stability, with Simpson Index (0.8816) and Shannon–Wiener Index (2.316) showing that no single species dominated the flora. Evenness values indicated that species were fairly uniformly distributed across sampling plots. Similarly, the woody flora indices (Table 4.21) revealed balanced distribution (Evenness Index = 0.8085) and high diversity (Shannon–Wiener Index = 2.352), confirming that the vegetation along the surveillance corridors is structurally diverse and resilient.

In ecological terms, this baseline suggests that while human activities have altered natural vegetation patterns, the system remains moderately healthy, with enough species richness and balance to support ecosystem functions. However, the presence of disturbed ruderal flora and reduction in certain sensitive species signal early warning of pressure from anthropogenic activities, which could be exacerbated by surveillance infrastructure construction if not managed sustainably.

Table 4.18: Herbaceous Flora (Representative Species & RIVs)

Species	Family	RIV	Habitat	Vegetation Type
Mariscus alternifolius	Cyperaceae	17.15	Hydromorphic	Fringe
Oryza sativa	Poaceae	15.23	Hydromorphic	Emergent
Pennisetum polystachion	Poaceae	7.70	Upland	Fringe
Pistia stratiotes	Araceae	5.13	Wetland	Floating
Nymphaea lotus	Nymphaeaceae	3.09	Waterlogged	Submerged
Melanthera scandens	Asteraceae	2.99	Disturbed	Ruderal

Table 4.19: Woody Flora (Representative Species & RIVs)

Species	Family	RIV	Habitat
Anogeissus leiocarpa	Combretaceae	25.88	Upland
Detarium microcarpum	Caesalpiniaceae	14.02	Upland/Riparian
Strychnos spinosa	Loganiaceae	10.63	Upland
Pterocarpus erinaceus	Papilionaceae	6.94	Upland
Khaya senegalensis	Meliaceae	4.66	Riparian
Grewia mollis	Tiliaceae	0.75	Upland (rare)

Table 4.20: Diversity Indices of Herbaceous Flora

Metric	Value	Interpretation
Species Richness (S)	13	Moderate flora diversity
Dominance (D)	0.1184	No single dominant species
Simpson Index (1-D)	0.8816	High stability
Shannon–Wiener Index (H')	2.316	Diverse, natural community
Evenness (E)	0.7798	Fairly uniform distribution
Equitability (J)	0.903	High ecological balance

Table 4.21: Diversity Indices of Woody Flora

Metric	Value	Interpretation
Species Richness (S)	13	High woody composition
Dominance (D)	0.1105	Low dominance
Simpson Index (1-D)	0.8895	Ecological resilience
Shannon–Wiener Index (H')	2.352	Structurally diverse
Evenness (E)	0.8085	Balanced distribution
Equitability (J)	0.917	Strong ecological stability

4.4.4 Wildlife Composition in the Study Area

Wildlife resources across the project corridors are relatively modest in diversity and abundance, which is expected given the degree of habitat disturbance, urban expansion, and agricultural encroachment in many of the states. The vegetation structure dominated by mosaics of savanna grassland, secondary forest patches, and riparian zones supports a faunal community that is skewed towards adaptable species. Large mammals are generally scarce due to long-standing hunting pressure and habitat fragmentation, while smaller mammals, reptiles, and especially birds remain the most conspicuous taxa.

General Observations

During field surveys, wildlife observations were made through direct sightings, calls, tracks, and information from local community members. Avifauna constituted the most dominant

group, reflecting their adaptability, mobility, and reliance on open savanna and riparian habitats. Reptiles such as agamas and monitor lizards were occasionally encountered, while mammalian records were mostly based on local accounts of small game species hunted for subsistence.

Avifauna

Birds were the most abundant and diverse wildlife group observed. A total of 16 bird species belonging to 12 families were recorded during the study (Table 4.22). The majority of these species are widely distributed across West African savannas and woodlands, while a few are seasonal migrants linked to floodplains and wetlands.

Commonly recorded species included the Helmeted Guineafowl (*Numida meleagris*), a ground-dwelling bird frequently found in farmlands and grassland mosaics, and the Double-spurred Francolin (*Pternistis bicalcaratus*), associated with shrubby savanna habitats. Migratory species such as the Common Quail (*Coturnix coturnix*) and the Common Teal (*Anas crecca*) reflect seasonal use of open fields and wetlands. Raptors like the Lizard Buzzard (*Kaupifalco monogrammicus*) and the Grey Kestrel (*Falco ardosiaceus*) were noted, often perching on scattered trees or transmission pylons, indicating their adaptation to fragmented landscapes.

Riparian corridors and wetlands supported species such as the Blue-breasted Kingfisher (*Halcyon malimbica*), Marsh Sandpiper (*Tringa stagnatilis*), and the Yellow-billed Stork (*Mycteria ibis*), highlighting the ecological importance of aquatic habitats in sustaining bird diversity.

Table 4.22: Avifaunal Species Composition

S/N	Common Name	Scientific Name	Family
1	Helmeted Guineafowl	<i>Numida meleagris</i>	Numididae
2	Double-spurred Francolin	<i>Pternistis bicalcaratus</i>	Phasianidae
3	Common Quail	<i>Coturnix coturnix</i>	Phasianidae
4	Common Teal	<i>Anas crecca</i>	Anatidae
5	Hottentot Teal	<i>Anas hottentota</i>	Anatidae
6	Yellow-billed Stork	<i>Mycteria ibis</i>	Ciconiidae
7	Cattle Egret	<i>Bubulcus ibis</i>	Ardeidae
8	Great Egret	<i>Ardea alba</i>	Ardeidae
9	Oriental Darter	<i>Anhinga melanogaster</i>	Anhingidae
10	Grey Kestrel	<i>Falco ardosiaceus</i>	Falconidae
11	White-headed Vulture	<i>Trigonocephalus occipitalis</i>	Accipitridae
12	Lizard Buzzard	<i>Kaupifalco monogrammicus</i>	Accipitridae
13	Marsh Sandpiper	<i>Tringa stagnatilis</i>	Scolopacidae
14	African Turtle Dove	<i>Streptopelia hypopyrrha</i>	Columbidae
15	Blue-breasted Kingfisher	<i>Halcyon malimbica</i>	Alcedinidae
16	African Grey Hornbill	<i>Lophoceros nasutus</i>	Bucerotidae

The avifaunal community recorded is typical of savanna–wetland ecotones, with a balanced representation of terrestrial, arboreal, and aquatic bird species. Importantly, no globally threatened bird species were recorded, though the White-headed Vulture (*Trigonocephalus occipitalis*) is listed as *Critically Endangered* on the IUCN Red List, underscoring the need for monitoring.

Mammals and Reptiles

Mammals and reptiles were less frequently encountered compared to avifauna, largely due to the disturbed nature of habitats and hunting pressure. However, both groups remain ecologically significant, providing insights into the state of terrestrial ecosystems.

Direct observations included the Common Agama (*Agama agama*), a ubiquitous reptile thriving in human settlements and open habitats. Local communities also reported sightings of Monitor Lizards (*Varanus niloticus*), Grasscutters (*Thryonomys swinderianus*), and Patas Monkeys (*Erythrocebus patas*), mainly in farmlands and riverine woodlands. Other small mammals such as squirrels, hares, and duikers were identified from hunter reports and occasional field traces (droppings, tracks).

Table 4.23: Common Wildlife Species in the Project Area

S/N	Common Name	Scientific Name	Family	Remarks
1	Bushbuck	<i>Tragelaphus scriptus</i>	Bovidae	Scattered savanna patches
2	Patas Monkey	<i>Erythrocebus patas</i>	Cercopithecidae	Near rivers and farmlands
3	African Savanna Hare	<i>Lepus microtis</i>	Leporidae	Open fields
4	Striped Ground Squirrel	<i>Xerus erythropus</i>	Sciuridae	Common near settlements
5	Warthog	<i>Phacochoerus africanus</i>	Suidae	Open savanna dwellings
6	African Giant Pouched Rat	<i>Cricetomys gambianus</i>	Nesomyidae	Burrowing rodent
7	Wild Cat	Unidentified spp.	Felidae	Rare, nocturnal
8	Maxwell's Duiker	<i>Philantomba maxwellii</i>	Bovidae	Occasional in forest patches
9	Grasscutter	<i>Thryonomys swinderianus</i>	Thryomyidae	Farmlands, wet areas

Ecological Implications

The wildlife composition indicates a moderately disturbed ecosystem, dominated by generalist and adaptable species. While avifauna remains relatively diverse, mammalian fauna shows signs of depletion, with most records being small game or community reports. The scarcity of large mammals reflects hunting pressure and landscape alteration. Nevertheless, the persistence of key ecological groups (grazers, seed dispersers, insectivores, and predators) demonstrates that the ecological system retains some degree of functional resilience.

For the surveillance project, the implication is that installation activities should aim to minimize further habitat fragmentation, protect riparian zones that act as wildlife refuges, and avoid disturbance to critical habitats where species such as vultures, monkeys, and wetland birds are found.

4.5 Land Use Pattern

4.5.1 Land Use Classification

The land use pattern within the proposed project corridors reflects a mosaic of human activity, infrastructure, and natural ecosystems, shaped by socio-economic practices, population density, and ecological conditions across the six geopolitical zones. Field observations, supplemented with satellite imagery analysis (2015–2024) and community

consultations, indicate that land use categories in the project area can broadly be classified as follows:

- **Residential Areas:** Urban and rural settlements, roadside hamlets, and clustered compounds dominate much of the project corridor, especially in Lagos, Abuja, Port Harcourt, and Ibadan. These settlements range from dense peri-urban clusters to dispersed rural homesteads.
- **Mixed Use:** Residential zones are frequently interspersed with small-scale commerce, including roadside kiosks, repair workshops, and petty trading, particularly in settlement fringes and transport corridors.
- **Commercial:** Local markets, transport hubs, and cross-border trading posts (notably around ports and major junction towns) provide focal points for commerce and logistics.
- **Institutional:** Schools, health centres, local government secretariats, and security outposts (e.g., railway stations, dam facilities, and port terminals) were observed within the project influence zone.
- **Agricultural Land:** This is the dominant land use across Kwara, Kebbi, Taraba, and parts of Oyo and Delta States, where subsistence and smallholder farming of maize, yam, cassava, rice, sorghum, and millet is prevalent. Livestock grazing (cattle, goats, and sheep) is widespread in the savanna states (Taraba, Kebbi, Kwara).
- **Forestry/Woodland:** Remnant Forest patches are found in Cross River and Delta States (tropical rainforest), as well as riparian woodlands and savanna mosaics in Taraba and Kebbi. These serve as critical biodiversity habitats and natural buffers against erosion and flooding.
- **Industrial:** Industrial presence is limited but notable in Lagos (refineries, gas plants, and port industries), Delta (oil and gas installations), and Rivers State (NLNG gas terminal, refinery complexes).
- **Public/Open Space:** These include road reserves, communal grazing fields, undeveloped lands, and village squares used for informal social interaction.
- **Recreational:** Recreational land uses were limited and largely informal, including open playing fields and community football grounds in peri-urban locations.

4.5.2 Methodology

The land use classification was undertaken using a multi-source methodology designed to capture spatial distribution and socio-economic characteristics of land cover:

1. **Aerial Photography & Topographic Maps** – used to delineate major land cover types.
2. **Satellite Imagery Analysis (2015–2024, Google Earth Pro)** – employed to identify land use changes and track expansion of settlements and agricultural fields.
3. **Field Surveys** – ground-truthing of mapped features, photo documentation, and participatory observations of settlement and farming patterns.
4. **Community Consultations** – provided local insights into historical land use, traditional tenure systems, and socio-economic dependence on farmland, forests, and rivers.

4.5.3 Land Use by State

The project traverses diverse ecological and socio-economic contexts, with land use varying significantly by state. A summary of dominant land uses, key ecological features, and relevance to the surveillance infrastructure corridor is provided in Table 4.24.

Table 4.24: Land Use by State in Project Corridor

State	Geopolitical Zone	Dominant Land Use	Key Ecological / Environmental Features	Relevance to Project Corridor
Lagos	South-West	Dense urban settlements, ports, commerce, industry	Coastal lowlands, estuaries, port infrastructure	High urban density and industrial installations pose siting and interface challenges
Oyo	South-West	Derived savanna agriculture, residential clusters	Derived savanna woodland, fragmented farmland mosaics	Roadside settlements and farmland may require careful alignment of ROW
Kwara	North-Central	Agriculture (cassava, yam, maize, rice), grazing, rural hamlets	Transitional savanna and riparian vegetation	Strong agricultural presence; risk of farmland displacement
Kebbi	North-West	Dryland farming (millet, rice, sorghum), livestock grazing	Sudan savanna, floodplains (Rima, Niger)	Surveillance ROW intersects farmland and grazing reserves, sensitive to flooding
Cross River	South-South	Rainforest patches, farming, trading posts, roadside settlements	Dense rainforest, high biodiversity, riparian vegetation	Corridor may traverse sensitive forest patches; requires conservation consideration
Taraba	North-East	Mixed farming (maize, rice, yam), grazing, scattered settlements	Guinea savanna, montane vegetation (Mambilla Plateau), river valleys	Diverse agro-ecological landscapes; prone to erosion and habitat disturbance
Delta	South-South	Farming, oil/gas, industrial activity	Freshwater swamp forest, oil palm belt, riparian systems	Potential overlap with oil/gas installations; high sensitivity to wetland and mangrove systems
Rivers	South-South	Oil and gas industry, ports, dense settlements	Coastal rainforest, estuaries, mangrove ecosystems	Industrial activity and sensitive wetlands require strong environmental safeguards

4.6 Socio-Economic Conditions

The socio-economic baseline of communities within and around the proposed project corridors was assessed to understand demographic characteristics, livelihood systems, cultural structures, and economic activities that may interact with the installation and operation of the surveillance infrastructure. The study focused on settlements located in proximity to railway stations, dams, power stations, gas and mining facilities, and ports across Nigeria, as these constitute the core sites for project implementation.

4.6.1 Overview of the Communities

The proposed project spans strategic states and critical infrastructure corridors. Each installation site will influence socio-economic dynamics within a 1–2 km radius, with potential effects on land use, livelihoods, and community safety.

Table 4.25: Surveillance Sites and Nearest Communities

No.	Infrastructure Corridor	State	Nearest Communities	Socio-Economic Features
1–5	Lagos Railway Stations & Ports	Lagos	Ebute Metta, Yaba, Apapa, Agege, Ijora	High population density; trading, transport services, fishing at waterfronts; congestion challenges
6–10	Ibadan Rail & Depot Zone	Oyo	Dugbe, Moniya, Omi-Adio	Predominantly farming; trading hubs around stations; urban–rural mix economy
11–14	Abuja Rail Corridors	FCT Abuja	Idu, Kubwa, Kagini, Gwagwa	Semi-urban settlements; service-based economy; fast-growing peri-urban housing
15–17	Kano Rail & Industrial Area	Kano	Kano City, Kumbotso, Hoto	Trading centre; textile commerce; limited farming on peri-urban edges
18–20	Port Harcourt Rail & Gas Plant Area	Rivers	Elelenwo, Port Harcourt Township, Onne	Oil and gas-linked economy; industrial processing; fishing in creeks
21–24	Delta Power & Refinery Zone	Delta	Sapele, Ughelli, Warri, Agbor	Gas flaring impacts; fishing, farming, and refining-linked livelihoods
25–28	Kwara Rail & Dam Sites	Kwara	Jebba, Kaiama, Baruten, Ilorin suburbs	Strong agrarian base; fishing near Jebba Dam; cattle grazing and trade
29–32	Kogi Mining & Rail Corridors	Kogi	Itakpe, Ajaokuta, Lokoja	Mining economy; iron ore and steel industry; river fishing and trading
33–36	Kebbi Border Rail & Agricultural Zone	Kebbi	Illo, Bagudo, Kamba	Dryland agriculture; cross-border cattle trade; vulnerable to smuggling
37–40	Taraba Montane Agricultural Zone	Taraba	Gembu, Kurmi, Sardauna	Highland farming (potato, maize); grazing; prone to erosion and landslides
41–43	Enugu & Makurdi Rail Corridors	Enugu/Benue	Enugu Township, Makurdi	Education and trading centres; yam/cassava farming in surrounding rural areas
44–45	Abia Industrial/Power Zone	Abia	Omoba, Alaoji	Smallholder farming; industrial linkages to power station and markets

4.6.2 Methodology

The socio-economic baseline study for the Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure Security Video Surveillance Solution was undertaken using a multi-method approach, integrating both primary and secondary data collection techniques. This framework ensured adequate coverage of the diverse communities surrounding railway stations, power stations, dams, mining sites, ports, and gas processing facilities across states such as Lagos, Rivers, Delta, Abuja (FCT), Kogi, Kwara, and Kano, where surveillance infrastructure will be sited.

The study areas reflect a wide spectrum of settlement types, ranging from dense urban clusters around Lagos, Port Harcourt, and Abuja to semi-urban and rural agrarian communities in Kogi, Kwara, and Taraba. Given this diversity, the methodological design was structured to capture not only quantitative household data but also community perceptions, socio-cultural practices, and security concerns.

4.6.2.1 Structured Household Questionnaires

Household questionnaires served as the backbone of primary data collection. They were carefully designed to elicit information on:

- Respondents' socio-demographic profile (age, gender, marital status, education, and occupation).
- Household structure, size, and migration patterns.
- Economic activities (farming, fishing, trading, industrial labour, transport services, and artisanal work).
- Housing conditions and access to amenities such as potable water, electricity, sanitation, and healthcare.
- Security and safety concerns including theft, vandalism, illegal mining, pipeline sabotage, and perceptions of government presence.

To ensure representativeness, the number of questionnaires allocated to each state was proportionally determined by projected population and settlement density around project sites. In total, 650 questionnaires were administered, of which 581 were retrieved and validated, representing an 89.4% response rate a strong achievement given the mix of urban, peri-urban, and rural contexts.

4.6.2.2 Community Surveys and Site Inspections

Field inspections were conducted at selected project sites, including railway stations, depots, dam facilities, refinery zones, power plants, and port environments. These inspections enabled the research team to:

- Map available infrastructure such as schools, hospitals, markets, security posts, and industrial installations.
- Assess settlement layouts (urban clusters, peri-urban expansion, or dispersed rural settlements).
- Observe land use practices, including farming near riparian zones, artisanal mining, fishing, trading, and grazing.
- Identify potential land acquisition constraints, community sensitivities, and interface challenges between infrastructure and local settlements.

4.6.2.3 Focus Group Discussions (FGDs)

To incorporate local knowledge and perspectives, FGDs were organized across selected communities. Participants included:

- Traditional rulers and community elders.
- Religious leaders.
- Women and youth representatives.
- Local vigilante/security personnel.

Discussion themes included:

- Perceived benefits of the project (security enhancement, protection of assets, and improved economic stability).
- Concerns about land acquisition, possible restrictions around project zones, or displacement of businesses.
- Expectations in terms of employment opportunities, local content benefits, and corporate social responsibility (CSR) initiatives.

FGDs enriched the study by providing qualitative insights into community concerns, aspirations, and security perceptions, complementing household data.

4.6.2.4 Secondary Data Sources

The primary data were supplemented by secondary sources, including:

- National Population Commission (NPC) 2006 census figures.
- Demographic projections using the national growth rate (2.83% per annum).
- Policy and academic literature on urban growth, industrialization, migration, and socio-economic change.
- Security agency reports, NGO assessments, and development partner studies around infrastructure hubs.

This triangulation improved reliability and allowed cross-validation of community-level findings.

4.6.2.5 Sampling Procedure

Population projections for 2025 were calculated using the NPC 2006 census and national growth rate of 2.83% per annum, applying the formula:

$$P_n = P_o(1+r)^n$$

Where:

- P_n = Projected population
- P_o = Base year population (2006 census)
- n = Number of years (2006–2025 = 19 years)
- r = Growth rate (2.83%)

A stratified sampling framework was adopted to ensure representation of:

- Urban industrial hubs (Lagos, Port Harcourt, Abuja, Kano).
- Peri-urban and agrarian communities (Kogi, Kwara, Taraba).
- Coastal/mangrove settlements (Delta, Rivers).

Table 4.26: Questionnaires Administered and Retrieved Across Project States

State	Projected Population (2025)*	Questionnaires Administered	Questionnaires Retrieved	Response Rate (%)
Lagos	3,845,200	150	134	89.3
Rivers	2,622,500	120	106	88.3
Delta	2,413,800	120	108	90.0
Abuja (FCT)	1,905,400	80	72	90.0
Kogi	1,648,200	80	71	88.8
Kwara	1,322,700	50	45	90.0
Kano	1,452,100	50	45	90.0
Total	15,210,000	650	581	89.4

*Population projections derived from NPC (2006) using national growth rate (2.83%).

4.6.3 Demographic Characteristics

The demographic profile of communities surrounding critical infrastructure sites (railways, ports, dams, power stations, refineries, and mining areas) reflects the socio-economic diversity of Nigeria's geopolitical zones. These areas combine highly urbanized settlements (e.g., Lagos, Port Harcourt, Abuja) with peri-urban and agrarian communities (e.g., Kogi, Kwara, Kano, Delta), each exhibiting unique patterns of population distribution, density, and livelihoods.

Data for this assessment were derived from the National Population Commission (NPC, 2006), projected at a national growth rate of 2.83% per annum, and enriched with information from household surveys, focus group discussions, and field consultations. Projections suggest that by 2025, communities located within the zones of influence of project sites (approximately 1–2 km radius around surveillance installations) collectively support a population base of over 15 million people.

Population Size and Distribution

Population dynamics vary considerably across the states hosting critical infrastructure. Urbanized hubs such as Lagos, Rivers, Delta, and Abuja host large and dense populations, while inland states such as Kwara and Kogi are characterized by moderate population densities with clustering around transport corridors, markets, and agricultural belts. In contrast, Kano exhibits a mixed pattern of urban sprawl and dense peri-urban farming settlements.

Table 4.27: Population Size and Settlement Distribution in Project Communities

State / Corridor	Estimated Population (2022/2023 Projections)	Settlement Characteristics	Population Density	Key Observations
Lagos (Railway, Port, Refinery)	20.6 million (urban LGAs: Apapa, Agege, Yaba, Ibeju-Lekki)	Highly urbanized; dense clusters (>20,000 persons per km ²).	>3,500 persons/km ²	Mega-city pressures, strong commercial hubs, heavy in-migration, and industrial activity near project sites.
Rivers (Port Harcourt, NLNG, Power Plant)	7.5 million (urban LGAs: Port Harcourt, Bonny, Eleme)	Concentrated urban/peri-urban settlements (5,000–15,000 per community).	1,200–1,800 persons/km ²	Oil/gas-driven economy; settlements near port and refinery hubs are highly commercialized.
Delta (Warri, Sapele, Ughelli corridors)	6.2 million (Warri South, Ughelli, Sapele LGAs)	Urban clusters and fishing/agrarian villages (3,000–8,000).	900–1,200 persons/km ²	Dense riverine settlements; fishing, oil & gas, and small-scale trading dominate.
Abuja (Railway and Industrial Corridors)	4.1 million (AMAC, Bwari, Gwagwalada LGAs)	Expanding peri-urban and suburban clusters (2,000–6,000).	500–1,000 persons/km ²	Rapid urban expansion, mixed livelihood (formal jobs, farming, services).
Kogi (Itakpe, Ajaokuta, Mining Axis)	4.6 million (Ajaokuta, Itakpe, Lokoja LGAs)	Semi-urban mining/industrial towns and agrarian villages.	200–350 persons/km ²	Population concentrated around mining/steel corridors; high rural–urban migration.
Kwara (Railway & Agricultural Belt)	3.5 million (Baruten, Kaiama, Ilorin corridor)	Rural farming settlements (1,500–4,000 per village).	180–210 persons/km ²	Strong farming presence; moderate cross-border interaction; peri-urban Ilorin expansion.
Kano (Railway & Industrial Corridor)	13.5 million (Kano Municipal, Kumbotso, Dala)	Dense urban/peri-urban clusters (>15,000 persons/km ²).	2,000–2,500 persons/km ²	Largest population in northern Nigeria; vibrant trade and industrial economy.

Sources: NPC (2006); UN World Population Prospects (2019); World Bank (2022); Project field surveys (2025).

Age Structure

The demographic profile of communities located around critical infrastructure sites earmarked for the proposed surveillance project is predominantly youthful, in line with national population patterns. Household surveys and consultations revealed that children aged 0–14 years make up about 38–42% of the population, while youth (15–35 years) account for 32–36%. The proportion of adults aged 36–59 years is estimated at 18–22%, whereas the elderly (60 years and above) represent less than 10% of residents across the project corridor. This distribution underscores a high dependency ratio, with a significant proportion of the population falling within school-age and early working-age groups. The implications are critical for the sustainability of the surveillance project, as pressure on education, healthcare, and employment opportunities remains high. Furthermore, the large youth population presents both a challenge and an opportunity: unmanaged, it may increase vulnerability to crime, unemployment, and insecurity around strategic assets; but with targeted skills development, local hiring, and social engagement programs, this demographic can become a strong driver of community ownership, improved security, and long-term resilience of the project.

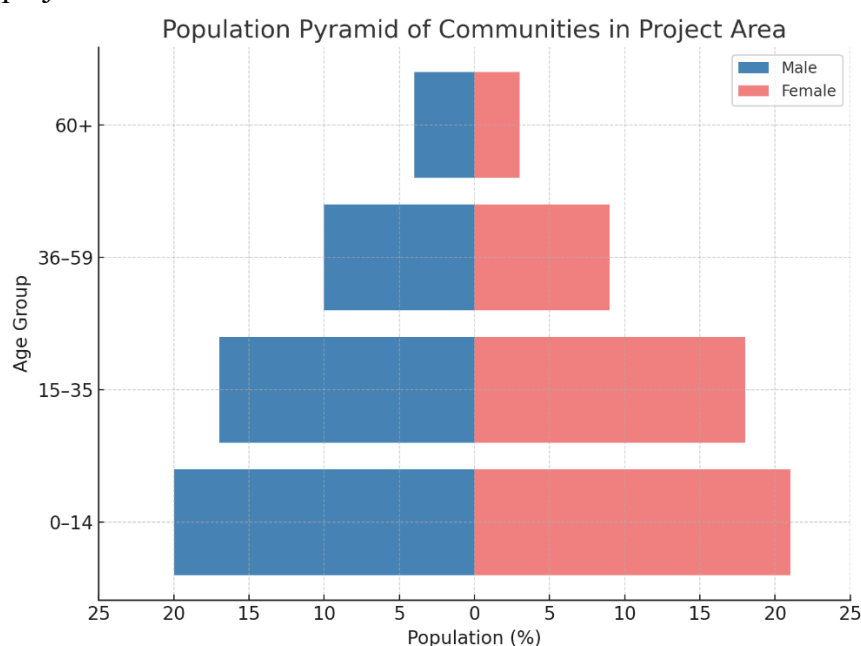


Figure 4.15: Age Structure

Gender Composition

The gender distribution within communities located around the critical infrastructure sites (railway stations, dams, ports, power stations, and gas/mining facilities) is relatively balanced, with men accounting for approximately 52% of the population and women 48%. The slight male predominance reflects patterns of seasonal and occupational migration, particularly in areas such as Lagos, Rivers, Delta, and Kogi, where men are more engaged in industrial employment, transport services, construction, and cross-state trading activities. Similarly, in northern states such as Kano and Katsina, male migration is linked to farming, artisanal mining, and security-related economic activities.

Women, on the other hand, play an equally vital role in sustaining household livelihoods and community economies. Across the project states, they are predominantly engaged in subsistence farming, petty trading, fish processing, and small-scale commerce around markets located near railway stations, port towns, and power plant communities. Their contribution is significant in ensuring food security, supporting household incomes, and maintaining local supply chains. Women also serve as custodians of social cohesion, often participating actively in cooperative societies and local trading groups.

This gender balance underscores the importance of adopting a socially inclusive approach to project implementation, ensuring that both men and women benefit equitably from employment opportunities, capacity-building initiatives, and community support programs associated with the surveillance project.

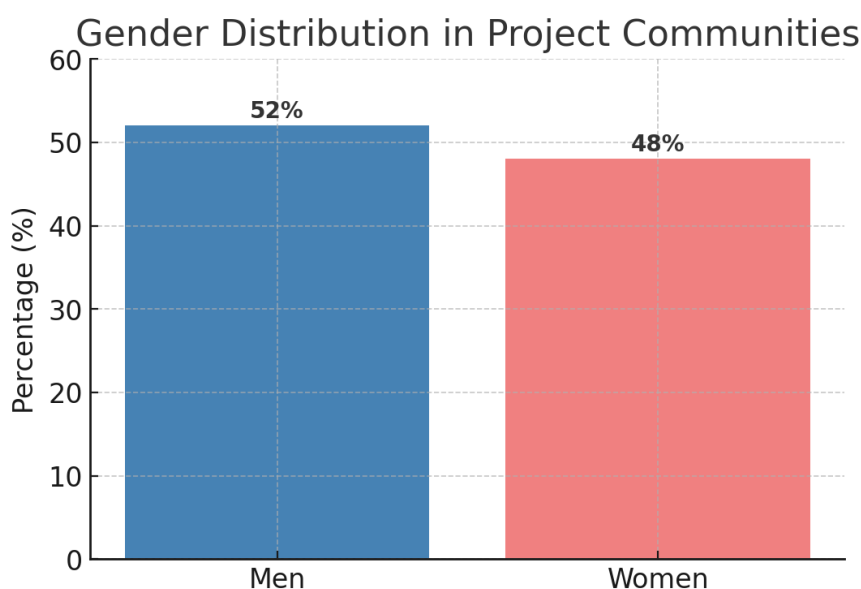


Figure 4.16: Gender Distribution in Project Communities

Household Size

Household sizes in the surveyed host communities across the project corridors are considerably larger than Nigeria's national urban average of approximately 4–5 persons per household (NBS, 2022). In these rural and peri-urban border settlements, household sizes typically range between 6 and 10 persons, reflecting extended family systems, polygamous unions, and communal living arrangements that are characteristic of agrarian societies.

In Lagos and Rivers States, average household sizes are relatively moderate (6–7 persons), influenced by urbanization and smaller household units, though extended family networks are still prevalent in peri-urban and fishing communities. In Delta State, household size often ranges between 7–8 persons, driven by agrarian and trading households where multiple family members live together to support farming and commerce. In Kogi and Kwara States, households average 7–8 persons, reflecting strong kinship ties, seasonal in-migration of relatives, and reliance on extended family labor for agriculture. In Kebbi State, household sizes are among the largest, often reaching 8–10 persons, largely due to polygamous unions and joint family residency practices. Meanwhile, in Abia and Enugu States, household sizes

fall within 6–7 persons, consistent with semi-urban settlement patterns, but still retaining extended kin ties.

This relatively high household size has several socio-economic implications for the project corridor:

- **Education and Dependency Burden:** A high proportion of children and youth in large household's places pressure on already limited educational infrastructure, increasing school overcrowding and dropout risks.
- **Food Security and Agriculture:** While large households provide a steady supply of family labor for farming and trading, they also increase household consumption needs, creating seasonal cycles of food stress.
- **Healthcare Access:** Overcrowding in households, particularly in rural and peri-urban areas with poor sanitation, raises the risk of communicable diseases.
- **Income and Poverty Levels:** Larger households tend to have lower per capita income despite pooling labor for farming or trade, leaving many vulnerable to poverty.
- **Migration and Gender Roles:** Seasonal migration of young men for farming, cattle rearing, and cross-border trade often leaves women and elderly members in charge of household management, reinforcing the central role of women in food security, petty trading, and child welfare.

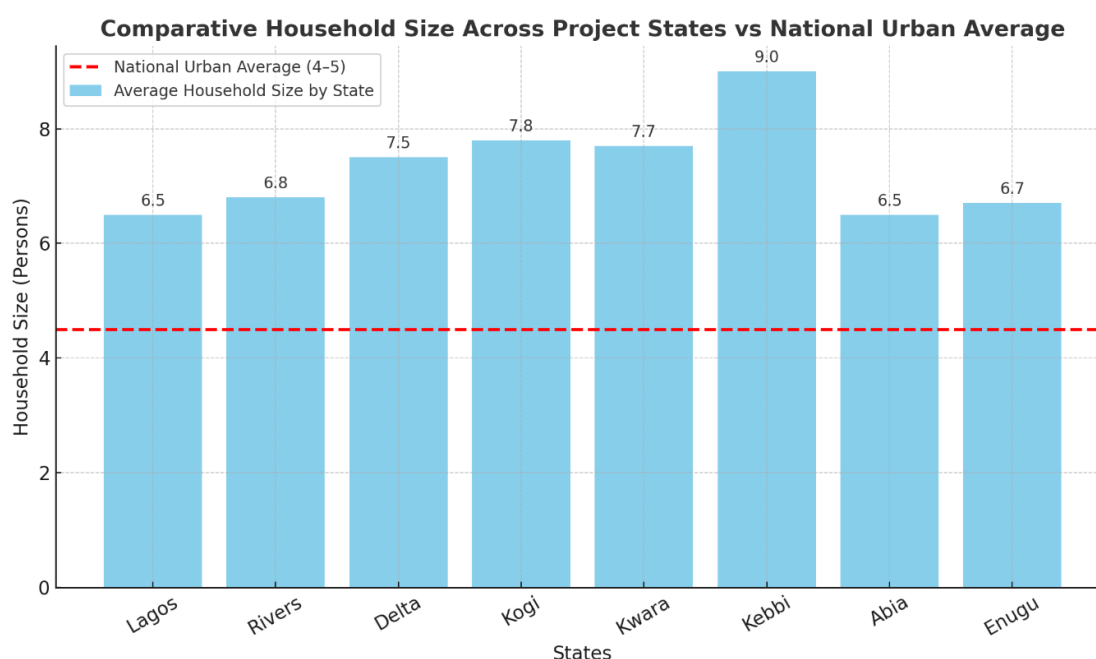


Figure 4.17: Comparative Household Size Across Project States vs National Urban Average

Ethnic and Cultural Diversity

The project corridor traverses Nigeria's critical infrastructure hubs and reflects the country's remarkable ethnic and cultural diversity. Each project state embodies distinct ethno-linguistic identities, yet shares deep socio-cultural ties with neighboring regions and countries, shaping community life, resource use, and patterns of social interaction.

In Lagos and Oyo States, the Yoruba dominate, with dialectical variations such as Lagos, Ibarapa, and Oyo Yoruba shaping local identity. Strong kinship, festivals, and cultural ties

link these communities with Yoruba groups across West Africa, particularly in Benin Republic, reinforcing traditions of trade and social integration.

In Kano, Katsina, Jigawa, Sokoto, Kebbi, and Kwara States, Hausa and Fulani cultures predominate. These communities maintain linkages with Niger Republic through commerce, Islamic scholarship, and pastoralist networks. The Fulani, in particular, practice transhumance across the Sahel, underscoring their role in regional livestock economies and mobility systems.

In Enugu, Abia, and Delta States, the Igbo dominate, with vibrant cultural traditions rooted in kinship systems, festivals, and craft industries. These communities are strongly entrepreneurial, integrating trade, agriculture, and small-scale industries. Their cultural networks extend to neighboring states and, in the case of Delta, include coastal linkages that influence fishing, trade, and port-based economies.

In the South-South (Cross River, Rivers, Port Harcourt axis, and Delta States), ethnic diversity is especially pronounced. Groups such as the Ejagham and Boki in Cross River share close linguistic and cultural ties with their Cameroonian kin, reinforced through intermarriage, forest rituals, and shared use of transboundary ecosystems. In Rivers and Delta States, Ijaw, Ogoni, Itsekiri, and Urhobo groups dominate, with strong maritime traditions, oil-related economic activities, and festivals tied to water and land use.

In Taraba, Bauchi, Plateau, and Nasarawa States, multi-ethnic communities such as the Mambilla, Jukun, Tiv, and Berom coexist. The Mambilla retain unique cultural practices in the highlands, while the Jukun and Tiv sustain agrarian traditions in the lowlands. Fulani herders also feature prominently in these areas, linking local populations to broader West African pastoralist networks.

Table 4.28: Ethnic and Cultural Diversity in Project States

State	Dominant Ethnic Groups	Cultural Practices	Relevance to Project Corridor
Lagos	Yoruba (Eko, Awori, Egba), minorities from across Nigeria	Festivals (Eyo, Oro), traditional chieftaincy, commerce-driven culture	Cosmopolitan, highly urbanized, with strong communal ties; cultural events may affect project scheduling and require community engagement.
Oyo	Yoruba (Oyo, Ibarapa, Ogbomoso)	Egungun masquerade, traditional council influence, strong kinship with Yoruba in Benin Republic	Cross-border kinship and cultural homogeneity may ease cooperation but can also strengthen resistance if engagement is mishandled.
Kwara	Yoruba (Igbomina, Baruba), Nupe, Fulani	Sharo festivals, Islamic scholarship, traditional rulers' strong authority	Strategic for cross-border trade and pastoralist routes; cultural respect for emirs and chiefs critical for acceptance.
Kebbi	Hausa, Fulani	Durbar festivals, Islamic scholarship, transhumant pastoralism	Important livestock and cross-border trade hub; Fulani movement across borders affects surveillance utility.
Kano	Hausa-Fulani	Durbar, Islamic religious schools, artisan traditions	Densely populated corridor; cultural leadership (emirs, scholars) essential for acceptance of surveillance infrastructure.
Abuja (FCT)	Gwari (Gbagyi), Hausa-Fulani, multi-ethnic settlers	Traditional Gwari festivals, cosmopolitan influence	Multi-ethnic population; cultural diversity requires multi-stakeholder consultation.
Enugu	Igbo	New Yam Festival, village assemblies, Christianity-influenced norms	Strong community leadership via town unions; must engage Igbo cultural groups for local buy-in.
Port	Ikwerre, Ogoni, Ijaw	Fishing festivals, traditional	Oil-region sensitivities; community

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Harcourt (Rivers)		rites, Christianity-dominant	expectations for CSR and employment high.
Makurdi (Benue)	Tiv, Idoma, Igede	Yam Festival, communal farming	Agrarian communities; land and cultural ties central to project acceptance.
Katsina	Hausa-Fulani	Islamic scholarship, Durbar festivals	Culturally homogenous, conservative; requires alignment with Islamic leaders.
Jigawa	Hausa-Fulani	Rural Islamic culture, Durbar festivals	Traditional rulers play major role in community acceptance.
Bauchi	Hausa-Fulani, Sayawa, Jarawa	Durbar, traditional craftwork	Multi-ethnic, agrarian society with seasonal migration; requires inclusive engagement.
Gombe	Fulani, Tangale, Waja	Mixed Islamic and Christian cultural festivals	Multi-religious composition; sensitivity needed in engagement.
Plateau	Berom, Ngas, Tarok, Hausa	Christian festivals, traditional rites	Ethnically diverse; history of conflicts means cultural balancing is essential.
Nasarawa	Gwandara, Alago, Hausa-Fulani	Agricultural festivals, religious coexistence	Multi-ethnic frontier; land tenure and cultural respect critical.
Kogi	Igala, Ebira, Okun-Yoruba	Masquerade festivals, traditional councils	Cultural diversity requires multi-ethnic consultation; project may face overlapping claims.
Abia	Igbo	New Yam Festival, traditional town unions	Strong role of chiefs and unions; effective for mobilization.
Delta	Urhobo, Itsekiri, Ijaw, Isoko	Fishing, masquerade, riverine traditions	Oil-producing hub; cultural groups expect compensation and CSR benefits.
Sokoto	Hausa-Fulani	Durbar, Islamic heritage	Strong Islamic institutions; engagement must be religiously sensitive.
Rivers	Ogoni, Ikwerre, Ijaw	Festivals, fishing-based culture	Oil-producing, socio-culturally sensitive; community resistance possible if not engaged.

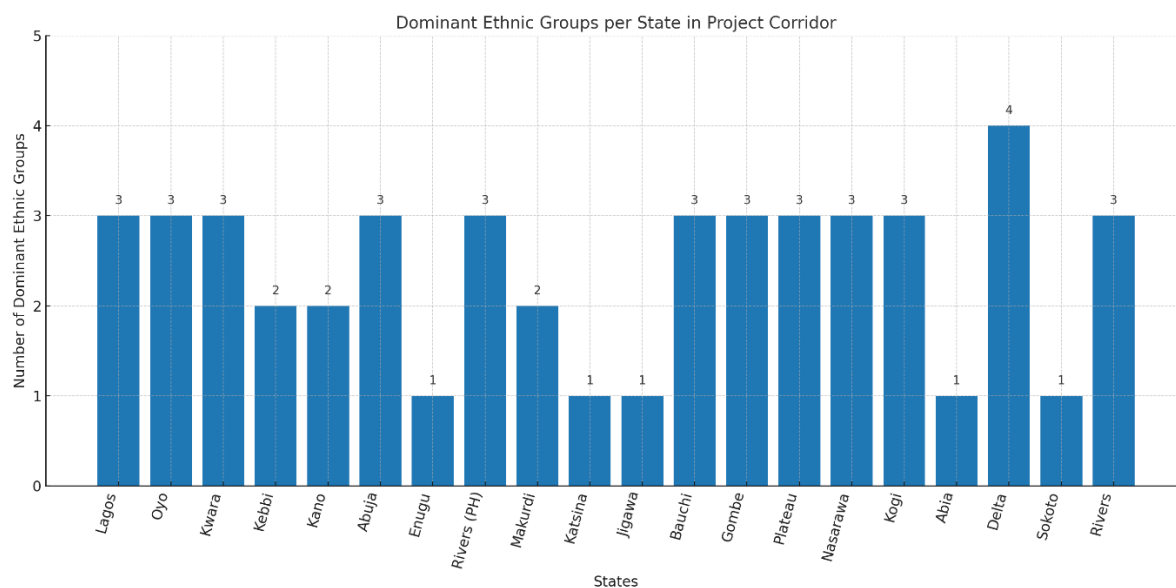


Figure 4.18: Ethnic and Cultural Diversity Across States

4.6.4 Religious Affiliation

Religion constitutes a central pillar of socio-cultural life in host communities along the critical infrastructure corridors where the proposed video surveillance installations will be sited. Islam, Christianity, and Traditional belief systems coexist across these regions, shaping social organization, governance, and local identity. The religious profile of each community has direct implications for project acceptance, social cohesion, and the effectiveness of stakeholder engagement strategies.

In Lagos, Kwara, and Kebbi States, Islam is the dominant faith, reflecting strong historical connections with northern Nigeria and deep transboundary linkages with Niger and Benin Republic. Mosques function not only as places of worship but also as community hubs for religious instruction, conflict mediation, and local governance. Religious leaders (Imams and scholars) play a critical role in guiding public opinion, influencing attitudes toward development projects, and ensuring communal buy-in for government initiatives such as surveillance infrastructure.

In Delta, Rivers, and Enugu States, Christianity is the prevailing religion, particularly within urban centers, forested areas, and riverine communities. Churches are focal points for community solidarity, social mobilization, and education. They often double as venues for civic meetings, youth associations, and women's groups. Denominational diversity including Catholic, Anglican, Pentecostal, and evangelical fellowships underscores the pluralistic Christian landscape. Clergy hold considerable sway in mobilizing grassroots support and must therefore be engaged as key stakeholders in project consultations.

In Taraba and Cross River highland and forest zones, Traditional belief systems remain deeply rooted, coexisting alongside Christianity. Practices such as ancestral veneration, forest rituals, and community shrine observances continue to shape local decision-making and land-use customs. These indigenous systems retain symbolic legitimacy, particularly in rural and marginalized communities where elders and custodians of tradition exercise authority. Their inclusion in consultation processes is critical to avoid cultural exclusion and to foster project ownership at the community level.

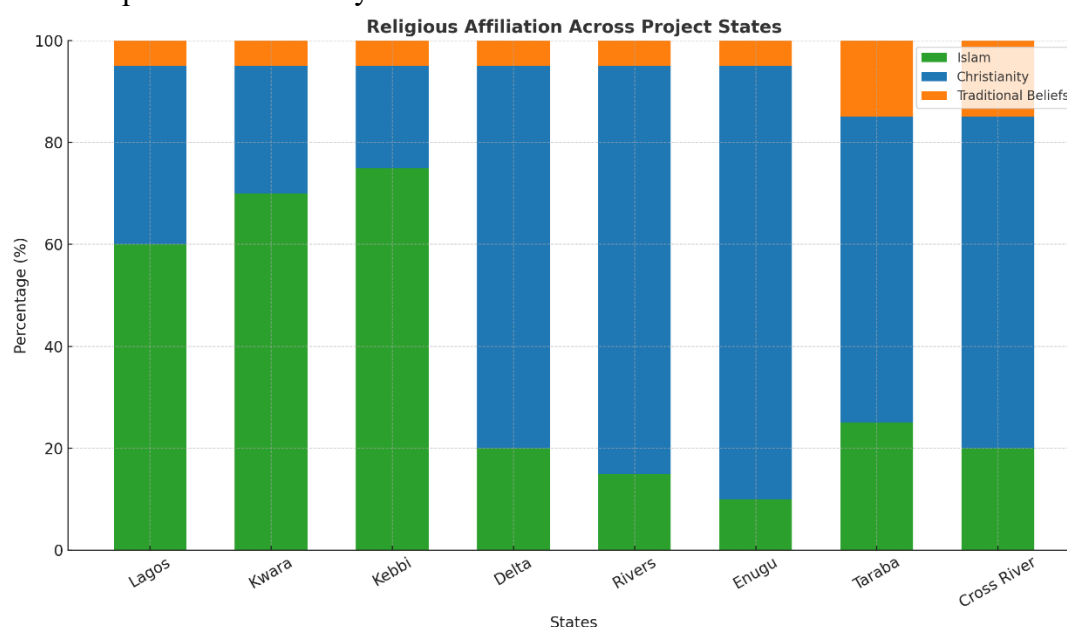


Figure 4.19: Religious Affiliation Across Project States

4.6.6 Gender Roles and Vulnerable Groups

Gender roles within the project corridors spanning Lagos, Rivers, Delta, Abuja, Kano, Kebbi, Oyo, Kwara, and other critical infrastructure host states are strongly shaped by traditional norms, religious practices, and socio-economic realities. Men continue to dominate community leadership structures and engage more actively in large-scale farming, artisanal works, construction, and transport-related livelihoods. Women, however, form the backbone of household sustenance through subsistence agriculture, petty trading, food processing, and informal economic activities, even though their contributions are often undervalued due to structural inequalities such as limited land ownership rights, weak access to credit facilities, and exclusion from agricultural extension services.

Women and Livelihoods

Women play a central role in ensuring household food security, engaging in small-scale farming of cassava, yam, maize, and vegetables, alongside backyard livestock rearing (goats, poultry). In peri-urban and rural settlements, women also take responsibility for fuelwood collection and water fetching, exposing them to physical stress, time poverty, and health challenges. In commercial hubs such as Lagos and Port Harcourt, women are active in market associations and cooperatives, which enhance their bargaining power, though their participation in formal or large-scale trade remains minimal compared to men.

Youth

Youth (15–35 years) constitute a significant demographic segment, but high unemployment and underemployment persist across the project states. Many young people rely on motorcycle transport services (“okada”), petty trading, and artisanal work, while others migrate seasonally for farm labor or informal urban jobs. A smaller but increasing number of educated youths are finding employment in ICT, teaching, and public service in state capitals like Abuja, Lagos, and Kano. However, limited opportunities make youth highly vulnerable to social risks.

Children

Children in the project communities contribute significantly to household labor, especially in farming households, where they assist with planting, harvesting, and market trading. In urban and semi-urban settlements, children are also engaged in petty trading, hawking, and domestic chores. Unfortunately, child labor remains prevalent, particularly in rural areas, affecting school attendance and learning outcomes. Healthcare and nutrition are inadequate in many of the communities, resulting in persistent cases of stunting and preventable illnesses.

Elderly and Persons with Disabilities (PWDs)

The elderly depend largely on family and community-based support systems, as formal state social safety nets are weak or absent. Persons with Disabilities (PWDs) remain one of the most marginalized groups, facing barriers to education, healthcare, and infrastructure. They are often excluded from decision-making processes, with their voices rarely represented in community consultations related to land, resource use, or development projects.

Vulnerable Groups

The socio-economic assessment identified the following as the most vulnerable groups across the project communities:

- Widows and female-headed households – facing restricted land rights, low asset ownership, and economic insecurity.
- Children, particularly out-of-school children, who are at risk of exploitation in informal labor and trafficking networks.
- Youth, who, due to unemployment and social exclusion, are exposed to risky economic alternatives and potential criminal networks.
- Persons with Disabilities (PWDs), who suffer from structural discrimination and lack of inclusion in socio-economic development.
- Pastoralist groups, especially Fulani herders, who frequently face marginalization, conflict over grazing lands, and limited access to infrastructure and social services.

4.6.7 Household Characteristics (Housing, Land Tenure, and Income)

Household characteristics across the critical infrastructure states (Lagos, Rivers, Delta, Abuja, Kano, Kebbi, Oyo, Kwara, and Taraba) reflect a mix of urban–rural disparities, cultural practices, and economic realities. These characteristics provide insights into living standards, poverty levels, and socio-economic vulnerabilities that may influence community interactions with the surveillance infrastructure.

1. Housing

Housing quality varies considerably across the project corridor, reflecting urban–rural divides:

- Urban centers such as Lagos, Port Harcourt, Abuja, and Kano feature predominantly permanent structures built with cement blocks, corrugated iron or aluminum roofing sheets, and concrete flooring. These cities, being economic hubs, have higher access to modern housing infrastructure, although slum clusters persist in peri-urban fringes (e.g., Ajegunle in Lagos, Rumuolumeni in Port Harcourt).
- Semi-urban settlements in states like Delta, Oyo, and Kwara show a combination of permanent and semi-permanent dwellings, where concrete-block houses coexist with mud or zinc-roofed structures.
- Rural communities, especially in Kebbi and Taraba, remain dominated by non-permanent housing, often constructed with mud walls, thatched roofing, and bare earth floors. These settlements are vulnerable to flooding, fire hazards, and seasonal displacements.
- Overcrowding is a common feature, with household sizes ranging between 6–9 persons per household, exceeding Nigeria’s national urban average of 4–5 persons (NBS, 2022). This is linked to extended family systems, polygamy, and joint living arrangements typical of agrarian and pastoralist societies.

2. Land Tenure

Land access and ownership remain largely governed by customary tenure systems, with implications for project-related land acquisition and community interface:

- Men dominate landholding, while women's access is primarily through male relatives (husbands, fathers, or brothers), reinforcing gender-based inequalities in land ownership.
- In urban centers (Lagos, Abuja, Port Harcourt), formal land titles and Certificates of Occupancy (C of O) are more common, though high costs and bureaucratic hurdles limit widespread access.
- In rural areas (Taraba, Kebbi, Oyo, Kwara), less than 15% of households hold formal legal titles, relying instead on traditional rulers, family heads, or community elders for land allocation.
- Communal grazing reserves and farmlands are common in northern states such as Kebbi and Taraba, but frequent farmer–herder conflicts complicate land use security. These conflicts pose potential risks to project infrastructure located near grazing corridors.

3. Household Income and Livelihood Sources

Household income levels vary widely between urban, semi-urban, and rural contexts, with livelihoods shaped by geography and infrastructure development:

- Urban households (Lagos, Abuja, Port Harcourt, Kano, Warri) derive income from public service, commercial trading, transport businesses, civil service employment, and small-to-medium-scale enterprises.
- Semi-urban and rural households in Oyo, Kwara, Taraba, Kebbi, and parts of Delta and Rivers states rely heavily on subsistence farming, artisanal fishing, logging, and seasonal labor.

Estimated average household monthly incomes

- Lagos: ₦95,000 – ₦120,000 (highest among project states, though inequalities are stark between high-income and slum areas).
- Rivers: ₦80,000 – ₦100,000 (Port Harcourt city households fare better than rural riverine communities).
- Delta: ₦70,000 – ₦90,000 (oil-rich zones sustain higher informal earnings, but rural agrarian households remain poor).
- Abuja (FCT): ₦85,000 – ₦110,000 (urban elites vs. low-income peri-urban slum dwellers).
- Kano: ₦65,000 – ₦80,000 (dominated by trade, textiles, and transport but lower rural earnings).
- Oyo/Kwara: ₦55,000 – ₦70,000 (trade and smallholder farming).
- Kebbi: ₦40,000 – ₦55,000 (lowest household incomes, driven by agriculture and pastoralism).
- Taraba: ₦42,000 – ₦60,000 (agro-pastoralism and small-scale trading).

Household income remains seasonal and volatile, tied largely to agricultural cycles. Planting seasons are marked by cash flow shortages, while harvest periods temporarily boost liquidity. A significant proportion of households in Kebbi, Taraba, and Cross River zones live below the national poverty line of ₦137,430 per year (NBS, 2020), highlighting persistent vulnerability.

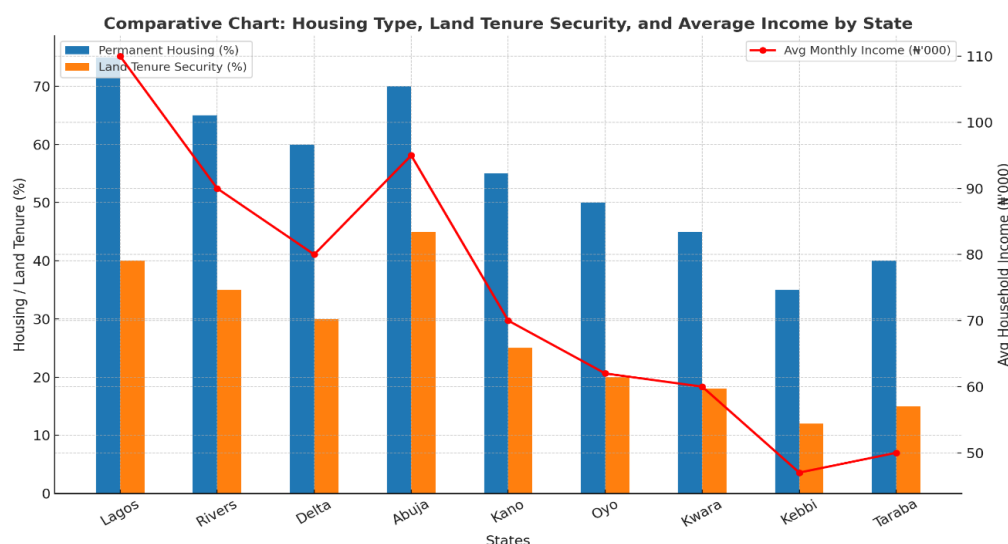


Figure 4.20: Comparative Chart of Housing Type, Land Tenure, Security, and Average Income by State

4.6.4 Occupation

The socio-economic survey across communities situated around the proposed surveillance infrastructure corridors revealed that livelihoods are shaped by agrarian practices, trade, services, and, in some urban centers, professional employment. While farming and trading dominate in rural and peri-urban areas, civil service and specialized occupations are more common in state capitals and urbanized nodes such as Lagos, Abuja, Port Harcourt, and Kano.

▪ Farming and Crop Production

Agriculture remains the most widespread occupation across host communities, particularly in states such as Kebbi, Taraba, Delta, and Kwara. Households engage in subsistence and small-scale commercial cultivation of cassava, yam, maize, rice, sorghum, and vegetables, which provide both food security and income through sales in local markets. Irrigated farming was observed in riverine zones, while rain-fed agriculture remains dominant in upland areas.

▪ Livestock Rearing

Pastoralism is central to livelihoods in northern corridors such as Kebbi, Taraba, Katsina, and Jigawa, where Fulani herders engage in transhumant cattle grazing. Alongside cattle, small ruminants (goats and sheep) and poultry are reared to supplement household nutrition and income. Livestock also holds cultural and religious significance, being integral to festivals such as Eid celebrations.

▪ Trade and Informal Services

Trading is another significant occupation, especially in Lagos, Oyo, Delta, and Cross River, where markets and urban centers attract diverse commerce. Petty trading in agricultural produce, food items, livestock, and consumer goods dominates rural economies. Informal services such as fuelwood sales, food vending, tailoring, carpentry, mechanics, and masonry were observed to provide alternative income, particularly for women and youth. Markets often held weekly act as socio-economic hubs where goods, livestock, and manufactured items are exchanged.

▪ Professional and Formal Sector Employment

In major towns and cities like Lagos, Abuja, Port Harcourt, Kano, and Enugu, professional employment opportunities exist in education, health, engineering, banking, transport, ICT, and government services. Teachers, health workers, engineers, and civil servants provide essential services and represent a small but vital occupational class that stabilizes the local economy. In port and industrial zones, some residents are employed in logistics, oil and gas support services, and processing activities.

▪ Cultural and Religious Activities

Beyond economic functions, cultural and religious activities also shape the occupational calendar. Celebrations such as Eid-el-Fitr, Eid-el-Kabir, Christmas, and Easter foster community cohesion and periodic increases in trading and agricultural sales. Unlike in some traditional societies, field investigations did not reveal the presence of shrines, deities, or sacred forests of archaeological significance within the proposed surveillance installation corridors.

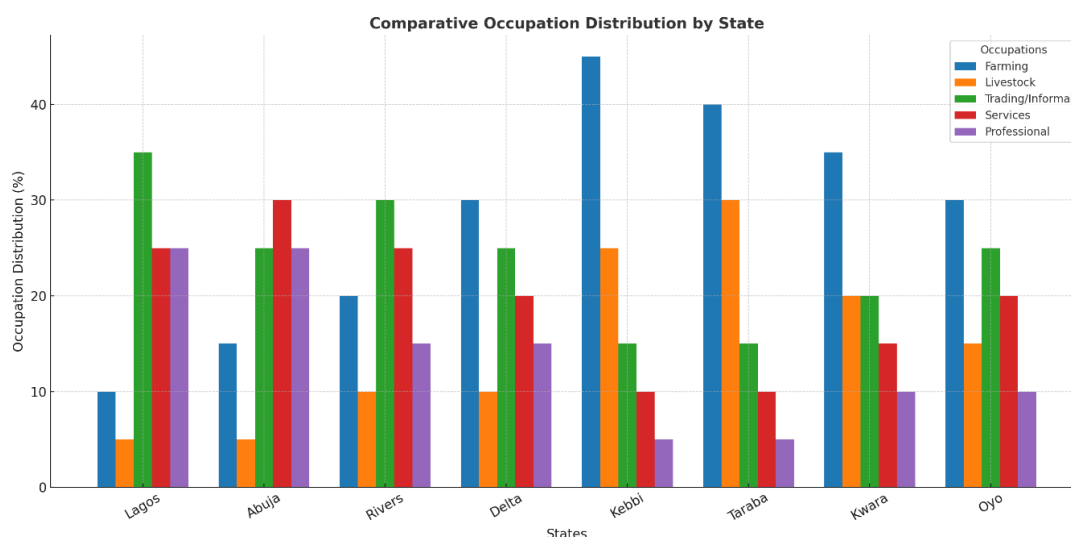


Figure 4.21: Comparative Occupation Distribution by State

4.6.5 Educational Institutions

Educational institutions across the states hosting the proposed surveillance infrastructure demonstrate significant disparities in terms of access, quality, and distribution. These institutions play a critical role in shaping literacy levels, skills development, and socio-economic advancement, which in turn influence the level of community participation, acceptance, and sustainability of the project.

▪ Lagos and Abuja

Lagos and Abuja, as Nigeria's main urban and economic hubs, host the highest concentration of primary, secondary, and tertiary institutions. Lagos State is home to the University of Lagos, Lagos State University (LASU), and Yaba College of Technology, alongside thousands of public and private schools. Abuja, the Federal Capital Territory (FCT), houses the University of Abuja, Baze University, and several polytechnics and colleges of education. However, while urban communities benefit from high-quality private schools and relatively

good infrastructure, peri-urban and satellite settlements within project corridors often experience overcrowded classrooms, poor facilities, and teacher shortages.

▪ **Rivers and Delta States**

Rivers and Delta States host strong educational networks given their oil and gas economies and urban centers like Port Harcourt and Warri. Rivers State has the University of Port Harcourt (UNIPORT), Ignatius Ajuru University of Education, and several polytechnics, while Delta hosts Delta State University (DELSU) and Petroleum Training Institutes (PTI). Despite this, riverine and rural communities remain underserved, with limited access to functional schools and high dropout rates among children due to poverty and livelihood pressures. These disparities underscore the risk of unequal educational access within oil-producing regions that host critical infrastructure.

▪ **Oyo and Kwara States**

Oyo State is a traditional education hub, hosting premier institutions such as the University of Ibadan, Ladoke Akintola University of Technology (LAUTECH), and numerous polytechnics. Kwara also has strong tertiary institutions, including the University of Ilorin and Kwara State Polytechnic.

▪ **Kebbi and Taraba States**

Kebbi and Taraba are among the least served in terms of educational infrastructure. Kebbi hosts the Federal University, Birnin Kebbi, Waziri Umaru Federal Polytechnic, and the College of Education, Argungu. However, remote villages near Niger Republic depend mainly on small primary schools with dilapidated buildings and inadequate teachers. Taraba, with Federal University Wukari and College of Education Zing, faces similar challenges in its LGAs such as Sardauna and Kurmi. In these areas, education is hindered by rugged terrain, poverty, and weak infrastructure, resulting in low literacy levels and high dropout rates.

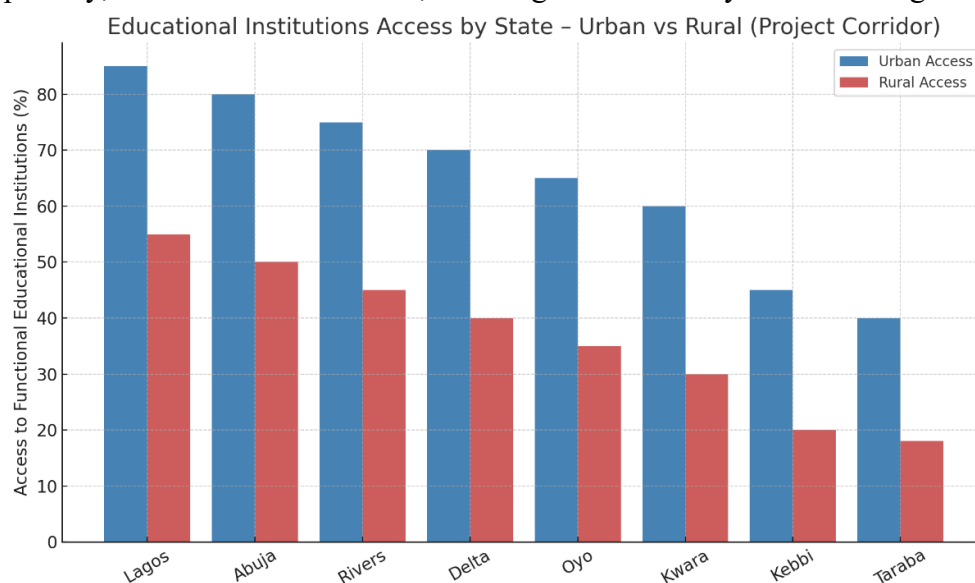


Figure 4.22: Educational Institutions Access by State

4.6.6 Infrastructure and Social Services

The availability, accessibility, and quality of infrastructure and social services in host states directly influence the feasibility, sustainability, and socio-economic impact of the Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution. Surveillance systems depend not only on robust physical installations but also on functional road networks, energy access, communication systems, and social services that sustain host communities.

Across the selected states, infrastructure remains unevenly distributed. While urban and industrial hubs such as Lagos, Abuja, Port Harcourt, and Kano have relatively well-developed infrastructure, rural communities hosting dams, mining sites, and energy assets (e.g., in Taraba, Kogi, Plateau, and Gombe) lag behind, with limited road access, weak electricity supply, and poor social amenities.

Roads and Transportation

- **Lagos & Rivers States (Port Corridors):** Lagos (Apapa, Tin Can, Lekki) and Port Harcourt serve as Nigeria's busiest maritime and logistics hubs. Both states enjoy extensive federal road coverage and port-access highways. However, congestion is a chronic challenge in Lagos, where gridlock around port access roads increases travel time and reduces efficiency. In Rivers, the East–West Road remains critical but poorly maintained in sections, affecting access to port facilities and oil/gas terminals.
- **Abuja & Kano (Railway and Administrative Corridors):** Abuja is connected by expressways and the Abuja–Kaduna railway, though peri-urban roads remain poorly maintained. About 48% of Abuja roads are paved (FMW, 2023). Kano, a northern trade hub, connects to the Lagos–Kano standard-gauge rail. Yet, rural feeder roads across Kano State remain untarred, constraining surveillance installations in hinterlands.
- **Delta, Kogi, and Nasarawa (Gas & Mining Corridors):** In Delta State, oil and gas installations are located in swampy terrain with limited all-season access. Kogi (iron ore, limestone, and coal deposits) and Nasarawa (solid minerals) rely heavily on trunk roads that deteriorate in rainy seasons, impeding mining logistics. Rural road density is below 12 km/100 sq. km, much lower than urban corridors.
- **Bauchi, Gombe, Plateau, and Taraba (Dam and Energy Corridors):** These states host major hydropower and irrigation dams (e.g., Dadin Kowa, Shiroro via Kogi–Niger corridor, Mambilla in Taraba). However, road access remains sparse, with less than 30% paved coverage. Mountainous and erosion-prone terrain (e.g., Plateau, Taraba) often cuts off settlements during rainy seasons, restricting both community mobility and security patrols.
- **Enugu, Abia, and Sokoto (Secondary Corridors):** Enugu and Abia serve as transit corridors linking the southeast rail and trade networks. Enugu has better urban road density but rural settlements remain underserved. In Sokoto and Kebbi, feeder roads into pastoral and agrarian zones are often earth roads, limiting patrol effectiveness and increasing transport costs by 20–30% compared to urban averages.

Table 4.29: Roads and Transportation in Host States

State / Corridor	% Paved Roads	Road Density (km/100 sq. km)	Common Transport Modes	Key Challenges
Lagos (Ports)	55%	35	Trucks, buses, motorcycles	Severe port congestion, poor traffic management
Rivers (Ports/Oil)	46%	22	Trucks, boats, motorcycles	East–West road degradation, oil corridor insecurity
Abuja (Rail/Admin)	48%	28	Buses, taxis, rail	Poor peri-urban feeder roads, urban congestion
Kano (Rail/Trade)	39%	19	Trucks, buses, motorcycles	Weak rural roads, overdependence on rail corridor
Delta (Oil & Gas)	32%	15	Boats, trucks, motorcycles	Swampy terrain, oil theft hotspots
Kogi (Mining/Energy)	28%	13	Trucks, motorcycles, taxis	Mining corridor erosion, weak feeder roads
Nasarawa (Mining)	30%	12	Motorcycles, vans	Seasonal flooding, poor road density
Plateau (Hydropower)	26%	11	Buses, motorcycles, portage	Mountainous terrain, erosion
Gombe (Hydropower)	27%	10	Buses, motorcycles, bicycles	Low rural access, flooding of dam access roads
Taraba (Mambilla Dam)	24%	8	Motorcycles, bicycles, walking	Landslides, isolation of upland communities
Enugu (Rail)	41%	21	Buses, taxis, motorcycles	Poor rural–urban linkages
Abia (Rail/Trade)	37%	18	Buses, motorcycles	Poor rural connectivity, flooding in Aba–Umuahia axis
Sokoto (Pastoralism)	29%	13	Motorcycles, carts, vans	Sparse roads, desertification impact
Kebbi	32%	12	Motorcycles, donkey carts, vans	Rain-season inaccessibility, poor cross-border connectivity

Sources: NBS Road Transport Data (2023); Federal Ministry of Works (2022); Field Consultations (2025).

4.6.6.2 Electricity and Power Supply

Electricity access remains one of the most pressing infrastructural challenges for the host states where critical infrastructure facilities (railway, dam, gas & mining sites, power stations, and ports) are located. Although all states are technically connected to the national grid via the Transmission Company of Nigeria (TCN), supply reliability, rural penetration, and energy quality vary widely between urban-industrial hubs (e.g., Lagos, Abuja, Port Harcourt) and rural extractive or agrarian regions (e.g., Kogi, Plateau, Gombe, Taraba).

Urban-Industrial Corridors (Lagos, Abuja, Port Harcourt, Kano, Enugu): Lagos and Rivers (Port Harcourt) record relatively higher electrification rates, with 70–80% of households and businesses grid-connected. However, supply reliability is low, with outages averaging 8–10 hours daily. The heavy concentration of ports, oil terminals, and industries leads to high energy demand, forcing dependence on diesel generators for up to 40% of daily electricity needs. Abuja and Kano have slightly lower household penetration (60–68%) but benefit from stronger federal grid priority. In Enugu, access is estimated at 55–60%, though rural LGAs remain poorly served.

Mining and Energy Corridors (Kogi, Nasarawa, Delta, Plateau, Bauchi, Gombe): Electrification levels drop considerably in mining-intensive states. In Kogi and Nasarawa, only 40–50% of households are connected to the grid, with frequent outages of 14–16 hours

daily, limiting productivity in cement, iron ore, and coal clusters. Delta’s oil and gas host communities are paradoxically energy-poor, with grid penetration at 45–55% and communities depending heavily on small petrol generators despite being close to energy installations. Plateau, Bauchi, and Gombe record electrification levels below 45%, with outages stretching 16–18 hours daily. Hydropower sites such as Dadin Kowa (Gombe) and Mambilla (Taraba–Plateau axis) remain constrained by poor transmission capacity, limiting spillover benefits to surrounding communities.

Northern Corridors (Katsina, Jigawa, Sokoto, Kebbi): Electrification rates in the far north remain the lowest. In Katsina and Jigawa, grid access is 30–40%, and in Sokoto and Kebbi, rates hover around 35–45%, with outages lasting 18–20 hours daily. Households rely heavily on kerosene lamps, firewood, and small solar systems. Rural electrification is minimal, and donor-supported solar mini-grids (e.g., in Argungu, Sokoto East) provide partial relief.

Table 4.30: Electricity Access and Reliability in Host States for Critical Infrastructure Surveillance

State / Corridor	Household Access to Grid (%)	Avg. Hours Without Power/Day	Common Alternatives	Key Challenges
Lagos (Ports/Industry)	70–80%	8–10 hrs	Generators, solar, diesel plants	Port congestion, high industrial demand
Rivers (Port Harcourt)	65–75%	9–11 hrs	Generators, solar, diesel	Oil corridor insecurity, grid overload
Abuja (Admin/Railway)	60–68%	8–10 hrs	Generators, solar, inverters	Urban sprawl, poor peri-urban coverage
Kano (Rail/Trade)	58–65%	10–12 hrs	Generators, solar	Low rural penetration, demand pressure
Enugu (Rail/Energy)	55–60%	12–14 hrs	Generators, kerosene, solar	Weak rural electrification
Delta (Oil & Gas)	45–55%	14–16 hrs	Generators, solar lanterns, firewood	Paradox of energy poverty in oil zones
Kogi (Mining/Energy)	42–50%	14–16 hrs	Generators, kerosene, solar mini-grids	Weak grid extension, mining corridor load
Nasarawa (Mining)	40–48%	15–17 hrs	Kerosene, generators, solar	Minimal rural electrification
Plateau (Hydropower)	38–45%	16–18 hrs	Firewood, solar, kerosene	Terrain barriers, weak grid transmission
Bauchi (Hydropower)	35–42%	16–18 hrs	Firewood, solar, generators	Low grid reliability, poor coverage
Gombe (Hydropower)	34–40%	16–18 hrs	Firewood, solar, kerosene	Access roads poor, low rural penetration
Katsina (Northern Corridor)	30–40%	18–20 hrs	Firewood, kerosene, solar	Rural poverty, weak transmission lines
Jigawa (Northern Corridor)	32–38%	18–20 hrs	Firewood, generators, solar	Sparse grid coverage
Sokoto (Northern Corridor)	35–42%	18–20 hrs	Firewood, kerosene, solar lanterns	Desertification, minimal rural coverage
Kebbi (Northern Corridor)	35–45%	17–19 hrs	Generators, solar mini-grids, kerosene	Limited REA projects, poor reliability

Sources: NBS Power Statistics (2023); REA Reports (2022); Federal Ministry of Power (2023); Field Consultations (2025).

4.6.6.3 Water Supply and Sanitation

Access to safe and reliable water supply in the host states of the proposed Critical Infrastructure Surveillance Project remains uneven, with significant disparities between urban industrial hubs (Lagos, Abuja, Port Harcourt, Kano) and rural extractive/mining and agrarian communities (Kogi, Gombe, Plateau, Kebbi, Nasarawa, Jigawa, Katsina, Sokoto, etc.).

Water Supply Sources

- **Urban–Industrial States (Lagos, Abuja, Rivers, Kano, Enugu, Delta):** These states benefit from State Water Boards, public utilities, and municipal piped water systems, but effective coverage remains below 40–50% due to aging infrastructure, intermittent supply, and population pressure. Many households and businesses resort to private boreholes, water tankers, and sachet/bottled water for drinking and domestic use.
- **Mining & Agrarian States (Kogi, Plateau, Nasarawa, Bauchi, Gombe, Kebbi):** Reliance is predominantly on hand-dug wells (30–40%), rivers/streams (25–30%), and boreholes (20–25%). Boreholes often suffer from poor maintenance and frequent breakdowns. Rural water access coverage is estimated at <30%, leaving communities vulnerable during the dry season.
- **Northern States (Katsina, Jigawa, Sokoto, Kebbi):** Communities face acute seasonal water stress, with dry-season scarcity forcing residents to trek 2–4 km daily to fetch water. Open wells and ponds are widely used, raising contamination risks. NGO-supported motorized boreholes and solar-powered pumps are gradually improving coverage but remain insufficient.
- **Southern States (Delta, Rivers, Abia, Enugu):** Water supply is more reliable in urban centers, yet peri-urban and rural oil-host communities still depend on streams, rainwater harvesting, and commercial vendors, especially where oil exploration and pollution have degraded natural water sources.

Sanitation

Access to improved sanitation is below national averages across most project states. According to UNICEF (2023) and NBS (2024):

- **Urban States (Lagos, Abuja, Port Harcourt):** Around 50–65% of households use improved sanitation facilities (flush toilets, septic tanks), though slums and peri-urban zones still rely on shared or unimproved pit latrines.
- **Mining/Agrarian States (Kogi, Plateau, Gombe, Bauchi, Nasarawa, Kebbi):** Coverage drops to 20–30%, with open defecation rates exceeding 40% in rural areas.
- **Northern States (Katsina, Jigawa, Sokoto):** Sanitation is weakest here, with open defecation common in more than 50% of households. Basic pit latrines dominate, though many are unimproved and unsafe.
- **Southern Oil Corridor (Delta, Rivers, Abia):** Flood-prone and swampy terrain makes sanitation challenging. Many riverine households use hanging latrines over water, leading to direct contamination.

Table 4.31: Water Supply and Sanitation in Host States

State / Corridor	Main Water Sources	% Access to Improved Water	Sanitation Coverage
Lagos (Ports/Urban)	Piped water, boreholes, vendors	50–60%	55–65%
Abuja (Admin Corridor)	Piped water, boreholes, sachet/bottled	45–55%	50–60%
Rivers (Port Harcourt)	Piped water, boreholes, vendors, rainwater	40–50%	35–45%
Delta (Oil Corridor)	Streams, boreholes, water vendors	35–45%	30–40%
Kano (Rail/Trade)	Boreholes, wells, streams	40–50%	35–45%
Enugu (Energy Corridor)	Boreholes, streams, piped water	45–55%	40–50%
Kogi (Mining/Energy)	Boreholes, rivers, hand-dug wells	30–40%	25–30%
Plateau (Hydropower)	Streams, boreholes, rainwater harvesting	30–40%	25–35%
Bauchi (Mining)	Wells, boreholes, streams	28–35%	20–30%
Gombe (Hydropower)	Wells, boreholes, rivers	30–38%	22–32%
Nasarawa (Mining)	Boreholes, streams, hand-dug wells	25–35%	20–30%
Katsina (Northern)	Wells, boreholes, streams	30–35%	20–25%
Jigawa (Northern)	Wells, boreholes, rainwater	28–34%	20–25%
Sokoto (Northern)	Wells, boreholes, streams	30–40%	18–25%
Kebbi (Northern)	Wells, boreholes, rivers	32–38%	20–28%
Abia (South-East)	Streams, boreholes, piped water (urban)	35–45%	30–40%

Sources: UNICEF WASH Report (2023); NBS (2024); Field Consultations (2025).

4.6.7 Markets and Commercial Services

Markets and commercial services in the host states where critical infrastructure is located (railway corridors, dams, gas and mining hubs, power stations, and ports) play a pivotal role in sustaining socio-economic life and linking communities to broader national and regional economies.

Urban Commercial Hubs: States such as Lagos, Abuja, Port Harcourt, and Kano serve as major national and international commercial hubs. They host organized daily and weekly markets (e.g., Balogun Market in Lagos, Wuse Market in Abuja, Mile 1 Market in Port Harcourt, and Sabon Gari Market in Kano), which sustain millions of traders and consumers. These markets provide a wide range of goods agricultural produce, industrial products, imported items, and manufactured goods and are critical for household livelihoods.

Industrial and Extractive Zones: In Delta, Kogi, Kebbi, and Kwara States, markets are closely linked to extractive and industrial activities. For instance, Delta and Rivers States host petroleum and gas-related commercial services, while Kogi and Kwara feature mining-related markets (limestone, iron ore, and agro-processing). Local communities depend heavily on these markets for farm produce and artisanal goods, while larger enterprises supply industrial input materials.

Rural and Semi-Urban Markets: In secondary towns across states such as Enugu, Gombe, Nasarawa, Katsina, and Plateau, commercial services are dominated by weekly rural markets. These serve as collection points for agricultural produce (cassava, maize, yam, sorghum, palm produce) and livestock, linking rural farmers to urban trade corridors. The functionality of these markets is often constrained by poor road infrastructure, limited storage facilities, and seasonal fluctuations in commodity supply.

Commercial and Financial Services: Formal banking and financial institutions are more concentrated in urban centers (Lagos, Abuja, Port Harcourt), while rural communities in states like Taraba, Kebbi, and Plateau depend largely on informal cooperative societies, mobile money agents, and thrift savings schemes (ajo/esusu). Limited access to credit facilities continues to restrict small-scale enterprises, artisans, and farmers. However, mobile money penetration is expanding, particularly in Lagos, Abuja, and Rivers, where digital platforms are increasingly adopted by youth and traders.

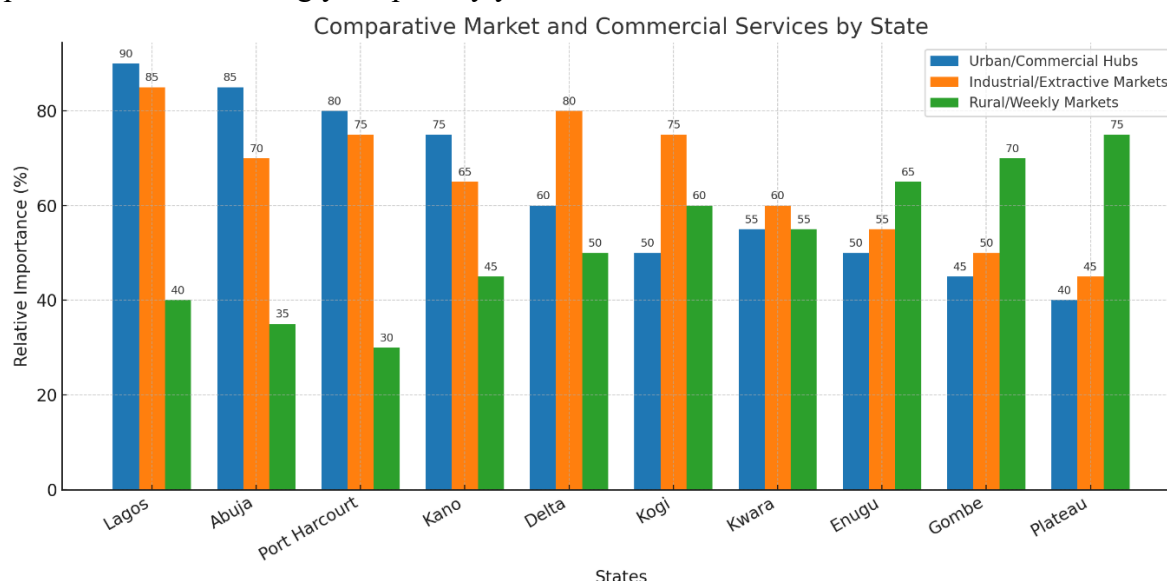


Figure 4.23: Comparative Markets and Commercial Services by State

4.6.8 Communication and Information Technology

Access to communication and information technology infrastructure remains uneven across the host states of the proposed critical infrastructure corridors. While metropolitan areas such as Lagos, Abuja, Ibadan, Port Harcourt, Kano, and Enugu benefit from strong network coverage and relatively stable internet services, peri-urban and rural settlements surrounding project corridors continue to face weak or irregular connectivity.

In Lagos and Abuja, communication networks are highly developed, with multiple providers (MTN, Glo, Airtel, 9mobile) offering extensive 3G/4G coverage and emerging 5G penetration in central business districts. This facilitates digital trade, e-banking, security operations, and real-time communication for surveillance systems. However, even in these cities, informal settlements and peri-urban fringes still report network fluctuations and high internet costs.

In Ibadan and Kwara, semi-urban and agrarian communities benefit from moderate mobile service penetration due to their proximity to urban centers such as Ilorin and Ibadan metropolis. While voice and SMS services are widespread, broadband internet is still limited, constraining ICT adoption in education, commerce, and small enterprises.

In Kebbi and Taraba, communication infrastructure is weakest. Remote agrarian, fishing, and pastoral settlements along the Niger and Cameroon borders often experience unstable or absent mobile network signals. Coverage gaps in these areas severely limit access to trade

information, health alerts, and government messaging, while also creating operational constraints for surveillance technology that requires consistent communication links.

In Cross River and Delta, mountainous, forested, and coastal terrain affects signal transmission, especially in Ikom, Boki, and Bakassi areas. While towns such as Calabar and Warri enjoy strong ICT services, rural border and riverine communities are left with basic 2G coverage, relying on SMS and voice for communication.

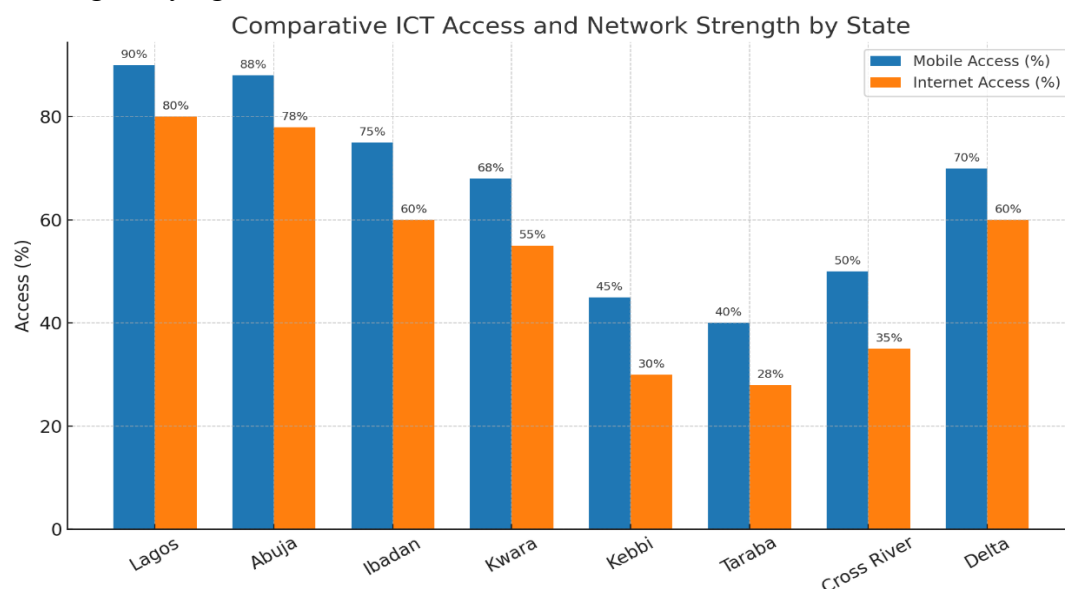


Figure 4.24: Comparative ICT Access and Network Strength by State

4.6.9 Community Services and Public Institutions

Community services and public institutions within the host states for the Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station, and Port) Security Video Surveillance Solution reflect marked disparities in availability, accessibility, and effectiveness. These disparities directly shape community resilience, socio-economic well-being, and the overall enabling environment for project implementation.

Governance and Social Institutions: Governance structures at the local level are anchored in Local Government Secretariats, traditional rulers’ palaces, community halls, and ward-level assembly points. These institutions are central to grassroots governance, conflict resolution, and mobilization for collective activities. Traditional and religious institutions (churches, mosques, shrines) not only serve as spiritual centers but also function as platforms for community cohesion, information dissemination, and advocacy. Their influence is particularly critical in shaping community acceptance of infrastructure projects, including security surveillance installations.

Security and Law Enforcement: The level of formal security presence varies across the host states. In Lagos, Abuja, and Delta, relatively strong institutional representation exists through agencies such as the Nigeria Police Force (NPF), Nigerian Immigration Service (NIS), Nigeria Customs Service (NCS), and Nigeria Security and Civil Defence Corps

(NSCDC). These agencies operate around ports, railway hubs, airports, and power installations, reflecting the importance of these areas for national security and commerce. Conversely, in more rural states such as Taraba, Kebbi, and Plateau, security presence is often limited to checkpoints along highways or near critical facilities, leaving remote settlements underserved. This has resulted in reliance on vigilante groups, community policing committees, and informal security arrangements. Such gaps in state coverage increase vulnerability to threats such as vandalism of infrastructure, smuggling of materials, illegal mining, and sabotage of energy and port facilities.

Public Services and Utilities: Formal public services remain grossly inadequate, especially outside state capitals and industrial hubs. In Lagos and Abuja, organized waste management systems and municipal drainage infrastructure are operational but face pressure from population growth and urban expansion. In contrast, communities in states such as Taraba, Kebbi, and Cross River rely largely on open-dumping of waste, with minimal government oversight. Monthly environmental sanitation exercises coordinated by local councils exist but are inconsistently implemented. Drainage and stormwater systems are poorly developed in many locations, leaving urban and peri-urban settlements vulnerable to flooding, erosion, and related health hazards.

4.6.7 Health Facilities and Conditions

Health service delivery across the host states of the Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station, and Port) Security Video Surveillance Solution is generally constrained by inadequate facilities, shortage of skilled personnel, poor infrastructure, and inequitable distribution of healthcare services. These limitations are particularly acute in peri-urban and rural settlements surrounding critical infrastructure locations, where the proposed surveillance sites will be installed. The state of healthcare is of direct relevance to the project because weak health systems reduce resilience, limit emergency response, and heighten community vulnerabilities in areas where infrastructure development is taking place.

1. Health Facilities Distribution

Primary Healthcare Centres (PHCs): Lagos and Abuja lead in terms of the number and relative accessibility of PHCs, reflecting their higher population density, urbanization levels, and greater government and donor investments. Lagos State alone hosts more than 550 PHCs, while Abuja has approximately 420. Other states such as Delta, Rivers, and Kano also have significant PHC coverage (ranging from 300–400), although distribution is uneven, with urban hubs better served than surrounding satellite towns. In contrast, states such as Kebbi and Taraba record fewer PHCs (below 300), limiting outreach to dispersed rural and pastoralist communities. This imbalance highlights both geographic and socio-economic disparities in access to basic healthcare services.

General Hospitals: The availability of general hospitals reflects similar disparities. Lagos (40) and Rivers (28) stand out with relatively stronger secondary healthcare infrastructure, supported by state and private sector investments. Abuja maintains 22 general hospitals distributed across the six area councils, while Delta has 26. Conversely, states such as Kebbi

(18) and Taraba (20) remain underserved, with many residents relying on small PHCs or mission clinics for services that ideally require hospital-level care.

Tertiary Facilities: Each host state has at least one federal tertiary hospital (teaching hospital or federal medical center), which serves as the ultimate referral point. For instance, Lagos is served by the Lagos University Teaching Hospital (LUTH) and Lagos State University Teaching Hospital (LASUTH), while Abuja has the National Hospital and University of Abuja Teaching Hospital. Delta, Rivers, Kano, and Enugu also maintain tertiary-level facilities. However, access remains inequitable: patients in remote settlements (e.g., Sardauna in Taraba or Bagudo in Kebbi) often travel several hours before reaching tertiary care, which poses challenges in emergency situations.

Private and Mission Hospitals: The private and mission-based health sector plays a strong complementary role in Lagos, Abuja, and Delta, with more than 150–200 private hospitals and clinics combined. These facilities supplement overstretched public health systems and are better equipped with diagnostic and specialist services. Rivers and Kano also have robust private sector presence. However, in states like Taraba and Kebbi, private sector participation is limited (fewer than 70 facilities), reflecting low investment attractiveness and weaker economic activity. This uneven distribution accentuates regional disparities, leaving residents of poorer, rural areas with minimal options for reliable care.

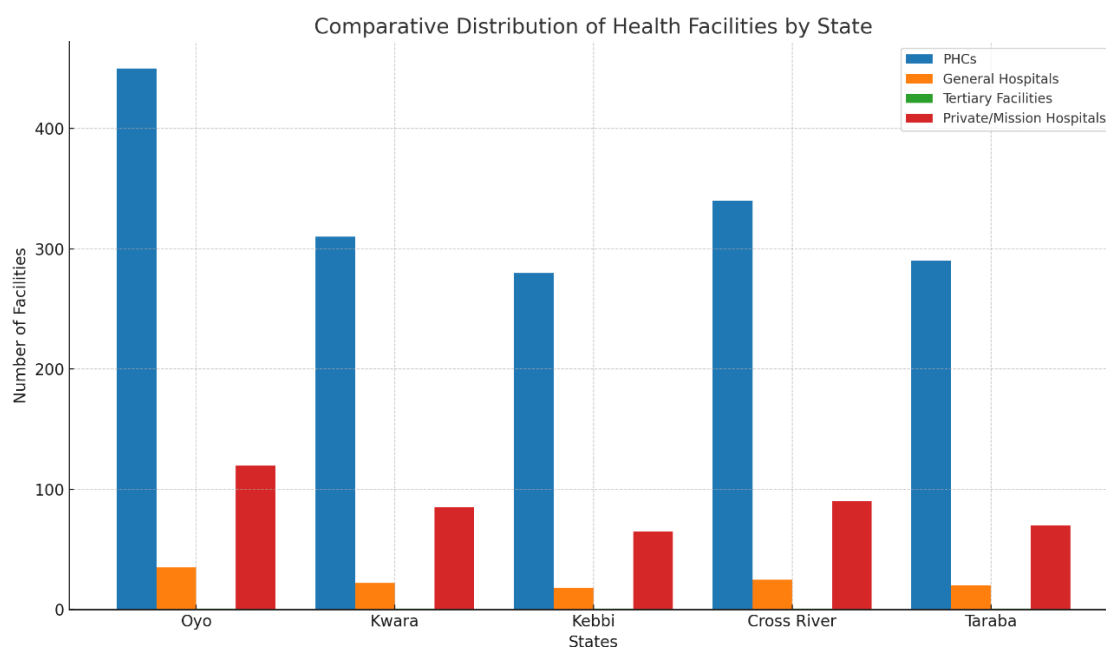


Figure 4.25: Comparative Distribution of Health Facilities by State

2. Implications for the Project

- **Health Infrastructure Gaps:** Communities around critical infrastructure sites in Taraba, Kebbi, and Plateau may face challenges in accessing timely healthcare, increasing risks during project construction and operation phases.
- **Urban–Rural Divide:** While Lagos, Abuja, and Delta enjoy stronger health infrastructure, the surrounding peri-urban fringes (where surveillance installations

may be located) still suffer service gaps, particularly in emergency response and maternal health.

- Dependence on Informal Health Systems: Many rural settlements in Cross River, Taraba, and Kebbi depend heavily on traditional medicine, patent drug vendors, and mission clinics due to limited formal health facilities.
- Project Relevance: The success of the surveillance solution will partly depend on local resilience, which is strongly linked to the availability of functional healthcare services. Integrating health support initiatives (e.g., CSR-driven PHC rehabilitation, provision of first aid units at installation sites) could strengthen community acceptance and mitigate public health risks.

3. Health Conditions and Burden

The burden of both communicable and non-communicable diseases is compounded by weak health infrastructure, socio-cultural practices, and poor access to healthcare in rural and peri-urban areas.

Malaria: Malaria remains the most prevalent health condition across all states. Cross River and Taraba States record particularly high incidence rates due to their humid, forested environments that provide ideal breeding grounds for *Anopheles* mosquitoes. High malaria prevalence undermines productivity and increases household health expenditures, affecting both community resilience and project labor availability.

Waterborne Diseases (Cholera, Typhoid, Dysentery): Kebbi and Taraba communities are disproportionately vulnerable to cholera, typhoid, and dysentery due to their dependence on untreated surface water (rivers, streams, and hand-dug wells) and low sanitation coverage. Poor drainage and open defecation practices further exacerbate disease transmission, raising public health risks around critical infrastructure corridors.

Maternal Mortality and Immunization Trends: Maternal mortality remains elevated across all five states. Kebbi and Taraba stand out as the most affected due to poor road access, weak referral systems, and cultural barriers that discourage institutional deliveries. Although Oyo State has relatively better health infrastructure, rural LGAs still record preventable maternal deaths arising from delayed referrals and inadequate obstetric care. Data from NDHS (2018) estimates maternal mortality at 512–800 deaths per 100,000 live births in rural areas, far exceeding national targets. Immunization coverage remains below the national average across all surveyed states, with the most severe gaps in Kebbi and Taraba. Weak PHC outreach, poor logistics, and vaccine hesitancy contributes to increased risk of vaccine-preventable diseases among under-five children.

Non-Communicable Diseases (NCDs): Urbanized states such as Oyo and Kwara show a rising burden of hypertension, diabetes, and related NCDs linked to lifestyle and dietary changes. In Kebbi and Taraba, lower reporting rates mask an underlying burden, as diagnostic infrastructure remains weak and underdiagnosis is common. These NCDs pose emerging risks for workforce productivity in semi-urban corridors.

Health Emergencies and Insecurity: Cross-border insecurity periodically disrupts healthcare service delivery, particularly in Kebbi and Taraba. Episodes of banditry, cattle rustling, and communal clashes often force temporary closures of health facilities and contribute to the

migration of health workers from already underserved areas. Such instability threatens the reliability of health services near critical infrastructure installations.

Human Resources for Health: Human resource gaps remain a major limitation across the five states. Doctor-to-patient ratios remain critically low, estimated at 1:45,000 in Taraba and 1:38,000 in Kebbi, compared to the WHO standard of 1:1,000. This deficit contributes to high maternal mortality, poor management of infectious diseases, and weak response capacity during health emergencies.

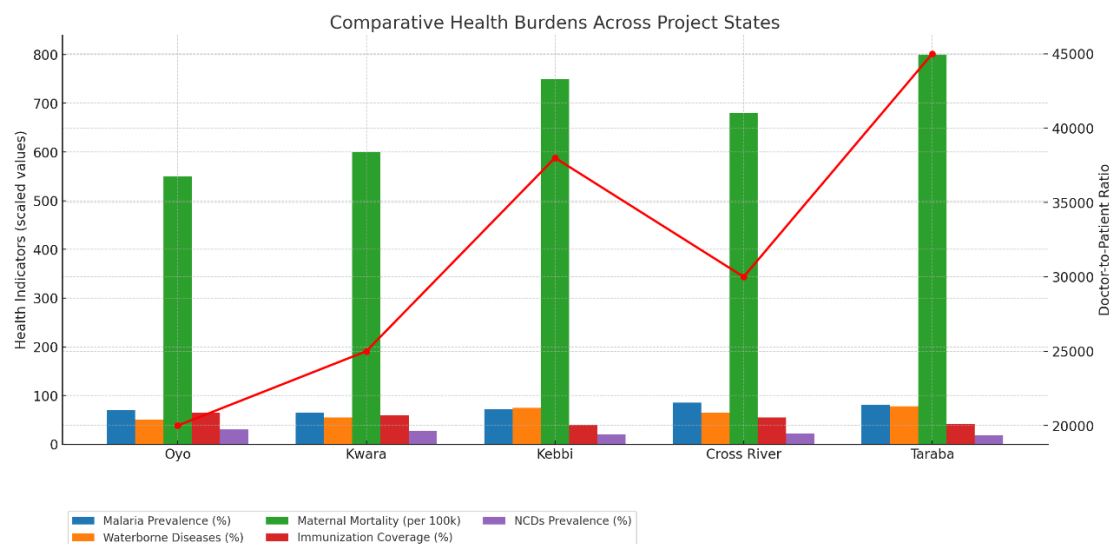


Figure 4.26: Comparative Health Burdens Across Project States

Health Indicators

Available secondary data from State Ministries of Health and the National Health Surveys reveal that health outcomes within the host states are generally poor compared to national averages. Life expectancy in the project communities is estimated at 53–55 years, which falls significantly below Nigeria’s national average of 61 years. This disparity is driven by high prevalence of communicable diseases (particularly malaria and waterborne illnesses), weak healthcare infrastructure, and limited access to quality services.

Immunization coverage across the project states remains low, averaging below 60%, against the national target of >80%. This gap increases the vulnerability of children under five to vaccine-preventable diseases such as measles, polio, and diphtheria, particularly in remote and underserved rural border settlements.

In terms of healthcare workforce, the ratio of health workers to population in the surveyed states remains critically below the WHO benchmark of 1:1,000. In Taraba, the doctor-to-patient ratio is estimated at 1:45,000, while Kebbi reports approximately 1:38,000. Even in Oyo and Kwara, where health infrastructure is comparatively stronger, rural LGAs continue to experience shortages of skilled birth attendants, nurses, and community health extension workers.

These indicators collectively highlight significant public health challenges that may influence the implementation of the surveillance project. Limited access to quality healthcare, low life expectancy, and inadequate immunization coverage not only undermine community

resilience but also pose risks of health-related disruptions to project labor and security operations. Strengthening health systems in project host communities through partnerships with State Ministries of Health and donor-supported interventions (e.g., REA for solar health centers, UNICEF immunization campaigns) will be essential for project sustainability and community acceptance.

4.5 Stakeholders Consultations

Introduction

Stakeholder consultation is a critical element of the socio-economic baseline study and an integral component of the Environmental Impact Assessment (EIA) process. For the Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station, and Port) Security Video Surveillance Solution, the Federal Ministry of Interior recognizes that inclusive, transparent, and participatory consultations are essential for project acceptance, minimizing conflict, and enhancing sustainability.

Consultations created platforms for stakeholders including local communities, government agencies, civil society, and security institutions to access information on the project, express concerns, and suggest mitigation measures. This process fostered trust, improved communication, and strengthened collaborative ownership of the project's objectives.

Objectives of Stakeholder and Community Consultations

The consultations across the host states (Lagos, Oyo, Kwara, Kogi, Enugu, Port Harcourt, Delta, Rivers, Abia, Nasarawa, Plateau, Kebbi, Gombe, Bauchi, Jigawa, Katsina, Sokoto, and Taraba) were guided by the following objectives:

- **Awareness Creation:** To inform stakeholders of the project scope, objectives, and benefits in improving national security and infrastructure protection.
- **Sustaining Communication:** To establish permanent dialogue channels between the Ministry of Interior, project implementers, host communities, and Project Affected Persons (PAPs).
- **Impact Discussions:** To highlight potential socio-economic, cultural, and environmental impacts while providing space for dialogue on mitigation strategies.
- **Documentation of Concerns:** To capture and integrate community inputs into project design and Environmental & Social Management Plans (ESMP).
- **Strengthening Institutional Collaboration:** To engage MDAs, security agencies, NGOs, and CBOs in defining roles for project support and sustainability.
- **Inclusive Participation:** To ensure marginalized groups, women, youth, traditional leaders, and vulnerable groups were adequately represented.

Methods of Consultation

A participatory and multi-method approach was used, including:

1. **Reconnaissance Visits** – for legitimacy-building and initial information sharing.
2. **Community Meetings** – large gatherings led by traditional rulers and local councils.
3. **Key Informant Interviews (KII)** – engagements with LGA chairmen, traditional rulers, women leaders, youth groups, religious leaders, and heads of regulatory/security agencies.

4. Focus Group Discussions (FGDs) – sessions with traders, transporters, farmers, and artisanal groups.
5. Structured Questionnaires/Surveys – to collect demographic, socio-economic, and perception data.
6. Workshops & Institutional Consultations – with FMEnv, NESREA, TCN, Customs, Immigration, NUPRC, NMDPRA, and security agencies responsible for critical infrastructure.

Levels of Consultation

- Primary Stakeholders: Local communities, households near surveillance installations, PAPs, traditional institutions, LGAs, traders' unions, farmers' cooperatives, market associations, and transport unions.
- Secondary Stakeholders: Federal MDAs (FMEnv, NESREA, NUPRC, NMDPRA, Ministry of Power, Ministry of Mines & Steel, Ministry of Transport), state governments, NGOs, CBOs, donor agencies, and international border/security partners.

Project Stakeholders Consulted

Key stakeholders engaged during the consultation process included:

- Federal Government Institutions: FMEnv, NESREA, Ministry of Interior, NUPRC, NMDPRA, Nigeria Ports Authority (NPA), Transmission Company of Nigeria (TCN).
- Security Agencies: Nigerian Immigration Service (NIS), Nigeria Customs Service (NCS), NSCDC, Police, DSS.
- State Ministries & LGAs: Environment, Health, Agriculture, Women Affairs, and Local Government Chairmen across host states.
- Community Institutions: Traditional rulers, clan heads, religious leaders (Imams, Pastors, shrine custodians), youth councils, and women associations.
- Civil Society & NGOs: Border development NGOs, trade associations, cooperative societies, environmental groups.

Consolidated Observations from Stakeholder Engagements

- Railway Corridor States (Lagos, Ibadan, Kano, Abuja, Plateau, Nasarawa, Kogi, Kwara)
Communities emphasized the importance of railway safety given recurrent theft, vandalism, and accidents. Concerns were raised about land acquisition, possible displacement, and security risks from railway trespassing. Stakeholders welcomed surveillance as a means to protect passengers, cargo, and reduce crime.
- Port & Coastal States (Lagos, Rivers, Delta, Cross River, Port Harcourt)
Fishermen and traders expressed concerns about restricted access to fishing waters and port facilities. However, port authorities and unions saw opportunities in reducing smuggling, piracy, and oil theft. Surveillance was strongly supported if linked with improved job opportunities and port security.
- Dam & Power Infrastructure States (Kogi, Niger, Taraba, Gombe, Bauchi, Abuja, Enugu)
Stakeholders identified risks of flooding, displacement, and vandalism of power

stations and dams. Communities around hydropower dams (e.g., Kainji, Jebba, Taraba) requested better compensation frameworks and CSR support. Surveillance was seen as necessary to protect energy assets vital to national development.

- Mining and Oil/Gas States (Delta, Abia, Rivers, Kebbi, Sokoto, Katsina, Jigawa) Mining host communities (Kogi, Kebbi) demanded employment, royalties, and environmental remediation. Oil and gas states (Delta, Rivers, Abia) raised concerns about past neglect by operators and emphasized CSR commitments. Surveillance was welcomed as a deterrent to pipeline vandalism, bunkering, and sabotage.
- Montane & Forest States (Taraba, Cross River, Enugu) Communities in highland and rainforest corridors reported erosion, landslides, and illegal logging as persistent challenges. Traditional leaders requested environmental safeguards to ensure surveillance infrastructure did not exacerbate deforestation or cultural displacement.

Community Perception of the Project

Despite concerns over possible land restrictions, surveillance installations were widely welcomed across all states. Communities and stakeholders believe the project will:

- Improve safety and reduce vandalism, theft, and cross-border crime.
- Strengthen trade security and protect national economic assets.
- Provide temporary job opportunities during construction and operation phases.
- Enhance socio-economic activities through corporate social responsibility (CSR) interventions.

Summary of Issues and Concerns Raised by Stakeholders

- Need for employment opportunities for local residents.
- CSR interventions such as potable water, schools, clinics, and micro-credit support.
- Concerns over land restrictions, farmland loss, and displacement.
- Demand for improved access roads and drainage systems.
- Calls for continuous engagement, grievance redress mechanisms, and fair compensation.

Community Demands

- Youth and women employment opportunities during construction and operations.
- Provision of basic amenities (health centers, boreholes, electricity, schools).
- Rehabilitation of local access roads to ease connectivity.
- Micro-credit schemes for small traders, farmers, and cooperative groups.
- Effective mitigation measures to address environmental, livelihood, and social risks.

Table 4.32: Summary of Stakeholder Consultation Outcomes by Host States

S/N	State / Corridor	Issues Discussed / Concerns Raised	Questions Asked by Stakeholders	Responses Provided	Respondent(s)	Remarks
1	Lagos (Railway, Port & Power Corridor)	Land acquisition & resettlement near ports and railway	Will our houses, shops, and markets be displaced by surveillance towers?	Only minimal land will be acquired; PAPs to be compensated under Land	Ministry of Interior / Consultant	Market leaders demanded transparency in valuation; youth emphasized protection of

EIA for the Proposed Nigeria Internal Security Project Phase II - Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution

				Use Act & FME nv guidelines.		Apapa–Tin Can communities.
2		Port security & livelihoods	Will surveillance restrict fisherfolk and port workers' access?	Surveillance will protect legal fishing and port trade; only illegal smuggling will be curtailed.	NPA / NCS	Fisherfolk requested alternative jetty access; unions welcomed improved port safety.
3	Oyo (Railway & Inland Corridor)	Agricultural livelihoods	Will farmlands near Ibadan–railway alignment be taken?	ROW mapping avoids farmlands where possible; compensation assured where impact is unavoidable.	Project Engineer / Consultant	Farmers requested community involvement in siting.
4	Kwara (Railway & Dam Corridor)	Youth employment	How will local youths benefit directly?	Local youths will be prioritized for surveillance maintenance training and ICT support.	Ministry of Labour / Contractor	Youth groups welcomed ICT skill acquisition.
5	Kebbi (Mining & Power Corridor)	Insecurity and smuggling	Will surveillance reduce cattle rustling and banditry?	Cameras and sensors will monitor illegal movements and support law enforcement.	NSCDC / NIS	Traditional leaders strongly supported, citing high insecurity levels.
6		Mining impacts	How will mining host communities benefit?	CSR programs to include road repairs, water boreholes, and skills training.	NUPRC / Ministry of Mines	Mining cooperatives requested royalties and employment quotas.
7	Cross River (Forest & Border Corridor)	Forest and biodiversity impacts	Will surveillance towers clear forest reserves and cocoa farms?	Minimal vegetation clearance; biodiversity offsets and reforestation included.	Consultant / FME nv	Farmers demanded support for cocoa farmers and community forestry.
8		Health and road access	Will poor road and healthcare facilities be addressed?	Though not core mandate, CSR will consider road maintenance and mobile health outreach.	Project Proponent	Women's groups demanded maternal health interventions.
9	Taraba (Dam, Mining & Montane Corridor)	Erosion and land use	Will tower foundations worsen erosion on mountain slopes?	Civil works will integrate erosion control (retaining walls, drainage).	Project Engineer	Communities accepted but requested monitoring.
10		Gender & vulnerable groups	Will women and IDPs be included?	Gender strategy ensures	Social Specialist	Women leaders requested employment

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				women's inclusion in jobs, micro-credit, and grievance committees.		quotas and market stalls.
11	Delta (Oil, Gas & Port Corridor)	Oil & gas security	Will surveillance reduce oil theft and vandalism?	Yes, installations will integrate with NNPC and NMDPRA monitoring systems.	NNPC / NMDPRA	Host communities requested stronger CSR in education and health.
12		Port access	Will surveillance restrict fishing in Warri/Escravos axis?	Legal fishing unaffected; monitoring will reduce piracy.	Navy / NPA	Fisherfolk supported but requested alternative landing sites.
13	Rivers (Gas, Port & Power Corridor)	Gas flare & pipeline monitoring	Will surveillance reduce vandalism and flare risks?	Integrated systems will track sabotage and flare compliance.	NUPRC / Ministry of Power	Youth groups welcomed; asked for employment quotas.
14	Enugu (Power Corridor)	Transmission line safety	Will surveillance affect electricity ROW farming?	ROW use will continue; installations limited to nodes.	TCN / Consultant	Communities requested compensation for damaged crops.
15	Kogi (Railway, Mining & Power Corridor)	Land acquisition	Will surveillance towers displace farmland along Lokoja-Itakpe corridor?	Minimal farmland impacts; PAPs will be compensated.	Consultant / FMEnv	Farmers requested prompt payment of compensation.
16	Abia (Oil & Gas Corridor)	Livelihoods	How will gas pipeline host communities benefit?	Surveillance will enhance safety; CSR to include water and schools.	Contractor / NUPRC	Communities requested stronger community content.
17	Nasarawa (Railway & Power Corridor)	Employment & safety	Will surveillance create jobs?	Yes, in installation and ICT monitoring.	Contractor / Ministry of Labour	Youth groups requested training centers.
18	Plateau (Mining Corridor)	Environmental impacts	Will mining surveillance affect grazing lands?	Towers sited outside grazing fields; no displacement.	Consultant / Ministry of Mines	Herders requested grazing routes be safeguarded.
19	Gombe & Bauchi (Dam & Power Corridor)	Energy supply & security	Will dams and power plants benefit from surveillance?	Surveillance ensures safety from vandalism and insurgency.	TCN / REA	Farmers asked for irrigation support as CSR.
20	Katsina, Jigawa & Sokoto (Railway & Border-linked Corridor)	Security concerns	Will project reduce cross-border banditry?	Yes, through real-time monitoring and inter-agency alerts.	NSCDC / Military Liaison	Stakeholders strongly welcomed initiative.

The consultation process revealed that while host communities across the project states face deep-rooted socio-economic vulnerabilities including limited access to infrastructure, healthcare, education, and secure livelihoods they broadly perceive the proposed surveillance project as a transformative intervention. Communities recognize its potential to enhance safety, reduce insecurity, protect critical infrastructure, and stimulate local economic activities.

However, stakeholders emphasized that sustained community support will depend on how well the project integrates inclusive engagement, transparent communication, and equitable benefit-sharing mechanisms. Continuous dialogue with community leaders, youth, women, and vulnerable groups will be essential to managing expectations, resolving grievances, and strengthening trust.

Importantly, the consultations underscored that linking the surveillance project with complementary socio-economic benefits such as job creation, local capacity building, social amenities, and Corporate Social Responsibility (CSR) interventions will not only enhance acceptance but also embed the project within the long-term aspirations of the host communities.

CHAPTER FIVE

ASSOCIATED AND POTENTIAL IMPACTS

5.1 Introduction

This chapter presents the assessment of associated and potential impacts of the Proposed Nigeria Internal Security Project Phase II - Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution as described in Chapter 3 of this Report.

The assessment focuses on project interactions with the biophysical, social, and health environments of the project area. It provides an overview of the adopted impact assessment methodology, the outcomes of the initial impact screening exercise, and a detailed evaluation of the identified impacts. Both associated impacts (those certain to occur) and potential impacts (those that could arise under specific conditions) are systematically analyzed.

The adopted impact assessment methodology combines internationally recognized techniques that have been applied and validated in Environmental Impact Assessments (EIAs). These include:

- Checklists for ensuring comprehensive coverage of environmental and social parameters;
- Matrices and flowcharts for identifying cause-effect relationships;
- Networks for mapping interactions among multiple project activities and receptors;
- Mathematical and statistical models for quantitative predictions where data allows; and
- Overlays using maps and Geographic Information Systems (GIS) for spatial analysis of sensitive environmental and social receptors.

This hybrid approach was selected to align with the SCOPE (1979) criteria for EIA methodologies, ensuring that the assessment is:

- Comprehensive, covering all relevant aspects of the environment;
- Selective, focusing on significant issues;
- Exclusive, avoiding duplication and overlap;
- Reliable, by providing confidence limits to predictions;
- Objective, minimizing subjective bias; and
- Interactive, predicting complex cause-effect relationships.

The impact assessment methodology is further detailed in Section 5.2, while the results of the assessment covering construction, operation, and decommissioning phases—are discussed in subsequent sections of this chapter.

5.2 Methodology

This section discusses the overall methodology used to identify, qualify and quantify the impacts of the Proposed Nigeria Internal Security Project Phase II - Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution project on the host environment. The overall methodology comprises five stages (Figure 5-1).

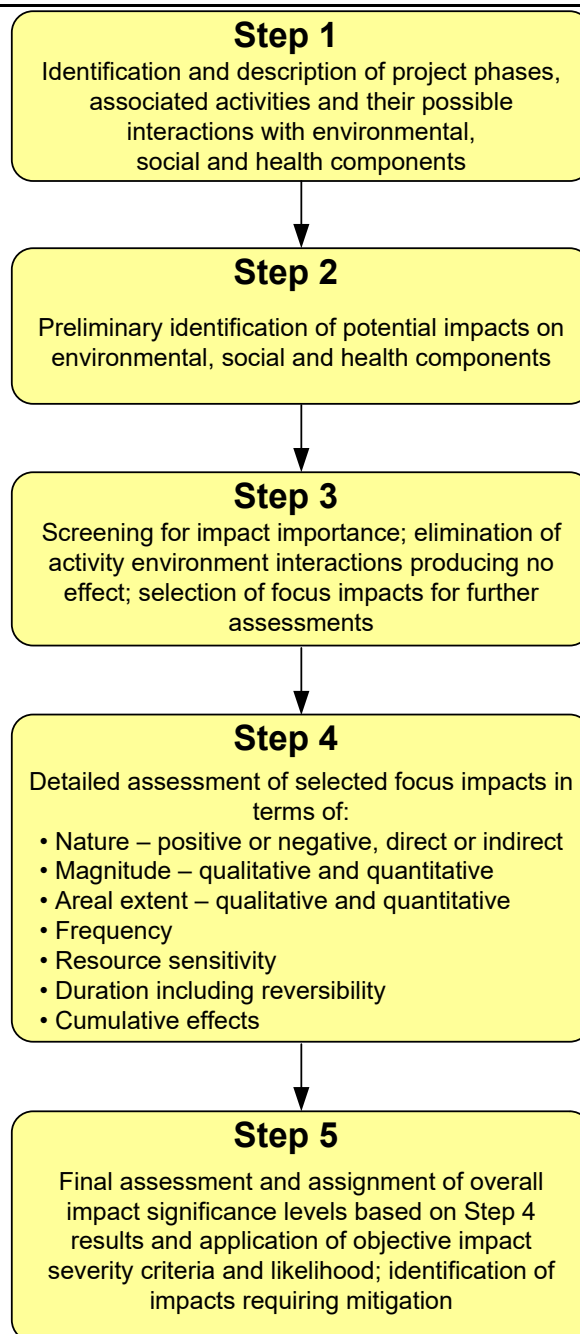


Figure 5 1: Impact Assessment Process

5.2.1 Activities and Affected Media

The impact analysis for the Proposed Nigeria Internal Security Project Phase II - Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution covers the following project phases and associated activities:

- Site Preparation and Clearing: vegetation clearance, minor grading, and access road preparation for surveillance sites.
- Civil and Structural Works: excavation, foundation laying, mast erection, and construction of equipment shelters/control rooms.
- Equipment Installation: mounting of high-definition surveillance cameras, communication towers, solar power units, and associated cabling.

-
- System Integration and Commissioning: configuration of video management systems, connectivity to the Ministry of Interior's command centers, and testing of power and backup systems.
 - Operations and Maintenance: routine surveillance operations, data storage and transmission, maintenance of camera sites, power supply management, and security patrol support.
 - Decommissioning: dismantling of surveillance structures, safe removal of electronic and power equipment, site restoration, and disposal of residual wastes.

For each project phase, the potentially affected environmental media are identified, and the nature of the effects is qualitatively and, where possible, quantitatively described. These include impacts on air quality, soil, water resources, vegetation, wildlife, noise environment, land use, socio-economic systems, and community health and safety.

The schedule of proposed activities also includes estimated labour levels, timelines, and equipment requirements.

To facilitate the impact analysis, individual activities are mapped against their interactions with environmental and social components. However, two cross-cutting areas are emphasized across all phases of the project:

- Wastes and Emissions Handling – covering solid wastes (e.g., packaging, construction debris), e-waste (from equipment replacement), hazardous materials (e.g., batteries, fuels, lubricants), and gaseous/particulate emissions during construction and operation.
- Health and Safety Considerations – encompassing occupational health for workers (e.g., exposure to heights, electrical risks, and equipment handling) and public health for host communities (e.g., noise, security-related disturbances, and electromagnetic exposure concerns).

5.2.2 Preliminary Identification and Screening

In line with recommended impact assessment approaches (FMEnv, 1995; UNEP, 1996; Canter, 1996; DPR 2002, Lohaniet *al.*, 1997) the first level of impact assessment involves the preliminary identification and screening of potential environmental impacts by anticipating activity-environment interactions. This requires a thorough understanding of the project activities (project description), the project setting (the environmental and social characteristics), and the interaction with environmental components. A modified Leopold matrix (Leopold, 1971) was used for the identification and screening. The matrix arrays project activities against environmental (biophysical, social and health) components, and supports a methodical, comprehensive, and objective identification of the impacts that each distinct project activity may have on the biophysical, social, and health components.

Impact identification is based on Wathern (1988), who defines an impact as “having both spatial and temporal components and can be described as the change in an environmental parameter over a specified period within a defined area, resulting from a particular activity compared with the situation which would have occurred had the activity not been initiated”.

To further guide the identification and screening of impacts using the matrix, established environmental impact indicators or indices are developed for each of the environmental

interaction categories. Impact indicators are the observable or measurable parameters of each environmental component that can be directly or indirectly linked to changes in environmental conditions. **Error! Reference source not found.** gives the specific environmental components and sub-elements used and a description of the indicators.

The integrated impact assessment is conducted with consideration of environmental, social and health elements and has therefore utilized procedures specific to each element where applicable. For example, the health aspects considered procedures of Samuel *et al.* (1998) and Commonwealth of Australia (2001) in the approach. In general though, the impact identification and assessment methodology has integrated the procedures into a single approach.

Table 5.1: 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
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
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

Modified Leopold Matrix Screening

The modified Leopold impact matrix (Table 5.2) consists of a horizontal list of biophysical and social environment components that could be affected by the proposed project activities versus a vertical list of project activities, which represent environmental aspects, or “sources of impact,” associated with each sub project phase. Environmental aspects are elements of an activity that can or will interact with the biophysical, social and health conditions within the area of influence.

Entries in the matrix cells represent the nature and ***preliminary*** ranking of the severity of the impact. Ranking of the severity is based on the following scale and symbols:

- Major: 2
- Minor: 1
- Negligible or no effect: - (*a dash*)
- Positive: +

For this preliminary impact assessment stage, the impacts are defined as follows:

- A **Major impact** is one that would affect a large (higher than 40%) amount of a resource and or have a relatively large footprint and persist for a long time or is irreversible.
- A **Minor impact** is one that could either affect a large (as defined above) or moderate (less than 40%) amount of an affected resource, has a mid to long term effect (1 to 10 years) but is most likely reversible.
- A **Negligible impact** is one that may occur but based on experience, available scientific information and expert knowledge will have no measurable effect on the environmental component.
- A **Positive impact** is one that adds a measurable benefit to the immediate and larger project environment including its social, cultural and health dimensions.

All number entries denote negative impacts. Cells with both positive sign (+) and numbers indicate that the specific activity and environment interaction will potentially result in both a positive and negative impact.

All potential impacts, whether likely or unlikely, are also considered at this stage. The likelihood of an impact is further assessed in the *detailed* impact evaluation. The identification and screening of impacts has relied on the following:

- Available knowledge of the project activities;
- Documented impacts of similar projects in similar environments;
- Consultation with experts;
- Discussions with project personnel; and
- Professional judgment.

Spatial boundaries of interactions were decided based on map overlays, specialist knowledge and documented experience of the specific activity-environment interaction.

5.2.3 Detailed Assessment of Impacts

The preliminary identification and screening of environmental impacts resulted in a group of focus impacts (impacts ranked 1 and 2), which were further assessed in terms of severity and significance. Impact severity and significance criteria used at this next stage relied on a number of resources and tools including the following:

- Federal Ministry of Environment (FMEnv) EIA Guidelines;
- Overlaying project components on maps of existing conditions to identify potential impact areas and issues;
- Environmental Baseline Studies conducted specifically for this project;
- Consultation with Nigerian experts and residents;
- Experience from similar projects in Nigeria and worldwide;
- Discussion with design contractors and project engineers;
- Published and unpublished documents (such as *The World Bank Environmental Assessment Sourcebook*, relevant IFC Performance Standards, and other authoritative texts on performing environmental impact assessments) providing guidance on performing impact analysis for industrial development activities;
- UNEP EIA Training Resources Manual (1996); and
- European Commission Guidance on EIA/EIS Review (*European Commission, 2001*).

The impact assessment approach applied to the Nigeria Internal Security Project Phase II - Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution Project also incorporates additional impact quantification steps.

Table 5.1: Screening Matrix for Potential Impacts (Biophysical and Social Impacts)

Table 5.1: Screening Matrix for Potential Impacts (Biophysical and Social Impacts)																			
PROJECT PHASES AND ACTIVITIES	Biophysical Impact Indicators											Social Impact Indicators							
	Geology / Topography	Soil	Surface Water	Hydrobiology and Fisheries	Vegetation	Wildlife	Air /Radiation	Vibration and Noise	Aesthetics	Groundwater	Sediments	Population	Infrastructure	Macro and micro economy	Social and Cultural Structure	Physical and Economic Displacement	Cultural and Archaeological	Transportation	Education
Clearing and Site Excavation Activities																			
Physical Presence of Workers, Equipment and Materials on Site	-	1	1	-	-	-	-	1	-	1	-	1	1	1	1	2	1	1	1
Transportation of Workers and Materials	-	-	1	1	-	-	1	-	-	-	-	-	-	+, 1	-	+, 1	-	1	-
Site Clearing	-	1	1	1	2	2	1	1	-	-	-	-	-	+	1	1	1	1	-
Excavation	2	-	2	2	-	-	1	1	-	-	2	-	-	2	-	2	-	1	-
Wastes and Emissions Handling and Disposal	2	1	2	2	2	1	1	1	-	-	2	-	1	2	-	2	-	-	-
Onsite Construction Works																			
Physical Presence of Workers, Equipment and Materials on site	-	-	1	1	-	-	1	1	-	1	1	1	1	+, 1	1	1	1	-	1
Transportation of Workers and Materials	-	-	1	1	-	-	1	1	-	-	-	-	-	+, 1	-	1	-	1	-
Wastes and Emissions Handling and Disposal	-	1	1	1	-	-	1	-	-	1	1	-	-	+, -	-	-	-	-	-
Construction Activities																			

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Tower Construction	1	1	-	-	2	-	1	1	-	-	-	-	-	+, 1	-	1	1	1	1
Civil Works	-	-	1	1	-	-	1	1	-	1	-	-	-	+, 1	-	-	-	-	1
Installation, Hook Up and Commissioning																			
Operations																			
Equipment Operations	-	-	-	-	-	-	2	2	2	1	1	-	+	+	-	+	-	-	+
Wastes and Emissions Handling and Disposal	-	-	1	1	-	-	2	2	-	-	-	-	1	+	-	-	-	-	-
Decommissioning																			
Removal of Installed Facilities	1	1	1	1	1	-	1	1	-	1	1	-	-	+, 1	-	+,1	-	+, 1	-
Wastes and Emissions Handling and Disposal	-	1	1	1	-	-	1	1	-	1	1	-	-	+, 1	-	+,1	-	-	-

5.2.3.1 Impact Severity Evaluation

During detailed assessment, five criteria were used to assess the severity of the environmental (biophysical, social, and health) impacts that were not screened out in the earlier steps.

The severity criteria set forth in this section are applicable to all types of impacts identified, including impacts that can be expected from the project and impacts resulting from emergencies. Several types of potential consequences (or impacts) were considered for all project stages where applicable:

- Biological and physical environment
- Social environment
- Health and Safety of the public or workers

The detailed assessment of impacts involved evaluating the potential effects of project activities on the impact indicators but in greater detail. Impacts were assessed as to whether they are positive (beneficial) or negative (detrimental). Only negative impacts were given detailed assessment.

5.2.3.2 Evaluation Criteria

Five impact severity evaluation criteria were applied in this study: Magnitude, Duration, Frequency, Areal Extent, and Sensitivity of the Receptor. Within these five criteria, impacts were also evaluated as to whether they might result in cumulative effects or indirect (secondary) effects. The overall impact evaluation considers not only the potential severity of the impact but also the likelihood of its occurrence.

Note that characterization of an impact includes the criteria for negligible. This would be applied when an impact characteristic either does not apply or when it is so low so as not to be noticed. In general, impact effects need to be observed to pass the initial screening but negligible is used in some instances and a negligible rating would be considered in deriving the overall impact severity. The term is omitted from the impact assessment matrix table that follow this section, but the criteria are described in the preceding text.

The following describes the severity rating criteria.

Magnitude

Magnitude is defined as the quantitative intensity of the impact, and 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; easily observable and measurable effect
- Medium - moderate amount of the resource or population is affected; generally measurable and observable effect
- Low – small amount of the resource or population is affected; low magnitude impact may be within the range of normal variation of background conditions
- Negligible – amount of resource or population affected is unnoticeable or immeasurably small

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

Duration

Duration is defined as the time that is estimated for a population or resource to return to baseline conditions (i.e., before the impact). The duration is calculated from the time the impact begins, which may coincide with the start of the activity that causes the impact. The duration of an impact is characterized as follows:

- High – long-term impact (recovery would not occur within ten years)
- Medium – moderate-term impact (recovery time between one year and ten years)
- Low – short-term impact (recovery time within or less than one year)
- Negligible – impact or recovery time is very short or immediate

Characterization of the duration of an impact as low, medium, or high includes consideration of the degree of reversibility of the impact. Impacts for which the duration is classified as high, as defined above, are considered irreversible impacts.

Frequency

Frequency is defined as the number of times an impact is expected to occur over the life of the project. The frequency of an impact is characterized as follows:

- High – impact will occur continuously throughout the life of the project (e.g., continuous process wastewater discharge)
- Medium – impact will occur intermittently over the life of the project (e.g., blow down, flaring and venting)
- Low - impact will occur rarely or a very limited number of times (e.g., construction impacts)

There is no “negligible” category for frequency because impacts with no frequency would not occur, and were screened out.

Extent

Areal Extent refers to the potential geographic range of an impact, and may be quantified in units of area affected (e.g., hectares). The areal extent is characterized as follows:

- High – impact has influence well beyond the project environment to the regional or even global environment
- Medium – impact limited to the general vicinity of the project site or study area
- Low – impact limited to the immediate area of the activity or occurrence
- Negligible – impact limited to a very small part of the activity area

Sensitivity

Sensitivity refers to economic, social, and/or environmental/ecological relevance of the receptor, including the intrinsic sensitivity of the resource, reliance on the receptor 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., fresh water resources and mangroves).
- 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.

5.2.3.3 Impact Significance

The following section describes the method by which the overall impact severity rating and associated impact significance is derived.

Impact Severity Rating

To reach an overall impact severity rating for each impact assessed, the five impact severity criteria above are aggregated using impact severity matrices. Aggregation is at three levels. First, magnitude and areal extent are combined to arrive at a rating for the Impact Quantum while duration and frequency are aggregated to give the overall Temporal Effects. Impact Quantum and Temporal Effects are then combined and their resulting aggregate assessed in terms of sensitivity to arrive at the overall impact severity. Table 5.3, Table 5.4, and Table 5.5 show the aggregation process.

Impact Likelihood

To further assess the significance of the severity associated with each potential negative impact identified in the previous section, a likelihood criterion is applied to each negative impact. The likelihood criteria are used to determine whether negative impacts can be prevented or mitigated or if they are unavoidable.

It should be noted that the likelihood criteria are applied to the likelihood of the impact occurring and not of the activity occurring. Thus the overall severity rating (significance) of a negative environmental impact is a function of its severity as earlier defined and the likelihood of occurrence as defined in the table. For example, a moderate impact that has a high likelihood of occurrence would be more severe than a major impact with a very low likelihood of occurrence. Assigning a significance ranking and a likelihood ranking to each impact allows for semi-quantitative evaluation of the severity of the impact. The colour coded

impact severity matrix presented in (Table 5.6) illustrates the application of the impact severity and likelihood. The likelihood ranking is placed in the y-axis and the impact significance ranking in the x-axis. The colour codes are also used in the text discussing each impact assessed using this method.

Overall Impact Significance

The overall impact significance level is indicated by the position on the impact significance matrix. For example, impacts placed within the red boxes have a high likelihood of occurrence and serious consequence; thus they have a high significance rating. These high-significance impacts become high priority for further evaluation or management action (e.g., design change or mitigation). Impacts in the yellow category are moderate impacts, with medium priority; impacts in green boxes are lower priority. Impacts identified by the white boxes indicate positive or beneficial impacts. The criteria and severity matrix set forth in this section are applicable to all the types of events and impacts identified.

The criteria are summarized in Table 5.3.

Table 5.3: Impact Assessment of Spatial Effects

SPATIAL EFFECTS			
Magnitude	Areal Extent		
	Low	Medium	High
Low	Low	Medium	Medium
Medium	Low	Medium	High
High	Medium	High	High

Table 5.4: Impact Assessment of Temporal Effects

TEMPORAL EFFECTS			
Frequency	Duration		
	Low	Medium	High
Low	Low	Low	Medium
Medium	Low	Medium	High
High	Medium	High	High

Table 5.5: Impact Assessment of Combined Spatial and Temporal Effects

COMBINED SPATIAL AND TEMPORAL EFFECTS			
TEMPORAL EFFECTS	SPATIAL EFFECTS		
	Low	Medium	High
Low	Low	Low	Medium
Medium	Low	Medium	High

High	Medium	High	High
------	--------	------	------

Table 5.6: Overall Impact Assessment Severity (Combined Spatial and Temporal Effects and Sensitivity)

IMPACT ASSESSMENT AND SENSITIVITY			
SENSITIVITY	COMBINED SPATIAL AND TEMPORAL EFFECTS		
	Low	Medium	High
Low	Minor	Minor	Moderate
Medium	Minor	Moderate	Major
High	Moderate	Major	Major

Table 5.7: Overall Impact Significance

OVERALL SIGNIFICANCE				
LIKELIHOOD	SEVERITY			
	Positive	Minor	Moderate	Major
Low	BENEFICIAL	LOW	LOW	MODERATE
Medium	BENEFICIAL	LOW	MODERATE	HIGH
High	BENEFICIAL	MODERATE	HIGH	HIGH

Table 5.8: Summary of Impact Severity

	SPATIAL EFFECTS		TEMPORAL EFFECTS		SENSITIVITY	LIKELIHOOD
	Magnitude	Areal Extent	Frequency	Duration	Receptor	Likelihood
High	Large amount of resource or population affected; easily measurable; or greater than the quantitative or semi-quantitative criteria	Impact to the national, regional, or global environment	Impact will occur continuously throughout the life of the project	Impact is long-term; recovery would not occur within ten years	Receptor is of high economic, social, and/or environmental relevance; has very high intrinsic sensitivity	Impact is likely to occur during normal operations (i.e., greater than 70% likelihood of occurring or has been known to result routinely, though not necessarily in all similar circumstances)
Medium	Moderate amount of resource or population affected; generally measurable or observable; or at the quantitative or semi-quantitative criteria	Impact to the general vicinity of the project site or study area	Impact will occur intermittently over the life of the project	Impact is moderate-term and recovery will occur between one year and ten years	Receptor is of moderate economic, social, and/or environmental relevance; has moderate intrinsic sensitivity	Impact could occur infrequently during construction or normal operations, but could occur more readily if safeguards and controls breakdown (i.e., between approximately 20% to 70% likelihood of occurring or impact has been known to result in similar circumstances)
Low	Small amount of resource or population affected; or less than the quantitative or semi-quantitative criteria; may be in the range of normal	Impact limited to the immediate vicinity of the activity or occurrence	Impact will rarely occur or will occur on a limited number or occasions	Impact is short-term and recovery will occur in less than one year	Receptor is of low economic, social, and/or environmental relevance; has low intrinsic sensitivity.	Impact highly unlikely, given the controls in place (i.e., between approximately 2% to 20% likelihood of occurring or impact has been known to result, but only very rarely, in similar circumstances)
Negligible	Amount of resource or population affected is unnoticeable or immeasurably small; or impact not detected or at background conditions	Impact limited to a very small part of the activity area	Impact never occurs or impact is not possible	Impact is very short term and recovery is nearly immediate	Receptor is not of economic, social, and/or environmental relevance; has no sensitivity to impact	Impact has approximately less than 2% likelihood of occurring; impact unknown to have previously occurred in similar circumstances

5.2.4 Project Associated and Potential Impacts

The associated (i.e., known) and potential impacts discussed in the following sections are those activity–environment interactions in the impact matrix that have been scored as significant (entries of “1”, “2”, or “+”) and were therefore not screened out during preliminary evaluation.

For clarity and to avoid repetition, the detailed discussion of impacts is presented under project phases and key activities. Impact identification prefixes have been assigned to each impact discussion for ease of reference. Impacts are grouped into two major phases:

Pre-Operations Impacts

These are impacts that occur prior to the commissioning and operation of the surveillance system. Project activities under pre-operations include:

- **PP** = Physical Presence of Workers, Equipment, and Machinery
- **TR** = Transportation of Materials and Workers to Site
- **SC** = Site Clearing and Preparation
- **CS** = Civil and Structural Works (mast foundations, shelters, and control rooms)
- **EI** = Equipment Installation (cameras, masts, solar units, batteries, and communication hardware)
- **IC** = Integration and Commissioning of Surveillance Systems
- **WE** = Wastes and Emissions Handling and Disposal

Operations Impacts

These are impacts that arise during the functional lifespan of the surveillance infrastructure. Project activities under this phase include:

- **OM** = Operations and Routine Maintenance
- **VS** = Video Surveillance Activities (monitoring, data storage, and transmission)
- **PS** = Power Supply and Backup Systems (solar arrays, batteries, and auxiliary generators)
- **WE** = Wastes and Emissions Handling and Disposal (including e-waste from equipment replacement)

Cross-Cutting Beneficial and Health Impacts

Beneficial (positive) and health-related impacts are considered in the context of the entire project, spanning both pre-operations and operations phases. Their prefixes are:

- **B** = Beneficial Impacts (e.g., job creation, enhanced security, improved local commerce, and infrastructure development)
- **H** = Health Impacts (e.g., occupational health risks, community health and safety concerns, and improved security-related wellbeing)

Other project–environment interactions and associated or potential negative impacts that are peculiar to individual activities are discussed under the relevant project activity headings.

The following sections and tables present the identified positive and negative impacts of the Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution Project activities. Positive impacts largely relate to increased employment opportunities, enhanced security, deterrence of crimes, and improved socio-

economic stability. Negative impacts are mainly linked to construction disturbances, waste generation, occupational hazards, and potential community concerns.

5.3 Project Beneficial (Positive) Impacts

The Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution Project will generate a range of beneficial impacts within the host environment. Most of these positive impacts will affect the social, economic, and health characteristics of the communities and surrounding regions.

5.3.1 Increase in Income from Transportation (B1)

During project implementation, workers, equipment, and materials will be transported to and from surveillance sites at critical infrastructure locations such as railways, dams, gas and mining facilities, power stations, and ports. Nigerian-owned haulage and local transport companies are expected to benefit directly from the increased demand for logistics and mobility services generated by the project. While precise income projections cannot currently be determined, it is anticipated that over 95% of transport services will be provided by Nigerian operators, creating employment opportunities for drivers, logistics personnel, and support workers within and around the project areas

5.3.2 Increase in Income from Employment (B2)

The project will create substantial employment opportunities for Nigerians across the construction, installation, and operational phases at railway corridors, dams, gas and mining facilities, power stations, and ports. Jobs will span skilled, semi-skilled, and unskilled categories, including civil works, ICT support, equipment installation, and security services. Priority will be given to local contractors and national workers, while expatriates will provide only specialized technical expertise. The project is expected to generate direct and indirect jobs during implementation and sustain long-term employment opportunities throughout its operational phase.

5.3.3 Project-Supporting Income Generating Service Activities (B3)

The project will stimulate diverse support services and small-scale enterprises around critical infrastructure sites. Local businesses are expected to provide goods and services such as catering, accommodation, cleaning, security, and waste management. Additional opportunities will emerge in transportation support, communication services, and the supply of construction materials, thereby boosting local commerce and strengthening economic linkages in host communities.

5.3.4 Increased Trading of Local and National Materials (B4)

The implementation of the surveillance project will require large volumes of raw materials, equipment, and consumables. Construction inputs such as cement, sand, gravel, electrical fittings, steel, batteries, and solar units will be sourced primarily from local and national suppliers. In addition, food, office supplies, and other consumables will be procured from nearby towns and cities. The influx of workers and contractors will stimulate commercial activity and significantly expand trading opportunities around project sites and adjoining urban centers.

5.3.5 Skills Acquisition and Training for Workers from Local Communities (B5)

The project will provide opportunities for workers recruited from host communities to acquire valuable vocational skills and technical training. Areas of capacity development will include equipment installation, electrical works, ICT system maintenance, solar power operations, and workplace health and safety practices. These skills will enhance employability, promote workforce development, and empower local workers to participate in future infrastructure and ICT-driven projects beyond the life cycle of this initiative.

5.3.6 Enhanced Security and Protection of Critical Infrastructure (B6)

The most significant positive impact of the project is the enhanced protection of Nigeria's critical infrastructure through advanced surveillance systems. The deployment of high-definition cameras, intelligent monitoring platforms, and real-time data integration will help safeguard railways, dams, gas and mining facilities, power stations, and ports from vandalism, sabotage, theft, and terrorism. This system will deter criminal activities, improve operational safety, and strengthen national resilience. Host communities and the wider economy will benefit from improved security, uninterrupted infrastructure services, and increased investor confidence in Nigeria's critical assets.

5.3.7 Improved Quality of Life (B7)

Enhancing security and creating wider socio-economic opportunities, the project will significantly improve the quality of life in host communities. Safer environments, stable livelihoods, and increased commercial activities will help reduce poverty and social vulnerability. In addition, indirect benefits such as better infrastructure, more reliable power supply, and community-focused investments arising from the project's presence will foster inclusive growth and support long-term sustainable development across affected regions.

5.3.8 Better Social Inclusion (B8)

Communities located around critical infrastructure sites often face marginalization due to remoteness and inadequate access to national development opportunities. This project will help bridge such gaps by integrating these communities into national security and ICT networks. Strengthened surveillance and improved safety will foster an enabling environment for investment, attract new business opportunities, and promote social inclusion, while also supporting stronger cooperation between communities and government institutions.

Table 5.9: Summary of Positive and Negative Impacts of the Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution Project

Impact ID	Project Phase / Activity	Impact Category	Description of Environmental / Social Impact	Impact Significance
B1	All Phases	Positive Impact	Increased income from transportation of workers, equipment, and materials to surveillance sites.	Beneficial
B2	All Phases	Positive Impact	Employment generation for skilled, semi-skilled, and unskilled workers during construction, installation, and operations.	Beneficial
B3	All Phases	Positive Impact	Opportunities for income-generating support services (catering, security, accommodation, waste management, etc.).	Beneficial
B4	All Phases	Positive Impact	Increased trading of local and national construction materials, ICT equipment, and consumables.	Beneficial
B5	All Phases	Positive Impact	Skills acquisition and technical training in ICT, surveillance systems, solar power, and electrical works.	Beneficial
B6	Operations	Positive Impact	Enhanced Critical Infrastructure security, deterrence of smuggling, trafficking, and Critical Infrastructure crimes.	Beneficial
B7	Operations	Positive Impact	Improved quality of life from safer communities, stable commerce, and social development.	Beneficial
B8	All Phases	Positive Impact	Better social inclusion by integrating Critical Infrastructure communities into national infrastructure and development.	Beneficial
PP1	Pre-Operations – Physical Presence of Workers/Equipment	Social	Pressure on existing infrastructure (roads, housing, utilities).	Moderate
PP2	Pre-Operations – Physical Presence	Economic	Temporary inflation, disruption of local trade patterns.	Moderate
PP3	Pre-Operations – Physical Presence	Socio-cultural	Impacts on local customs, community relations, and security perception.	Moderate
SC1	Pre-Operations – Site Clearing and Excavation	Biophysical	Loss of vegetation, soil disturbance, and habitat alteration.	Moderate
SC2	Pre-Operations – Site Clearing	Biophysical	Noise, dust, and vibration from earthworks and equipment.	Low
SC3	Pre-Operations – Site	Social	Possible land acquisition, displacement of small farms/structures.	Moderate

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	Clearing			
EI1	Pre-Operations – Equipment Installation	Biophysical	Temporary visual intrusion from towers/masts.	Low
EI2	Pre-Operations – Equipment Installation	Biophysical	Risk of soil and water contamination from fuel, lubricants, and chemicals.	Moderate
WE1	Pre-Operations – Waste and Emissions	Pollution	Generation of solid wastes (packaging, scrap metal, plastics).	Moderate
WE2	All Phases – Waste and Emissions	Pollution	E-waste and hazardous waste from batteries, solar panels, and electronic parts.	Moderate
OM1	Operations – Surveillance Activities	Biophysical	Visual impacts of camera masts/towers on landscape.	Low
OM2	Operations – Surveillance Activities	Health	Concerns over electromagnetic exposure from communication equipment.	Low
OM3	Operations – Power Systems	Pollution	Minor air/noise emissions from backup generators.	Low
OM4	Operations – Maintenance	Pollution	Waste generation from faulty/obsolete surveillance equipment.	Moderate
H1	All Phases	Health	Risks from poor sanitation, solid waste, and dust exposure.	Moderate
H2	Pre-Operations / Operations	Health	Communicable diseases linked to labour influx (HIV, malaria, etc.).	Moderate
H3	Pre-Operations / Operations	Health	Occupational accidents (heights, electrocution, machinery).	High
H4	Operations	Health	Road safety risks from increased traffic and transport of equipment.	Moderate
H5	Operations	Health	Psychosocial stress in communities due to heightened military/security presence.	Low
CM1	All Phases	Cumulative	Land take for multiple surveillance sites at Critical Infrastructure	Low
CM2	All Phases	Cumulative	Increased pressure on transport systems, housing, and services.	Moderate
D1	Decommissioning	Social	Loss of jobs and income from project activities.	Moderate
D2	Decommissioning	Biophysical	Risks from improper dismantling and disposal of towers, batteries, and e-waste.	Moderate
D3	Decommissioning	Biophysical	Land restoration and remediation challenges after dismantling.	Moderate

5.4 Project Negative Impacts

5.4.1 Impacts Associated with Physical Presence of Workers and Equipment (PP)

During construction and installation, temporary base camps will be established at selected critical infrastructure sites to support site preparation, mast erection, equipment installation, and associated civil works. These camps will include prefabricated shelters, storage facilities, and small workshops. While some workers will reside within the camps, others will be accommodated in nearby host communities and towns. Inevitably, the project will also attract an influx of job seekers and camp followers, drawn by the prospects of employment and increased commercial activities, which may place additional pressure on local resources, infrastructure, and social services.

5.4.1.1 Impact on Infrastructure (PP1)

The mobilization of workers and job seekers during the pre-operation phase will place significant pressure on existing infrastructure around project sites. Housing demand is expected to rise sharply, with many local residents leasing accommodation to migrants, which may cause temporary rental inflation. Increased traffic from construction vehicles and worker movements will intensify wear on already inadequate road networks, while limited health facilities, schools, and markets may become overstretched.

For this surveillance project, pre-operation activities are projected to engage between 250 and 300 workers for site clearing, civil works, mast erection, equipment installation, and commissioning, though not all will be present at once. It is anticipated that for every direct worker, at least one dependent or job seeker may migrate into the area, leading to a potential influx of 500–600 people. With 70–80% of the workforce expected to be migrants, host communities could experience population increases of up to 5%, particularly in smaller settlements (1,000–10,000 people).

- Magnitude of Impact: Medium – given the scale of influx relative to host communities.
- Areal Extent: Low – confined to host and adjoining settlements.
- Frequency: Medium – intermittent during construction and installation.
- Duration: Long-term – as some migrants may remain post-project, sustaining pressure on infrastructure.
- Sensitivity of Receptor: Medium – due to weak infrastructure and low community resilience.
- Overall Impact Severity: Moderate
- Impact Likelihood: Medium
- Impact Significance: Moderate

5.4.1.2 Impact on Micro and Macro Economy (PP2)

The physical presence of workers during site preparation, mast foundation works, civil construction, and installation together with the influx of job seekers and support enterprises will stimulate both micro and macroeconomic activity within host and nearby communities. Increased demand for food, accommodation, healthcare, transport, and general supplies will create income opportunities for traders, artisans, transport operators, and service providers.

Local recruitment of labour will inject disposable income into rural economies, providing a temporary boost to household welfare.

At the macroeconomic level, national suppliers of construction materials, ICT equipment, and energy systems (e.g., solar panels, batteries, generators) will also benefit, enhancing backward linkages to Nigeria's manufacturing and service sectors.

However, this growth will not be without risks. Short-term inflationary pressures on essential commodities particularly food, fuel, medicine, and housing are likely, disproportionately affecting vulnerable groups not directly employed by the project. Furthermore, a "boom–bust" cycle may occur: once installation and pre-operation works end, many temporary jobs and income flows will cease. For communities where a large proportion of residents live below the poverty line (earning less than ₦10,000/month), the higher wages from project employment could encourage unsustainable lifestyle changes and increased financial obligations, resulting in frustration, income shocks, or local tensions when demobilization occurs.

- Areal Extent: Low – confined to host and adjoining communities.
- Frequency: Medium – recurring throughout the 12–14-month pre-operation and installation phase.
- Duration: Medium – with some residual effects persisting post-construction.
- Sensitivity of Receptor (Local Economy): High – due to low-income levels and vulnerability to price instability.
- Overall Impact Severity: Moderate
- Impact Likelihood: Medium
- Overall Impact Significance: Moderate

5.4.1.3 Social and Cultural Structure (PP3)

During the pre-operations phase of the Critical Infrastructure Security Video Surveillance Project, temporary base camps will be established to accommodate workers and provide support facilities for mast erection, equipment installation, and civil works. This may trigger a population increase of up to 5% in some host communities surrounding railway lines, dams, mining sites, power stations, and port corridors.

Given that the majority of workers and economic migrants are expected to be male, the influx could alter the gender balance in these communities, affecting the existing social fabric. Increased disposable income among workers may fuel social issues such as prostitution, petty crime, and substance abuse. These risks include a rise in sexually transmitted diseases (STDs), including HIV/AIDS, and a gradual erosion of traditional community value systems. The emergence of new income streams, particularly among young workers, may challenge traditional authority structures and create intergenerational tensions, as financial independence shifts local power dynamics. Housing disparities may further exacerbate these tensions: while about 10% of housing in project areas remains rudimentary, worker camps will have potable water, electricity, and organized facilities, creating visible inequalities that could foster resentment or conflict between locals and project staff.

- Magnitude of Impact: Low – due to the relatively small population influx, though socially sensitive.
- Areal Extent: Low – limited to host and adjacent communities near project corridors.

- Frequency: Medium – likely to occur intermittently during pre-operations.
- Duration: Long-term – as migrants may remain and higher standards of living reshape community expectations.
- Sensitivity of Receptor (Social and Cultural Systems): Medium – reflecting fragile traditional structures and socio-economic vulnerabilities.
- Overall Impact Severity: Moderate
- Impact Likelihood: Medium
- Impact Significance: Medium

5.4.1.4 Cultural and Archaeological Resources (PP4)

In many of the host communities, cultural and religious resources such as shrines, sacred forests, and burial grounds remain highly valued and protected. While Christianity and Islam dominate across the project areas, traditional practices still persist, particularly in rural and indigenous settlements. Burial sites, in particular, are regarded as sacred heritage and central to communal identity.

The influx of non-local workers and migrants during construction and installation poses a risk of inadvertent cultural insensitivity. Unfamiliarity with local customs may result in unauthorized entry into shrines, disruption of sacred grounds, or disregard for burial sites, which communities could interpret as desecration. Such incidents, even if isolated, may provoke social tension, mistrust, or conflict between project stakeholders and host communities.

Construction activities such as site clearing, staging of equipment, and access road construction also carry the risk of disturbing undocumented cultural or archaeological resources. Although the overall footprint of the project is small and most surveillance sites are sited away from major settlements, the potential impacts on cultural heritage remain significant if due diligence and community engagement are not strictly observed.

- Magnitude of Impact: Low – since shrines and burial sites are not widespread across all host locations.
- Areal Extent: Low – impacts will be localized to communities with cultural or archaeological resources.
- Frequency: Intermittent – possible during worker presence and site preparation.
- Duration: High – as damage to cultural or religious sites is irreversible.
- Sensitivity of Receptor (Cultural/Archaeological Resources): High – due to their cultural, religious, and spiritual significance.
- Impact Severity: Moderate
- Impact Likelihood: Low – given that communities typically safeguard sacred sites and cultural awareness measures can reduce risks.
- Overall Impact Significance: Low

5.4.1.5 Impact on Education (PP5)

During site preparation, mast erection, and construction activities for surveillance systems at railway corridors, dams, mining sites, power stations, and ports, direct and indirect job opportunities will emerge for semi-skilled and unskilled workers, particularly youths aged 15 and above. These opportunities, offering higher wages than local alternatives such as

farming, petty trading, or artisanal labour, may attract school-aged youths and young adults from host communities.

While this could temporarily boost household incomes, there is a risk that some students especially those in secondary schools may suspend or abandon their education to pursue short-term employment or related commercial activities. Exposure to quick income could also increase vulnerability to negative social behaviours such as petty theft, gambling, and transactional sex.

This concern is heightened by existing weaknesses in educational infrastructure across many host communities. Overcrowded classrooms, limited teachers, and inadequate learning resources already constrain educational outcomes. Any diversion of students into project labour could worsen these conditions, potentially diminishing long-term human capital development.

- Magnitude of Impact: Low – given the relatively limited workforce requirements.
- Areal Extent: Low – restricted to host communities around project corridors.
- Frequency: Low – mainly during pre-operation and construction activities.
- Duration: High – impacts could be long-term if students permanently withdraw from school.
- Sensitivity of Receptor (Education System): Low – as cultural value for education and government free-basic education policies encourages continued enrollment.
- Overall Impact Severity: Moderate
- Impact Likelihood: Low – since parental emphasis on education and additional household income from project wages may also support school fees and reduce dropout risks.
- Overall Impact Significance: Low

5.4.1.6 Impact on Groundwater Quality (PP6)

The establishment of temporary base camps, storage yards, and the use of heavy machinery during site preparation, foundation works, and mast erection for surveillance infrastructure around railways, dams, mining sites, power stations, and ports could pose risks to groundwater quality. Baseline studies show that many host communities depend on shallow hand-dug wells and boreholes, with groundwater tables often less than 2 m deep and soils highly permeable. This raises vulnerability to contamination from construction-related activities.

Potential contamination pathways include:

- Oil and grease wash-off from construction equipment and vehicles;
- Accidental spills of fuels, lubricants, or hydraulic fluids during storage, transfer, or refuelling;
- Poor management of domestic wastewater and sewage from worker camps;
- Leaching of cement slurry, concrete wash water, or other construction residues into surrounding soils.

Although the quantities of hazardous materials stored on-site are expected to be small and managed under standard protocols, even localized spills can significantly affect groundwater used for domestic supply. Given the reliance of project communities on groundwater for drinking and household needs, the sensitivity of receptors is considered high.

- Magnitude of Impact: Low – due to limited volumes of hazardous materials expected.
- Areal Extent: Low – confined to immediate construction sites and nearby water points.
- Frequency: Medium – potential for intermittent incidents during active construction.
- Duration: High – hydrocarbon or chemical contamination could persist long-term in aquifers.
- Sensitivity of Receptor (Groundwater): High – as groundwater is the primary source of potable water in host communities.
- Impact Severity: Moderate
- Impact Likelihood: Medium
- Overall Impact Significance: Moderate

5.4.1.7 Impact on Transportation (TR1)

During the pre-operations phase of the Critical Infrastructure Security Video Surveillance Project, there will be a significant increase in the transportation of workers, surveillance equipment, steel masts, solar panels, batteries, ICT systems, and construction materials to railway corridors, dam sites, mining areas, power stations, and ports. Movement will occur along federal highways, access routes into project sites, and secondary community roads linking settlements to installation points. In port and dam environments, waterway transport may also be required to move equipment and personnel.

The rise in vehicular traffic, including heavy-duty trucks carrying masts and equipment, buses conveying workers, and vans transporting supplies, is expected to affect local mobility and safety. In specific areas, limited boat traffic may also increase to support transport of materials to difficult-to-reach sites.

Potential negative effects include:

- Traffic congestion on narrow or poorly maintained community and access roads;
- Longer commuting times for residents, traders, and transport users;
- Higher risk of road and waterway accidents due to increased vehicle and boat traffic;
- Accelerated wear and tear of access roads from heavy-duty trucks and frequent trips.
- Magnitude of Impact: Medium – as traffic could increase by 30–40% above baseline levels.
- Areal Extent: Low – limited to roads and waterways serving the project sites.
- Frequency: Medium – intermittent throughout site clearing, foundation works, and installation.
- Duration: Low – short-term, as traffic volumes will normalize after construction.
- Sensitivity of Receptor (Transport Network): Medium – due to reliance on limited and often poorly maintained transport infrastructure.
- Impact Severity: Minor
- Impact Likelihood: Medium – traffic increases are expected.
- Overall Impact Significance: Low

5.4.2 Impacts of Site Clearing / Preparation Activities (SC)

The implementation of the Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station, and Port) Security Video

Surveillance Solution will require land acquisition for surveillance masts, equipment shelters, access roads, and supporting facilities. Each site will occupy a small footprint (generally less than 0.5 hectares), but cumulatively, dozens of hectares will be cleared across multiple critical infrastructure locations nationwide.

Site preparation will involve:

- Removal of vegetation, tree roots, and topsoil at mast and equipment shelter points;
- Ground levelling and grading to ensure stable foundations;
- Opening of access routes to remote installations;
- Excavation for underground cabling, drainage, and power supply systems; and
- Clearing of temporary areas for worker camps, equipment storage, and laydown yards.

Heavy-duty machinery such as bulldozers, excavators, graders, and dump trucks will be deployed. Topsoil stripped during clearing will be stockpiled for reuse in site rehabilitation, while excess soil may be managed through reclamation activities. Useful timber and vegetation may be distributed to local communities, but non-reusable biomass may be stacked, mulched, or burnt, subject to environmental regulations.

Potential impacts of site clearing include:

- Loss of vegetation cover and disturbance to local habitats;
- Land conversion and alteration of landscape aesthetics;
- Soil erosion, compaction, and reduced fertility;
- Loss of agricultural land or productive economic trees;
- Generation of biomass waste and dust emissions affecting air quality.

These impacts are particularly significant in rural and ecologically sensitive environments, where community livelihoods depend heavily on farmlands, forests, and natural resources.

5.4.2.1 Impact on Soil and Ecology (SC1)

Site preparation for surveillance installations across railway corridors, dams, gas and mining facilities, power stations, and ports will involve the removal of vegetation and topsoil in diverse ecological zones. Affected habitats may include savanna grasslands, riparian vegetation, secondary forests, cultivated farmlands, and coastal or wetland ecosystems depending on site location.

The clearing of vegetation will result in the loss of economically and ecologically valuable plant species, some of which provide medicinal, nutritional, and livelihood benefits to local communities. Habitat disruption will reduce biodiversity and displace fauna such as small mammals, reptiles, birds, and insects that depend on these ecosystems. Soil disturbance from grading, excavation, and compaction may reduce fertility, heighten erosion risks, and limit the future productivity of cleared areas.

- Magnitude of Impact: Low – given the relatively small footprint of each site (<0.5 ha), though the cumulative impact across multiple critical infrastructure sites is significant.
- Areal Extent: Low – confined to site footprints and adjoining access routes.
- Frequency: Low – occurring once during the pre-operations phase.
- Duration: High – land will be permanently converted for infrastructure, making full ecological restoration difficult.

- Sensitivity of Receptor (Soil and Ecology): Medium – many areas are already degraded by agriculture and human activity, though remaining natural vegetation is important for biodiversity and livelihoods.
- Impact Severity: Minor
- Impact Likelihood: High – as clearing is an unavoidable project requirement.
- Overall Impact Significance: Moderate

5.4.2.2 Impact on Surface Water Quality, Sediment, and Hydrobiology (SC2)

Site clearing and grading for surveillance installations along railway corridors, dams, gas and mining sites, power stations, and ports may lead to stormwater runoff carrying exposed soils and construction residues into nearby rivers, streams, and drainage channels, especially during the rainy season. Such runoff can increase turbidity and suspended solids, while oil, grease, and cement residues from machinery or site preparation may introduce additional pollutants.

These effects may reduce light penetration in water, limit primary productivity of phytoplankton, smother benthic organisms, and temporarily degrade fisheries resources that local communities rely upon for livelihood. Aquatic habitats near project sites may therefore face short-term stress during construction activities.

- Magnitude of Impact: Medium – runoff during peak rainfall could significantly affect small receiving water bodies.
- Areal Extent: Low – limited to water bodies directly adjacent to cleared or graded sites.
- Frequency: Medium – expected intermittently during rainfall events in the pre-operations phase.
- Duration: Low – largely short-lived, as natural systems in swampy or riparian zones are seasonally adapted to turbidity.
- Sensitivity of Receptor (Surface Water & Hydrobiology): Low – aquatic systems in these zones are already accustomed to seasonal sedimentation.
- Impact Severity: Minor
- Impact Likelihood: Medium – runoff is likely but can be mitigated with erosion control, silt traps, and proper drainage.
- Overall Impact Significance: Low

5.4.2.3 Impacts on Vegetation and Wildlife (SC3)

Clearing for surveillance masts, equipment shelters, access roads, and ancillary facilities at railway corridors, dams, gas and mining sites, power stations, and ports will involve the removal of trees, shrubs, grasses, and associated fauna within the designated footprints. Baseline land cover data indicate that most areas consist of savanna vegetation, fallow farmland, and secondary forest patches, though some sites extend into riparian zones and gallery forests of higher biodiversity value.

Vegetation in these zones provides timber, poles, fuelwood, fruits, medicinal plants, and weaving materials for local communities. Thus, clearance will result in ecological and socio-economic losses. Wildlife presence is already reduced by long-term human pressure, yet species listed under the Nigerian Endangered Species Act (1985) as Schedule I (Endangered)

and Schedule II (Vulnerable) occur within the wider landscape and may be indirectly affected.

- **Vegetation Loss:** Complete removal of vegetation within site footprints will permanently reduce ecological integrity.
- **Wildlife Displacement:** Mobile fauna (antelopes, birds, monkeys) are likely to disperse, while less mobile species (reptiles, amphibians, rodents, shrews) may be killed or displaced, creating potential human–wildlife conflicts.
- **Habitat Fragmentation:** Localized land conversion could fragment habitats further, though surrounding landscapes may buffer displaced species.
- **Magnitude of Impact:** Low – each site is small (<0.5 ha), though cumulative effects could be significant.
- **Areal Extent:** Low – restricted to cleared sites and their immediate surroundings.
- **Frequency:** Low – clearing is a one-time activity.
- **Duration:** High – impacts are long-term, as full habitat recovery is unlikely once infrastructure is in place.
- **Sensitivity of Resource (Vegetation/Wildlife):** Low – as habitats are already degraded by farming, logging, and hunting, though biodiversity pockets remain important.
- **Impact Severity:** Minor
- **Impact Likelihood:** High – clearing is certain to occur.
- **Overall Impact Significance:** Moderate

5.4.2.4 Cultural and Archaeological Resources (SC4)

Site clearing for surveillance masts, access roads, and equipment shelters at railway corridors, dams, mining areas, power stations, and ports will involve the conversion of several hectares of land across host communities. Baseline surveys indicate that shrines, sacred groves, and burial grounds are generally located within or near established settlements, while most surveillance installations are planned for remote or already disturbed areas, reducing the likelihood of direct impacts.

Nevertheless, risks remain. Unplanned clearing by migrants or informal settlers attracted to project sites may inadvertently disturb cultural or sacred sites. Excavation and grading activities could also uncover previously undocumented archaeological materials, relics, or sacred spaces. If such disturbances occur, they may trigger conflicts with host communities, given the cultural and spiritual importance of these resources.

- **Magnitude of Impact:** Low – as few known sites fall within project footprints.
- **Areal Extent:** Low – limited to installation areas and immediate surroundings.
- **Frequency:** Low – occurrences are expected to be rare.
- **Duration:** High – impacts would be permanent if sacred or archaeological sites are destroyed.
- **Sensitivity of Receptor (Cultural/Archaeological Resources):** High – due to their irreplaceable spiritual and heritage value.
- **Impact Severity:** Moderate
- **Impact Likelihood:** Medium – while risks are limited, they cannot be ruled out.
- **Overall Impact Significance:** Moderate

5.4.2.5 Physical and Economic Displacement (SC5)

The development of surveillance masts, equipment shelters, access roads, and temporary base camps within railway corridors, dam sites, mining zones, power stations, and port environments will require land acquisition and clearance. While the footprint for each site is relatively small (generally less than 0.5 hectares per mast site), the cumulative land take across multiple locations may extend to several hectares.

Physical Displacement: Large-scale community displacement is not anticipated since most installations will be sited outside densely populated settlements. However, small-scale displacement may occur if household structures, temporary shelters, or huts are located within designated mast sites or access roads.

Economic Displacement: This impact is more probable. In many host communities, livelihoods are tied to smallholder farming, grazing, fishing, and foraging. Land take may affect farm plots, grazing lands, and economic trees, leading to restricted access to resources. This could reduce livelihood opportunities for vulnerable households, particularly in resource-constrained rural settings.

5.4.2.6 Impact on Human Movement (SC6)

During the pre-operations phase, surveillance sites within railway corridors, dam zones, mining areas, power stations, and port facilities will be fenced or cordoned off to ensure safety and security. While each site has a relatively small footprint, some locations may overlap with informal routes such as footpaths, farm tracks, or minor access roads frequently used by community members for farming, trading, or daily commuting.

Where these routes are obstructed, residents may be compelled to take longer or alternative pathways, causing inconvenience and possible delays in accessing farms, markets, schools, and social facilities. Such disruptions are likely to be most pronounced on market days or during peak farming seasons when mobility is essential for livelihoods. Impacts will be particularly felt by vulnerable groups such as farmers, women traders, and pedestrians who rely heavily on foot travel.

- **Magnitude of Impact:** Low – only a few informal routes per site may be affected.
- **Areal Extent:** Low – restricted to the immediate surroundings of each project site.
- **Frequency:** Low – occurring mainly during clearing and site preparation.
- **Duration:** Low – temporary, as impacts will subside once clearing and fencing are completed.
- **Sensitivity of Receptor (Human Mobility):** Medium – since unrestricted movement is vital for local trade, farming, and social cohesion.
- **Impact Severity:** Minor
- **Impact Likelihood:** Low – as mitigation measures such as alternative footpaths and access routes will be implemented.
- **Overall Impact Significance:** Low

5.4.2.7 Vibration and Noise (SC7)

Site clearing and preparation for surveillance mast foundations, access roads, and equipment shelters at critical infrastructure locations (railway corridors, dam sites, mining areas, power stations, and port facilities) will require bulldozers, excavators, chain saws, graders, and

haulage trucks. These activities will generate elevated levels of noise and vibration, though limited to daytime hours, as no night operations are planned.

The main impacts of noise and vibration include temporary disturbance to fauna such as birds, reptiles, and small mammals, which may migrate away from cleared zones; short-term disruption to nearby residents and community members, particularly those living close to access roads or site boundaries; and ecological effects such as displacement of wildlife into adjoining habitats. While human health effects such as stress or annoyance are possible, these are addressed under the broader health impact section of this report.

- Magnitude of Impact: Low – as noise and vibration will be localized to active work areas.
- Areal Extent: Low – restricted to cleared sites and adjacent households or facilities.
- Frequency: Low – since clearing is a one-time activity during pre-operations.
- Duration: Low – short-term, ending once construction and installation activities are completed.
- Sensitivity of Receptor: Low – due to fauna mobility, generally dispersed settlement patterns, and planned noise control measures.
- Impact Severity: Minor
- Impact Likelihood: Moderate – as noise and vibration are certain to occur but temporary.
- Overall Impact Significance: Low

5.4.3 Onsite Construction Activities (CR)

The onsite construction phase of the Critical Infrastructure Security Video Surveillance Solution will involve extensive civil, mechanical, and electrical works to support the installation of surveillance systems across railway corridors, dam facilities, mining areas, power stations, and port environments.

Key activities will include:

- Civil Works: excavation, mast and foundation construction, equipment shelters, block and concrete works, joinery, and finishing.
- Mechanical and Electrical Works: mast erection, welding, cabling, electrical wiring, installation of solar/battery power systems, and equipment mounting.
- Support Activities: handling and temporary storage of construction materials, movement of vehicles and heavy machinery within sites, and testing/commissioning of surveillance systems.

While transportation-related impacts and those linked to worker presence have been addressed in earlier sections (PP and TR), this stage presents additional risks. These include noise and vibration from heavy machinery; dust generation and air quality concerns from excavation and haulage; soil disturbance and erosion during foundation works; and solid waste generation from debris, scrap, and packaging. Short-term disruptions to community activities may occur due to restricted access and increased construction traffic around project sites. Worker health and safety risks, such as accidents during welding, mast erection, or electrical works, are also anticipated. These impacts are largely localized, short-term, and reversible but require strict mitigation, monitoring, and adherence to occupational safety

protocols to minimize risks to host communities, infrastructure assets, and the surrounding environment.

5.4.3.1 Vibration and Noise Impacts (CR1)

Construction works for foundations, equipment shelters, access roads, and surveillance system installations will involve the use of heavy and medium machinery, power tools, and lifting equipment. These activities will generate noise and vibration at varying intensities during different stages of construction.

Key sources of noise and vibration include excavation and concrete mixing for mast foundations, welding and drilling during mast erection, carpentry and block works for shelters, operations of cranes, winches, and power generators, as well as movement of trucks transporting construction materials. Work will generally be restricted to daytime hours to limit disturbance.

The impacts include temporary disturbance to residents near project sites and access routes, displacement of mobile fauna such as birds and small mammals, and short-term ecological disruption as wildlife shifts to undisturbed habitats.

- Magnitude of Impact: Low – noise/vibration levels expected to remain localized.
- Areal Extent: Low – confined to immediate work zones and nearby households.
- Frequency: Medium – intermittent across the construction phase.
- Duration: Low – temporary, ceasing once construction is completed.
- Sensitivity of Receptor (Communities & Ecology): Low – due to sparse settlements and fauna mobility.
- Impact Severity: Minor
- Impact Likelihood: Moderate – as noise/vibration is certain but short-term.
- Overall Impact Significance: Low

5.4.4.1 Surface Water Quality and Hydrobiology (DR1.1)

Excavation will be required for foundations, underground cabling, drainage channels, and utility trenches. While most works will be land-based, some surveillance sites may be located near rivers, streams, areas. In such locations, stormwater runoff from excavation zones could transport suspended sediments and pollutants (oil, grease, cement residues) into water bodies. Potential impacts include increased turbidity reducing light penetration and affecting plankton productivity, smothering of benthic organisms due to sediment deposition, and short-term disturbance to fish resources relied upon by local communities. Alteration of drainage channels from misplaced excavated materials could also disrupt natural flow regimes.

- Magnitude of Impact: Medium – given potential sediment and contaminant loads.
- Areal Extent: Low – confined to adjacent streams or riparian areas.
- Frequency: Medium – intermittent, during rainfall and excavation works.
- Duration: Low to Medium – turbidity clears within days, but benthic recovery may take weeks.
- Sensitivity of Receptor (Surface Water & Hydrobiology): Medium – due to ecological and livelihood importance.
- Impact Severity: Moderate

- Impact Likelihood: High – runoff and turbidity are certain during rains.
- Overall Impact Significance: Moderate

5.4.4.2 Physical and Economic Displacement (DR1.2)

Excavation for foundations, utility trenches, and drainage systems will involve localized soil removal and land-use alteration. Large-scale displacement of settlements is not anticipated; however, economic displacement may occur where excavation interferes with smallholder farms, economic trees (mango, cashew, palm), communal grazing fields, or foraging/fuelwood collection areas. Such restrictions may temporarily reduce household incomes, food security, and resource access, potentially creating localized land-use conflicts. Although site footprints are relatively small (<0.5 ha), cumulative effects across multiple communities could be significant if not properly managed.

- Magnitude of Impact: Medium – small areas affected, but high livelihood dependence.
- Areal Extent: Low – site-specific.
- Frequency: Low – one-time during excavation.
- Duration: Medium – long-term where land is permanently converted.
- Sensitivity of Receptor (Livelihoods): High – communities depend heavily on land and natural resources.
- Impact Severity: Moderate
- Impact Likelihood: High – as some land-use restrictions are inevitable.
- Overall Impact Significance: High

5.4.4.3 Change in Topography (DR1.3)

Excavation for foundations, trenches, and drainage channels will modify the local topography of project sites. Excavated spoil will be stockpiled for reuse in backfilling or landscaping, but poorly managed heaps may cause localized elevation changes, drainage disruption, or depressions that create stagnant water pools. These changes may increase mosquito breeding sites, cause localized flooding, or reduce soil moisture available to vegetation. Altered runoff patterns could also accelerate erosion and stress adjacent vegetation.

- Magnitude of Impact: Low – excavation is localized and small-scale.
- Frequency: Low – one-time during excavation works.
- Duration: High – drainage impacts may persist if not mitigated.
- Sensitivity of Resource (Topography & Drainage): Low–Medium – as affected areas are not critical habitats.
- Impact Severity: Minor
- Impact Likelihood: Medium – risks arise from poor spoil management.
- Overall Impact Significance: Low

5.4.5 Surveillance Infrastructure Construction Impacts (PPL)

The construction of surveillance infrastructure for critical assets such as railways, dams, gas and mining facilities, power stations, and ports will involve a range of civil, mechanical, and electrical activities.

Key construction elements will include:

- **Mast and Tower Erection:** Installation of steel lattice towers or monopoles for mounting high-definition surveillance cameras, sensors, and communication equipment.
- **Equipment Shelters and Cabins:** Deployment of prefabricated shelters to accommodate ICT servers, inverters, battery banks, and cooling units.
- **Solar Power Systems:** Integration of solar panels with battery storage, supported by backup diesel generators to ensure uninterrupted power supply.
- **Access Roads and Platforms:** Construction or upgrading of minor roads and platforms to facilitate delivery of heavy equipment and provide long-term maintenance access.
- **Underground Cabling and Utilities:** Localized trenching and routing of power, control, and cables linking masts, shelters, and monitoring units.
- **Security Fencing:** Installation of perimeter fencing and protective barriers to safeguard infrastructure against vandalism, theft, or unauthorized access.

These construction activities, while localized in footprint, will collectively introduce environmental and socio-economic impacts across host communities, including soil disturbance, vegetation clearance, waste generation, noise, and temporary disruption of community movement and services. Careful planning and mitigation will be required to minimize risks while ensuring smooth project implementation.

5.4.6 Installation Impacts (IN)

The installation phase will involve the assembly, mounting, and integration of surveillance infrastructure across designated sites.

Key impacts include:

1. **Soil and Land Disturbance:** Localized excavation and cabling may disturb topsoil, causing erosion or drainage alteration. Magnitude is low due to minimal land take.
2. **Air Quality and Noise:** Cranes, drilling, welding, and generators will emit dust, fumes, and noise. Impacts are short-term and reversible but may disturb residents and displace wildlife.
3. **Waste Generation:** Packaging materials, cable cuttings, scrap, and defective parts will be generated. Hazardous waste streams such as batteries and lubricants require strict management.
4. **Community Movement:** Heavy equipment transport may restrict access on narrow roads and affect traditional routes, especially on market days.
5. **Visual and Aesthetic Effects:** Towers, solar panels, and shelters will alter the landscape, with long-term moderate significance in rural or scenic areas.
6. **Occupational Health and Safety Risks:** Mast climbing, welding, electrical works, and heavy lifting carry high risks of falls, electrocution, or struck-by accidents without strict HSE protocols.

5.4.7 Wastes and Emissions Impacts (WE)

The project will generate various wastes and emissions during pre-operations, installation, and operations phases.

1. **Air Emissions:** Exhaust from trucks, generators, and welding will temporarily affect air quality, causing localized respiratory discomfort. Significance: moderate.

2. Solid Waste: Excavated spoil, cleared vegetation, scrap metal, defective parts, and packaging may degrade soil and landscape if poorly managed. Significance: moderate.
3. Liquid Waste/Effluents: Wash water, sewage, and accidental fuel or lubricant spills could contaminate surface and groundwater, affecting aquatic systems. Significance: moderate–high.
4. Hazardous Waste: Used oils, solar batteries, and faulty electronics pose serious risks if not properly stored and disposed of. Significance: high without robust systems.
5. Noise Emissions: Construction noise from generators and machinery will disturb residents and fauna but is short-term. Significance: low–moderate.

5.4.8 Health Impacts (H)

The project presents a range of direct and indirect health risks to workers, host communities, and migrants.

1. Pollution-Related Health Effects: Dust, fumes, and waste mismanagement could cause respiratory and waterborne diseases. Significance: moderate.
2. Influx-Related Health Risks: Increased population may raise risks of HIV/AIDS, malaria, STDs, and overburdened healthcare facilities. Significance: moderate–high.
3. Occupational Hazards: Mast erection, welding, electrical works, and machinery handling pose high risks of falls, electrocution, struck-by injuries, and heat stress. Significance: high.
4. Special Health Risks: Stagnant water may increase malaria risks, while tall masts pose lightning hazards and fuel/battery storage risks include fire. Significance: low–moderate.

5.5 Positive and Negative Impacts of Decommissioning

At the end of its lifecycle, the project will require a Decommissioning and Restoration Plan Key Activities:

- Dismantling surveillance masts, shelters, cameras, solar systems, and fencing.
- Safe disposal/recycling of scrap metal, batteries, electronics, and hazardous wastes.
- Removal of foundations where required.
- Transporting dismantled materials offsite for reuse, recycling, or licensed disposal.
- Site rehabilitation, including soil stabilization and revegetation with native species.

Positive Impacts:

- Land restored for farming, grazing, or alternative community use.
- Removal of obsolete infrastructure, reducing environmental and safety risks.
- Temporary jobs in dismantling and restoration activities.

Negative Impacts:

- Short-term noise, dust, and truck traffic during dismantling.
- Occupational risks (falls, heavy lifting, hazardous waste handling).
- Waste disposal challenges, especially for batteries and ICT equipment.
- Temporary disruption of community access during dismantling.

Overall, decommissioning impacts are short-term and reversible with proper waste handling, site remediation, and HSE enforcement.

CHAPTER SIX

MITIGATION MEASURES

6.1 Introduction

Mitigation measures are actions designed to enhance the positive impacts of a project while minimizing or eliminating adverse environmental and social impacts. They are essential for ensuring that the project is implemented in a manner consistent with environmental sustainability, community well-being, and regulatory compliance.

For the Proposed Nigeria Internal Security Project Phase II - Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution, mitigation measures will address the potential impacts identified in earlier chapters, covering biophysical, socio-economic, health, and occupational safety aspects. Depending on the nature of the impact, these measures may be integrated into the project design, pre-construction planning, construction and installation works, operational protocols, or decommissioning activities.

The mitigation approach will be implemented as a continuous process throughout the project life cycle, ensuring that risks are effectively managed at every stage from site selection and preparation, mast and shelter installation, power system integration, operations, to eventual decommissioning and site restoration.

This chapter therefore summarizes the key mitigation measures that will be applied to the surveillance project and its associated activities to assure environmental sustainability, regulatory compliance, and positive social outcomes.

6.2 Specific and General Mitigations

Specific mitigation measures have been identified during the course of this Environmental Impact Assessment (EIA) to reduce or eliminate the negative effects of impacts highlighted in Chapter 5. These measures are prioritized for impacts assessed as having high or medium overall significance (“HIGH” and “MODERATE”), but appropriate mitigations are also proposed for low significance (“LOW”) impacts in order to maintain them at acceptable levels and prevent escalation.

Specific Mitigation Measures are developed in response to the potential adverse effects associated with project design, site clearing, excavation, construction, installation, operation, and decommissioning activities. These measures are targeted, impact-specific, and aimed at reducing adverse effects to acceptable thresholds while, where possible, enhancing the project’s beneficial impacts. Following their application, the impacts are re-assessed and the residual impact levels presented to demonstrate their effectiveness.

In addition, the project design and execution philosophy for the Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution Project incorporates General Mitigation Measures. These are proactive measures embedded in the project standards, engineering specifications, and operating guidelines to ensure compliance with health, safety, environmental (HSE), and social performance objectives. They represent the project’s built-in safeguards, covering issues such as:

- Site selection criteria to minimize environmental and social disruption;

- Standardized procedures for waste management, emissions control, and noise suppression;
- Adherence to occupational health and safety (OHS) protocols for workers;
- Engagement of host communities to promote transparency and social acceptance;
- Implementation of best practices in construction and operational activities, in line with FMEnv, NESREA, and IFC/WB EHS Guidelines.

Because these general mitigations are already integral to the project plan, they were taken into account during the impact significance evaluation in Chapter 5. They are expected to substantially improve the environmental sustainability and social acceptability of the surveillance project across all its phases.

6.3 Implementation of Mitigations

Mitigation measures identified in this report are linked to specific project activities such as site clearing, excavation, construction, installation, operations, and decommissioning. In practice, however, they will be implemented through the integrated operational procedures and management systems of the Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution Project and its contractors. These systems are designed to ensure compliance with protective measures, statutory requirements, and international best practices.

Throughout this chapter, reference is made to specific plans and procedures that will address individual impacts and their mitigation measures. The overall framework for organizing and coordinating these plans is provided in the Environmental Management Plan (EMP), which is fully described in Chapter 7 of this report.

As part of its sustainability and security commitment, the Federal Ministry of Interior and the implementing agency for the surveillance project will require that all contractors and sub-contractors comply with obligations in a manner consistent with the project's Environmental, Social, Health, and Safety (ESHS) standards. Mitigation measures will therefore be enforced through contractual obligations, ensuring that compliance is mandatory across all phases of the project.

Each contractor will be required to prepare a site-specific Environmental Management Plan (EMP) aligned with this EIA and the overall project EMP. They will also be required to submit formal plans, procedures, and technical documentation to demonstrate adequate implementation of protective measures and mitigation requirements identified in this report.

Contractor Submissions (for approval prior to mobilization):

- Environmental Management Plan (EMP);
- Waste Management Plan;
- Emergency Response and Contingency Plan;
- Security and Access Control Plan.

Project-Level Plans to be Developed by the Implementing Agency:

- Influx Management Plan;
- Labour Management Plan (including worker Code of Conduct and job rules);
- Compensation and Livelihood Restoration Plan;
- Community Development Plan;
- Transportation and Journey Management Plan.

The Environmental Management Plan (EMP) presented in Chapter 7 will specify monitoring requirements, performance indicators, and reporting mechanisms to evaluate the effectiveness of mitigation measures. Where monitoring indicates that a mitigation measure is not achieving its intended outcome, the project management will review and adopt corrective or alternative measures to strengthen environmental and social protection.

Table 6.1: Summary of Impacts, Mitigations and Residual Impacts of the Proposed Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution

Impact ID	Project Phase / Activity	Impact Category	Description of Environmental / Social Impact	Impact Significance	Mitigation Measures	Residual Impact
B1	All Phases	Positive	Increased income from transportation of workers, equipment, and materials.	Beneficial	Ministry of Interior (MoI) shall - Engage local transport contractors. - Train drivers on defensive driving & safety - Schedule heavy truck movements during off-peak hours. - Provide community sensitization on traffic safety.	Beneficial
B2	All Phases	Positive	Employment generation for skilled, semi-skilled, and unskilled workers.	Beneficial	Ministry of Interior (MoI) shall - Prioritize local labour recruitment. - Provide equal employment opportunities (gender/youth). - Ensure fair wages & contracts. - Establish skills transfer and apprenticeship programmes.	Beneficial
B3	All Phases	Positive	Opportunities for support services (catering, accommodation, etc.).	Beneficial	Ministry of Interior (MoI) shall - Contract local SMEs for catering & security - Establish transparent procurement process. - Provide training for SMEs to meet project standards. - Support waste/recycling businesses in host communities.	Beneficial
B4	All Phases	Positive	Increased trading of local and national materials and ICT equipment.	Beneficial	Ministry of Interior (MoI) shall - Source non-critical materials locally. - Partner with local cooperatives for supply chains. - Encourage fair pricing and trade standards. - Establish procurement monitoring to avoid elite capture.	Beneficial
B5	All Phases	Positive	Skills acquisition and training in ICT, surveillance, solar systems.	Beneficial	Ministry of Interior (MoI) shall - Provide structured ICT/electrical skills training. - Organize workshops on surveillance system maintenance. - Engage local institutions for vocational training. - Issue certification for workers after training.	Beneficial
B6	Operations	Positive	Enhanced security, deterrence of crime.	Beneficial	Ministry of Interior (MoI) shall - Integrate project with NSCDC operations. - Provide community awareness on surveillance benefits. - Establish complaint reporting system for citizens - Train security personnel in human rights compliance.	Beneficial
B7	Operations	Positive	Improved quality of life from safer communities and commerce.	Beneficial	Ministry of Interior (MoI) shall - Ensure regular security patrol integration. - Support social infrastructure projects (schools/clinics).	Beneficial

EIA for the Proposed Nigeria Internal Security Project Phase II - Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution

Impact ID	Project Phase / Activity	Impact Category	Description of Environmental / Social Impact	Impact Significance	Mitigation Measures	Residual Impact
					- Establish feedback platforms for communities. - Promote inclusive community safety programmes.	
B8	All Phases	Positive	Better social inclusion by integrating host communities.	Beneficial	Ministry of Interior (MoI) shall - Prioritize community participation in decision-making. - Implement social outreach programmes. - Provide scholarships/skills support to youth. - Establish grievance redress and community liaison offices.	Beneficial
PP1	Pre-Operations – Physical Presence	Social	Pressure on existing infrastructure (roads, housing, utilities).	Moderate	Ministry of Interior (MoI) shall - Develop Influx Management Plan. - Provide closed workers' camps with amenities. - Prioritize local labour to reduce in-migration. - Support host communities with infrastructure upgrades.	Low
PP2	Pre-Operations – Physical Presence	Economic	Temporary inflation, disruption of trade.	Moderate	Ministry of Interior (MoI) shall - Monitor food/commodity prices. - Strengthen local cooperatives & microfinance groups. - Phase workforce demobilization to reduce boom-bust effects. - Encourage local entrepreneurship to stabilize supply.	Low
PP3	Pre-Operations – Physical Presence	Socio-cultural	Risks of prostitution, crime, social tensions.	Moderate	Ministry of Interior (MoI) shall - Conduct HIV/STD awareness campaigns. - Create local cultural orientation/induction programmes. - Employ female/youth workers where possible. - Support traditional institutions in conflict mediation.	Low
SC1	Pre-Operations – Site Clearing	Biophysical	Loss of vegetation, soil disturbance, habitat alteration.	Moderate	Ministry of Interior (MoI) shall - Restrict clearing to approved zones. - Stockpile and reuse topsoil. - Implement reforestation and landscaping. - Prohibit poaching or logging by project staff.	Low
SC2	Pre-Operations – Site Clearing	Biophysical	Noise, dust, vibration from equipment.	Low	Ministry of Interior (MoI) shall - Spray water to suppress dust. - Maintain silencers/mufflers on equipment. - Restrict noisy operations to daytime. - Provide PPE (earplugs, masks) to workers.	Low
SC3	Pre-Operations – Site Clearing	Social	Land acquisition, small farm displacement.	Moderate	Ministry of Interior (MoI) shall Implement Compensation & Livelihood Plan.	Low

EIA for the Proposed Nigeria Internal Security Project Phase II - Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution

Impact ID	Project Phase / Activity	Impact Category	Description of Environmental / Social Impact	Impact Significance	Mitigation Measures	Residual Impact
					• Provide training for alternative livelihoods. • Establish grievance redress system. • Ensure timely compensation before land take.	
EI1	Pre-Operations – Equipment Installation	Biophysical	Visual intrusion from towers/masts.	Low	Ministry of Interior (MoI) shall • Blend towers with natural colours. • Use existing disturbed areas for siting. • Plant trees as natural screen buffers. • Minimize lighting spill (down-lighting).	Low
EI2	Pre-Operations – Equipment Installation	Biophysical	Risk of soil/water contamination from fuel/chemicals.	Moderate	Ministry of Interior (MoI) shall • Store fuels in bunded areas. • Develop Spill Prevention & Response Plan. • Train staff in hazardous materials handling. • Conduct regular inspections of storage sites.	Low
WE1	Pre-Operations – Waste & Emissions	Pollution	Solid waste generation from packaging, metals, plastics.	Moderate	Ministry of Interior (MoI) shall • Develop Waste Management Plan. • Enforce segregation at source. • Engage licensed waste contractors. • Conduct regular audits of waste streams.	Low
WE2	All Phases – Waste & Emissions	Pollution	E-waste from batteries, solar panels, electronics.	Moderate	Ministry of Interior (MoI) shall • Develop E-Waste Policy. • Return faulty batteries to suppliers. • Contract certified recyclers. • Train workers on safe handling of e-waste.	Low
OM1	Operations – Surveillance	Biophysical	Visual impacts of masts/towers.	Low	Ministry of Interior (MoI) shall • Plant buffer vegetation. • Design towers to reduce glare. • Avoid siting towers near sacred landscapes. • Engage communities in siting decisions.	Low
OM2	Operations – Surveillance	Health	Concerns over electromagnetic exposure.	Low	Ministry of Interior (MoI) shall • Implement EMF Safety Program. • Set exposure monitoring equipment. • Restrict public access near antennas. • Rotate staff to limit exposure.	Low
OM3	Operations – Power Systems	Pollution	Minor emissions from backup generators.	Low	Ministry of Interior (MoI) shall • Use low-emission generators • Maintain equipment regularly.	Low

EIA for the Proposed Nigeria Internal Security Project Phase II - Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution

Impact ID	Project Phase / Activity	Impact Category	Description of Environmental / Social Impact	Impact Significance	Mitigation Measures	Residual Impact
					• Install acoustic enclosures. • Monitor emissions against NESREA standards.	
OM4	Operations Maintenance	– Pollution	Waste generation from obsolete surveillance equipment.	Moderate	Ministry of Interior (MoI) shall • Establish E-Waste Collection Centres. • Contract approved disposal firms. • Train staff in safe dismantling of equipment. • Monitor disposal chain for compliance.	Low
H1	All Phases	Health	Sanitation, solid waste, dust exposure.	Moderate	Ministry of Interior (MoI) shall • Develop Contractor Sanitation Plans. • Provide mobile toilets and water supply. • Conduct hygiene awareness campaigns. • Regular health monitoring of workers.	Low
H2	Pre-Operations/Operations	Health	Communicable diseases from labour influx.	Moderate	Ministry of Interior (MoI) shall • Periodic STD & malaria campaigns. • Provide medical screening for workers. • Establish project clinic with first aid. • Collaborate with LGAs for health support.	Low
H3	Pre-Operations/Operations	Health	Occupational accidents (heights, electrocution, machinery).	High	Ministry of Interior (MoI) shall • Enforce OHS standards. • Provide PPE and training. • Develop Emergency Response Plans. • Conduct regular safety drills.	Moderate
H4	Operations	Health	Road safety risks from equipment transport.	Moderate	Ministry of Interior (MoI) shall • Develop Journey Management Plan. • Train drivers on defensive driving. • Install road signage in host communities. • Provide insurance for transport activities.	Low
H5	Operations	Health	Psychosocial stress from security presence.	Low	Ministry of Interior (MoI) shall • Implement community engagement forums. • Train security forces in human rights. • Provide grievance redress system. • Support community peacebuilding activities.	Low
CM1	All Phases	Cumulative	Land take for multiple surveillance sites.	Low	Ministry of Interior (MoI) shall • Advocate for land-use master planning. • Limit site footprint to minimum needed. • Rehabilitate land after use.	Low

EIA for the Proposed Nigeria Internal Security Project Phase II - Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution

Impact ID	Project Phase / Activity	Impact Category	Description of Environmental / Social Impact	Impact Significance	Mitigation Measures	Residual Impact
					Support conservation offsets (green belts).	
CM2	All Phases	Cumulative	Increased pressure on services, housing, transport.	Moderate	Ministry of Interior (MoI) shall - Collaborate with state gov't for infrastructure upgrades. - Develop Community Development Agreements. - Provide temporary housing for workers. - Monitor community wellbeing indicators.	Low
D1	Decommissioning	Social	Job and income losses.	Moderate	Ministry of Interior (MoI) shall - Develop worker exit programmes. - Provide retraining and reskilling schemes. - Support SME development in host communities. - Implement grievance mechanism for affected workers.	Low
D2	Decommissioning	Biophysical	Risks from improper dismantling & disposal.	Moderate	Ministry of Interior (MoI) shall - Develop Decommissioning & Disposal Plan. - Engage licensed waste contractors. - Train workers in safe dismantling. - Monitor disposal sites for compliance.	Low
D3	Decommissioning	Biophysical	Land restoration challenges.	Moderate	Ministry of Interior (MoI) shall - Restore sites with native vegetation. - Re-contour land to prevent erosion. - Monitor soil and water post-decommissioning - Partner with LGAs on restoration programs.	Low

CHAPTER SEVEN

ENVIRONMENTAL MANAGEMENT PLAN (EMP)

7.1 Introduction

An Environmental Management Plan (EMP) is a structured programme used in the management of project operations to ensure environmental sustainability. Within an Environmental Impact Assessment (EIA), the EMP provides the procedures and processes to be incorporated into project activities to continuously measure, check, and improve compliance with, and effectiveness of, the mitigation measures recommended for minimizing or eliminating identified negative impacts throughout the project's life cycle. In addition, the EMP ensures compliance with statutory requirements and corporate environmental, health, and safety (EHS) policies guiding the operations of the proposed project.

For the Nigeria Internal Security Project Phase II – Proposed Nigeria Internal Security Project Phase II - Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution, the EMP will be implemented from the project planning stage through to decommissioning. During the planning phase, mechanisms for the effective implementation of mitigation measures will be put in place. During construction and operational phases, the EMP will serve as a monitoring tool to ensure compliance of environmental attributes with applicable national regulations and international standards.

This EMP has been developed to address all known project activities, including site preparation, civil works, installation of surveillance infrastructure, network integration, and operational activities. It takes into account the predicted impacts of the proposed project (as outlined in Chapter 5) and the prescribed mitigation measures (as detailed in Chapter 6).

The implementing authorities of the Nigeria Internal Security Project Phase II shall integrate this EMP into all stages of project activities to manage, monitor, and control potential impacts on the biophysical and socio-economic environment, as well as safeguard the health and safety of workers, communities, and security personnel. The EMP shall also ensure alignment with Nigerian regulatory frameworks (FMEnv, NESREA, where applicable) and relevant international standards, including the World Bank Environmental and Social Framework (ESF), IFC Performance Standards, and Equator Principles.

The EMP forms part of the broader Environmental and Social Management System (ESMS) for the project. It is designed to achieve compliance with Health, Safety, and Environmental (HSE) requirements, institutional responsibilities, and other international commitments. Specifically, the EMP establishes the linkages between:

- Each significant impact identified in the EIA (high or moderate significance);
- Relevant mitigation measures, including construction and operational controls;
- Monitoring approaches for verifying effectiveness and compliance;
- Regulatory requirements, institutional roles, and responsibilities; and
- Project-specific best practices, operational procedures, and work instructions.

Accordingly, this EMP applies to all phases and components of the Nigeria Internal Security Project Phase II – Proposed Nigeria Internal Security Project Phase II - Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution, ensuring that environmental, health, and social performance is safeguarded in line with both national and international obligations.

7.2 Policies

The Nigeria Internal Security Project Phase II – Proposed Nigeria Internal Security Project Phase II - Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution is committed to implementing robust Health, Safety, and Environment (HSE) policies and sustainability commitments. These policies affirm the project proponent's dedication to conducting operations in a socially responsible, ethical, and transparent manner while protecting the health and safety of personnel, host communities, and the environment.

In its HSE Policy, the project has committed to:

- **Integration of HSE in Operations:** Incorporate health, safety, and environmental considerations into every aspect of project planning, design, construction, and operation, with clear objectives to drive continual improvement.
- **Regulatory Compliance:** Comply fully with all relevant Nigerian environmental, health, and safety laws, regulations, and guidelines, as well as applicable international standards (World Bank ESF, IFC Performance Standards, Equator Principles).
- **Stakeholder Communication:** Establish and maintain effective communication with contractors, host communities, government agencies, and other stakeholders on all health, safety, and environmental matters.
- **Best Practices and Risk Management:** Apply relevant standards, good engineering practices, and risk management principles to safeguard health, safety, and the environment, ensuring the reliability, integrity, and efficiency of surveillance facilities and installations.
- **Leadership and Transparency:** Demonstrate socially responsible leadership by striving for exemplary HSE performance and publicly reporting progress on sustainability commitments.
- **Resource Conservation:** Conserve project assets and natural resources, minimize emissions, discharges, and waste, and ensure efficient energy use throughout construction and operation phases.
- **Hazard Identification and Risk Control:** Identify actual or potential HSE hazards arising from project activities, conduct systematic risk assessments, and implement effective measures to mitigate risks.
- **Systematic HSE Planning:** Develop and implement a comprehensive HSE Management Plan, supported by prioritized procedures that collectively form a functional management system.
- **Emergency Preparedness:** Maintain adequate preparedness and response mechanisms to manage emergencies and incidents that may arise during project execution.
- **Contractor and Subcontractor Compliance:** Clearly communicate HSE requirements to contractors and subcontractors, ensuring that their activities align with the overarching HSE Policy and standards of the project.
- **Compliance Assurance:** Implement a robust compliance program, including periodic audits, inspections, and corrective actions, to ensure adherence to this policy.
- **Resourcing and Capacity Building:** Adequately allocate resources and build capacity for effective health, safety, and environmental management functions across all stages of the project.

The primary vehicles through which the Nigeria Internal Security Project Phase II will achieve these commitments are:

1. A comprehensive HSE Management System (HSE-MS) designed to integrate with the Environmental and Social Management System (ESMS) of the project.
2. Planning documents, including this Environmental Management Plan (EMP) and supporting operational and monitoring frameworks, which guide implementation, reporting, and compliance assurance.

7.3 Planning

7.3.1 Management Programme

This Environmental Management Plan (EMP) has been designed to meet the management programme requirements of the World Bank Environmental and Social Framework (ESF), IFC Performance Standard 1 (Assessment and Management of Environmental and Social Risks and Impacts), and Nigeria's national environmental regulations. The goal is to establish and implement a structured programme of mitigation and performance-improvement measures that address the identified environmental and social risks associated with the Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution.

7.3.2 Environmental Management Plan

The primary objective of this EMP is to ensure full compliance with the project's HSE Policy, regulatory requirements, and mitigation commitments outlined in this EIA. The EMP outlines the specific actions, timelines, and responsibilities necessary to achieve these objectives.

The project adopts a systematic approach in line with ISO 14001: Environmental Management Systems to ensure effective planning, implementation, and continuous improvement. The EMP integrates policies, plans, and procedures while assigning clear roles and responsibilities across project actors.

This EMP provides overarching guidance and shall take precedence over contractors' Environmental Management Plans (C-EMPs). Engineering, Procurement, and Construction (EPC) Contractors will be required to prepare project-specific management plans that detail the what, where, and how of applying mitigation measures, monitoring their effectiveness, and reporting results.

The EMP incorporates several associated plans that provide detailed frameworks for compliance, including:

- HSE Management Plan (Safety Plan);
- Waste Management Plan;
- Emergency Preparedness and Response Plan;
- Influx Management Plan;
- Labour Management Plan (including Job Rules and Codes of Conduct);
- Community Relations and Development Plan; and
- Journey/Logistics Management Plan.

Other supporting plans that are linked to the EMP but broader in scope include:

- Health Management Plan; and
- Compliance and Permitting Plan.

7.3.2.1 EPC Contractor Management Plan(s)

EPC Contractors engaged to deliver the surveillance infrastructure will be required to:

- Comply with relevant Nigerian and international HSE legislation, regulations, and guidelines;
- Align their management systems with the overarching project HSE Management System; and
- Conform to the project's technical, quality, and environmental specifications.

As a contractual requirement, EPC Contractors must develop and submit specific HSE management plans covering:

- HSE Policy Statements, Programs, and Management Systems;
- HSE Organizational Structure and Responsibilities;
- HSE Procedures and Work Instructions;
- Employee HSE Training and Competency Development;
- Waste Management Plan;
- Emergency Response and Evacuation Plan;
- Land Transportation and Journey Management Plan;
- Hazardous Materials Management Plan; and
- Occupational Health, Industrial Hygiene, and Medical Protection Plans.

In addition, EPC Contractors must provide detailed documentation for:

- Implementation of mitigation and monitoring measures identified in the EIA/EMP;
- Local Content development strategies;
- Security Management and Protocols;
- Logistics and Material Handling; and
- Community Relations and Stakeholder Engagement.

All EPC Contractor plans must conform to the overarching EMP for the Nigeria Internal Security Project Phase II. Plans will be reviewed and approved by the project proponent before commencement of works. Contractors will be obligated to self-monitor compliance with their plans and provide regular monitoring reports.

The project proponent (and regulators where applicable) will conduct routine audits and inspections of EPC Contractors' operations. Contractors will be required to allocate adequate resources for HSE management, including ensuring sub-contractor compliance and maintaining an emergency stop-work mechanism to be triggered in case of significant environmental or safety risks.

7.4 Implementation

7.4.1 Management Organization

In line with Nigerian regulatory requirements and applicable international standards, the Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution shall establish a dedicated HSE management organization. This structure clearly defines roles, responsibilities, and authority levels required to implement an effective HSE Management System. It also provides for the necessary training, communication pathways, and accountability mechanisms to ensure compliance with the Environmental Management Plan (EMP).

During the pre-construction and construction phases, all instructions and official communications relating to environmental and social issues shall follow the generic organogram

presented in Figure 7-1. This organizational structure sets out lines of authority and communication among the project proponent, contractors, consultants, and regulators. It will be subject to review and adjustment as the project progresses.

The roles and responsibilities of each key actor in the implementation of this EMP are described in Table 7.1 and further elaborated below.

7.4.1.1 Project HSE Manager

The Project HSE Manager shall:

- Oversee the implementation, administration, and enforcement of the EMP within all project areas, including construction sites, surveillance installation locations, and support facilities.
- Ensure adherence to the conditions, responsibilities, and provisions contained in the EMP and associated plans.
- Regularly update the EMP to reflect monitoring results, lessons learned, and evolving best practices, as well as findings from the EIA.
- Ensure that EMP requirements are integrated into all project tender documents, and that prospective contractors commit to full compliance.
- Appoint an HSE Supervisor to continuously monitor implementation and ensure compliance with EMP provisions throughout construction and operation.
- Provide periodic reports to the Project Management Unit (PMU), Federal Ministry of Interior, and other oversight bodies on EMP implementation status, including compliance levels and corrective actions.
- Notify the project’s management and regulatory authorities of the commencement of major construction or installation operations, including confirmation of EMP compliance arrangements.
- Be accountable to relevant regulatory authorities (e.g., FMEnv, NESREA, and state environmental agencies) for any contravention of the EIA Approval, Environmental Authorization, or non-compliance by contractors under their supervision.

The Project HSE Manager will work closely with the Construction/Installation Manager to ensure that all environmental, health, and safety issues are addressed during project execution.

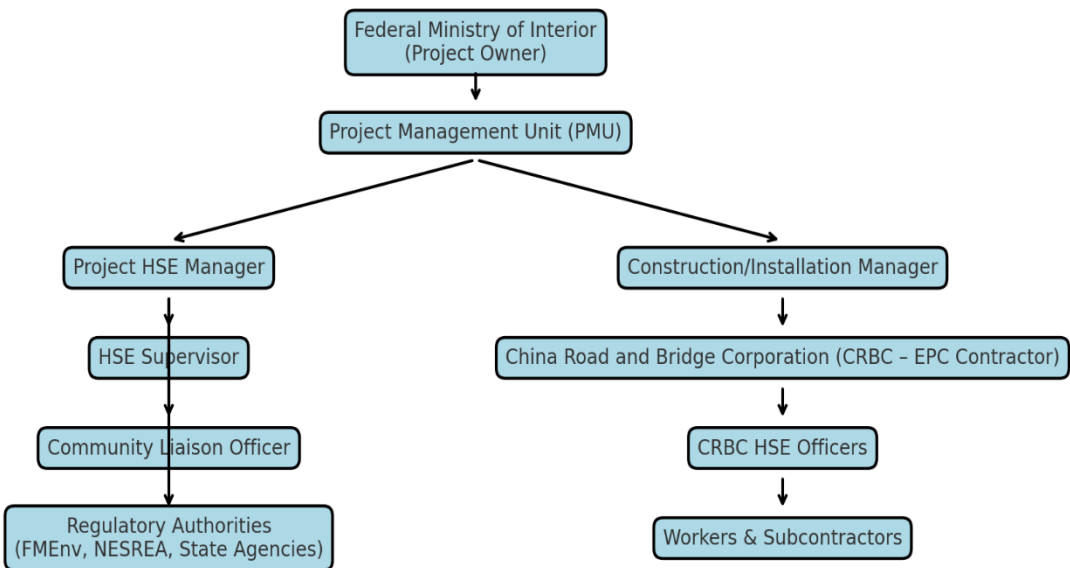


Figure 7-1: HSE Responsibility and Communication Organogram

7.4.1.2 Technical Advisory Committee

The role of the Technical Advisory Committee (TAC) will be to provide the Project Proponent with expert comments and input on the following:

- The contents of the EMP and the need for periodic review and updating;
- The design, installation, and construction of surveillance facilities;
- Compliance with the EMP and other regulatory permit conditions; and
- Documentation and reports produced as part of the EMP.

The Committee shall function strictly as an advisory forum. It will not interfere with the administrative functions of the Project Management Unit (PMU) or the professional duties of staff, nor will it impair the ability of staff to implement policy decisions of the Project Owner (Federal Ministry of Interior). The Committee has no legal standing except as it relates to providing advisory comments on the EMP. The TAC may also be invited to form part of the Audit Committee during compliance reviews by the PMU.

7.4.1.3 The HSE Supervisor

The HSE Supervisor shall be appointed for the duration of all pre-construction and construction activities. The Supervisor will be responsible for monitoring, reviewing, and verifying compliance with the EMP by China Road and Bridge Corporation (CRBC – EPC Contractor) and subcontractors engaged on the project.

The HSE Supervisor shall:

- Visit the work sites regularly to ascertain compliance, attend contractor meetings, and participate in monthly site meetings with the project management team. The Supervisor should preferably reside on site or nearby during the implementation phase.
- Monitor and verify that the EMP is adhered to at all times and take corrective action if specifications are not followed.
- Ensure environmental impacts are minimized and mitigation measures effectively applied.
- Review and approve construction method statements together with the Consultants/Engineers Representative and the Technical Advisory Committee.
- Support the Contractor in finding environmentally responsible solutions to site challenges.
- Report on environmental issues at monthly site meetings and other relevant forums.
- Maintain a register of complaints and ensure community concerns are addressed promptly.
- Monitor contractor-led environmental awareness training for all new personnel, or directly deliver such training where required.
- Ensure compliance with all relevant environmental legislation.
- Compile and complete HSE performance checklists.
- Facilitate continuous environmental awareness among contractor personnel.

7.4.1.4 The Community Liaison Officer (CLO)

The Community Liaison Officer (CLO) shall:

- Serve as the main contact between host community representatives and the Project (through the HSE Supervisor, Construction Manager, and External Relations Directorate of the Ministry of Interior).

- Assist in resolving disputes between the Project, CRBC, subcontractors, and host communities.

7.4.1.5 The Contractor (China Road and Bridge Corporation – CRBC)

CRBC, as the EPC Contractor, shall ensure that:

- A dedicated person responsible for HSE matters is appointed on site.
- All employees, subcontractors, and vendors comply with the provisions of the EMP.
- The HSE Supervisor is notified of the anticipated programme of works, including details of activities to be undertaken.
- All requisite information, as required under the EMP, is submitted for approval prior to commencement of activities.
- All incidents, accidents, and non-compliance issues are reported promptly to the HSE Supervisor, along with corrective or remedial actions taken.
- Any complaints received are communicated to the HSE Supervisor.
- All personnel on site are provided with adequate HSE awareness and training.

7.4.1.6 Consultants / Construction Manager

The Consultants / Construction Manager shall:

- Ensure that all pre-construction and construction activities are executed in accordance with contract specifications and environmental requirements.
- Support the HSE Supervisor in ensuring CRBC's compliance with EMP provisions.

Table 7.1: EMP Roles and Responsibilities

Position	Responsibility
Federal Ministry of Interior / Project Management Unit (PMU)	Oversee and coordinate all project activities; ultimately responsible for HSE performance during the construction and installation phases.
Project HSE Manager	Ensure that the Project and all its contractors operate in full compliance with applicable regulatory environmental requirements and the project's HSE Management System (HSE-MS); provide technical support to line management in fulfilling HSE responsibilities.
HSE Supervisor	Assume ownership of HSE issues. Ensure that environmental regulatory requirements are met and that mitigation measures recommended in the EIA are properly implemented. Conduct regular site visits to monitor HSE compliance and supervise third-party HSE performance audits.
Community Liaison Officer (CLO)	Act as the primary liaison between the project and host communities/regulators; ensure contractor compliance with labour and community relations protocols. Manage community engagement, compensation, and land acquisition issues. Monitor, report, and support resolution of community concerns throughout the project cycle.

7.4.2 Training

The Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution shall identify, plan, monitor, and document all HSE training needs for personnel whose activities may have significant environmental or social impacts. The Project recognizes that it is critical for

employees and contractors, at all relevant levels, to be fully aware of the Project's environmental, social, and health policies; the potential impacts of their activities; and their roles and responsibilities in achieving conformance with established procedures and regulatory requirements.

This will be achieved through a structured and formalized HSE training programme. Training will be mandatory for all project personnel and contractors, and will emphasize:

- Environmental and social impacts that may arise from project-related activities;
- The importance of complying with EIA and EMP requirements to minimize or prevent impacts; and
- Individual roles and responsibilities for maintaining compliance, including responsibilities related to change management and emergency response.

The Project HSE Manager shall coordinate all training activities, maintain employee training records, and ensure that records are regularly monitored and reviewed. The HSE Manager will also periodically verify staff competency through discussions, direct observation, and field performance assessments.

Employees tasked with site inspections and compliance monitoring will undergo specialized training, drawing on external professional resources where necessary. Training will be coordinated by the HSE Manager and/or Community Liaison Officer prior to the commencement of site activities. Upon successful completion of training and once deemed competent, trained staff will be permitted to train additional personnel (train-the-trainer approach).

Similarly, the Project shall require that China Road and Bridge Corporation (CRBC – EPC Contractor) and any subcontractors implement structured HSE training programmes for their personnel. Each contractor is responsible for ensuring that:

- All site workers receive HSE induction and awareness training before commencing activities;
- Additional training needs are identified and provided to maintain competency; and
- Training records are maintained and available for review by the HSE Supervisor and Project Management Unit (PMU).

7.4.3 Communication

The Project HSE Manager shall be responsible for communication with regulatory authorities, while the Community Liaison Officer (CLO) shall handle interactions with host communities and the general public. The Project's Community Relations Plan will provide formal written procedures to ensure that all such communications are documented, transparent, and traceable.

With regard to HSE issues, the Managing Director of the Project Management Unit (PMU), Federal Ministry of Interior will oversee the dissemination of information necessary to mitigate project impacts. This will be achieved through coordinated public notifications (e.g., town hall meetings, press/media announcements, and public notices) and continuous stakeholder engagement.

The Project HSE Manager shall be the designated point of contact for all formal communication with regulatory authorities such as FMEnv, NESREA, and relevant State Environmental Protection Agencies. The Managing Director will be kept informed of such communications, and all pertinent information arising from these interactions will be disseminated to China Road and Bridge Corporation (CRBC – EPC Contractor) and other contractors for appropriate action.

Project communication will also occur across different levels of the PMU, CRBC, subcontractors, and federal/state regulatory authorities during project execution. These meetings may be scheduled to accommodate field visits, review work progress, or address emerging HSE concerns. Discussions are expected to focus on areas of concern, environmental and social performance (based on audits and field monitoring reports), and coordination of upcoming work plans. While CRBC's HSE staff may interact informally with regulatory representatives on routine matters, formal communications shall always be channeled through the Project HSE Manager.

7.4.4 Documentation

The Project Management Unit (PMU), Federal Ministry of Interior shall establish and maintain a formal procedure for the control of all Health, Safety, and Environment (HSE) documentation. This includes plans (e.g., the Environmental Management Plan), associated procedures, checklists, forms, monitoring reports, and other related deliverables.

The document control procedure shall describe the processes the PMU and the China Road and Bridge Corporation (CRBC – EPC Contractor) will employ for official communication of both hardcopy and electronic document submissions.

The PMU shall appoint a Document Control Manager, a senior member of staff responsible for:

- Maintaining a master register of all applicable HSE documents, including the EMP and associated plans;
- Ensuring that the register is accessible and communicated to relevant stakeholders;
- Coordinating with the Project HSE Manager to ensure document revisions are promptly disseminated; and
- Ensuring that updated documents are issued to affected parties and properly integrated into their organizational processes.

The Project HSE Manager shall be responsible for:

- Notifying relevant stakeholders (including CRBC and subcontractors) of any updates or revisions to HSE documents;
- Issuing revised copies and ensuring receipt/acknowledgment; and
- Following up to confirm that changes have been incorporated into contractor and project-level activities.

CRBC shall be required to establish and maintain its own system for HSE document control, which will be consistent with the overarching project procedure. These systems must be described in their Contractor HSE Management Plans and Site-Specific HSE Plans, and will be subject to review and approval by the PMU.

7.5 Environmental Management System (EMS)

According to ISO 14001, an Environmental Management System (EMS) is that part of the overall management framework which includes organizational structure, planning activities, responsibilities, practices, procedures, processes, and resources for developing, implementing, achieving, reviewing, and maintaining the Environmental Policy. An EMS therefore requires that an organization have in place a clear Environmental Policy supported by health, safety, and social safeguards.

For the Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution, a combined Health,

Safety, Environment, and Social (HSES) Policy has been adopted. The EMS provides the framework to achieve continual improvement in environmental and social performance, regulatory compliance, and sustainable development outcomes.

The Project EMS ensures that:

- All operations are consistent with Nigeria's environmental regulatory requirements (FMEnv, NESREA, and State EPAs), as well as international standards (ISO 14001, IFC Performance Standards, and World Bank ESF).
- Responsibilities and accountability for HSE performance are clearly defined.
- Adequate procedures, practices, and resources are allocated to effectively manage risks.
- Monitoring, audits, and reviews are conducted to ensure continual improvement.

The EMS includes a hierarchy of key policies, supporting documents, and programs/plans designed to assure robust HSE performance:

A. Primary Documents

- Health & Safety Policy
- Environmental Policy
- Driving and Road Safety Policy
- Harassment, Violence & Abuse Policy
- Alcohol, Drug & Substance Abuse Policy
- Contractor's HSE Policy (CRBC and subcontractors)
- Management of Change Policy

B. Primary Supporting Documents

- HSE-MS Manual (Project-level)
- Contractor's HSE Manual (CRBC and subcontractors)
- Employees' HSE Handbook
- Office HSE Manual (PMU)

C. Programs & Plans

- Short Service Employees (SSE) Induction Program
- Hazard Communication Program
- Lock-Out/Tag-Out (LOTO) Program
- Waste Management Plan
- Commitment, Training, Targets & Recognition Program
- Incident Investigation and Reporting Program
- Emergency Preparedness & Response Plan
- Behaviour-Based Safety Program
- Inspection, Audit & Compliance Program
- Journey and Transport Management Program
- Alcohol, Drug, and Smoking Control Program
- Risk Assessment & Management Program
- Ergonomics & Workplace Safety Program

7.6 Environmental Monitoring Plan

An Environmental Monitoring Plan (EMP-Mon) provides a structured schedule for the collection and analysis of environmental data through a series of systematic and repetitive

measurements. According to UNEP (1996), three main types of environmental monitoring are recognized within the EIA framework:

- **Baseline Monitoring:** Measurements of environmental and social parameters during the pre-project period to establish reference conditions.
- **Effects Monitoring:** Measurements of environmental and social parameters during project construction, installation, and operational phases to detect changes attributable to project activities.
- **Compliance Monitoring:** Periodic or continuous measurement of environmental parameters and emissions/discharges to ensure compliance with regulatory standards and project commitments. Compliance monitoring is further subdivided into:
 - **Mitigation Measures Monitoring:** Verification that prescribed mitigation measures identified in the EIA are being effectively implemented.
 - **Regulatory Compliance Monitoring:** Comparison of monitoring results with statutory requirements, occupational health standards, and environmental benchmarks.

For the Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution, the Project Management Unit (PMU) shall adopt a comprehensive monitoring schedule covering both effects monitoring and compliance monitoring throughout project implementation.

Baseline environmental and social conditions have already been established and documented in Chapter 4 of this report, and therefore are not repeated in this section.

The monitoring schedule prescribed by this EIA shall be implemented as the Post-EIA Monitoring Programme, under the supervision of the Project HSE Manager in collaboration with the Federal Ministry of Environment (FMEnv), NESREA, relevant State Environmental Agencies, and China Road and Bridge Corporation (CRBC – EPC Contractor).

7.6.1 Objectives of Post-EIA Environmental Monitoring

The Post-EIA Environmental Monitoring Plan for the Nigeria Internal Security Project Phase II has the broad objective of determining whether environmental or social changes occur as a result of excavation, site preparation, construction, installation, and operational activities. The monitoring plan also serves as an early warning system for detecting unanticipated adverse impacts or changes in impact trends.

Specific objectives are to:

- Verify the effectiveness of proposed mitigation measures;
- Ensure that project activities (pre-construction, construction, and operation) are carried out in accordance with prescribed mitigation measures and regulatory compliance procedures; and
- Provide an early warning mechanism such that prompt corrective actions can be taken whenever an impact indicator approaches a critical threshold.

Impact indicators will be defined in terms of carrying capacity, threshold levels, and regulatory enforcement standards. Implementation of this Post-EIA Monitoring Programme will enable the Project Management Unit (PMU) and China Road and Bridge Corporation (CRBC – EPC Contractor) to manage and control the timing, location, and level of impacts, while also generating empirical cause-and-effect data to validate predictive models of project-impact relationships.

7.6.2 Scope of the Environmental Monitoring Plan

The Environmental Monitoring Plan will cover two key categories of monitoring:

a. Compliance Monitoring

- Monitoring of mitigation measures during site preparation and construction.
- Monitoring of mitigation measures during operations, including equipment performance standards.

b. Effects Monitoring

- Sampling and analysis of discharges and affected environmental components during site preparation, construction, and operations.

The monitoring programme will establish parameters for each environmental and socioeconomic component likely to be affected by the project, including:

- Air quality
- Noise and vibration
- Water quality (surface and groundwater)
- Hydrology
- Hydrobiology and fisheries
- Vegetation and wildlife
- Soil and sediment quality
- Waste management practices
- Traffic and transport impacts
- Occupational health and safety
- Public health and safety
- Socioeconomic impacts

Based on predicted impacts and prescribed mitigation measures, this programme is considered adequate for the project.

7.6.2.1 Proposed Environmental Monitoring Programme

Across all project phases, regular data collection, audits, inspections, and monitoring will be required for each impact category at pre-determined frequencies. Monitoring schedules will be based on statutory requirements and project-specific post-EIA monitoring provisions.

Monitoring results will be reported to the Federal Ministry of Environment (FMEnv) and other relevant regulatory agencies as stipulated in approval conditions. Internal audits will be conducted by the Project HSE Manager, while external audits will be carried out by Nigerian regulators.

Monitoring frequencies may be daily, weekly, quarterly, semi-annual, annual, biennial, or continuous, depending on the parameter and regulatory requirements.

The monitoring programme will follow both Nigerian regulatory standards and the World Bank's Environmental Performance Monitoring and Supervision Guidelines (Update to the Environmental Assessment Sourcebook No. 14, 1996, and subsequent updates). For each affected environmental or social component, the programme will define:

- Monitoring objectives;
- Parameters to be measured, methods employed, sampling locations, frequency, and thresholds;
- Institutional responsibilities and timelines;
- Reporting requirements; and

- Costs and financing provisions.

7.6.2.2 Monitoring Schedule and Parameters

The Post-EIA Monitoring Programme developed for the project will include both compliance and effects monitoring. Table 7.2 (to follow) summarizes the recommended mitigation, monitoring, and training measures for each environmental resource.

After the first six months of project operations, the monitoring programme will be reviewed. Frequencies may be adjusted depending on observed trends for example, parameters consistently found below thresholds may be monitored less frequently or excluded. While the PMU will retain overall responsibility for monitoring, specific monitoring activities may be outsourced to qualified and certified contractors. Nonetheless, accountability for compliance with Regulatory Monitoring and Post-EIA Monitoring obligations will remain with the PMU.

Monitoring reports shall be submitted periodically to the FMEnv, NESREA, and other regulators in accordance with the conditions of the EIA approval.

7.6.2.3 Regulatory Approval Process

The Project shall incorporate procedures to ensure that all necessary regulatory approvals are obtained prior to site activities. Specifically:

- The FMEnv EIA approval is a mandatory requirement before the commencement of any on-site construction or installation.
- Where applicable, permits from NESREA, State Environmental Protection Agencies, and other competent authorities shall also be obtained.
- CRBC and subcontractors will be required to operate strictly within the limits of these approvals and permits.

The PMU will coordinate with regulatory bodies to ensure timely submissions, approvals, and compliance reporting throughout the project life cycle.

Table 7.2: Summary of Impacts, Mitigations, Effects Monitoring Requirements and Residual Impacts

Impact ID	Project Phase / Activity	Impact Category	Description of Environmental / Social Impact	Impact Significance	Mitigation Measures	Effects and Mitigation Compliance Monitoring	Monitoring Frequency	Responsible Party	Residual Impact
B1	All Phases	Positive	Increased income from transportation of workers, equipment, and materials.	Beneficial	Engage local transport contractors; driver training; schedule off-peak truck movements; traffic safety sensitization.	Review driver training records; transport contractor engagement reports; road safety statistics.	Quarterly	MoI/PMU, CRBC Logistics Unit	Beneficial
B2	All Phases	Positive	Employment generation for skilled, semi-skilled, and unskilled workers.	Beneficial	Prioritize local labour; equal opportunities; fair wages; skills transfer/apprenticeships.	Check % of local hires; audit employment contracts; gender/youth recruitment statistics.	Monthly	MoI/PMU, CRBC HR	Beneficial
B3	All Phases	Positive	Opportunities for SMEs (catering, accommodation, security).	Beneficial	Contract SMEs; transparent procurement; SME training; recycling businesses support.	Monitor SME contracts; procurement audit; SME capacity-building records.	Semi-annual	MoI/PMU Procurement, CRBC	Beneficial
B4	All Phases	Positive	Increased trading of local/national materials and ICT equipment.	Beneficial	Source non-critical materials locally; cooperative supply chains; fair pricing; procurement monitoring.	Procurement audit; cooperative participation review; fair pricing checks.	Quarterly	MoI/PMU, CRBC Procurement	Beneficial
B5	All Phases	Positive	Skills acquisition and training in ICT, surveillance, solar.	Beneficial	Structured training; workshops; vocational institutions engagement; certification.	Training attendance; certification records; skills audit.	Semi-annual	MoI/PMU Training Unit, CRBC	Beneficial
B6	Operations	Positive	Enhanced security, deterrence of	Beneficial	Integrate with NIS/NSCDC; community awareness;	Security reports; awareness campaigns;	Quarterly	MoI/PMU, Security Agencies	Beneficial

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			crime.		complaint system; human rights training.	complaint logs; training records.			
B7	Operations	Positive	Improved quality of life from safer commerce.	Beneficial	Patrol integration; social infrastructure; feedback platforms; inclusive safety programmes.	Patrol schedules; infrastructure investment logs; feedback reports.	Annual	MoI/PMU, NSCDC, CRBC	Beneficial
B8	All Phases	Positive	Better social inclusion for host communities.	Beneficial	Community participation; outreach; scholarships; grievance redress.	Review participation records; scholarships awarded; grievances resolved.	Semi-annual	MoI/PMU, CLO, CRBC	Beneficial
PP1	Pre-Operations – Physical Presence	Social	Pressure on infrastructure (roads, housing, utilities).	Moderate	Influx Mgmt Plan; workers' camps; prioritize locals; support host infrastructure.	Inspect camp facilities; check local hire %; monitor service demand.	Monthly	MoI/PMU, CRBC HSE Supervisor	Low
PP2	Pre-Operations – Physical Presence	Economic	Temporary inflation, trade disruption.	Moderate	Monitor prices; strengthen cooperatives; phase demobilization; encourage entrepreneurship.	Price monitoring surveys; cooperative activity reports; entrepreneurship support review.	Quarterly	MoI/PMU, CRBC, Local Gov't	Low
PP3	Pre-Operations – Physical Presence	Socio-cultural	Prostitution, crime, social tensions.	Moderate	HIV/STD awareness; cultural induction; female/youth hiring; support traditional mediation.	Records of awareness campaigns; social audit; community liaison logs.	Quarterly	MoI/PMU, CLO, CRBC HR	Low
SC1	Pre-Operations – Site Clearing	Biophysical	Loss of vegetation, soil disturbance, habitat alteration.	Moderate	Restrict clearing; reuse topsoil; reforestation; ban poaching/logging.	Site inspection; reforestation audit; soil stockpile monitoring.	Weekly	CRBC HSE, PMU HSE	Low
SC2	Pre-Operations – Site Clearing	Biophysical	Noise, dust, vibration.	Low	Water spraying; equipment silencers;	Dust/noise monitoring; PPE	Weekly	CRBC HSE	Low

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					daytime limits; PPE for workers.	inspection; equipment records.			
SC3	Pre-Operations – Site Clearing	Social	Land acquisition, farm displacement.	Moderate	Compensation & Livelihood Plan; alternative training; grievance redress; timely payments.	Compensation records; grievance logs; livelihood training reports.	Quarterly	Mol/PMU, CLO	Low
EI1	Pre-Operations – Equipment Installation	Biophysical	Visual intrusion from towers/masts.	Low	Natural colours; use disturbed areas; plant buffers; minimize lighting.	Visual inspections; community feedback on siting.	Annual	CRBC HSE, PMU	Low
EI2	Pre-Operations – Equipment Installation	Biophysical	Soil/water contamination from fuel/chemicals.	Moderate	Bunded storage; Spill Plan; hazardous materials training; inspections.	Check bunded areas; spill drill records; water sampling.	Monthly	CRBC HSE, PMU	Low
WE1	Pre-Operations – Waste & Emissions	Pollution	Solid waste (packaging, metals, plastics).	Moderate	Waste Mgmt Plan; segregation; licensed contractors; audits.	Waste audits; contractor licenses; segregation checks.	Monthly	CRBC Waste Unit, PMU	Low
WE2	All Phases – Waste & Emissions	Pollution	E-waste (batteries, solar panels, electronics).	Moderate	E-Waste Policy; return batteries; recyclers; staff training.	Audit recycler certification; e-waste logs; staff training records.	Quarterly	Mol/PMU, CRBC Waste Mgmt	Low
OM1	Operations – Surveillance	Biophysical	Visual impacts of masts/towers.	Low	Plant buffers; reduce glare; avoid sacred sites; community siting input.	Site inspection; community consultation reports.	Annual	CRBC HSE, CLO	Low
OM2	Operations – Surveillance	Health	Electromagnetic exposure.	Low	EMF Safety Program; exposure monitors; restricted access; staff rotation.	EMF monitoring results; signage inspection; staff schedules.	Semi-annual	CRBC HSE, NESREA	Low
OM3	Operations – Power Systems	Pollution	Minor emissions from backup generators.	Low	Low-emission gensets; regular maintenance; acoustic enclosures; emission monitoring.	Emission monitoring; equipment records.	Quarterly	CRBC HSE, NESREA	Low
OM4	Operations –	Pollution	Waste from	Moderate	E-Waste Collection	Disposal audit;	Semi-annual	CRBC HSE,	Low

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	Maintenance		obsolete surveillance equipment.		Centres; approved disposal; safe dismantling; disposal monitoring.	dismantling training records; disposal chain checks.		MoI/PMU	
H1	All Phases	Health	Sanitation, solid waste, dust.	Moderate	Sanitation Plan; mobile toilets; hygiene campaigns; health monitoring.	Sanitation inspections; health audit reports.	Monthly	CRBC HSE, PMU	Low
H2	Pre-Operations/Operations	Health	Communicable diseases (labour influx).	Moderate	STD & malaria campaigns; medical screening; clinic/first aid; LGA collaboration.	Medical records; campaign logs; clinic service data.	Quarterly	CRBC HSE, Local Health Depts.	Low
H3	Pre-Operations/Operations	Health	Accidents (heights, electrocution, machinery).	High	Enforce OHS; PPE; Emergency Plans; drills.	Daily PPE checks; accident records; emergency drill reports.	Daily / Quarterly	CRBC HSE, PMU HSE	Moderate
H4	Operations	Health	Road safety risks (equipment transport).	Moderate	Journey Mgmt Plan; driver training; road signage; insurance.	Transport safety audits; driver records; signage inspection.	Monthly	CRBC Logistics, PMU	Low
H5	Operations	Health	Psychosocial stress from security presence.	Low	Community forums; human rights training; grievance system; peacebuilding.	Forum records; grievance logs; security training reports.	Semi-annual	MoI/PMU, CLO	Low
CM1	All Phases	Cumulative	Land take for surveillance sites.	Low	Land-use master planning; minimize footprint; land rehab; conservation offsets.	Land audits; rehabilitation inspections.	Annual	MoI/PMU, CRBC	Low
CM2	All Phases	Cumulative	Pressure on services, housing, transport.	Moderate	Work with gov't for infrastructure; CDAs; temporary housing; monitor wellbeing.	CDA records; community wellbeing indicators.	Annual	MoI/PMU, State Gov't, CLO	Low
D1	Decommissioning	Social	Job and income losses.	Moderate	Exit programmes; retraining; SME support; grievance mechanism.	Worker retraining records; grievance reports; SME support data.	Once-off / During decommissioning	MoI/PMU, CRBC HR	Low

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D2	Decommissioning	Biophysical	Improper dismantling & disposal.	Moderate	Decommissioning Plan; licensed contractors; safe dismantling; disposal monitoring.	Site inspections; contractor license checks; disposal site audits.	Weekly (during decommissioning)	PMU, CRBC, Regulators	Low
D3	Decommissioning	Biophysical	Land restoration challenges.	Moderate	Restore with native vegetation; re-contour land; post-restoration monitoring; LGA partnership.	Soil/water monitoring; vegetation growth checks; restoration audits.	Annual (3 yrs post-closure)	Moi/PMU, CRBC, LGA	Low

7.7 Emergency Response Planning Requirements

The Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution has incorporated critical safety measures into the engineering design of its surveillance and communication infrastructure to minimize risks of hazards, incidents, near misses, or accidents. Despite these preventive measures, the potential for emergencies remains due to human error, equipment malfunction, natural events, or deliberate acts of sabotage.

Therefore, it is essential to establish sound, cost-effective, and well-coordinated emergency response and contingency plans that can be promptly activated to reduce risks to human life, the environment, project assets, and host communities. These contingency plans shall cover all project facilities, installation sites, support services, transport routes, and ancillary operations.

The Project Management Unit (PMU), in collaboration with the China Road and Bridge Corporation (CRBC – EPC Contractor), shall implement international best practices in emergency preparedness and response. These procedures will:

- Ensure prompt detection, containment, and mitigation of leaks, spills, fires, structural failures, or other emergency situations;
- Provide clear lines of communication and responsibilities for emergency actions;
- Build confidence among regulators, security agencies, host communities, and the general public regarding the safety of project operations;
- Protect project personnel, contractors, and communities from unnecessary risks; and
- Minimize potential environmental and social consequences of accidents through rapid response, evacuation protocols, and coordination with security agencies (NIS, NSCDC, Police, and State Emergency Services).

The Emergency Response Plan (ERP) will include:

- Hazard Identification and Risk Assessment (HIRA) for all project phases;
- Emergency Command and Control Structure, defining responsibilities of PMU, CRBC, contractors, and community representatives;
- Notification and Communication Procedures with regulators, host communities, and first responders;
- Evacuation, Rescue, and Medical Response Protocols;
- Training and Simulation Drills for project staff, contractors, and security agencies; and
- Post-Incident Reporting, Review, and Corrective Action Procedures to ensure continuous improvement.

7.8 Checking and Corrective Action

The objective of the inspection and monitoring activities outlined in this section is to verify compliance with the Environmental Management Plan (EMP). These inspection and monitoring procedures will also be reflected in the Contractor's HSE procedures.

The China Road and Bridge Corporation (CRBC – EPC Contractor) will be responsible for implementing the environmental and social commitments of the Project Management Unit (PMU), Federal Ministry of Interior in the field on a daily basis. Auditing of inspection and monitoring activities by both CRBC and the PMU provides the mechanism to ensure compliance with regulatory requirements as well as the Project's own HSE standards and commitments.

The inspection activities described in this EMP refer to qualitative monitoring (e.g., visual inspections of construction sites, camps, and equipment). The monitoring activities described in

this EMP refer to effects and compliance monitoring, which are largely empirical, such as measurements of air quality, water quality, noise, and waste management indicators.

7.8.1 Inspection

- Inspections shall be conducted daily by CRBC's HSE Department across all active project sites.
- Findings from inspection and monitoring activities shall be documented and made available to the PMU HSE Supervisor on a weekly basis, or more frequently if required by the PMU HSE Manager.
- The inspections will include compliance checks on mitigation measures, worker safety practices, equipment maintenance, and environmental safeguards.

7.8.2 Monitoring

Monitoring will be carried out to:

- Ensure compliance with FMEnv, NESREA, and State EPA regulatory requirements.
- Evaluate the effectiveness of mitigation measures and operational controls.
- Track progress against the commitments outlined in Table 7.2 (Summary of Impacts, Mitigation, and Monitoring).

The Post-EIA Monitoring Programme developed for this project, as discussed in Section 7.6, provides the framework for monitoring all significant environmental and social impacts identified in the EIA.

7.8.3 Remediation Plans after Decommissioning

Remediation planning is incorporated into the overall project lifecycle to ensure that the environment is restored to its original or near-original condition during temporary or permanent closure of project facilities. This ensures that:

- Environmental degradation is minimized;
- Land is returned to productive or safe use; and
- Community safety and social stability are maintained after project closure.

The useful life of the surveillance infrastructure is estimated at 20 years, after which decommissioning and remediation shall be implemented.

Activities to be carried out during the decommissioning phase will include:

- Safe dismantling of surveillance towers, equipment, and ancillary infrastructure;
- Removal of all structures and restoration of affected land;
- Environmentally sound disposal or recycling of obsolete materials (including e-waste, metals, and construction debris).

The choice of remediation strategy will depend on the prevailing biophysical and social conditions at the time of decommissioning and the nature of impacts identified. Restoration will include land re-contouring, re-vegetation with native species, and monitoring of soil and water quality until the site is certified rehabilitated by regulators.

7.9 Mitigation Measures and Monitoring Implementation Budget

The costs associated with the implementation of mitigation measures, training, and environmental/social monitoring activities identified in Table 7.2 have been incorporated into the overall budget for the Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution.

These budget provisions will cover:

- Implementation of environmental and social mitigation measures;
- Capacity building and training of project staff, contractors, and community representatives;
- Environmental and social monitoring (baseline, compliance, and effects monitoring);
- Regulatory compliance audits; and
- Emergency preparedness and response measures.

The Project Management Unit (PMU), Federal Ministry of Interior, in collaboration with the China Road and Bridge Corporation (CRBC – EPC Contractor), shall ensure that adequate financial resources are allocated for EMP implementation. Costs will be refined and adjusted during project execution phases (pre-construction, construction, operations, and decommissioning) to reflect prevailing market realities and regulatory requirements at the time of implementation.

Where necessary, special provisions for unforeseen impacts or additional regulatory requirements shall also be included in contingency allocations.

CHAPTER EIGHT

DECOMMISSIONING AND ABANDONEMENT

8.1 Introduction

The Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution is designed for an operational lifespan of 20–30 years, after which decommissioning and abandonment will be necessary. This stage signifies the end of the infrastructure’s useful life and requires safe removal, repurposing, or disposal of facilities in accordance with Nigerian regulatory frameworks and international best practices.

Decommissioning may also occur earlier if facilities (e.g., towers, solar power systems, ICT servers, or control centres) become obsolete, uneconomical, or if the Project Management Unit (PMU) under the Federal Ministry of Interior determines discontinuation is more beneficial. Planning for decommissioning will commence at least five years before closure to ensure the process is safe, environmentally sound, and socially acceptable.

8.1.1 Refurbishment and Re-use

Where feasible, surveillance towers, ICT components, and control centres will be refurbished and redeployed. This promotes circular economy practices, reduces waste, and minimizes environmental costs.

8.1.2 Scrapping

Steel towers, batteries, and obsolete electronic components will be dismantled and recycled. Certified recycling contractors will be engaged to ensure compliance with FMEnv and NESREA standards.

8.1.3 Offsite Waste Disposal

Electronic waste (cameras, servers, solar units, storage devices, and batteries) not suitable for reuse will be transferred to licensed facilities. Only certified waste handlers using approved technologies will be engaged to prevent environmental and health hazards.

8.1.4 Remediation and Re-vegetation

- Decommissioned sites will be restored to safe and productive use through:
- Soil and groundwater monitoring with remediation where contamination (e.g., from fuel storage or battery leaks) is identified.
- Stabilisation or removal of tower foundations.
- Restoration of access roads and camp areas.
- Re-vegetation of disturbed land with native species.
- The Decommissioning and Abandonment Plan will define:
- Facilities to be dismantled.
- Approved reuse, recycling, and disposal methods.
- Stakeholder consultation procedures.
- Mitigation of environmental, social, and health impacts.
- Site rehabilitation and monitoring requirements.
- Post-decommissioning land-use restrictions, where applicable.

8.2 Stakeholder Consultation for Decommissioning

- Decommissioning will be carried out in consultation with:
- Host communities and traditional institutions.
- Federal and State regulators (FMEnv, NESREA, State EPAs).
- Security agencies (NIS, NSCDC, NPF, NEMA/SEMA).
- Contractors, technical experts, and NGOs.
- The decommissioning team will include representatives of the PMU, China Road and Bridge Corporation (EPC Contractor), regulatory authorities, and community stakeholders to ensure transparency and local acceptance.

8.3 Wind-down Operations

- As operations approach closure, the PMU will implement a structured wind-down plan that includes:
- Gradual shutdown of surveillance facilities.
- Rationalisation of workforce and redeployment where possible.
- Skill's re-training and livelihood support for affected personnel.
- Early notification to host communities and contractors to prepare for transition.

8.4 Decommissioning of Facilities

At project closure, all surveillance towers, ICT systems, solar arrays, and control shelters will be safely dismantled.

- Protection from Air Emissions: Dust suppression and emissions control measures will be applied during dismantling.
- Noise Control: Noise abatement will be enforced, with workers equipped with protective gear.
- Waste Handling: Wastes will be segregated into recyclable, inert, and hazardous streams. Licensed contractors will handle e-waste (e.g., batteries, solar cells, electronics) to ensure safe disposal.
- Site Restoration: Tower foundations and disturbed areas will be stabilized, re-vegetated, and returned to community use (e.g., agriculture, grazing, or communal facilities).
- Reuse/ Recycling of Equipment: ICT and surveillance devices may be redeployed to other government facilities. Prefabricated buildings may be converted into community assets (schools, clinics, or offices). Scrap metals and solar components will be recycled. Contaminated soils will be remediated and monitored until safe.

8.5 Reporting

- Upon completion, the Federal Ministry of Interior will submit a Post-Decommissioning Report to FMEnv and relevant regulators. The report will include:
- Facilities decommissioned and methods used.
- Scope of dismantling (partial or full).
- Stakeholder engagement records.
- Recovered recyclable/reusable materials.
- Waste handling and disposal methods.
- Site restoration outcomes.
- Post-decommissioning environmental monitoring results.

CHAPTER NINE

CONCLUSION AND RECOMMENDATION

The Environmental Impact Assessment (EIA) Study for the Nigeria Internal Security Project Phase II – Critical Infrastructure (Railway, Dam, Gas & Mining, Power Station and Port) Security Video Surveillance Solution has comprehensively evaluated the project’s potential environmental, health, safety, and socio-economic impacts. The study highlighted significant positive outcomes, including enhanced national security, job creation, capacity building, improved safety of critical assets, and strengthened socio-economic resilience in host communities. Potential negative impacts were also identified, such as land disturbance, waste generation, e-waste management challenges, noise, and occupational health and safety risks.

To address these risks, robust mitigation measures and management strategies have been developed through the Environmental Management Plan (EMP). The EMP outlines frameworks for waste and hazardous material management, influx and journey management, emergency response, occupational health and safety, and continuous community engagement. When strictly implemented, these measures will ensure that residual impacts remain within acceptable limits and that sustainability objectives are achieved.

It is recommended that the Federal Ministry of Interior (MoI), in collaboration with the EPC Contractor (China Road and Bridge Corporation), ensures full implementation of the EMP, backed by continuous monitoring, compliance audits, and transparent engagement with regulators, host communities, and other stakeholders. Doing so will safeguard the environment, protect community health and safety, and ensure that the project delivers its intended socio-economic and security benefits.

The successful execution of this project will not only enhance the protection of Nigeria’s critical infrastructure but will also contribute to long-term national stability, economic growth, and sustainable development.

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APPENDIX 1

DETAILED LABORATORY METHODS

Temperature, pH and Conductivity of Soil Samples

20.0 g of fresh soil sample were weighed into a 50ml beaker and 20ml of distilled water added to the beaker. The mixture was thoroughly stirred and allowed to stand for 30 minutes and the WTW multi-meter probes were then inserted to ensure the above parameters.

Particle Size Distribution of Soil Samples

Particle size distribution (PSD) was determined using the hydrometer method followed by sieving recommended for soil samples containing less than 35% fine particles i.e. clays and silts. The test method is based on the BS 1377 (Part 2; 1990) which is in accordance with the Dutch RAW and ASTM D422.

Total Microbial Count (Water and Soil Sample)

Indirect cell counts on water and soil samples were carried out to determine the total indirect microbial population. The test methods used are the ASTM D5465-93:

Determining Microbial Colony counts from Water Analyzed by Plating Methods, and APHA 907: Standard Plate Count

Total microbial colonies were calculated as follows:

Plate Count (cfu/ml) = (No. of colonies on plate) × (dilution factor)

Phosphate – Phosphorus in Soil Samples

Phosphate – phosphorus in soil samples were determined using UV/Visible spectrophotometer. The Stannous Chloride Reduction Method, based on the method described in the Chemical Analysis of Ecological Matter (2nd edition) and APHA 4500 PD, were applied.

Phosphate – phosphorus content of soil samples were calculated as follows:

$$\text{Phosphate – Phosphorus (mg/kg)} = \frac{C \text{ (mg/l)} \times \text{Solution Volume (l)}}{\text{Aliquot} \times \text{Sample Weight (g)}}$$

Where C = mg phosphorus obtained from calibration graph using the UV/Visible spectrophotometer and Vision software version 3.

1000 = Conversion factor to kg

Phosphate – Phosphorus in Water Sample

The phosphate-phosphorus (PO_4^{3-} - P) content of water sample was determined by spectrophotometry based on APHA 4500-PD using Helios Zita UV/Vis Spectrophotometer (Thermo Scientific). Phosphate (mg/l) content was calculated as follows.

$$\text{PO}_4^{3-} \text{ (mg/l)} = \frac{\text{mg PO}_4^{3-} \text{ (in approximately 104ml final volume)}}{\text{Sample volume (ml)}}$$

Sulphate – Sulphur in Water Sample

The APHA 4500 – SO_4^{2-} -E method (Visible Light Method) described in the Standard Method for Examination of Water and Wastewater was used to determine the sulphate (SO_4^{2-}) content of water sample. SO_4^{2-} was calculated as follows:

$$\text{SO}_4^{2-} \text{ (mg/l)} = \frac{\text{mg/l SO}_4^{2-} \text{ in sample} - \text{SO}_4^{2-} \text{ in reagent blank}}{\text{Sample volume (ml)}}$$

Nitrate – Nitrogen in Soil Samples

The Brucine Colorimetric method in accordance with CAEM and USEPA 352.1 was used to determine the nitrate-nitrogen (NO_3^- -N) content of soil samples. NO_3^- was calculated as follows:

$$\text{NO}_3^- \text{ (mg/kg)} = \frac{\text{mg (NO}_3^-) \text{ from calibration graph Volume of extractant}}{\text{Volume of extract (ml) Sample weight (g)}}$$

Nitrate - Nitrogen in Water Sample

The test method used to determine the nitrate-nitrogen content of water sample is the Brucine Colorimetric method in accordance with EPA 352.1. Nitrate-nitrogen (NO_3^- -N) content of water sample was calculated as follows:

NO_3^- (mg/l) = (mg/l NO_3^- in sample from calibration graph) – (mg NO_3^- in reagent blank)

Cations in Water Sample

Basic cations in water samples were determined using GBC Avanta Atomic Absorption Spectrophotometer (AAS). AAS measurements were carried out in accordance with the procedures described below.

Na, Mg and K: APHA 3111B (21st edition) / ASTM D3561

Ca: APHA 3111D (21st edition) / ASTM D3561

Cation contents were calculated as follows:
Cation concentrations (mg/l) =
$$\frac{C \times Y}{X}$$

Where C = Concentration of cation determined from calibration curve

(mg/l) Y = Final volume made-up (ml)

X = Volume of sample (ml)

Metals in Soil Samples

Heavy metal contents of soil samples were determined using x-ray fluorescence spectrometer in accordance with USEPA 6200. Samples were oven dried at 110°C, unwanted material removed and samples reduced to <2µm diameter by crushing. Crushed samples were further powdered because of the in homogeneity of soil samples. The powder was processed into pressed pellets, transferred to clean prolene foil and then into a sample vial and labeled, ready for elemental analyses.

Results are calculated automatically by the software as the sample name, method, job, sample mass, sample diameter, sample type, sample state and prolene foil sizes has been computed in the software.

Heavy Metals in Water Samples

Heavy metal content of water samples was determined using GBC Avanta Atomic Absorption Spectrophotometer (AAS). AAS measurement of heavy metal content in water sample was carried out following the procedures indicated below:

Cd, Zn, Cu, Ni and Pb: APHA 3111B (20th)

edition) V: APHA 303C (15th
edition)

Cr: APHA 311C

Results were calculated as follows:

$$\text{Metal concentration (mg/l)} = \frac{C \times V}{X}$$

Biochemical Oxygen Demand in Water

The respirometric method as described in APHA 5210D was used in water analysis based on manufacturer's instructions, reaction vessel type and volume, and instrument operating characteristics. The Biochemical Oxygen Demand (BOD) values were read from the equipment.

Chemical Oxygen Demand in Water

The titrimetric method of analysis was applied using APHA 5220D standard

method. The Chemical Oxygen Demand (COD) is thus:
and (COD), calculated as

$$\text{COD as mg O}_2 / \text{l} = \frac{(A - B) \times M \times 8000}{\text{Volume of sample, ml}}$$

Where: A = ml titrant used for blank
B = ml FAS used for
sample M = molarity of
titrant, and
8 = equivalent weight of
oxygen 1000 = conversion
factor to litre

Quality Assurance

A quality assurance (QA) plan that covered all aspects of the baseline study was adopted. The plan covered sample collection, handling, laboratory analysis and data (results) management as described below:

Sample Collection/Handling

Generally, samples were collected in accordance with the recommendations contained in Federal Ministry of Environment guidelines and standards. *In-situ* measurement of unstable physic-chemical parameters e.g. pH, temperature, dissolved oxygen and turbidity was carried out to assure reliability and integrity of the results. All field

instruments were cleaned and re-calibrated after each use. Other QA measures adopted during sample collection have been discussed earlier.

Sample chain of custody forms were used for logging and tracking of samples from the point of collection in the field to the laboratory where analysis were carried out. Samples were preserved in accordance with the recommendations contained in the Federal Ministry of Environment guidelines and standards.

Laboratory Analysis

Quality Assurance (QA) measures adopted for laboratory analysis are in accordance with Federal Ministry of Environment recommendations and included collection and analysis of duplicate samples to establish analytical precision, and analysis of spiked and blank samples to determine analytical accuracy. Blank analyses were also used to establish analysis. Other QA measures adopted are:

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

Data Management

Data management involved recording and transmitting of analytical results into standard data spreadsheets. Processing/calculation of results were done following written standard operating procedures. Final results were issued only after a general QA check and validation had been done.

Sample Handling, Tracking, Transportation

Prior to sampling and storage, an indelible label shall be attached to the containers identifying each sample. The label contained the following information:

- sample code;
- name and location of site;
- date and time of sampling;
- location of sampling;
- sample name and number;
- name of sampling personnel;
- type of sample; and

- type of preservative, if any.

All samples collected in the field were adequately labeled and recorded in the field notebook. Collected sub-samples were preserved in accordance with standard work instructions.

Prior to departure from field, inventory of the samples collected were taken and sample IDs and all necessary information recorded in chain of custody forms.

Prior to departure, all samples transferred into well-protected coolers fortified with ice cubes, sealed and adequately labeled for transfer to the laboratory. Upon arrival of the samples in our laboratory, the information on the chain of custody was cross-checked to confirm appropriate and adequate recording. Physical counts of the samples were carried out. Upon confirmation of correctness of all information and deliverables, the samples were received in accordance with sample procedure and stored appropriately.

The detailed sample handling procedure as contained in the work instruction and implemented to this field exercise is presented in the table below.

Sample Handling Protocol

Determination	Minimum Sample Vol.	Container	Preservative	Container Pre-treatment
Water				
Temp., pH, Conductivity	Measure on site. Collect 2L for check in the lab.	Plastic or glass	Cool	Rinsed with distilled water
Heavy Metals	1.0l	Plastic or glass	Add conc. HNO ₃ to pH <2	Rinsed with 1+1HNO ₃
Sulphide	2.0l	Plastic or glass	Cool, 4°C	Rinsed with distilled water
Hydrocarbon (THC, oil and grease)	1.0l 1.0l	Wide mouthed glass bottles	H ₂ SO ₄ to pH <2, & cool	Rinsed with solvent
COD	100ml	Plastic or glass	Add H ₂ SO ₄ to pH <2, & cool	-
Microbiology (HUF, HUB, etc)	200ml	Wide mouthed glass bottles	Cool	Sterilized
TPH	1.0l	Glass	Cool	Rinsed with solvent
Sediment / Soil				

Total hydrocarbon content	100g	Glass	Cool	Rinsed with solvent
Heavy metals	100g	Plastic	Cool	Rinsed with 1+1HNO ₃
Microbiology (HUF, HUB, etc)	50g	Plastic or glass	Cool	Sterilized

Sample Handling

Chain of custody forms were used for logging and tracking of samples from the point of collection in the field to the laboratory where analyses were carried out. Samples were preserved in accordance with FMEnv recommended procedures.

Laboratory Analyses

Quality Assurance and Quality Control (QA/QC) measures adopted for laboratory analysis were in line with standard practice and included collection and analysis of duplicate samples to establish analytical precision. Other QA/QC measures adopted include:

- only adequately trained personnel were used at all phases of the study;
- written analytical standard operating procedures were followed during analyses;
- routine auditing and checking of analyses results were carried out.

Data Management

Standard data spreadsheets were used for recording and transmitting analytical results. Presentation of results was carried out following written standard operating procedures. Final results were issued only after a general QA/QC check and validation had been carried out.

APPENDIX II

QUESTIONNAIRE/STRUCTURED INTERVIEW/FOCUS GROUP DISCUSSION FOR SOCIAL IMPACT ASSESSMENT (SIA)

1. Name of community
2. Language(s) spoken.....
- 3a Local Government Area/State.....
- 3b Estimate the population of the community.....

DEMOGRAPHIC DATA

4. Sex:.....
5. Age Last Birthday.....
6. What is your religion.....
7. Ethnic Group:
8. Marital Status.....
Single []
Married []
Separated []
Divorced []
Widowed []
- 8(b) If married, how many wives do you have:
9. Family Size (no. of children)
Small (1 – 3)
Average (4 – 6)
Large (above 6)
10. What is your highest educational qualification?
WASC/SSCE level [] Diploma level []
Degree level [] Masters/Ph.D. []
Primary School [] None at all []
11. How many people in your household with:
- Secondary Education []
- Post-Secondary Education []
12. What is your occupation?
13. What is your average monthly income?

Below N10,000 []

N10,001 – 20000 []

N20,001 – 50,000 []

N50,001 – 80,000 []

Above N80,000 []

14. Age Distribution/Composition of your household (including parents)

	Male	Female
No. of persons 0-15	[]	[]
No. of persons 16 – 24	[]	[]
No. of persons 25 – 34	[]	[]
No. of persons 35 – 50	[]	[]
No. of persons above 51	[]	[]

15. In your household, how many persons are:

	Male	Female
-Students/Apprentice	[]	[]
-Business/Contractor	[]	[]
-Technicians	[]	[]
-Farming/Fishing/Hunting	[]	[]
-Civil Servants	[]	[]
-Full housewives	[]	[]
-Unemployed	[]	[]
-Others	[]	[]

On the average, how many persons live in a room here?

17. **SOCIAL INFRASTRUCTURE**

Please complete the table on social infrastructure below:

Facility	Provided by Government	Provided by NGC	Provided by Others (specify)
Tarred Roads			
Electricity			
Portable Water			
Markets			
Primary Schools			
Secondary Schools			

Facility	Provided by Government	Provided by NGC	Provided by Others (specify)
Town Hall			
Health Centres			
Police Station			
Waste Disposal System			

ECONOMIC DATA

18. Which type of house do you live in?
19. Are you a tenant or Landlord?.....
20. How is land owned here?
 By individuals [] By community []
21. How do you acquire land in this area?
 Purchase [] Inheritance []
 Lease [] Rent []
22. Which industries exist in your community that offer people jobs (FGD)

23. What types of crops are grown here?

POLITICAL ORGANISATION

24. Who is the head of this community? (FGD).....
25. Describe the political structure of the community? (FGD)

26. How are disputes settled in this community? (FGD)

CULTURAL VALUES/LIFESTYLE

27. Please name the totem/animals you forbid in your community here

-
28. Name the traditional festivals you celebrate here.
-
-
29. Name the gods/deities worshipped in the community.
-
-
30. List names of the shrines/traditional place of worship in this community.
-
-
31. In the past five years, has any of these shrines been moved or destroyed? Yes or No. Give reasons:
-

SOCIAL/ENVIRONMENTAL PROBLEMS

32. Tick main environmental problems in this community
- Pollution
 - Rainstorm/flooding
 - Erosion
 - Soil infertility
 - Pest attack/invasion
 - Water salinity
 - Traffic congestion
33. Please list the diseases that are common in this area
-
-
-
34. Which crimes occur here frequently (please list them)
-
-
-

COMMUNITY CONCERNS

35. What do you think are lacking in the community that you would want provided? (Please list them)
-

.....

.....

HEALTH SURVEY (HIA)

- A. List the names of available health institutions in your area.

.....

.....

.....

.....

.....

- B. Assess the cost of goods and services in your locality
(a) Cheap (b) Moderate (c) Expensive

C. LIFE STYLE/HEALTH BEHAVIOURAL CHARACTERISTICS

1. Common food types taken in the community

.....

.....

2. Meal (24 hour recall)

	Fat	Protein	Carbohydrate	Minerals	Others
Yesterday morning					
Between Meals					
Yesterday Afternoon					
Between Meals					
Yesterday Evening					

3. During the last 4 weeks, how often have you had drinks containing alcohol?

Would you say:

- Every day
- At least once a week
- Less than once a week
- None at all (don't take alcohol)

Units of alcohol

- 1 pint – 1 bottle of beer – 2 units
- 1 glass of wine – 1 unit
- 1 shot of brandy – 1 unit.

4. Smoking (Yes/No) If yes, how many sticks per day?
5. Sanitation: Any existing household regular clean-up exercise?.....how often....
Any existing community regular clean-up exercise?... how often....
6. Use of Tobacco (Yes/No)
7. Exercises (Yes/No) (a) Type..... (b) How often.....
(c) Duration of walks per day.....
(d) How many hours per day/week:.....

D. COMMON HEALTH HAZARDS IN THE COMMUNITY

During the last 12 months, have you been admitted into a hospital on account of any ill health? (Yes/No)

2. If yes, for which of the following:
 - * Infectious disease (list common conditions, such as malaria, RTI, Diarrhoea, TB, AIDS, etc.)
 - * Injuries/Accidents (Yes/No)
 - * Others (specify):.....
3. List all illness episodes in the last 12 months:
.....
.....
4. Which of the following diseases/health conditions in your opinion poses the greatest Health threat to your community (Score 1-5) 1 = least threat; 5 = highest threat:

	1	2	3	4	5
Malaria					
Respiratory tract infectious					
Diarrhoea disease					
Skin disease					
Injuries/accidents					
Sexually Transmitted diseases					
Others (specify)					

NB: Tick the correct box

5. How many people on the average died in your community within the last 12 months:
Adults Under 5.....less than one year.....

6. What in your opinion is the most important cause of death in the community?
- (a) Amongst children under one year.....
- (b) Amongst children under 5 years
- (c) Amongst adults.....
- (d) Death during child birth:.....

E IMMUNISATION STATUS

1. Have you received any of the following vaccines?

	YES	NO
DPT		
BGG		
Oral Polio Vaccine (OPV)		
Typhoid		
Yellow fever		
Tetanus Toxoid		
Small pox		
Hepatitis Vaccine		
Others (specify)		

F. COMMUNITY HEALTH NEEDS

1. What in your opinion are the most important health needs of your community?
(Score in order of priority 1-5)
1 = least need, 5 = highest need

	1	2	3	4	5
Safe Drinking Water					
Food					
Health services/Clinics					
Electricity					
Good toilet system					
Waste disposal					
Others (specify)					

N.B: Tick the correct box

2. In order of preference, what do you think should be done to improve the health services in your community?

- (i).....
 (ii)
3. What health problems do you think may arise because of the central power plant projects in your community?
 (i).....
 (ii)
4. In order of preference, what do you think should be done to minimize these anticipated health problems?
 (i)..... (ii)

G. PERSONAL/HYGIENE PRACTICES

1. Source of water
- Tap
 - Well
 - River
 - Stream
 - Rainwater
2. Distance from source of water
- Within household
 - < 1 km
 - 1 – 2 km
 - 3 – 4 km
 - > 5 km
3. Nos of Baths/day/week
4. Brushing teeth
 Do you use
- Toothbrush
 - Chewing stick
 - Others (specify)
5. Frequency of mouth cleaning/day
6. Do you wash your hands after using the toilet
- Always
 - Sometimes
 - None

7. Type of Toilet
 - Water closet
 - Bush
 - Bucket
 - River/Stream
 - Public toilet
 - Others (specify)
8. Method of Refuse Disposal you practice:
 - Open dumping
 - Landfill
 - Bagging/dust bin
 - Composting
 - Incineration
 - Others (specify)

H. KAP RELATING TO COMMON HEALTH CONDITION

1. Have you heard about these diseases? (Yes/ No)
 - Hypertension
 - Diabetes
 - Typhoid
 - Malaria
 - Respiratory Infection
 - Epilepsies
 - Diarrhoea Disease
 - Sexually transmitted illness
 - HIV/AIDS
 - Tuberculosis
2. Do they occur in your community? (Yes/No)
3. What causes this illness?
 - Spiritual
 - Germs/parasites
 - Food/drink
 - Overeating/under eating
 - Blood transfusion
 - Sexual contacts

- Poor sanitary condition

4. Are these diseases transmissible from person to person? (Yes/No)

5. If yes, how?

- Spiritual
- Hugging/Kissing/sharing of plates/spoon
- Living in the same house
- Sexual contact

6. Are these diseases prevalence (Yes/No)

- Do you know anybody with these illnesses? Yes/No
- Can you stay in the same house with persons with these illnesses
- Can you share food/drinks/the same room with such persons
- If you have these illnesses, where will you seek treatment?

APPENDIX III

FIELD WORK METHODOLOGY

Sample collection and handling were done in accordance to FMEnv. guidelines and standards as highlighted in the following paragraph:

Preparation for field work - In the preparation for fieldwork, glassware to be used were washed with detergent solutions, rinsed with tap water, then soaked in 1:3 nitric acid solutions for 24 hours to remove organic materials, washed again with tap water and rinsed with distilled water. Plastic containers were washed with detergents, rinsed with tap water, followed by distilled water. After drying, all the containers were rinsed with acetone to remove organic materials, and rinsed with distilled water.

Handling of Samples - Aluminium foils were used to contain soils. Water sampling equipment was rinsed with portions of the water to be sampled. Composite samples per sampling point were taken with thoroughly cleansed containers. Sterile wide-mouth polypropylene and Pyrex glass sample bottles were used. Samples for oil and grease were collected in clean and dry glass-stoppered bottles and were usually not completely filled to avoid losing oil when the stopper was inserted.

A permanent label was attached to each sample container and reflected specific sample identification details like project name, date, sample matrix, sampling point, sample number, depth, as the case was.

As samples could be subject to microbial degradation and transformation, they were therefore analysed at minimum time after collection. Since storage was necessary for water samples to analyse Physico- chemical parameters, they were stored in ice-chest as a cooling device and transported to the laboratory where they were refrigerated at 4⁰C. Samples for heavy metal analyses were preserved with 1:1 nitric acid and oil and grease with 1 ml of 1:1 H₂SO₄ as soon as they were collected. Adherence to good preservation procedures ensured that errors were not introduced into the analytical process.

Inspectors and Statutory Regulators

One representative each from the Federal and State Ministries of Environment, were present throughout the duration of the fieldwork. Their function was to ensure that environmental samples were collected and preserved (where necessary) according to recommended procedures and practices for environmental data collection as per industry guidelines and standards (Nigeria and international). Two representatives from the project proponent were also part of the EIA data gathering team.

Quality Control/Quality Assurance (QC/QA)

QC/QA programmes cover all aspects of the study, including sample collection and handling, laboratory analyses, generation of data and coding, data storage and treatment as well as report preparation. The quality assurance programmes used by the consultant in its fieldwork and laboratory analyses are in accordance with recommendations by FMEnv.

QA/QC for Laboratory analysis and generation of data

Possible sources of error in laboratory analysis include contamination of reagents and materials, lack of sensitivity of equipment, lack of calibrations, poor data entry and interpretation. Glassware and other containers to be used for each analysis were thoroughly cleansed as appropriate for each parameter. All glassware used for oil and grease determination was pre-rinsed with Analar grade xylene. Glassware for determination of metals were pre-soaked in dilute nitric acid and then rinsed well with distilled water.

All reagents and chemicals of high purity (mostly Analar grade) were used. Freshly distilled water prepared in our laboratory was used for all dilutions.

The various instruments and equipment for measuring physico-chemical parameters were used while in good working condition. Periodic control checks were usually carried out on such instruments/equipment and performance records maintained. The United States National Bureau of Standards (NBS) certified mass standards were used to check the laboratory balances. The pH meters were calibrated using HACH commercial buffer standards. Using appropriate colour standards of diluted potassium dichromate or potassium permanganate solutions frequently checked the wavelength settings and sensitivities of the absorption spectrophotometer.

For analytical determination requiring the use of calibration curves, such curves were plotted using standard solutions prepared from analytical grade reagents. Records of such calibration curves were maintained and frequent re-calibration checks were carried out. Analytical blanks were incorporated per specific batches of samples to compensate for the sample preparation and determination steps. All the analyses were replicated and the means reported.

Chain of samples custody procedure

There is a Master register for all samples taken to the laboratory. Following registration of the sample, a SAMPLE DATA SHEET containing pertinent information on the sample was opened for each sample. The information includes:

- Sample reference number,
- Nature or type of sample,
- Site of collection,
- Date and time of collection,
- Mode of preservation (depends on nature of material) and analytical data from the field and results of laboratory analyses of representative samples.

Appropriate methods were used in storing the remaining stock materials and sub samples. Samples for storage were kept in labelled compartments on shelves in a storage room. Samples sent to other cooperating laboratories were recorded in the Master Register, accompanied by essential data pertaining to the sample material and appropriate custody transfer forms were filled.

Evaluation of results

Raw data obtained from the instrumental measurement were used in calculating the concentrations of the various parameters, using standardized formulae. All such calculations were crosschecked. Outlying values were deleted from the replicate data before calculation of mean concentrations. A quick identification of results, which deviate from the normal trend, was usually done. Some of the relationships used to evaluate the results include cation-anion balance. The sum of the anion concentration in meq/l should be equal to the sum of the cations concentration also in meq/l. Differences within 5% are acceptable.

$$\% \text{ Difference} = \frac{(\text{cations}) - (\text{anions})}{(\text{cations}) + (\text{anions})}$$

The above check on ionic balance was carried out. Also, calculated and observed conductivity measurements and IDS data are compared, to check reliability and accuracy of data.

Air Quality

The objective of air sampling and analysis is to adequately characterize air pollution for the region of interest at minimum expenditure of time and money. Moreover, the characterization is usually based on the intended use of the data and this use includes the following:

- a) checking adherence to air quality standards;
- b) observing pollution trends and relating any changes to emission variations;
- c) developing and evaluating abatement strategies;
- d) assessing health effects or plant damage which may have arisen from exposure to air pollutants (this will normally include geographic and temporal distributions);
- e) developing and applying a warning system for prevention of undesired air pollution episodes; and
- f) Developing and testing pollutant diffusion models.

Sampling Scheme

Measurements are made with a group of instruments, which are moved from one fixed measuring point to another in a predetermined manner. These measurements are then related to meteorological data made at the same time or obtained from a synoptic meteorological station. Because of the nature of our group of instruments, this second scheme was adopted. An advantage of this scheme is that a large area was covered with a minimum of instruments. The data obtained fulfils the main objectives of characterizing air quality and checking adherence to air quality standards.

Sampling Locations

These sampling stations are presented in the air project coordinate table and air quality map. and cover the entire study area where activities are expected to take place. The selection of sites for monitoring took into consideration the reproducibility of results and the following environmental factors.

1. Accessibility of site,
2. Availability of suitable open space,
3. Wind direction (up wind and downwind) and
4. Areas with minimal local influence from vehicular movement.

Sample Collection

The World Health Organisation (WHO) has selected methods of Analysing air pollutants. These methods are based on those adopted by the WHO, (1986). The Federal Ministry of Environment Formerly Federal Environmental Protection Agency (FEPA) in Nigeria has adopted these methods for the purpose of surveillance and monitoring air pollutants pending the development of her standard methods. These methods, as listed below, were used in this study.

Table 1: Standard methods for measurement of air quality parameters

S/N	Parameters	Measurement methods
1	Suspended Particulate Matter (SPM)	High Volume Air Sampler.
3	Sulphur oxide (SO ₂)	Portable SO ₂ Monitor
4	Carbon monoxide (CO)	Portable Carbon monoxide (CO) Monitor
5	Hydrogen sulphide (H ₂ S)	Portable Hydrogen sulphide (H ₂ S) Monitor
6	Ammonia gas (NH ₃)	Ammonia gas (NH ₃) Monitor
7	Nitrogen oxide (NO ₂)	Portable Nitrogen oxide (NO ₂) Monitor
8	Volatile Organic Carbon (VOC)	Portable VOC/CH ₄ Monitor

Supporting Measurements

The following supporting measurements were made:

- (i) Wind direction and Speed
- (ii) Air temperature

(iii) Relative humidity

Care was taken to avoid undue interference from any 'external' gaseous emission source while sampling.

Noise Measurement

Standard methods and techniques were adopted for the measurement of noise levels at the sites. Measurements were made using the precision Sound Level Meter (Bruel & Kjaer) Type 2203 and octave Band Filter (B&K) Type 1613 attached to the former. The meter was held with the microphone facing the noise source and at least 1m away from any reflecting surface. Measurement minimum noise levels, (L_{min}), maximum noise level (L_{max}) as well as noise exposure levels, (L_{exp}) were recorded between the hours of 9am and 4pm on hourly basis. These methods and techniques were consistent with those of ISO and International Electro Technical Commission (IEC, 1993).

Geology / Hydrogeology

Geology and Aquifer Parameters

Surface geological mapping was achieved using available maps, reports and data. In addition, bearing and pacing method was used in the field. This exercise was made possible with the aid of compass – clinometer and existing roads that served as traverses. The subsurface geological studies were carried out using drill log data from borings, existing report and literature.

Static water level (SWL) measurements were made with water level recorder (Type KLT-Du). This measurement guided the determination of groundwater flow direction.

The hydraulic conductivity (k) was estimated using the result of the grain size analyses by applying the Hazen's formula:

$$K = C d_{10}^2$$

where d_{10} (mm) corresponds to 10% cumulative weight passing and C is coefficient which have a value of 1.0, K hydraulic conductivity (cm/sec).

Vegetation and Wildlife

The materials used for the field work include secateur polythene bags, large jute bags, laundry pen, labelling tapes, specimen bottles, 70% ethanol, formal acetic acid (FAA), hand lens, improvised hook and measuring/calibrated tapes.

Sampling for diversity and abundance was carried out in blocks of 5 and 50m² each. Direct species counts were taken within the sampling blocks, which also served as quadrants. Leaf and stem materials were taken in specimen bottles containing 70% ethanol, fixative stain solution and formal acetic acid (FAA) for laboratory histochemical analysis.

Plants were examined in vivo for signs and evidence of environmentally induced stress as well as disease conditions. General health condition of the vegetation was visually evaluated. Plant materials that could not be identified (on-site) were taken for identification with taxonomic keys and flora in the laboratory. Information on wildlife was obtained by either direct sighting of animals concerned or from hunters in the different communities. Wildlife species inventory for the different faunal zones is essential in order to provide the basic information needed in EIA work. Furthermore, such information is necessary for the identification of some species of local and global concern which is at the brink of extinction; and such animals are listed as ‘Vulnerable’ or ‘Endangered’ in the IUCN Red List.

Waste Management

The various sources of wastes generated and the local waste disposal techniques in the project area were identified. This included identification of local waste management techniques and/or the ultimate destination of wastes.

Table 2: Summary of the Field Data Collection Procedures

Environmental components	Methods
Meteorology	Literature survey, field studies with rain gauge, Thermograph, Wind vane, EXTECH INSTRUMENTS-Hygro-Thermometer+Infra-Red Thermometer, Model No. RH 101
Air Quality	Portable Gas Monitors for gases, USEPA High-Volume sampler for SPM. Altair5X,
Noise	Sound Level Meter (Bruel & Kjaer) Type 2203 and octave B and Filter (B&K) Type 1613.

Vegetation	Transects, Quadrats, key informant interviews, Focus Group Discussion (FGD), Questionnaires and Direct observations
Land use/cover	Observations, interviews and sample collections. Environmental baseline survey (EBS) by remote sensing (satellite imagery interpretation), Direct physical observations
Fauna (Wildlife) Amphibians, Reptiles, Birds, Mammals	Direct observations, key informant interviews, Focus Group Discussions (FGD)
Geology and Hydrogeology	Boreholes sampling and measurements
Surface water/ Hydrodynamics	Observations, water sampler, current meter, pH meter, DO meter, sediment grab, TDS meter, Turbid meter and conductivity meter
Soil Quality	Soil samples with an auger and description of each sample with Munsell colours chart.
Microbiology	Collection of water samples with Hydro bios water sampler into sterile McCartney bottles; Soil samples with soil auger into aluminium foil Sediments samples with van Veen grab sampler into aluminium foil.
Waste Management	Physical examination, inventorisation and walk-through survey

Consultations

First Level Consultation

Consultation formed an important aspect of the execution of the fieldwork for the EIA. The steps involved in the consultation process include:

- i. Direct meeting with communities in their respective locations, and
- ii. Discussion with community opinion leaders during Focus Group Discussions (FGD).

Scoping Workshop

In line with policy of consultation with stakeholders and relevant authorities in all its activities, the scope of the EIA project was discussed between the proponents, consultants, and the regulators. The purpose was to identify the issues and concerns of stakeholders regarding the

project and to develop a term of reference for execution of the EIA. Other objectives of the consultation were:

- Educating and enlightening identified stakeholders (communities, government agencies, community based organizations (CBOs) etc.), on the need for their involvement in conducting the study and to assist the project team in articulating the concerns of the communities as well as those of their immediate environment;
- Building trust and confidence that would enhance the capacities of the identified stakeholders through participation in the project.
- Forming and promoting partnership with identified stakeholders through networking, information sharing and participation in consultation exercises.

Meeting with Communities

Direct meeting with community leaders within their localities formed a key element of data gathering. The purpose of such meetings was to intimate the communities of the project. Further to inform them on the need for the study, solicit their views and obtain their permission and co-operation during the data gathering exercises in their respective communities.

Consultation meetings involved free discussion with the community leaders after the normal customary respects and pleasantries have been observed. At each meeting, there was an understanding that immediate community would provide representatives to be employed as field assistants. These assistants are continually interviewed during the field work and also assist the consultants in related community data acquisition.

Second Level Consultation

The identified community stakeholders were informed of their expected participation during the commencement of fieldwork. At each field location, the study team met with community leaders, the women leader and the youth leader to discuss the objectives of the study. This rapport helped in securing the social license to conduct baseline studies in these communities. Consultation with other stakeholders is ongoing and shall be sustained throughout the duration of the project.

Socio-Economic Survey

The socio-economic survey adopted a combination of several data collection techniques to achieve the objectives of the study. A combination of the following methods was adopted at varying degrees

for the different communities. These include;

- a. Questionnaire interview
- b. Focus group discussion
- c. Key informants information
- d. Participant observation and estimation.

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

The questionnaire survey involved sampling households within the community using a set of questionnaire. Information gathered from the survey was presented in charts and pictures as appropriate, to give a picture of the base line situation in the area.

Environmental Health Survey

This study consisted of walk through surveys using prepared check list of environmental health issues such as general level of sanitation, waste disposal practices, water supply and the availability of health and health related facilities. The main issues assessed included:

- i. Types and quality of housing
- ii. Sources of water
- iii. Type of sewage disposal methods and facilities
- iv. Methods of refuse disposal and general physical environmental cleanliness.
- v. Health facilities available
- vi. Environment- Health interplay factors

The data generated were processed, presented in tables and charts, and further analyzed.

Epidemiological Survey

The study was designed for a cross section of the inhabitants.

Sample Size

A sample size of 5% of the total population of the study communities based on the 2006 national census Figures was used in the study. These Figures have been adjusted to 2020 using a projection of an annual growth rate of 3.2%.

Selection of Study Subjects

The multistage sampling technique was adopted in each settlement to select the study population. In the absence of streets, households were randomly selected.

All the inhabitants in the selected houses were then administered questionnaires until the required sample size was met. A sample of the questionnaire is provided in Appendix.

Focus Group Discussions and Interviews

Focus group discussions were held in each of the study communities. The following focus groups were identified:

- Adult males
- Adult females and
- Youths

Oral Interviews were also conducted. Those interviewed were mostly health personnel and community opinion leaders. The questions were related to the following:

- ❖ The health facilities available in the community
- ❖ The common diseases in the community
- ❖ Their health concerns related to the project
- ❖ Their health expectations from the project